

APPENDIX 2

Stack emissions monitoring: carbon capture and storage (amine scrubbing)

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As Carbon Capture and Storage (CCS) is a relatively new technology, we are providing guidelines below for the monitoring and testing of emissions from CCS facilities, for operators to apply as they begin commissioning individual installations.

- location and facilities must be compliant with Environment Agency Technical Guidance Note (TGN) M1 (available from www.mcerts.net)
- if droplets are present, sampling must be carried out isokinetically
- MCERTS accreditation is required for specified methods, where available, unless agreed in writing.

The following sampling and testing protocols should be used for CCS stack emissions monitoring:

- Homogeneity assessment (EN 15259 plus Method Implementation Document (MID) for EN 15259). If the stack gas is homogeneous at the sample plane, then single point sampling is permitted.
- Stack gas velocity and volumetric flow rate – EN 16911-1
- Oxygen (if required) - EN 14789
- Ammonia – EN ISO 21877 or procedural requirements of EN 14791 (Sulphuric acid (H₂SO₄) absorber solution)
- Amines - procedural requirements of CEN TS 13649 (silica gel tubes) or use procedural requirements of EN 14791 (Hydrochloric acid (HCl) absorber solution). Consider analysis for the following:
 - 2-ethanolamine (MEA)
 - Methyl diethanolamine (MDEA)
 - Diethanolamine (DEA)
 - Ethylamine
 - Methylamine
 - Dimethylamine
- Nitrosamines – CEN TS 13649 (Themosorb/N sorbent cartridge) or use procedural requirements of EN 14791 (Sulphamic acid (H₃NSO₃) solution). Consider analysis for the following
 - N-nitrosodiethanolamine (NDELA)
 - N-nitrosodimethylamine
 - N-nitrosomorpholine
 - N-nitrosomethylethylamine
 - N-nitrosodiethylamine
 - N-nitrosodiisopropylamine
 - N-nitrosodiisobutylamine

- N-nitrosodipropylamine
- N-nitrosodibutylamine
- N-nitrosopiperdine
- N-nitrosopyrrolidine
- N-nitrosodibenzylamine
- Formaldehyde - CEN TS 13649 (silica gel tube) or US EPA M316 (Deionised (DI) water or change to DNPH)
- Acetaldehyde - CEN TS 13649 (silica gel tube) or US EPA M316 (DI water or change to DNPH)
- TGN M22 or CEN TS 17337 (Fourier Transform Infrared (FTIR) analyser) may be used as an alternative method to those above, unless isokinetic sampling is required. This provides real time continuous data for periods of several hours or longer.

For further information on any of the monitoring protocols above, please contact EAL.consultation@environment-agency.gov.uk.

Glossary

CCS	Carbon Capture and Storage
CEN	European Committee for Standardisation
DNPH	2,4-Dinitrophenylhydrazine (Brady's reagent, Borche's reagent)
EN	European Standard
FTIR	Fourier Transform Infrared
H ₃ NSO ₃	Sulphamic acid
H ₂ SO ₄	Sulphuric acid
HCl	Hydrochloric acid
ISO	International Standards Organisation
MCERTS	Environment Agency Monitoring Certification Scheme
MID	Method Implementation Document
TGN	Technical Guidance Note
TS	Technical Specification
US EPA	United States Environmental Protection Agency