

International Test Center Network



University of Illinois Abbott Plant
CO2CRC
RITE
CCSKnowledge
Huaneng CERI
KIER
ACCTC



Collaborative Efforts

1. Uniform Test Plan – performance, accelerated degradation and secondary emission quantification
2. Uniform Sampling and Analytical Methods – round-robin verification

Regulated Air Pollutants				
Compound	Regulated VOC	Regulated HAP	Regulated TAC	STAR Program* De Minimis Emissions Rates
Formaldehyde	Yes	Yes	Yes/ Category 1	39.96 lb/yr & 0.042 lb/hr
Acetaldehyde	Yes	Yes	Yes/ Category 3	216 lb/yr & 0.24 lb/hr
Amines	Yes	No	No	N/A
* STAR regulations adopted by the Louisville Metro Air Pollution Control Board				

Standardization is under Way

Sampling Methods

Organization	Amines	Ammonia	Ketones	Aldehydes	Nitrosamines
NCCC	Modified EPA Method 5	NIOSH 1606	NIOSH 1301	EPA TO-11A	Modified EPA Method 5
UKy IDEA	CTM-027		EPA Method 0011 and Method 8315 with DNPH-derivatization, L/L extraction		CTM-027 using sulfamic acid with SPE extraction
SINTEF	Modified EPA Method 5	CTM-027	EPA Method 0011		Modified EPA Method 5
TCM	NS-EN 13284-1:2017, NS-EN 15259:2007, modified for using different chemicals for capture analytes; In case aerosol formation Modified EPA, Emission measurements of sulphuric acid mist, Method 8				
	sulfuric acid	sulfuric acid	DNPH cartridge	DNPH cartridge	sulfamic acid

Analytical Instrumentation

Organization	Amines	Ammonia	Ketones	Aldehydes	Nitrosamines
NCCC	HPLC-DAD (diode array detection)	GC, FID	GC, FID	HPLC	GC-TEA (thermal energy analysis)
UKy IDEA	IC	IC	HPLC-DAD	HPLC-DAD	GC-MS
SINTEF			LC-MS	LC-MS	GC-MS
TCM	IC (conductivity and MS detection)	IC (MS detection)	External lab (LC-MS)	External lab (LC-MS)	External lab (GC-MS)

Appendix: Analytical Instrumentation

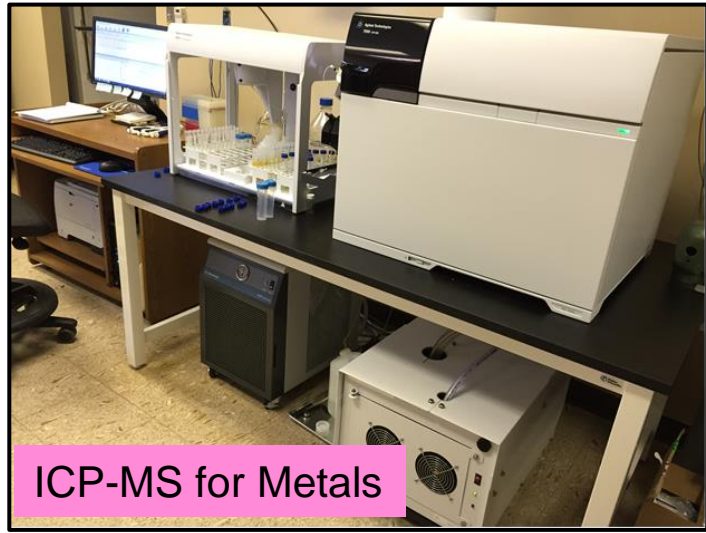
IC for HSS / Amine + NH₃ Emissions



LC-MS (TOF) for Amine Degradation

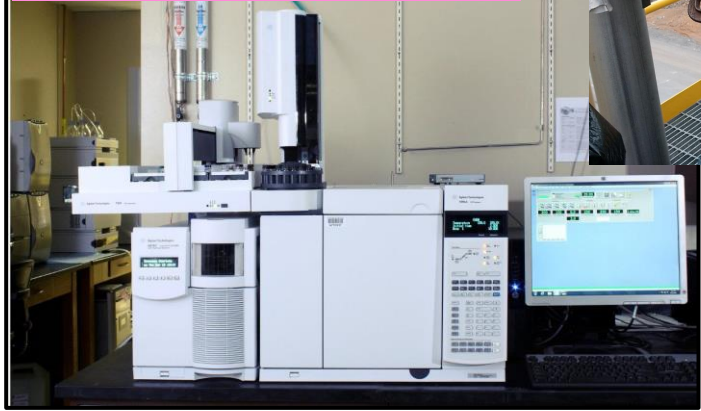


Manual Emission Sampling for Amines, NH₃, Aldehydes, Nitrosamines



ICP-MS for Metals

GC-MS for Nitrosamines



Appendix: Emissions Sampling

IC for HSS / Amine + NH₃ Emissions



Manual Emission Sampling
for Amines, NH₃,
Aldehydes, Nitrosamines

- Manual Isokinetic Sampling based on EPA Method 5
- Amine/NH₃ using CTM-027 with IC analysis
- Aldehydes and Ketones using EPA Method 0011 and Method 8315 with DNPH-derivatization, L/L extraction and HPLC-UV analysis
- Nitrosamines using setup from Method 5 and CTM-027, but using Sulfamic acid instead of sulfuric acid, with SPE extraction and GC/MS analysis
- Recently used new FTIR for amine emissions at the bench scale

Emissions Sampling

Manual isokinetic (impinger train) sampling was conducted by UK and EPRI/CB&I (as independent verification)



- CTM 027 (0.1N H₂SO₄ reagent) used for ammonia and amines
- Additional emissions data obtained from FT-IR monitoring performed by UT-Austin during MEA campaign