**Nitric acid production and N2O emissions - CEMS**

* Nitric acid is produced by a three-step high-temperature catalytic ammonia oxidation process. Each step of the process relates to a specific chemical reaction. A mixture of ammonia and heated air is reacted in a catalytic converter to produce nitric oxide (NO) and water. The most common catalyst consists of a 90 % platinum and 10 % rhodium gauze constructed from squares of fine wire. Up to 5 % palladium is also used. The NO produced from ammonia oxidation is then oxidized.  
    
  Residual oxygen and the NO process stream react in a cooler/condenser to form nitrogen dioxide (NO2) and nitrogen tetroxide (N2O4), a liquid dimer. The final step for the production of weak nitric acid is absorption. The NO2 and liquid dimer mixture are pumped into the bottom of an absorption tower, with additional liquid dimer introduced at a higher point in the tower.
* N2O emissions from nitric acid are a byproduct of the process stream and therefore characterized as “industrial process” emissions. Ammonia oxidation is the source of N2O emissions from nitric acid production. The amount of N2O formed depends on combustion conditions in the oxidizing unit, catalyst compositions, catalyst age, and burner design.
* Purpose of production / uses
* Fertilizer in agriculture; nitric acid is neutralized with ammonia to give ammonium nitrate
* Explosives (e.g. TNT)
* Precursor to organic nitrogen compounds
* Aniline as precursors to polyurethane
* Nylon
* Adipic acid

**Adipic Acid Production**

* the adipic acid manufacturing process N2O is inevitably generated as a by-product
* Purpose of production / uses
* Precursor for the production of nylon
* Monomer for production of Polyurethane
* Plasticizers, especially in PVC

**Glyoxal and Glyoxylic Acid Production**

* Main production process is liquid-phase oxidation of acetaldehyde with Nitric Acid
* Specific application due to chemistry (e.g. in laboratories)
* Coated paper
* Textile finishes
* Collagen

**Caprolactam**

* Precursor for the production of nylon
* nitrous oxide (N2O) is generated by side reaction of ammonia oxidation reaction of hydroxylamine production unit(same process as for nitric acidproduction)

**Retention of data**

* + Justification of the selection of this approach
  + Corroborating calculations
  + Technical description of the CEMS
  + Raw and aggregated data
  + Log-books, calibration, servicing and maintenance records
  + Information on any changes

EN 14181

* Three different quality assurance levels (QAL1, QAL2, and QAL3)
  + QAL1 - Certification of analyzers / equipment
  + QAL2 - Calibration and validation
  + QAL3 - Ongoing quality assurance during operation
* Requirement to run an Annual Surveillance Test (AST)
* Use of accredited service providers for QAL1, QAL2, and QAL3

EN 14181 – QAL1

* Certification of CEMS (components) to prove suitable for its measuring task, covering aspects like:
  + Uncertainty
  + Drift in time
  + Operation conditions
* Procedure specified by EN 15267-1, EN 15267-2, EN 15267-3 and EN ISO 14956 (relevant for certification companies accredited according to EN ISO 17025)

EN 14181 – QAL2

* QAL 2 covers the following items:
  + functional test of the AMS including check of correct installation;
  + parallel measurements with the SRM (Standard Reference Method);
  + data evaluation;
  + determination of the calibration function of the system and its range of validity;
  + calculation of variability of the CEMS measured values;
  + test of variability of the CEMS measured values;
  + Reporting

EN 14181 – QAL3

* QAL3 requires plant operators to have a procedure which describes the requirements for:
  + measuring zero and span values
  + plotting these values by use of control charts and
  + using the control charts to determine whether there are systematic deviations, whether the random deviations become too large, and to ignore the random deviations if they lie between defined control chart limits.

EN 14181 - AST

* AST covers the following items:
  + functional test of the AMS;
  + parallel measurements with the SRM;
  + data evaluation;
  + calculation of variability of the AMS measured values;
  + test of variability of the AMS measured values and validity of the calibration function;
  + Reporting;
* In principle the same as QAL2