



Remarks and Comments on Nitric Acid Production Project Protocol – PUBLIC DRAFT Version 1.0, October 2009, Issued by Climate Action Reserve

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 Date: November 10, 2009,
 Revision: 2

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1	p. 9, table 1	These measures may include catalytic decomposition or NSCR.	N ₂ O abatement by N ₂ O reduction should be also considered as tertiary abatement technology. See also 4.
2	p. 9, 2.2	Projects can only be implemented at existing, relocated or upgraded NAPs. ..NAPs restzartet after being out of operation for 24 minth...	New NAPs and NAPs restarted after 24 month should not be excluded from the protocol. There is also ongoing discussion at the moment for new nitric acid plants under the CDM mechanism to have the possibility to include these plants.
3	p. 10, S 2.2. 2	The combined use of a secondary and tertiary technology is forbidden in this section.	Is this a good idea? A poorly performing secondary technology could be supported by a tertiary technology to achieve a high rate of N ₂ O abatement overall with less tertiary catalyst.
4	p. 13 S 3.4. 2	<i>"2. A tertiary N₂O abatement catalyst, including catalytic decomposition or NSCR"</i>	Could consider amending to include selective N ₂ O reduction e.g. with hydrocarbon: <i>"2. A tertiary N₂O abatement catalyst, including catalytic decomposition, <u>selective reduction</u> or NSCR"</i>
5	p. 19 and p. 29-31	SSR 4. Tertiary technol.: CO ₂ emissions due to NH ₃ used in tertiary N ₂ O abatement to be included if plant did not contain a De-NO _x SCR.	NH ₃ should not be included if legal regulations require NO _x reduction to be implemented when the tertiary N ₂ O reduction technology is implemented.
6	p. 20, S 5.1	GWP for N ₂ O = 310	Should consider provision for using more up to date figures for GWPs or other GHG emission metric, if adopted in any post Kyoto agreement. According to latest 4 th Assessment Report of IPCC 100 year time frame GWPs of CH ₄ , N ₂ O are 25 and 298 vs. 21 and 310 for Kyoto Protocol (from 2 nd Assessment Rpt.)



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7	Eqn. 5.7, p.27	Parentheses for summation in Eqs. 5.7 seem to be missing: $BE = \left(\sum_i^n F_i \times CI_{N_2O,i} \times M_i \right) \times GWP_{N_2O}$	With parentheses: $BE = \left(\sum_i^n \left(F_i \times CI_{N_2O,i} \times M_i \right) \right) \times GWP_{N_2O}$
8	Eqn. 5.7, p. 27	When HNO ₃ _{RP} < HNO ₃ _{AVG} then the actual baseline emissions, BE, are reduced by the factor HNO ₃ _{AVG} / HNO ₃ _{RP} as in the equation below $BE = \left[\left(\sum_i^n F_i \times CI_{N_2O,i} \times M_i \right) \times GWP_{N_2O} \right] \times \frac{HNO_{3,AVG}}{HNO_{3,RP}}$ This means for example, if the average historical HNO ₃ production (over the 5 campaigns prior to installing the tertiary N ₂ O abatement) is 50 tph and the actual HNO ₃ production averaged over the reporting period was say 55 tph then the actual measured baseline emissions must be lowered by the factor 50/55 = 0.9091	The present provision would unfairly penalize the nitric acid plant operator, as it ignores the fact that nitric acid production rates typically vary during the year with higher production rates being achieved during winter than summer. For this reason higher plant throughput in the winter months should not be construed as an attempt at gaming. It is questionable whether any restriction is really needed on HNO ₃ production since the limit on gaming is already given by the cap on ammonia flow provided for in the Draft Protocol. The same comment applies to Eq. 5.9, Project Emissions. (Note: AM0028, see below, looks as the <i>design</i> production capacity (e.g. in mtpd) , not the average achieved capacity, and disregards baseline and project emissions achieved at higher than design capacities. Even here it is questionable whether any such limit on HNO ₃ production is necessary, since ammonia flow is also subject to a restriction.)
9	p. 27, p. 35	Tail gas flow rate is to be measured.	As an alternative it would be possible to calculate the tail gas flow rate by a mass balance using the tail gas oxygen concentration upstream of any NSCR and either the total air (primary + secondary) entering the NAP or the ammonia flow rate to the ammonia oxidation. The tail gas flow rate can be calculated from: a) the ammonia flow rate to the ammonia oxidation reactor or burner and the tail gas oxygen concentration. A serviceable formula is:



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			$\dot{V}_{TG} = (\dot{V}_{NH_3} \times 0,7901 \times 2) / ((0.2099 \times (1 - X_{O_2}/100)) - (0.7901 \times X_{O_2}/100))$ <p>where:</p> $\dot{V}_{TG} = \text{Tail gas flow [Nm}^3\text{/h]}$ $\dot{V}_{NH_3} = \text{Flow of ammonia to ammonia burner [Nm}^3\text{/h]}$ $X_{O_2} = \text{Concentration of oxygen in tail gas in Vol. \%}$ <p>b) the flow rate of primary and secondary air and tail gas oxygen concentration. The following formula appears in the French "Protocol for quantification of nitrous oxide emissions in the manufacture of nitric acid" AFNOR BP X 30-331, February 2003:</p> $\dot{V}_{TG} = 79 \times (\text{PRI} + \text{SEC}) / (100 - X_{O_2})$ $\dot{V}_{TG} = \text{Tail gas flow [Nm}^3\text{/h]}$ $\text{PRI} = \text{Primary air flow [Nm}^3\text{/h]}$ $\text{SEC} = \text{Secondary air flow [Nm}^3\text{/h]}$ $X_{O_2} = \text{Oxygen concentration in tail gas in Vol. \%}$ <p>The simplified mass balance method of course requires the plant parameters used to be known to a high degree of accuracy.</p>
10	Eq. 5.12 p. 32	Equation 5.12 uses "OXID _{HC} = Oxidation factor of hydrocarbon with two or more molecules of carbon"	This factor must always be set to 100%, otherwise the GHG emissions resulting from the use of higher hydrocarbons (CO ₂) will be ignored. Higher hydrocarbons (ethane, propane, butane, etc.) are not considered to be greenhouse gases in the Kyoto Protocol presumably because they are so reactive that they are converted to CO ₂ in the atmosphere quickly in relation to typical GHG lifetimes.
11	Eq. 5.12 &	Equation 5.12 uses: "OXID _{CH4} = Oxidation factor of methane"	The use of OXID _{CH4} in these formulae begs the question of how to obtain this parameter. OXID _{CH4} cannot be measured directly and is also not a constant number, at



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	5.13 p. 32	without stating how to obtain OXID _{CH4}	<p>least for Uhde EnviNOx[®] technology. A simpler approach to allow for the effect on project emissions of CO₂ and CH₄ emissions from any hydrocarbons used in the DF which uses measurable data would be:</p> <p>either conservatively assume that all the CH₄ in any fuel or reducing agent supplied to the DF is emitted unchanged and all other hydrocarbons are converted to CO₂ or Measure the CH₄ concentration on the outlet side of the DF (online analyzer for continuous measurement of CH₄ required). From this the amount of CH₄ that passes unchanged through the DF can be calculated. Assume that the remaining CH₄ and all the higher hydrocarbons in the hydrocarbon input are converted to CO₂.</p>
12	Tab. 6.1, 6.2	General Project Parameters for Secondary and Tertiary Catalyst Projects are different	<p>The General Project Parameters for Secondary Catalyst Projects appear to be incorrect or incomplete. They should surely be the same as the General Project Parameters for Tertiary Catalyst Projects, which seem to be almost complete. Some specific comments:</p> <ul style="list-style-type: none"> i) Number each parameter P1, P2,... or B1, B2,... as in AM0028 or AM0034 for easier identification. ii) The historical range of ammonia:air ratios is missing iii) The units of ammonia:air ratio is %, not m³/h. iv) Consistent units between Secondary and Tertiary parameters are desirable, e.g., either tNH₃/h (secondary) or kgNH₃/h (tertiary) but not both. v) bar g for historical and current ammonia oxidation operating pressure seems a more practical unit than Pa. Some of the other parameters are not in SI either. vi) Table 6.2: For the (tail gas) volume flow rate measurement, are not continuous T and P measurements also necessary to provide a T,P correction? vii) OXID_{HC} should not be measured but set to 100% (see comment on CH₄ concentration measurement above) viii) OXIC_{CH4} cannot be measured. Better to measure the CH₄ outlet concentration or assume any CH₄ in inlet hydrocarbon is emitted unchanged. ix) EF_{HC}, “Carbon emission factor of hydrocarbon, with two or more molecules of carbon” is a parameter that depends on the composition of the hydrocarbon fuel or reducing agent, therefore the composition of the hydrocarbon needs to be monitored on a regular basis, e.g. once per year and EF_{HC} calculated from



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			the composition. x) Q _{HC} ("Hydrocarbon with two or more molecules of carbon, input during the reporting period", (m ³)) cannot be directly measured if natural gas, a mixture of CH ₄ and higher hydrocarbons, is used. It can only be derived from the total quantity of hydrocarbon used and the hydrocarbon composition.

Extract from AM0028 Version 4.2, page 14

Baseline emissions are limited to the design capacity of the existing nitric acid or caprolactam production plant. If the actual production of nitric acid or caprolactam ($P_{product,y}$) exceeds the design capacity ($P_{product,max}$) then emissions related to the production above $P_{product,max}$ will neither be claimed for the baseline nor for the project scenario.

If, $P_{product,y} > P_{product,max}$ (12)

Then

$BEN_{2O,y} = SEN_{2O,y} \times P_{product,max}$ (13)

Where:

- $BEN_{2O,y}$ = Baseline emissions of N₂O in year y (tN₂O)
- $SEN_{2O,y}$ = Specific N₂O emissions per unit of output product of nitric acid or caprolactam in year y (tN₂O/ t Product)
- $P_{product,max}$ = Design capacity (t Product)