

QUANTIFICATION PROTOCOL FOR NITROUS OXIDE ABATEMENT PROJECTS



ClimateCHECK
SET THE STANDARD™

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Quantification Protocol Technical
Review

Process Overview

- Seed Materials / Key References
 - Information provided by EPCOR Utilities Inc. & Orica Canada Inc.
 - Alberta Continuous Emission Monitoring System (CEMS) Code, Appendices A & B - largely based on the methodologies developed and used by Environment Canada and the US Environmental Protection Agency (EPA)
 - Clean Development Mechanism AM0034 v3.1
- Technical Review
 - External review conducted during protocol development (Saskatchewan Research Council - 3rd party and other technical experts)
 - All reporting will be done according to procedures outlined in Section 2.3.6 of the Specified Gas Emitters Regulation Offset Credit Project Guidance Document (February, 2008)

Project Scope and Description

- Quantification of reductions in greenhouse gas (GHG) emissions created by the abatement of N₂O during production of nitric acid
 - Resulting from installation of a dedicated N₂O abatement catalyst inside the ammonia burner of a nitric acid plant
 - Catalyst consists of precious metal coated ceramic substrate
- This protocol applies to projects where the nitrous oxide would otherwise have been released into the atmosphere during the production of nitric acid

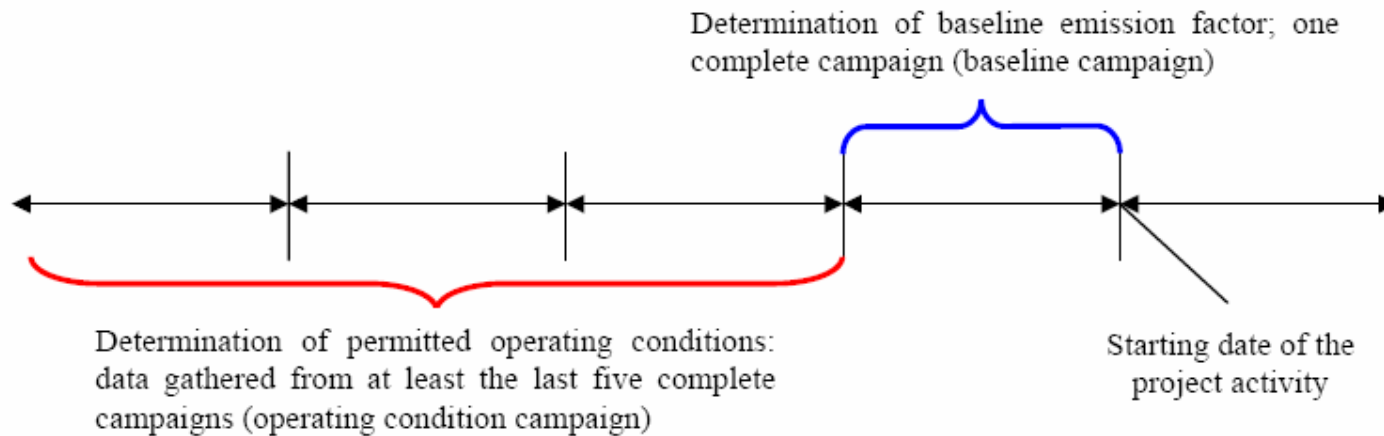
Project and Baseline Conditions

- Baseline Condition = the operating condition prior to the implementation of the N₂O abatement project
 - Baseline Emissions are determined by the continuous monitoring of nitrous oxide concentration and total flow rate in the tail gas of the nitric acid plant for one complete campaign
- Project Condition = the operating condition after the implementation of the N₂O abatement catalyst
 - Considers leakage emissions, material recycling and reduction of emissions via installation of a dedicated N₂O abatement catalyst inside the ammonia burner of a nitric acid plant

Project and Baseline Conditions cont'd

Baseline Emissions

The baseline shall be established through continuous monitoring of both N₂O concentration and gas flow volume in the stack of the nitric acid plant for one complete campaign prior to project implementation. The schematic of the procedure is as follows:



Basis for Reductions

- Emission Reduction Mechanism
 - Reductions in (GHG) emissions resulting from the installation of a dedicated N_2O abatement catalyst inside the ammonia burner of a nitric acid plant that catalytically reduces N_2O , once it has been formed in the Ammonia Oxidation Reactor
- Functional Equivalence
 - The addition of an N_2O abatement technology (catalyst) will not affect the production rate of the plant
 - » Therefore functional equivalence will be maintained between the project and the baseline

Applicability Criteria

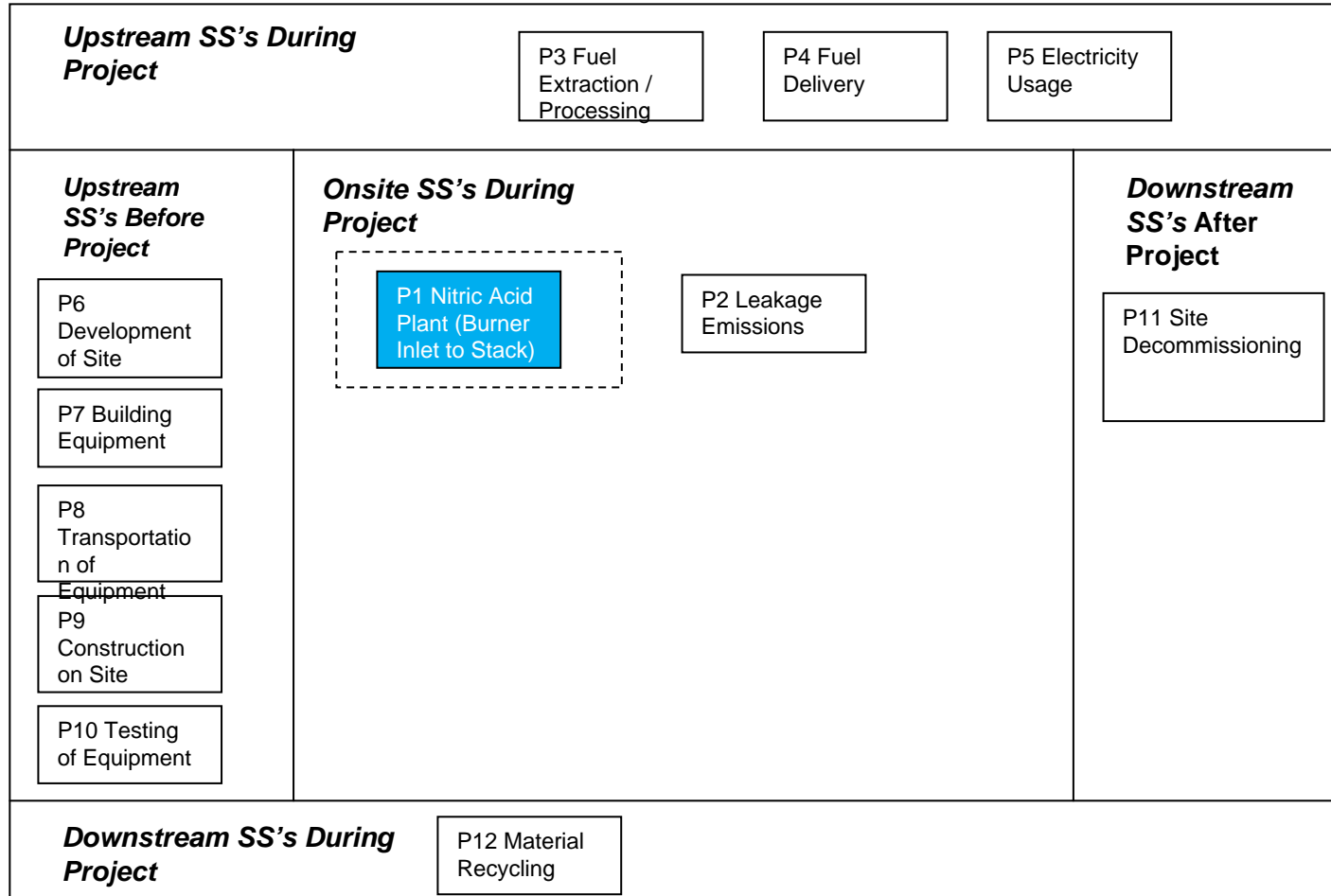
Protocol applies to:

- The nitric acid producer that installs a secondary catalyst dedicated to the abatement of N₂O
- N₂O abatement projects that do not affect the level of nitric acid production
- Where reductions are achieved based on actual measurements and monitoring (where indicated in the protocol)
- The project activity will not result in the shutdown of any existing N₂O abatement facility or equipment in the plant
- Projects that meet all applicable Alberta Offset System requirements

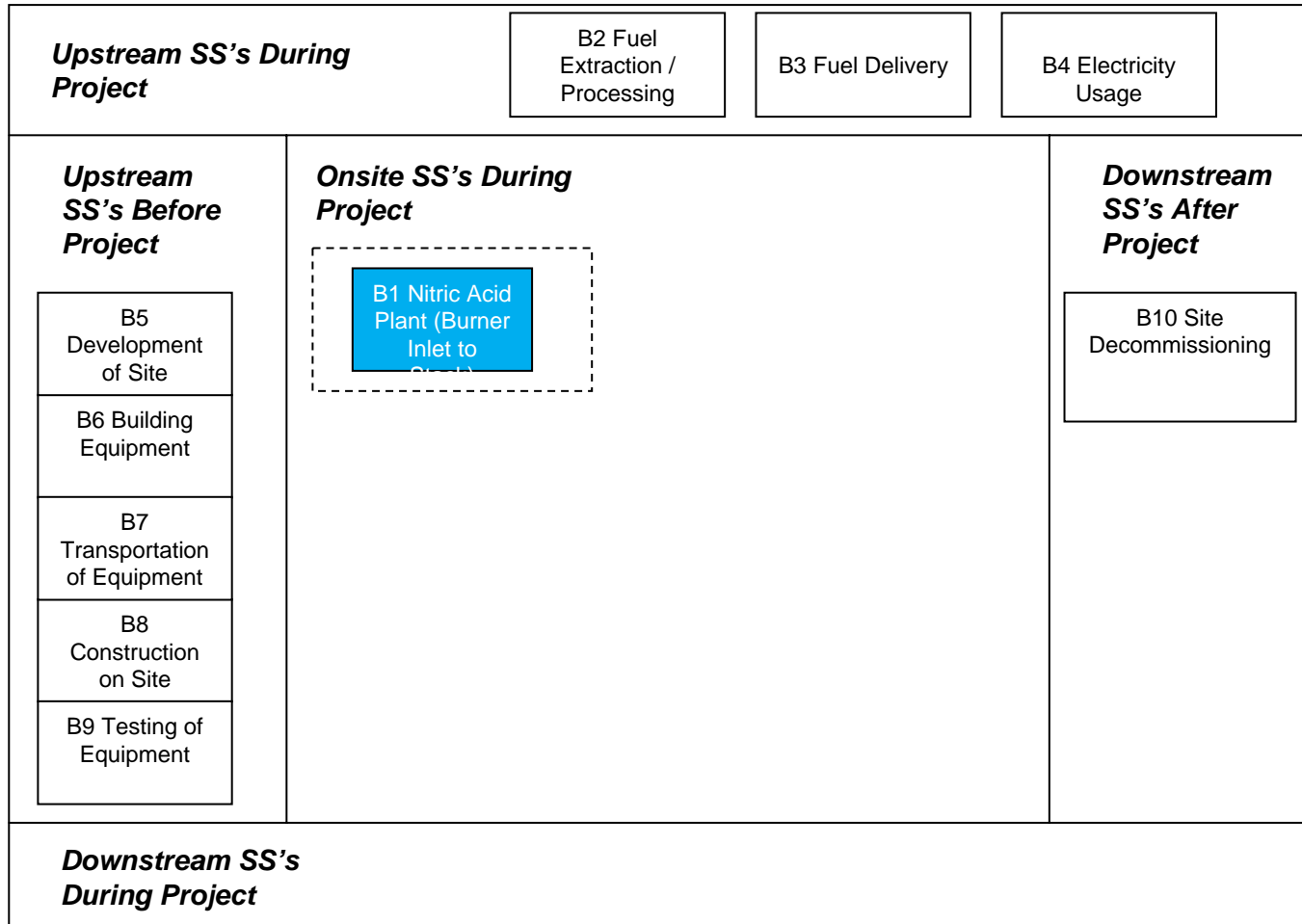
Flexibility Mechanisms

- Project developers may use alternative monitoring methodologies and/or equipment rather than those described in this protocol
- If this approach is taken, the proponent must justify that the chosen methodology and/or equipment provides equivalent, more accurate or more conservative data

Project Lifecycle Diagram



Baseline Lifecycle Diagram



Emission Reduction Calculation

- The calculation methodologies presented in the CDM methodology AM0034 serve to complete the following three equations for calculating the emission reductions of the project

$$\text{Emission Reduction} = (\text{Emissions}_{\text{Baseline}} - \text{Emissions}_{\text{Project}})$$

$$\text{Emissions}_{\text{Baseline}} = \text{Emissions Factor}_{\text{Baseline}} * \text{NAP} * \text{GWP}_{\text{N2O}}$$

$$\text{Emissions}_{\text{Project}} = \text{Emissions Factor}_{\text{Project}} * \text{NAP} * \text{GWP}_{\text{N2O}}$$

Baseline Calculation explained...

$$\text{Emission Reduction} = (\text{Emissions}_{\text{Baseline}} - \text{Emissions}_{\text{Project}})$$

$$\text{Emissions}_{\text{Baseline}} = \text{Emissions Factor}_{\text{Baseline}} * \text{NAP} * \text{GWP}_{\text{N}_2\text{O}}$$

$$\text{Emissions}_{\text{Project}} = \text{Emissions Factor}_{\text{Project}} * \text{NAP} * \text{GWP}_{\text{N}_2\text{O}}$$

$\text{Emissions}_{\text{Baseline}}$ = the sum of the GHG emissions under the baseline condition (tCO₂e)

$\text{Emissions Factor}_{\text{Baseline}}$ = calculated emissions factor under the baseline conditions (tN₂O/tHNO₃)

- Emissions Factor (EF) calculated by the tonnes of N₂O created divided by the tonnes of nitric acid produced

NAP = Nitric acid production for the baseline campaign (tHNO₃)

$\text{GWP}_{\text{N}_2\text{O}}$ = Global Warming Potential of N₂O (tCO₂e/tN₂O)

Note: To demonstrate that the baseline was established under normal operating conditions, data from 5 previous campaigns must be provided

Project Calculation explained...

$$\text{Emission Reduction} = (\text{Emissions}_{\text{Baseline}} - \text{Emissions}_{\text{Project}})$$

$$\text{Emissions}_{\text{Baseline}} = \text{Emissions Factor}_{\text{Baseline}} * \text{NAP} * \text{GWP}_{\text{N}_2\text{O}}$$

$$\text{Emissions}_{\text{Project}} = \text{Emissions Factor}_{\text{Project}} * \text{NAP} * \text{GWP}_{\text{N}_2\text{O}}$$

- $\text{Emissions}_{\text{Project}}$ = the sum of the GHG emissions under the project condition (tCO₂e)
- $\text{Emissions Factor}_{\text{Project}}$ = calculated emissions factor under the project conditions (tN₂O/tHNO₃)
- NAP = Nitric acid production for the baseline campaign (tHNO₃)
- $\text{GWP}_{\text{N}_2\text{O}}$ = Global Warming Potential of N₂O (tCO₂e/tN₂O)
- Note: For this protocol each project campaign stands on its own, the protocol does not prescribe the use of a moving average emission factor

Questions?

