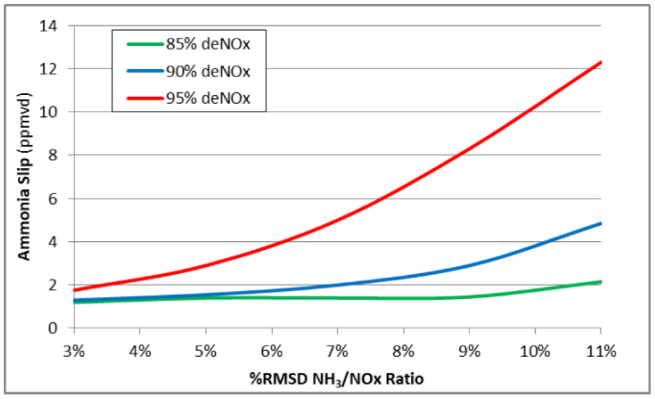
SCR NOx Reduction Capability Assessment



Example of effect of NH3/NOx RMS on ammonia slip for three different deNOx levels

- Application of EPRI CatReact™ software using a modified process control approach will enable a cost/benefit analysis of CSAPR Group 3 trading allowances (where prices over $20,000 per ton have been encountered)
- Participants will be able to assess maximum SCR NOx reduction capabilities at a target NH3 slip level
- Fleetwide assessment will enable comparison of achievable ozone season NOx mass emissions relative to Federal Implementation Plans (FIP) NOx allocation

Background, Objectives, and New Learnings

Utilities are taking action to comply with the latest of five EPA interstate transport Good Neighbor Federal Implementation Plans (FIP) issued since 1998:

- 2003 NOx Budget Trading Program
- 2009 Clean Air Interstate Rule (CAIR)
- 2015 Cross-State Air Pollution Rule (CSAPR)
- 2017 CSAPR Update Rule
- 2021 Revised CSAPR Update Rule

The recently revised CSAPR Update Rule created a new CSAPR "Group 3" ozone season trading program that has been expanded to 25 states in 2023. Individual state NOx budgets and allocations are based on optimized use of existing controls, with further reductions in 2024 based on combustion controls, and 2026 NOx budgets based on SCR installation on all large coal-fired boilers.

With limited liquidity in the allowance market, Group 3 facilities are currently encountering NOx allowance prices in excess of $20,000 per ton, with Group 2 allowances over $2,000 per ton. As many SCR facilities were designed for NOx reduction capabilities ranging from 80-90%, there is potential opportunity to operate SCR systems at higher NOx reduction levels to meet ozone season tonnage NOx emission limits. As shown in the above figure, at a given NH_3/NOx distribution (i.e., RMS), increased NOx reductions can be achieved with a tradeoff of increased ammonia slip. By adopting a revised SCR process control approach that controls the ammonia injection flow rate based on a target ammonia slip, as opposed to a target NOx reduction, SCR systems can potentially provide increased NOx reductions during the ozone season.

Prior EPRI research (*Advanced Concepts for New Unit SCR Systems,* 1020387) documented a SCR process control approach that achieved NOx reduction levels greater than 94% while maintaining ammonia slip levels at, or below, 2 ppm. A central question is how to determine SCR NOx reduction potential for a given SCR reactor potential over the load range while limiting ammonia slip to target levels.

The objective of the current project is to apply EPRI's CatReact™ software in combination with participant site-specific coal-fired unit and SCR data to calculate maximum achievable NOx reductions at a defined maximum acceptable ammonia slip level based on site-specific SCR catalyst activity and NH_3/NOx distribution levels. New learnings that arise from this project are intended to improve understanding of potential increased SCR NOx reduction capability that can be achieved during ozone season operation via application of a revised SCR process control approach.

Benefits

Completion of the project scope is intended to provide the necessary data for project funders to better understand maximum achievable SCR NOx reduction levels with current SCR operating conditions over the load range. Project performance will enable a NOx mass emission profile versus

load curve to be generated. Integration of data over multiple sites will enable a system-wide assessment of ozone season NOx mass emissions relative to utility specific NOx allocations.

Project Approach and Summary

The EPRI project team will work with each participant SCR site to define current unit full load operating conditions and SCR operating performance, as well as required inputs to run CatReact™ SCR performance assessment software. SCR performance will be evaluated over a range of conditions for individual units, which may include SCR inlet NOx, SCR inlet NH_3 / NOx RMS distributions, as well as different target ammonia slip levels. The analyses will be conducted at up to three loads. This will enable an estimate of NOx emission levels across the load range at different ammonia slip levels, such that the impact of ammonia slip on NOx reduction can be quantified.

Deliverables

Each project host site will be invited to participate in a webcast to review CatReact™ results and to address questions related to the analysis. Project results will be summarized in a letter report, documenting unit and SCR operating conditions used in the analysis, as well as SCR NOx reduction results obtained over a range of operating conditions to enable an estimate of incremental tonnage NOx reduction benefits associated with implementation of the proposed modified SCR process control approach.

Price of Project

The project cost to conduct unit-specific incremental NOx calculations as a function of ammonia slip for a specified catalyst activity is estimated at $15,000 for each SCR unit analyzed. The project qualifies for Self-Directed Funding (SDF) and Tailored Collaboration (TC).

Project Status and Schedule

Following receipt of required SCR performance data, the assessment of site-specific SCR NOx reduction capabilities as a function of ammonia slip will be completed within three months.

Who Should Join

Utilities in need of incremental ozone season NOx reductions for compliance with state NOx tonnage allowances in response to the Good Neighbor Plan that is scheduled to be implemented in 2023.

Contact Information

For more information, contact the EPRI Customer Assistance Center at 800.313.3774 (askepri@epri.com).

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Product ID: 3002025947 Project ID: 1-117561 December 2022

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