BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

In the Matter of:	)	
	)	
AMENDMENTS TO 35 ILL. ADM. CODE PARTS 201, 202, AND 212	)	R23-018(A) (Rulemaking – Air)
	)	

NOTICE OF FILING

To: Attached Service List

PLEASE TAKE NOTICE that today I have electronically filed with the Office of the Clerk of the Illinois Pollution Control Board **EAST DUBUQUE NITROGEN FERTILIZERS, LLC'S SUPPLEMENTAL RESPONSE TO ILLINOIS EPA'S COMMENT** and a **CERTIFICATE OF SERVICE,** which are attached and copies of which are herewith served upon you.

Dated: March 15, 2024

Respectfully submitted,

/s/ John M. Heyde
East Dubuque Nitrogen Fertilizers, LLC
By One of Its Attorneys

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BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

In the Matter of:	)	
AMENDMENTS TO 35 ILL. ADM. CODE PARTS 201, 202, AND 212	)	R23-018(A) (Rulemaking – Air)

EAST DUBUQUE NITROGEN FERTILIZERS, LLC'S SUPPLEMENTAL RESPONSE TO ILLINOIS EPA'S COMMENT

East Dubuque Nitrogen Fertilizers, LLC ("EDNF") respectfully submits this supplemental response to those portions of the comment filed by the Illinois Environmental Protection Agency ("Illinois EPA") on October 23, 2023 that relate to EDNF, consistent with the Hearing Officer's March 6, 2024 order.

EDNF filed its proposal in this rulemaking proceeding on August 7, 2023. The Illinois Pollution Control Board (the "Board") held a first hearing in this proceeding on September 27, 2023, at which EDNF appeared and presented testimony in support of its proposal. After that hearing, Illinois EPA filed a comment in the docket for this proceeding, identifying additional information that it said would be appropriate for EDNF and the other rulemaking proponents in the proceeding to provide.

EDNF responded to a portion of Illinois EPA's comment in its First Post-Hearing Comment, filed in this docket on October 26, 2023. On November 1, 2023, the Board held a second hearing, during which the Hearing Officer requested that rulemaking proponents provide initial responses to Illinois EPA's comment by December 1, 2023. Consistent with that request, EDNF filed an initial response on December 1. This filing completes EDNF's response to Illinois EPA's comment and documents that EDNF has provided Illinois EPA with all the information it requested.

In addition, on March 11, 2024, Illinois EPA sent EDNF a proposed revision to the rule language in EDNF's proposal. EDNF has reviewed the Agency's proposed revision and has no objection to it. This filing describes Illinois EPA's revision and presents the text as Exhibit 1.

The Requested Information

Illinois EPA's comment requested the following information regarding EDNF's proposal: (a) continuous emission monitoring system ("CEMS") data for NOx on an hourly basis in pounds per ton of acid produced for a five-year period[1]; (b) the date and duration of each startup and shutdown period over the same time period; (c) air dispersion modeling of a "worst-case" emission scenario; (d) confirmation that there is not a particulate matter element to opacity readings during startup and shutdown; and (3) a discussion of the justification for proposing a standard of 1.5 pounds per ton (the level EDNF has proposed) rather than a more stringent standard.

EDNF has responded to all of Illinois EPA's requests, as follows:

CEMS Data

On January 28, 2024, EDNF provided hourly NOx emissions, in pounds per ton of acid produced, for calendar years 2021 to 2023, fulfilling the Agency's revised request for a three-year time period. The data were provided separately for EDNF's two nitric acid plants (known as "NAP-1" and "NAP-2"). For each plant, EDNF provided a spreadsheet with 26,280 rows of data.

[1] Illinois EPA later reduced the timeframe for this request to a three-year period.

These data are too voluminous to include in the docket for this proceeding. EDNF has received no follow-up questions from Illinois EPA.

Date and Duration of Startup and Shutdown Events

On January 28, 2024, EDNF provided the dates and duration of all startup and shutdown events, for calendar years 2021 to 2023, fulfilling the Agency's request. These data were also provided in a spreadsheet for each nitric acid plant. The same information is attached to this response as Exhibits 2 and 3. EDNF has received no follow-up questions from Illinois EPA.

Air Dispersion Modeling

As EDNF has indicated previously, air dispersion modeling is not appropriate for EDNF's proposal. EDNF does not propose to change its operations or increase emissions. Its proposal merely restores the regulatory treatment for nitric acid manufacturing startups that existed for decades until the Pollution Control Board revised the Illinois air regulations in Docket R23-18. That rulemaking was not undertaken in response to any concern about the air quality in any location near a nitric acid manufacturing plant; it was undertaken in response to a "SIP call" from the U.S. Environmental Protection Agency ("U.S. EPA"). U.S. EPA issued that SIP call under the mistaken belief that the federal Clean Air Act did not allow a state's State Implementation Plan ("SIP") to contain any limits that were not applicable at all times and under all operating scenarios. The U.S. Court of Appeals for the D.C. Circuit recently vacated U.S. EPA's SIP call, *Environmental Cmte. Of the Fla. Elec. Power Coordinating Group, Inc. v. EPA*, No. 15-1239 (D.C. Cir. March 1, 2024), meaning that, if the Board had not already enacted Illinois EPA's proposal in R23-18, it no longer would be required to do so. This provides another reason why air dispersion modeling is not needed.

Even before U.S. EPA's SIP call was vacated, U.S. EPA had made clear that a proposal such as EDNF's did not require air dispersion modeling for approval. As the Board pointed out prior to the first hearing, U.S. EPA last year approved Florida's SIP revision in response to the SIP call, including NOx limitations for nitric acid plants. Hearing Officer Order, R23-18(A) (Sep. 20, 2023) at 7. The Florida SIP revision is similar to EDNF's proposal here, in that both replace a limit of 3.0 pounds per ton of production with a lower numerical limit to be averaged over 30 days. EDNF First Post-Hearing Comment, R23-18(A) (Oct. 26, 2023) at 7-8. U.S. EPA approved Florida's revision based on a simple comparison of maximum allowable NOx emissions before and after the revision and without mentioning or discussing any air dispersion modeling to justify the revision. *Id.* Despite no reference to modeling, U.S. EPA concluded that Florida had "developed its new . . . limits in an appropriate way to ensure that the SIP is not relaxed and that increased emissions will not occur because of the SIP revision." *Id.* at 7, quoting 88 Fed. Reg. 51702, 51705 (Aug. 4, 2023).

Nonetheless, EDNF performed air dispersion modeling at Illinois EPA's request. EDNF performed modeling using AERMOD to investigate the potential impact of startup/shutdown emissions on achievement of the one-hour NO2 standard. (The annual standard is not at issue because EDNF's proposed rule tightens the NOx emission standard when averaged over time.) EDNF based its modeling on U.S. EPA guidance on the application of its "Appendix W" to the one-hour NOx standard, and EDNF used reasonable worst-case startup/shutdown emissions, over the 2021-23 timeframe for which Illinois EPA had requested data, as inputs. The resulting NO2 concentrations were below 5 percent of the National Ambient Air Quality Standard ("NAAQS") at all modeled receptors.

EDNF provided model input and output files to Illinois EPA on February 2, 2024. These files are too voluminous to include in the docket for this proceeding. EDNF has received no follow-up questions from Illinois EPA.

Particulate Matter Information

EDNF investigated the possibility of performing Method 5 emission testing to confirm that the opacity readings during startup and shutdown do not result from particulate matter emissions. EDNF concluded that Method 5 testing was not feasible. A Method 5 test conducted during normal operations would not be representative of startup and shutdown conditions. As a result, even if testing resulted in no detection of particulate matter, the test results would not address Illinois EPA's question. Startup and shutdown operations are also too intermittent and occur on short notice, making it impractical to plan to test during a startup or shutdown.

EDNF instead conducted a literature review and determined that no literature exists indicating or even suggesting that the opacity readings during startup and shutdown are due to particulate matter. Several U.S. EPA documents address the issue, explain that no evidence of particulate matter has been found, and explain why U.S. EPA used an opacity limit in the Subpart G NSPS rule. For example, the AP-42 background report for nitric acid production concludes that there is no evidence of particulate matter emissions: "[n]o data on emissions of . . . particulate matter were found nor expected in the nitric acid process." Pacific Envt'l Serv., Inc., Background Report, AP-42 Section 5.9, Nitric Acid, prepared for U.S. Environmental Protection Agency (Jan. 1996) at 25 (attached as Exhibit 4).

The Federal Register notices for the Subpart G and Ga NSPS rules also do not note any particulate matter in stack emissions from nitric acid plants. The Subpart Ga notices explain that opacity was included in the Subpart G rule solely because it was seen as a surrogate indicator of compliance with the NOx standard. 77 Fed. Reg. 48,433, 48,435 (Aug. 14, 2012). By the time EPA finalized Subpart Ga, it had concluded that the use of NOx CEMS made the opacity limit unnecessary. 76 Fed. Reg. 63,878, 63, 885 (Oct. 14, 2011). (Both Federal Register notices are already in the record as Exhibits 3 and 4 to EDNF's rulemaking petition.)

Finally, EPA's Alternative Control Techniques Document for nitric acid production explains the visible emissions as directly related to NO2 gas. U.S. EPA, Alternative Control Techniques Document – Nitric and Adipic Acid Manufacturing Plants, EPA-450/3-91-026 (Dec. 1991) at p. 4-5 ("A reddish-brown plume reveals the presence of NO2. Plume opacity is directly related to NO2 concentration and stack diameter.") (This document is already in the record as Exhibit 2 to EDNF's rulemaking petition.)

These documents are consistent with EDNF's previous filings, which indicate that opacity readings during startup and shutdown are the result of the NO2 gas itself – which is visible at the concentrations occurring during startup and shutdown – rather than particulate matter. This is why EDNF has proposed that 35 Ill. Adm. Code 217.381 apply during startup and shutdown in place of the general particulate matter opacity limit in Section 212.123.

EDNF has received no follow-up questions on the particulate matter information from Illinois EPA.

Derivation of the Proposed 1.5 Pound/Ton Limit

EDNF provided the information Illinois EPA requested on the derivation of the proposed 1.5 pound/ton limit and why it did not propose a lower limit in EDNF's First Post-Hearing Comment, filed in this docket on October 26, 2023. As EDNF explained in that post-hearing comment, in the spirit of cooperation, EDNF proposed, on its own initiative, to cut the general NOx limit for nitric acid plant production in half, averaged over 30 operating days and using an appropriate calculation method. Illinois EPA noted, in its comment, that annual emission rates at both nitric acid plants are below 1 pound/ton on an annual basis. However, EDNF is not proposing an annual average; it is proposing a 30-day operating period average. EDNF's first post-hearing comment explains further how the 1.5 pound/ton limit was derived.

Illinois EPA's Language Revision

Illinois EPA's proposed revision to EDNF's language makes no substantive changes to EDNF's proposal. The proposed revision does the following:

1. Illinois EPA has informed EDNF that, while it agrees that the provisions of Section 217.381(a) with respect to opacity should apply to nitric acid plants instead of the provisions of Section 212.123, it prefers to amend Part 212, rather than Part 217. Illinois EPA, therefore, deleted EDNF's proposed Section 217.381(a)(4) ("The limitations on visible emissions in this section are in lieu of the limitations in 35 Ill. Adm. Code 212.123"), and added a subsection (d) to Section 212.124 ("Section 212.123 shall not apply to emission units subject to 35 Ill. Adm. Code 217.381(a).").

2. The revision adds additional clarifying language to proposed Section 217.381(a)(1) and (a)(6).

3. The revision adds additional detail to the requirement, in Section 217.381(a)(3)(B), to maintain a log of startup and shutdown events.

4. The revision deletes the phrase "during all Operating Periods." (EDNF agrees that this phrase is superfluous.)

5. The revision adds introductory language to the definitions in Section 217.381(a)(6) – now numbered 217.381(a)(5) – to clarify that they apply "[f]or the purposes of this Section."

EDNF does not object to Illinois EPA's proposed language revision. EDNF presents the revised language as Exhibit 1. This exhibit includes the affected portion of Part 212 along with the affected portion of Part 217. In addition, the exhibit also reflects EDNF's proposed integration of language changes previously proposed by JCAR and Board staff.

Conclusion

EDNF has provided Illinois EPA with all the data and information that the Agency requested for its review of EDNF's rulemaking proposal. EDNF has also reviewed Illinois EPA's proposed language revision and has no objection to it. EDNF believes its proposal is ready for adoption and urges the Board to move forward with second notice and adoption of the proposal.

Dated: March 15, 2024

Respectfully submitted,

/s/ John M. Heyde
East Dubuque Nitrogen Fertilizers, LLC
By One of Its Attorneys

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CERTIFICATE OF SERVICE

I, the undersigned, on affirmation, state that I have served the attached **East Dubuque Nitrogen Fertilizers, LLC's Supplemental Response to Illinois EPA's Comment** by email on the following:

Illinois Pollution Control Board Don Brown - Clerk of the Board don.brown@illinois.gov 100 W. Randolph St., Suite 11-500 Chicago, IL 60601 Timothy Fox – Hearing Officer Tim.Fox@illinois.gov Chloe Salk – Hearing Officer Chloe.Salk@illinois.gov 60 E. Van Buren St., Suite 630 Chicago, IL 60605	**Office of the Attorney General** Jason E. James - Assistant Attorney General Jason.James@ilag.gov 201 West Point Drive, Suite 7 Belleville, IL 62226 Molly Kordas - Assistant Attorney General Molly.Kordas@ilag.gov Ann Marie A. Hanohano - Assistant Attorney General annmarie.hanohano@ilag.gov 69 West Washington Street, Suite 1800 Chicago, IL 60602
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I further state that my email address is as stated in the signature block below, that the number of pages in this email transmission is 79 and that the email transmission took place before 5 p.m. on March 15, 2024.

Dated: March 15, 2024

Respectfully submitted,

/s/ John M. Heyde
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EXHIBITS

Exhibit 1

TITLE 35: ENVIRONMENTAL PROTECTION
SUBTITLE B: AIR POLLUTION
CHAPTER I: POLLUTION CONTROL BOARD
SUBCHAPTER c: EMISSION STANDARDS AND LIMITATIONS FOR STATIONARY SOURCES

PART 212
VISIBLE AND PARTICULATE MATTER EMISSIONS

SUBPART A: GENERAL

SUBPART B: VISIBLE EMISSIONS

SUBPART D: PARTICULATE MATTER EMISSIONS FROM INCINERATORS

SUBPART E: PARTICULATE MATTER EMISSIONS FROM FUEL COMBUSTION EMISSION UNITS

SUBPART K: FUGITIVE PARTICULATE MATTER

Section

SUBPART L: PARTICULATE MATTER EMISSIONS FROM PROCESS EMISSION UNITS

Section

SUBPART N: FOOD MANUFACTURING

SUBPART O: PETROLEUM REFINING, PETROCHEMICAL AND CHEMICAL MANUFACTURING

SUBPART Q: STONE, CLAY, GLASS AND CONCRETE MANUFACTURING

SUBPART R: PRIMARY AND FABRICATED METAL PRODUCTS AND MACHINERY MANUFACTURE

SUBPART S: AGRICULTURE

SUBPART T: CONSTRUCTION AND WOOD PRODUCTS

SUBPART U: ADDITIONAL CONTROL MEASURES

AUTHORITY: Implementing Section 10 and authorized by Section 27 and 28.5 of the Environmental Protection Act [415 ILCS 5/10, 27 and 28.5].

SOURCE: Adopted as Chapter 2: Air Pollution, Rules 202 and 203: Visual and Particulate Emission Standards and Limitations, R71-23, 4 PCB 191, filed and effective April 14, 1972; amended in R77-15, 32 PCB 403, at 3 Ill. Reg. 5, p. 798, effective February 3, 1979; amended in R78-10, 35 PCB 347, at 3 Ill. Reg. 39, p. 184, effective September 28, 1979; amended in R78-11, 35 PCB 505, at 3 Ill. Reg. 45, p. 100, effective October 26, 1979; amended in R78-9, 38 PCB 411, at 4 Ill. Reg. 24, p. 514, effective June 4, 1980; amended in R79-11, 43 PCB 481, at 5 Ill. Reg. 11590, effective October 19, 1981; codified at 7 Ill. Reg. 13591; amended in R82-1 (Docket A), at 10 Ill. Reg. 12637, effective July 9, 1986; amended in R85-33 at 10 Ill. Reg. 18030, effective October 7, 1986; amended in R84-48 at 11 Ill. Reg. 691, effective December 18, 1986; amended in R84-42 at 11 Ill. Reg. 1410, effective December 30, 1986; amended in R82-1 (Docket B) at 12 Ill. Reg. 12492, effective July 13, 1988; amended in R91-6 at 15 Ill. Reg. 15708, effective October 4, 1991; amended in R89-7(B) at 15 Ill. Reg. 17710, effective November 26, 1991; amended in R91-22 at 16 Ill. Reg. 7880, effective May 11, 1992; amended in R91-35 at 16 Ill. Reg. 8204, effective May 15, 1992; amended in R93-30 at 18 Ill. Reg. 11587, effective July 11, 1994; amended in R96-5 at 20 Ill. Reg.7605, effective May 22, 1996; amended in R23-18 at 47 Ill. Reg. 12107, effective July 25, 2023.

BOARD NOTE: This Part implements the Illinois Environmental Protection Act as of July 1, 1994.

SUBPART B: VISIBLE EMISSIONS

Section 212.124 Exceptions

a) Sections 212.122 and 212.123 will not apply to emissions of water or water vapor from an emission unit.

b) An emission unit that has obtained an adjusted opacity standard in compliance with Section 212.126 will be subject to that standard rather than the limitations of Section 212.122 or 212.123.

c) Compliance with the particulate regulations of this Part will constitute a defense.

1) For all emission units that are not subject to Chapters 111 or 112 of the CAA and Sections 212.201, 212.202, 212.203 or 212.204 but are subject to Sections 212.122 or 212.123: the opacity limitations of Sections 212.122 and 212.123 will not apply if it is shown that the emission unit was, at the time of emission, in compliance with the applicable particulate emissions limitations of Subparts D through T.

2) For all emission units that are not subject to Chapters 111 or 112 of the CAA but are subject to Sections 212.201, 212.202, 212.203 or 212.204:

A) An exceedance of the limitations of Section 212.122 or 212.123 will constitute a violation of the applicable particulate limitations of Subparts D through T. It will be a defense to a violation of the applicable particulate limitations if, during a subsequent performance test conducted within a reasonable time not to exceed 60 days, under the same operating conditions for the unit and the control devices, and in accordance with Method 5, 40 CFR 60, incorporated by reference in Section 212.113, the owner or operator shows that the emission unit is in compliance with the particulate emission limitations.

B) It will be a defense to an exceedance of the opacity limit if, during a subsequent performance test conducted within a reasonable time not to exceed 60 days, under the same operating conditions of the emission unit and the control devices, and in accordance with Method 5, 40 CFR part 60, Appendix A, incorporated by reference in Section 212.113, the owner or operator shows that the emission unit is in compliance with the allowable particulate emissions limitation while, simultaneously, having visible emissions equal to or greater than the opacity exceedance as originally observed.

d) Section 212.123 shall not apply to emission units subject to 35 Ill. Adm. Code 217.381(a).

(Source: Amended at _____ Ill. Reg. ______, effective___________)

TITLE 35: ENVIRONMENTAL PROTECTION
SUBTITLE B: AIR POLLUTION
CHAPTER I: POLLUTION CONTROL BOARD
SUBCHAPTER ~~C~~c: EMISSION STANDARDS AND LIMITATIONS FOR STATIONARY SOURCES

PART 217
NITROGEN OXIDES EMISSIONS
SUBPART A: GENERAL PROVISIONS

Section

SUBPART B: NEW FUEL COMBUSTION EMISSION SOURCES

Section

SUBPART C: EXISTING FUEL COMBUSTION EMISSION UNITS

Section

SUBPART D: NOx GENERAL REQUIREMENTS

Section

SUBPART E: INDUSTRIAL BOILERS

Section

SUBPART F: PROCESS HEATERS

Section
217.180 Applicability
217.182 Exemptions
217.184 Emissions Limitations
217.185 Combination of Fuels
217.186 Methods and Procedures for Combustion Tuning

SUBPART G: GLASS MELTING FURNACES

Section
217.200 Applicability
217.202 Exemptions
217.204 Emissions Limitations

SUBPART H: CEMENT AND LIME KILNS

Section
217.220 Applicability
217.222 Exemptions
217.224 Emissions Limitations

SUBPART I: IRON AND STEEL AND ALUMINUM MANUFACTURING

Section
217.240 Applicability
217.242 Exemptions
217.244 Emissions Limitations

SUBPART K: PROCESS EMISSION SOURCES

Section
217.301 Industrial Processes

SUBPART M: ELECTRICAL GENERATING UNITS

Section
217.340 Applicability
217.342 Exemptions
217.344 Emissions Limitations
217.345 Combination of Fuels

SUBPART O: CHEMICAL MANUFACTURE

Section
217.381 Nitric Acid Manufacturing Processes

SUBPART Q: STATIONARY RECIPROCATING
INTERNAL COMBUSTION ENGINES AND TURBINES

Section

SUBPART T: CEMENT KILNS

Section

SUBPART U: NOx CONTROL AND TRADING PROGRAM FOR
SPECIFIED NOx GENERATING UNITS

Section

SUBPART V: ELECTRIC POWER GENERATION

SUBPART W: NOx TRADING PROGRAM FOR
ELECTRICAL GENERATING UNITS

SUBPART X: VOLUNTARY NOx EMISSIONS REDUCTION PROGRAM

~~Authority~~AUTHORITY: Implementing Sections 9.9 and 10 and authorized by Sections 27 and 28.5 of the Environmental Protection Act [415 ILCS 5/9.9, 10, 27 and 28.5 (2004)].

~~Source~~SOURCE: Adopted as Chapter 2: Air Pollution, Rule 207: Nitrogen Oxides Emissions, R71-23, 4 PCB 191, April 13, 1972, filed and effective April 14, 1972; amended at 2 Ill. Reg. 17, p. 101, effective April 13, 1978; codified at 7 Ill. Reg. 13609; amended in R01-9 at 25 Ill. Reg. 128, effective December 26, 2000; amended in R01-11 at 25 Ill. Reg. 4597, effective March 15, 2001; amended in R01-16 and R01-17 at 25 Ill. Reg. 5914, effective April 17, 2001; amended in R07-18 at 31 Ill. Reg. ~~14254~~14271, effective September 25, 2007; amended in R07-19 at 33 Ill. Reg. 11999, effective August 6, 2009; amended in R08-19 at 33 Ill. Reg. 13345, effective August 31, 2009; amended in R09-20 at 33 Ill. Reg. 15754, effective November 2, 2009; amended in R11-17 at 35 Ill. Reg. 7391, effective April 22, 2011; amended in R11-24 at 35 Ill. Reg. 14627, effective August 22, 2011; amended in R11-08 at 35 Ill. Reg. 16600, effective September 27, 2011; amended in R09-19 at 35 Ill. Reg. 18801, effective October 25, 2011; amended in R15-21 at 39 Ill. Reg. 16213, effective December 7, 2015; amended in R 23-18(A), at 47 Ill. Reg. , effective .

SUBPART O: CHEMICAL MANUFACTURE

Section 217.381 Nitric Acid Manufacturing Processes

a) New Weak Nitric Acid Processes. ~~No~~A person ~~shall~~must not cause or allow the emission of nitrogen oxides into the atmosphere from any new weak nitric acid manufacturing process to exceed the following standards and limitations:

1) 0.75 ~~1.5~~ kg of nitrogen oxides (expressed as nitrogen dioxide) per metric tonne of acid produced (100 percent acid basis) (1.5 ~~3.0~~ lbs/T), on a 30-day rolling average~~, rolled daily, during all~~ basis, calculated from the quantity of NOx emitted per quantity of acid produced (100 percent acid basis) for each operating hour within the prior 30 operating days, and the average of those hourly values over the 30-day Operating ~~Periods (including during Startup and Shutdown);~~Period;

2) Visible emissions in excess of 5 percent opacity, ~~during all Operating Periods~~ except during Startup and Shutdown;

3) During Startup and Shutdown, as defined in subsection (e~~) below,~~), visible emissions ~~shall~~must be controlled through:

A) Operating in a manner consistent with good air pollution control practices for minimizing emissions;

B) Maintaining a log of Startup and Shutdown events, including the dates, times, and durations of those events, quantity of acid produced during those events (lb/hr), and NOx emissions during those events (lb/hr). These records shall be submitted to the Agency upon request; and

C) Operating ~~in accordance with~~according to written Startup and Shutdown procedures that are specifically developed to minimize Startup and Shutdown emissions, duration of individual ~~starts~~Startups and Shutdowns, and frequency of Startups and Shutdowns.

~~4) The limitations on visible emissions in this section are in lieu of the limitations in 35 Ill. Admin. Code 212.123.~~

~~5~~3~~4~~) 0.05 kg of nitrogen oxides (expressed as nitrogen dioxide) per metric tonne of acid produced (100 percent acid basis) from any acid storage tank vents (0.1 lbs/T).

~~6~~5) In determining compliance with ~~paragraph~~subsection (a)(1), during process operating periods where there is little or no acid production (e.g., Startup or Shutdown), the average hourly acid production rate ~~shall~~must be determined from the data collected over the previous 30 days of normal acid production periods. For any hour in which subsection 217.381(a)(5) is utilized for compliance calculations, the owner or operator must maintain records of the quantity of acid produced within that hour.

~~b) Existing Weak Nitric Acid Processes. No person shall cause or allow the emission of nitrogen oxides into the atmosphere from any existing weak nitric acid manufacturing process to exceed the following standards and limitations:~~

~~1) 2.75 kg of nitrogen oxides (expressed as nitrogen dioxide) per metric tonne of acid produced (100 percent acid basis) (5.5 lbs/T);~~

~~2) Visible emissions in excess of 5 percent opacity;~~

~~3) 0.1 kg of nitrogen oxides (expressed as nitrogen dioxide) per metric tonne of acid produced (100 percent acid basis) from any acid storage tank vents (0.2 lbs/T).~~

c) Concentrated Nitric Acid Processes. No person shall cause or allow the emission of nitrogen oxides into the atmosphere from any concentrated nitric acid manufacturing process to exceed the following standards and limitations:

1) 1.5 kg of nitrogen oxides (expressed as nitrogen dioxide) per metric tonne of acid produced (100 percent acid basis)(3.0 lbs/T);

2) 225 ppm of nitrogen oxides (expressed as nitrogen dioxide) in any effluent gas stream emitted into the atmosphere;

3) Visible emissions in excess of 5 percent opacity.

d) Nitric Acid Concentrating Processes. No person shall cause or allow the emission of nitrogen oxides into the atmosphere from any nitric acid concentrating process to exceed the following limitations:

1) 1.5 kg of nitrogen oxides (expressed as nitrogen dioxide) per metric tonne of acid produced (100 percent acid basis) (3.0 lbs/T);

2) Visible emissions in excess of 5 percent opacity.

e) Definitions:

………………………………………………………..

e) Definitions. For the purposes of this Section, the following definitions apply:

1) "Operating Periods" shall mean periods during which a process is producing nitric acid and nitrogen oxides are emitted. Operating Periods begin at the initiation of Startup, end at the completion of Shutdown, and include all periods of malfunctionMalfunction.

2) "Shutdown" shall meanmeans the cessation of nitric acid production operations of the process for any reason. Shutdown begins at the time the feed of ammonia to the process ceases and ends the earlier of three hours later or the cessation of feed of compressed air to the process.

3) "Startup" shall meanmeans the process of initiating nitric acid production operations at a process. Startup begins one hour prior to the initiation of the feed of ammonia to the process and ends no more than five hours after such initiation of the feed of ammonia.

(Source: Amended at Ill. Reg. , effective____________).

Exhibit 2

Startup & Shutdown Events
Period: January 1, 2021 - December 31, 2023
#1 Nitric Acid Plant
East Dubuque Nitrogen Fertilizers, LLC, East Dubuque, IL

Date	Process	Startup/Shutdown	Duration (hr)
1/28/2021	NAP-1	Shutdown	1.30
1/30/2021	NAP-1	Startup	1.03
1/30/2021	NAP-1	Shutdown	0.47
1/31/2021	NAP-1	Startup	0.88
2/12/2021	NAP-1	Shutdown	2.57
4/1/2021	NAP-1	Startup	1.90
4/21/2021	NAP-1	Shutdown	0.08
4/21/2021	NAP-1	Startup	1.38
4/24/2021	NAP-1	Shutdown	0.08
4/24/2021	NAP-1	Startup	1.90
8/10/2021	NAP-1	Shutdown	1.20
8/12/2021	NAP-1	Startup	1.27
8/12/2021	NAP-1	Shutdown	0.42
8/12/2021	NAP-1	Startup	0.27
8/12/2021	NAP-1	Shutdown	0.37
8/12/2021	NAP-1	Startup	0.88
8/22/2021	NAP-1	Shutdown	2.73
8/23/2021	NAP-1	Startup	1.80
8/29/2021	NAP-1	Shutdown	3.93
8/31/2021	NAP-1	Startup	1.95
9/6/2021	NAP-1	Shutdown	2.70
9/9/2021	NAP-1	Startup	2.08
9/13/2021	NAP-1	Shutdown	0.68
9/13/2021	NAP-1	Startup	1.50
9/15/2021	NAP-1	Shutdown	1.02
9/16/2021	NAP-1	Startup	1.70
9/16/2021	NAP-1	Shutdown	0.93
9/16/2021	NAP-1	Startup	1.70
9/17/2021	NAP-1	Shutdown	1.47
9/17/2021	NAP-1	Startup	1.78
9/20/2021	NAP-1	Shutdown	0.08
9/23/2021	NAP-1	Startup	1.12
9/23/2021	NAP-1	Shutdown	0.62
9/23/2021	NAP-1	Startup	1.10
9/23/2021	NAP-1	Shutdown	0.78
9/24/2021	NAP-1	Startup	1.12

9/24/2021	NAP-1	Shutdown	1.65
9/24/2021	NAP-1	Startup	0.72
10/8/2021	NAP-1	Shutdown	0.80
10/8/2021	NAP-1	Startup	0.45
10/20/2021	NAP-1	Shutdown	1.08
10/31/2021	NAP-1	Startup	1.97
11/21/2021	NAP-1	Shutdown	0.05
12/11/2021	NAP-1	Startup	1.35
12/11/2021	NAP-1	Shutdown	0.58
12/11/2021	NAP-1	Startup	0.43
12/23/2021	NAP-1	Shutdown	2.25
12/23/2021	NAP-1	Startup	2.55
12/27/2021	NAP-1	Shutdown	1.82
12/29/2021	NAP-1	Startup	1.02
12/29/2021	NAP-1	Shutdown	0.22
12/29/2021	NAP-1	Startup	0.00
12/29/2021	NAP-1	Shutdown	2.68
12/29/2021	NAP-1	Startup	0.02
12/29/2021	NAP-1	Shutdown	0.28
12/29/2021	NAP-1	Startup	0.12
12/29/2021	NAP-1	Shutdown	2.90
12/29/2021	NAP-1	Startup	1.02
12/29/2021	NAP-1	Shutdown	0.65
12/29/2021	NAP-1	Startup	0.00
12/29/2021	NAP-1	Shutdown	2.32
12/29/2021	NAP-1	Startup	1.00
12/29/2021	NAP-1	Shutdown	4.52
12/30/2021	NAP-1	Startup	1.65
1/22/2022	NAP-1	Shutdown	4.12
1/27/2022	NAP-1	Startup	1.37
1/27/2022	NAP-1	Shutdown	1.37
1/27/2022	NAP-1	Startup	0.82
1/29/2022	NAP-1	Shutdown	1.07
1/29/2022	NAP-1	Startup	1.07
1/29/2022	NAP-1	Shutdown	0.38
1/29/2022	NAP-1	Startup	0.63
1/31/2022	NAP-1	Shutdown	1.12
2/1/2022	NAP-1	Startup	2.05
2/21/2022	NAP-1	Shutdown	1.13
3/3/2022	NAP-1	Startup	1.57
3/4/2022	NAP-1	Shutdown	3.15
3/7/2022	NAP-1	Startup	2.82
3/9/2022	NAP-1	Shutdown	1.88
3/30/2022	NAP-1	Startup	1.92
4/2/2022	NAP-1	Shutdown	4.88
4/6/2022	NAP-1	Startup	1.68
4/9/2022	NAP-1	Shutdown	1.72

4/11/2022	NAP-1	Startup	1.28
4/11/2022	NAP-1	Shutdown	0.58
4/11/2022	NAP-1	Startup	0.40
5/2/2022	NAP-1	Shutdown	1.65
5/6/2022	NAP-1	Startup	2.33
5/21/2022	NAP-1	Shutdown	0.50
5/21/2022	NAP-1	Startup	0.02
5/21/2022	NAP-1	Shutdown	0.15
5/21/2022	NAP-1	Startup	0.02
5/21/2022	NAP-1	Shutdown	0.03
5/21/2022	NAP-1	Startup	0.08
5/21/2022	NAP-1	Shutdown	1.98
5/21/2022	NAP-1	Startup	1.53
6/4/2022	NAP-1	Shutdown	0.52
6/4/2022	NAP-1	Startup	0.42
6/6/2022	NAP-1	Shutdown	0.52
6/6/2022	NAP-1	Startup	0.02
6/6/2022	NAP-1	Shutdown	0.07
6/6/2022	NAP-1	Startup	0.55
6/10/2022	NAP-1	Shutdown	1.38
6/10/2022	NAP-1	Startup	0.47
6/19/2022	NAP-1	Shutdown	0.43
6/19/2022	NAP-1	Startup	0.12
6/19/2022	NAP-1	Shutdown	0.12
6/19/2022	NAP-1	Startup	0.13
6/22/2022	NAP-1	Shutdown	0.23
6/22/2022	NAP-1	Startup	0.97
6/22/2022	NAP-1	Shutdown	2.27
6/22/2022	NAP-1	Startup	1.02
6/24/2022	NAP-1	Shutdown	1.68
6/24/2022	NAP-1	Startup	1.08
6/24/2022	NAP-1	Shutdown	0.28
6/24/2022	NAP-1	Startup	0.58
7/1/2022	NAP-1	Shutdown	0.07
7/1/2022	NAP-1	Startup	2.00
7/2/2022	NAP-1	Shutdown	1.10
7/2/2022	NAP-1	Startup	1.08
7/2/2022	NAP-1	Shutdown	0.27
7/2/2022	NAP-1	Startup	0.77
7/11/2022	NAP-1	Shutdown	5.47
7/12/2022	NAP-1	Startup	1.98
7/23/2022	NAP-1	Shutdown	0.05
7/23/2022	NAP-1	Startup	2.15
7/26/2022	NAP-1	Shutdown	1.08
7/27/2022	NAP-1	Startup	1.55
8/13/2022	NAP-1	Shutdown	2.80
9/23/2022	NAP-1	Startup	1.67

9/27/2022	NAP-1	Shutdown	1.58
9/28/2022	NAP-1	Startup	2.53
9/28/2022	NAP-1	Shutdown	3.48
9/29/2022	NAP-1	Startup	2.15
10/1/2022	NAP-1	Shutdown	1.58
10/3/2022	NAP-1	Startup	1.60
10/18/2022	NAP-1	Shutdown	0.08
10/18/2022	NAP-1	Startup	1.35
10/26/2022	NAP-1	Shutdown	1.40
10/28/2022	NAP-1	Startup	1.88
12/1/2022	NAP-1	Shutdown	1.83
12/2/2022	NAP-1	Startup	1.02
12/2/2022	NAP-1	Shutdown	2.10
12/7/2022	NAP-1	Startup	1.17
12/7/2022	NAP-1	Shutdown	0.32
12/7/2022	NAP-1	Startup	0.97
12/9/2022	NAP-1	Shutdown	0.40
12/9/2022	NAP-1	Startup	0.40
12/21/2022	NAP-1	Shutdown	0.08
12/22/2022	NAP-1	Startup	1.03
12/22/2022	NAP-1	Shutdown	2.72
12/22/2022	NAP-1	Startup	0.02
12/22/2022	NAP-1	Shutdown	1.83
12/22/2022	NAP-1	Startup	0.05
12/22/2022	NAP-1	Shutdown	0.27
12/22/2022	NAP-1	Startup	0.12
12/22/2022	NAP-1	Shutdown	2.17
12/22/2022	NAP-1	Startup	2.53
1/1/2023	NAP-1	Shutdown	1.48
1/1/2023	NAP-1	Startup	0.10
1/1/2023	NAP-1	Shutdown	0.13
1/1/2023	NAP-1	Startup	0.00
1/1/2023	NAP-1	Shutdown	0.12
1/1/2023	NAP-1	Startup	0.02
1/1/2023	NAP-1	Shutdown	0.98
1/1/2023	NAP-1	Startup	1.53
1/20/2023	NAP-1	Shutdown	2.28
1/20/2023	NAP-1	Startup	1.80
1/27/2023	NAP-1	Shutdown	0.37
1/27/2023	NAP-1	Startup	0.30
2/2/2023	NAP-1	Shutdown	0.97
2/2/2023	NAP-1	Startup	1.45
2/6/2023	NAP-1	Shutdown	3.87
2/8/2023	NAP-1	Startup	2.60
3/8/2023	NAP-1	Shutdown	1.95
3/8/2023	NAP-1	Startup	1.03
3/8/2023	NAP-1	Shutdown	1.18

3/9/2023	NAP-1	Startup	1.08
3/9/2023	NAP-1	Shutdown	0.15
3/9/2023	NAP-1	Startup	0.43
3/9/2023	NAP-1	Shutdown	0.33
3/9/2023	NAP-1	Startup	0.47
3/9/2023	NAP-1	Shutdown	1.25
3/9/2023	NAP-1	Startup	0.53
4/3/2023	NAP-1	Shutdown	1.35
4/3/2023	NAP-1	Startup	2.85
4/21/2023	NAP-1	Shutdown	2.65
4/23/2023	NAP-1	Startup	3.33
4/24/2023	NAP-1	Shutdown	1.68
4/24/2023	NAP-1	Startup	1.73
6/19/2023	NAP-1	Shutdown	3.00
6/20/2023	NAP-1	Startup	1.68
6/24/2023	NAP-1	Shutdown	0.12
6/25/2023	NAP-1	Startup	2.62
7/11/2023	NAP-1	Shutdown	0.92
7/13/2023	NAP-1	Startup	1.97
7/28/2023	NAP-1	Shutdown	2.05
7/30/2023	NAP-1	Startup	1.82
9/27/2023	NAP-1	Shutdown	2.15
10/15/2023	NAP-1	Startup	2.20
11/1/2023	NAP-1	Shutdown	1.80
11/2/2023	NAP-1	Startup	1.30
11/2/2023	NAP-1	Shutdown	0.25
11/2/2023	NAP-1	Startup	1.07
11/11/2023	NAP-1	Shutdown	2.68
11/16/2023	NAP-1	Startup	2.12

Exhibit 3

Startup & Shutdown Events
Period: January 1, 2021 -December 31, 2023
#2 Nitric Acid Plant
East Dubuque Nitrogen Fertilizers, LLC, East Dubuque, IL

Date	Process	Startup/Shutdown	Duration (hr)
1/29/2021	NAP-2	Shutdown	2.47
1/29/2021	NAP-2	Startup	1.62
2/15/2021	NAP-2	Shutdown	2.97
2/16/2021	NAP-2	Startup	3.35
2/20/2021	NAP-2	Shutdown	0.78
2/23/2021	NAP-2	Startup	1.58
3/13/2021	NAP-2	Shutdown	3.08
3/13/2021	NAP-2	Startup	1.88
3/13/2021	NAP-2	Shutdown	1.27
3/13/2021	NAP-2	Startup	0.48
3/25/2021	NAP-2	Shutdown	1.55
3/25/2021	NAP-2	Startup	2.80
3/28/2021	NAP-2	Shutdown	2.10
4/6/2021	NAP-2	Startup	2.62
4/6/2021	NAP-2	Shutdown	2.75
4/7/2021	NAP-2	Startup	4.05
4/26/2021	NAP-2	Shutdown	2.02
4/26/2021	NAP-2	Startup	1.67
7/6/2021	NAP-2	Shutdown	0.07
7/6/2021	NAP-2	Startup	1.23
7/6/2021	NAP-2	Shutdown	0.18
7/6/2021	NAP-2	Startup	0.12
7/6/2021	NAP-2	Shutdown	0.08
7/7/2021	NAP-2	Startup	1.50
8/4/2021	NAP-2	Shutdown	1.08
8/5/2021	NAP-2	Startup	2.12
8/6/2021	NAP-2	Shutdown	1.73
8/6/2021	NAP-2	Startup	3.03
8/11/2021	NAP-2	Shutdown	2.42
8/11/2021	NAP-2	Startup	0.38
8/11/2021	NAP-2	Shutdown	0.68
8/11/2021	NAP-2	Startup	0.60
8/13/2021	NAP-2	Shutdown	1.42
8/13/2021	NAP-2	Startup	1.33
8/13/2021	NAP-2	Shutdown	2.85
8/13/2021	NAP-2	Startup	1.67
8/17/2021	NAP-2	Shutdown	1.03

8/17/2021	NAP-2	Startup	1.75
8/19/2021	NAP-2	Shutdown	1.42
8/19/2021	NAP-2	Startup	1.82
8/20/2021	NAP-2	Shutdown	1.08
8/20/2021	NAP-2	Startup	1.43
8/21/2021	NAP-2	Shutdown	1.88
8/21/2021	NAP-2	Startup	1.13
8/22/2021	NAP-2	Shutdown	1.38
8/22/2021	NAP-2	Startup	0.17
8/22/2021	NAP-2	Shutdown	0.27
8/22/2021	NAP-2	Startup	2.80
8/23/2021	NAP-2	Shutdown	1.90
8/23/2021	NAP-2	Startup	0.42
8/28/2021	NAP-2	Shutdown	0.38
8/28/2021	NAP-2	Startup	0.67
8/31/2021	NAP-2	Shutdown	1.68
8/31/2021	NAP-2	Startup	0.97
9/1/2021	NAP-2	Shutdown	1.37
9/1/2021	NAP-2	Startup	1.43
9/11/2021	NAP-2	Shutdown	0.12
9/11/2021	NAP-2	Startup	2.02
9/20/2021	NAP-2	Shutdown	0.08
9/21/2021	NAP-2	Startup	1.57
9/21/2021	NAP-2	Shutdown	0.75
9/21/2021	NAP-2	Startup	2.68
9/30/2021	NAP-2	Shutdown	2.67
9/30/2021	NAP-2	Startup	1.90
10/4/2021	NAP-2	Shutdown	1.55
10/6/2021	NAP-2	Startup	1.78
10/23/2021	NAP-2	Shutdown	1.22
10/30/2021	NAP-2	Startup	1.73
11/7/2021	NAP-2	Shutdown	0.70
11/7/2021	NAP-2	Startup	1.40
11/8/2021	NAP-2	Shutdown	0.65
11/8/2021	NAP-2	Startup	0.28
12/7/2021	NAP-2	Shutdown	0.10
12/8/2021	NAP-2	Startup	2.03
12/19/2021	NAP-2	Shutdown	2.90
12/23/2021	NAP-2	Startup	1.23
12/23/2021	NAP-2	Shutdown	0.08
12/23/2021	NAP-2	Startup	1.53
1/11/2022	NAP-2	Shutdown	1.05
1/11/2022	NAP-2	Startup	1.68
1/23/2022	NAP-2	Shutdown	1.87
1/26/2022	NAP-2	Startup	1.68
1/26/2022	NAP-2	Shutdown	1.05
1/26/2022	NAP-2	Startup	1.67

1/26/2022	NAP-2	Shutdown	0.72
1/26/2022	NAP-2	Startup	0.05
1/26/2022	NAP-2	Shutdown	0.63
1/26/2022	NAP-2	Startup	0.28
1/26/2022	NAP-2	Shutdown	1.18
1/26/2022	NAP-2	Startup	0.57
1/27/2022	NAP-2	Shutdown	1.18
1/27/2022	NAP-2	Startup	0.12
1/27/2022	NAP-2	Shutdown	1.57
1/27/2022	NAP-2	Startup	0.42
1/27/2022	NAP-2	Shutdown	0.83
1/27/2022	NAP-2	Startup	0.55
2/25/2022	NAP-2	Shutdown	1.93
2/25/2022	NAP-2	Startup	1.90
3/18/2022	NAP-2	Shutdown	1.55
3/21/2022	NAP-2	Startup	1.25
3/21/2022	NAP-2	Shutdown	1.25
3/21/2022	NAP-2	Startup	0.65
3/28/2022	NAP-2	Shutdown	2.07
3/28/2022	NAP-2	Startup	1.73
3/31/2022	NAP-2	Shutdown	1.95
3/31/2022	NAP-2	Startup	2.35
4/15/2022	NAP-2	Shutdown	1.93
4/16/2022	NAP-2	Startup	1.40
6/14/2022	NAP-2	Shutdown	1.27
6/14/2022	NAP-2	Startup	1.55
7/7/2022	NAP-2	Shutdown	0.93
7/8/2022	NAP-2	Startup	2.42
7/11/2022	NAP-2	Shutdown	0.05
7/11/2022	NAP-2	Startup	3.48
7/20/2022	NAP-2	Shutdown	3.02
7/20/2022	NAP-2	Startup	1.37
7/20/2022	NAP-2	Shutdown	2.28
7/20/2022	NAP-2	Startup	1.17
7/21/2022	NAP-2	Shutdown	0.05
7/21/2022	NAP-2	Startup	0.37
7/21/2022	NAP-2	Shutdown	1.85
7/21/2022	NAP-2	Startup	1.25
7/24/2022	NAP-2	Shutdown	2.02
7/25/2022	NAP-2	Startup	1.63
7/25/2022	NAP-2	Shutdown	3.12
7/25/2022	NAP-2	Startup	1.52
8/9/2022	NAP-2	Shutdown	1.80
8/9/2022	NAP-2	Startup	1.82
8/14/2022	NAP-2	Shutdown	2.77
9/26/2022	NAP-2	Startup	2.13
9/26/2022	NAP-2	Shutdown	2.72

9/26/2022	NAP-2	Startup	2.22
10/3/2022	NAP-2	Shutdown	1.03
10/3/2022	NAP-2	Startup	0.47
10/18/2022	NAP-2	Shutdown	0.08
10/18/2022	NAP-2	Startup	1.35
10/29/2022	NAP-2	Shutdown	2.05
11/16/2022	NAP-2	Startup	1.75
11/16/2022	NAP-2	Shutdown	0.28
11/16/2022	NAP-2	Startup	0.03
11/16/2022	NAP-2	Shutdown	0.02
11/16/2022	NAP-2	Startup	0.80
11/16/2022	NAP-2	Shutdown	1.80
11/16/2022	NAP-2	Startup	1.02
11/16/2022	NAP-2	Shutdown	2.38
11/22/2022	NAP-2	Startup	2.10
12/8/2022	NAP-2	Shutdown	2.15
12/20/2022	NAP-2	Startup	1.60
12/20/2022	NAP-2	Shutdown	0.33
12/20/2022	NAP-2	Startup	1.18
12/22/2022	NAP-2	Shutdown	1.23
12/22/2022	NAP-2	Startup	0.47
12/22/2022	NAP-2	Shutdown	2.60
12/22/2022	NAP-2	Startup	0.15
12/22/2022	NAP-2	Shutdown	0.12
12/22/2022	NAP-2	Startup	0.08
12/22/2022	NAP-2	Shutdown	0.03
12/22/2022	NAP-2	Startup	0.72
12/22/2022	NAP-2	Shutdown	1.83
12/24/2022	NAP-2	Startup	1.22
12/24/2022	NAP-2	Shutdown	2.35
12/24/2022	NAP-2	Startup	0.85
12/28/2022	NAP-2	Shutdown	1.27
12/28/2022	NAP-2	Startup	0.47
1/31/2023	NAP-2	Shutdown	1.35
1/31/2023	NAP-2	Startup	0.62
2/2/2023	NAP-2	Shutdown	0.08
2/2/2023	NAP-2	Startup	1.32
2/26/2023	NAP-2	Shutdown	0.08
2/26/2023	NAP-2	Startup	1.58
3/6/2023	NAP-2	Shutdown	0.08
3/6/2023	NAP-2	Startup	1.22
3/7/2023	NAP-2	Shutdown	0.58
3/7/2023	NAP-2	Startup	1.23
4/5/2023	NAP-2	Shutdown	1.87
4/5/2023	NAP-2	Startup	0.30
4/22/2023	NAP-2	Shutdown	2.25
4/26/2023	NAP-2	Startup	1.22

4/28/2023	NAP-2	Shutdown	2.17
4/29/2023	NAP-2	Startup	1.53
5/5/2023	NAP-2	Shutdown	1.50
5/5/2023	NAP-2	Startup	1.67
5/24/2023	NAP-2	Shutdown	0.33
5/24/2023	NAP-2	Startup	0.33
5/24/2023	NAP-2	Shutdown	2.87
5/24/2023	NAP-2	Startup	1.70
6/24/2023	NAP-2	Shutdown	0.12
6/25/2023	NAP-2	Startup	1.60
7/15/2023	NAP-2	Shutdown	2.20
7/18/2023	NAP-2	Startup	1.78
7/18/2023	NAP-2	Shutdown	0.37
7/18/2023	NAP-2	Startup	0.38
7/28/2023	NAP-2	Shutdown	3.88
7/30/2023	NAP-2	Startup	3.55
7/31/2023	NAP-2	Shutdown	0.25
7/31/2023	NAP-2	Startup	0.38
8/16/2023	NAP-2	Shutdown	0.30
8/16/2023	NAP-2	Startup	0.17
8/16/2023	NAP-2	Shutdown	2.77
8/16/2023	NAP-2	Startup	1.42
8/24/2023	NAP-2	Shutdown	1.32
8/25/2023	NAP-2	Startup	2.37
8/27/2023	NAP-2	Shutdown	1.23
8/27/2023	NAP-2	Startup	0.33
8/27/2023	NAP-2	Shutdown	0.77
8/27/2023	NAP-2	Startup	0.48
9/8/2023	NAP-2	Shutdown	1.40
9/8/2023	NAP-2	Startup	0.37
10/1/2023	NAP-2	Shutdown	2.03
10/11/2023	NAP-2	Startup	0.67
10/11/2023	NAP-2	Shutdown	0.22
10/11/2023	NAP-2	Startup	0.73
10/11/2023	NAP-2	Shutdown	0.53
10/11/2023	NAP-2	Startup	0.20
10/11/2023	NAP-2	Shutdown	0.25
10/11/2023	NAP-2	Startup	0.02
10/13/2023	NAP-2	Shutdown	1.05
10/13/2023	NAP-2	Startup	2.90
10/16/2023	NAP-2	Shutdown	1.88
10/21/2023	NAP-2	Startup	3.48
10/24/2023	NAP-2	Shutdown	1.60
11/14/2023	NAP-2	Startup	2.83

Exhibit 4

[Note: with the publication of the Fifth Edition of AP-42, the Chapter and Section number for Nitric Acid was changed to 8.8.]

BACKGROUND REPORT

AP-42 SECTION 5.9

NITRIC ACID

Prepared for

U.S. Environmental Protection Agency
OAQPS/TSD/EIB
Research Triangle Park, NC 27711

1-96

Pacific Environmental Services, Inc.
P.O. Box 12077
Research Triangle Park, NC 27709
919/941-0333

1-96
AP-42 Background Report

TECHNICAL SUPPORT DIVISION

U.S. ENVIRONMENTAL PROTECTION AGENCY
Office of Air Quality Planning and Standards
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1.0 INTRODUCTION

The document "Compilation of Air Pollutant Emission Factors" (AP-42) has been published by the U.S. Environmental Protection Agency (EPA) since 1972. Supplements to AP-42 have been routinely published to add new emission source categories and to update existing emission factors. AP-42 is routinely updated by the EPA to respond to new emission factor needs of the EPA, State and local air pollution control programs, and industry.

An emission factor relates the quantity (weight) of pollutants emitted to a unit of activity of the source. The uses for the emission factors reported in AP-42 include:

1. Estimates of area-wide emissions;
2. Emission estimates for a specific facility; and
3. Evaluation of emissions relative to ambient air quality.

The purpose of this report is to provide background information from process information obtained from industry comment and 14 test reports to support revision of the process description and/or emission factors for nitric acid plants.

Including the introduction (Chapter 1), this report contains four chapters. Chapter 2 gives a description of the nitric acid industry. It includes a characterization of the industry, an overview of the different process types, a description of emissions, and a description of the technology used to control emissions resulting from the nitric acid process. A review of specific data sets which contributed any additional information for the revised AP-42 section is also presented.

Chapter 3 is a review of emissions data collection and analysis procedures. It describes the literature search, the screening of emission data reports, and the quality rating system for both emission data and emission factors. Chapter 4 details criteria and noncriteria pollutant emission factor development. It includes the review of specific data sets and the results of data analysis. A data gap analysis for the pollutant emission factor development process is also presented. Appendix A presents a copy of the revised AP-42 Section 5.9.

2.0 INDUSTRY DESCRIPTION

2.1 GENERAL[1,2]

In 1991, there were approximately 65 nitric acid (HNO_3) manufacturing plants in the U.S. with a total capacity of 10 million megagrams (11 million tons) of acid per year.[2] The plants range in size from 5,400 to 635,000 megagrams (6,000 to 700,000 tons) per year. About 70 percent of the nitric acid produced is consumed as an intermediate in the manufacture of ammonium nitrate (NH_4NO_3), which is primarily used in fertilizers.[1] The majority of the nitric acid plants are located in agricultural regions such as the Midwest, South Central, and Gulf States in order to accommodate the high volume of fertilizer use. Another 5 to 10 percent of the nitric acid produced is used for organic oxidation in adipic acid manufacturing. Nitric acid is also used in organic oxidation to manufacture terephthalic acid and other organic compounds. Explosive manufacturing utilizes nitric acid for organic nitrations. Nitric acid nitrations are used in producing nitrobenzene, dinitrotoluenes, and other chemical intermediates.[1] Other end uses of nitric acid are gold and silver separation, military munitions, steel and brass pickling, photoengraving, and acidulation of phosphate rock.

2.2 PROCESS DESCRIPTION[1,3,4]

Nitric acid is produced by two methods. The first method utilizes oxidation, condensation, and absorption to produce a weak nitric acid. Weak nitric acid can have concentrations ranging from 30 to 70 percent nitric acid.[3] The second method combines dehydrating, bleaching, condensing, and absorption to produce high strength nitric acid from weak nitric acid. High strength nitric acid generally contains more than 90 percent nitric acid.[3] The following text provides more specific details for each of these processes.

Weak Nitric Acid Production

Nearly all the nitric acid produced in the U.S. is manufactured by the high temperature catalytic oxidation of ammonia as shown schematically in Figure 2.2-1.

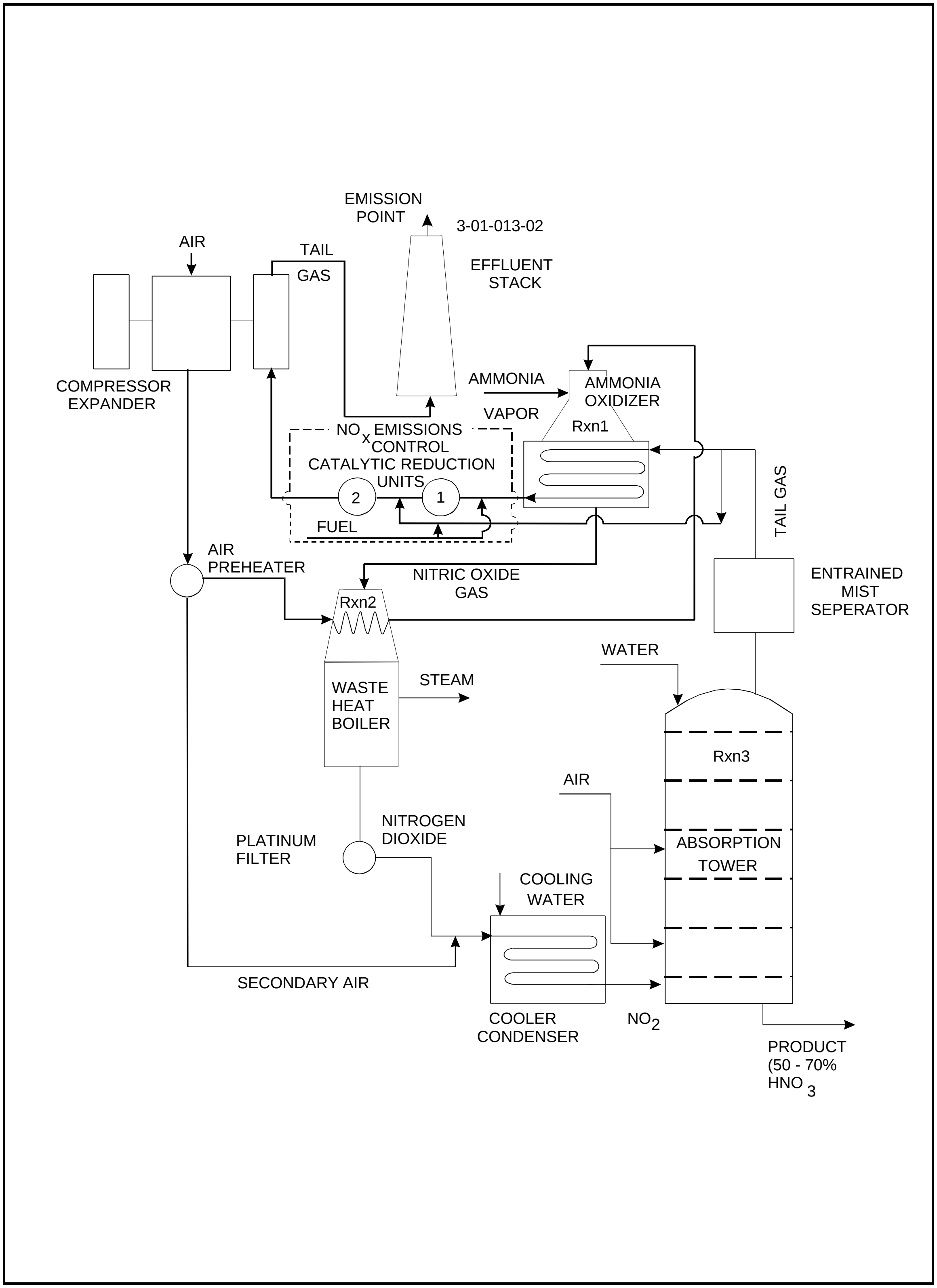

Figure 2.2-1 Flow diagram of typical nitric acid plant using single-pressure process (high-strength acid unit not shown).

This process typically consists of three steps: 1. ammonia oxidation, 2. nitric oxide oxidation, and 3. absorption. Each step corresponds to a distinct chemical reaction.

Ammonia Oxidation. First, a 1:9 ammonia/air mixture is oxidized at a temperature of 750 to 800°C (1380 to 1470°F) as it passes through a catalytic converter, according to the following reaction:[4]

$$4NH_3 + 5O_2 \rightarrow 4NO + 6H_2O \quad (1)$$

The most commonly used catalyst is made of 90 percent platinum and 10 percent rhodium gauze constructed from squares of fine wire. Under these conditions the oxidation of ammonia to nitric oxide proceeds in an exothermic reaction with a range of 93 to 98 percent yield.[1] Higher catalyst temperatures increase reaction selectivity toward nitric oxide (NO) production. Lower catalyst temperatures tend to be more selective toward nitrogen (N_2) and nitrous oxide (N_2O).[1] Nitric oxide is considered to be a criteria pollutant and nitrous oxide is known to be a global warming gas. The nitrogen dioxide/dimer mixture then passes through a waste heat boiler and a platinum filter.

Nitric Oxide Oxidation. The nitric oxide formed during the ammonia oxidation is oxidized in another operation. The process stream is passed through a cooler/condenser and cooled to 38°C (100°F) or less at pressures up to 800 kPa (116 psia). The nitric oxide reacts noncatalytically with residual oxygen to form nitrogen dioxide and its liquid dimer, nitrogen tetroxide:[1]

$$2NO + O_2 \rightarrow 2NO_2 \rightarrow N_2O_4 \quad (2)$$

This slow, homogeneous reaction is temperature and pressure dependent. Operating at low temperatures and high pressures promotes maximum production of NO_2 within a minimum reaction time.

Absorption. The final step introduces the nitrogen dioxide/dimer mixture into an absorption process after being cooled. The mixture is pumped into the bottom of the absorption tower, while liquid dinitrogen tetroxide is added at a higher point. Deionized water enters the top of the column. Both liquids flow countercurrent to the dioxide/dimer gas mixture. Oxidation takes place in the free space between the trays, while absorption occurs on the trays. The absorption trays are usually sieve or bubble cap trays. The exothermic reaction occurs as follows:

$$3NO_2 + H_2O \rightarrow 2HNO_3 + NO \quad (3)$$

A secondary air stream is introduced into the column to re-oxidize the NO which is formed in Reaction 3. This secondary air also removes NO_2 from the product acid. An aqueous solution of 55 to 65 percent (typically) nitric acid is withdrawn from the bottom of the tower.[1] The acid concentration can vary from 30 to 70 percent nitric acid.[3] The acid concentration depends upon the temperature, pressure, number of absorption stages, and concentration of nitrogen oxides entering the absorber.

There are two basic types of systems used to produce weak nitric acid: 1) single-stage pressure process, and 2) dual-stage pressure process. In the past, nitric acid plants have been operated at a single pressure, ranging from atmospheric pressure to 1400 kPa (14.7 to 203 psia).[1] However, since Reaction 1 is favored by low pressures and Reactions 2 and 3 are favored by higher pressures, newer plants tend to operate a dual-stage pressure system, incorporating a compressor between the ammonia oxidizer and the condenser. The oxidation reaction is carried out at pressures from slightly negative to about 400 kPa (58 psia), and the absorption reactions are carried out at 800 to 1,400 kPa (116 to 203 psia).[1]

In the dual-stage pressure system, the nitric acid formed in the absorber (bottoms) is usually sent to an external bleacher where air is used to remove (bleach) any dissolved oxides of nitrogen. The bleacher gases are then compressed and passed through the absorber. The absorber tail gas (distillate) is sent to an entrainment separator for acid mist removal. Next, the tail gas is reheated in the ammonia oxidation heat exchanger to approximately 200°C (392°F). The final step expands the gas in the power-recovery turbine. The thermal energy produced in this turbine can be used to drive the compressor.[1]

High Strength Nitric Acid Production

High strength nitric acid (98 to 99 percent concentration) can be obtained by concentrating weak nitric acid (30 to 70 percent concentration) using extractive distillation.[1] The weak nitric acid cannot be concentrated by simple fractional distillation. The distillation must be carried out in the presence of a dehydrating agent. Concentrated sulfuric acid (typically 60 percent sulfuric acid) is most commonly used for this purpose. The nitric acid concentration process consists of feeding strong sulfuric acid and 55 to 65 percent nitric acid into the top of a packed dehydrating column at approximately atmospheric pressure. The acid mixture flows downward, countercurrent to ascending vapors. Concentrated nitric acid leaves the top of the column as 99 percent vapor, containing a small amount of NO_2 and O_2 resulting from dissociation of nitric acid.[1] The concentrated acid vapor leaves the column and goes to a bleacher and a countercurrent condenser system to effect the condensation of strong nitric acid and the separation of oxygen and nitrogen oxide by-products. These by-products then flow to an absorption column where the nitric oxide mixes with auxiliary air to form NO_2, which is recovered as weak nitric acid. Inert and unreacted gases are vented to the atmosphere from the top of the absorption column. Emissions from this process are relatively small. A small absorber can be used to recover NO_2. Figure 2.2-2 presents a flow diagram of high strength nitric acid production from weak nitric acid.

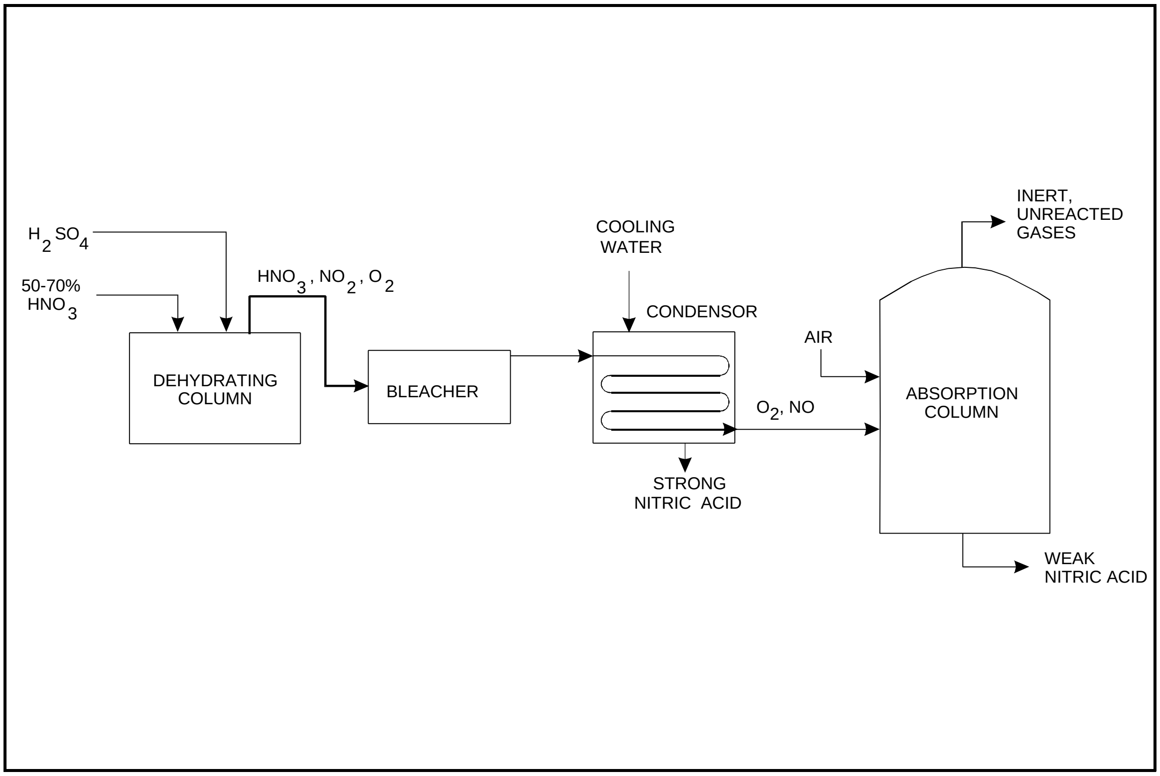

Figure 2.2-2. Flow diagram of high-strength nitric acid production from weak nitric acid.

2.3 EMISSIONS AND CONTROLS[3,4,5]

Emissions from nitric acid manufacture consist primarily of NO and NO_2 (which account for visible emissions), and trace amounts of HNO_3 mist and NH_3. By far, the major source of nitrogen oxides is the tail gas from the acid absorption tower. In general, the quantity of NO_x

emissions are directly related to the kinetics of the nitric acid formation reaction and absorption tower design. NO_x emissions can increase when there is (1) insuffficient air supply to the oxidizer and absorber, (2) low pressure, especially in the absorber, (3) high temperatures in the cooler/condenser and absorber, (4) production of an excessively high-strength product acid, (5) operation at high throughput rates, and (6) faulty equipment such as compressors or pumps which lead to lower pressures, leaks, and reduced plant efficiency.[4]

The two most common techniques used to control absorption tower tail gas emissions are extended absorption and catalytic reduction. Extended absorption reduces nitrogen oxide emissions by increasing the efficiency of the existing process absorption tower or incorporating an additional absorption tower. An efficiency increase is achieved by increasing the number of absorber trays, operating the absorber at higher pressures, or cooling the weak acid liquid in the absorber. The existing tower can also be replaced with a single tower of a larger diameter and/or additional trays (see reference 5 for the relevant equations).

In the catalytic reduction process (often termed catalytic oxidation or incineration), tail gases from the absorption tower are heated to ignition temperature, mixed with fuel (natural gas, hydrogen, propane, butane, naphtha, carbon monoxide, or ammonia) and passed over a catalyst bed. In the presence of the catalyst, the fuels are oxidized and the nitrogen oxides are reduced to N_2. The extent of reduction of NO_2 and NO to N_2 is a function of plant design, fuel type operating temperature and pressure, space velocity through the reduction catalytic reactor, type of catalyst, and reactant concentration. Catalytic reduction can be used in conjunction with other NO_x emission controls. Other advantages include the capability to operate at any pressure and the option of heat recovery to provide energy for process compression as well as extra steam. Catalytic reduction can achieve greater NO_x reduction than extended absorption. However, high fuel costs have caused a decline in its use.

Two seldom used alternative control devices for absorber tail gas are molecular sieves and wet scrubbers. In the molecular sieve technique, tail gas is contacted with an active molecular sieve which catalytically oxidizes NO to NO_2 and selectively adsorbs the NO_2. The NO_2 is then thermally stripped from the molecular sieve and returned to the absorber. The molecular sieve technique has successfully controlled NO_x emissions in existing plants. However, many new plants do not install this method of control. Its implementation incurs high capital and energy costs. The molecular sieve technique is a cyclic system, whereas most new nitric acid plants are continuous systems.

Wet scrubbers use an aqueous solution of alkali hydroxides or carbonates, ammonia, urea, potassium permanganate, or caustic chemicals to "scrub" NO_x from the absorber tail gas. The NO and NO_2 are absorbed and recovered as nitrate or nitrate salts. When caustic chemicals are used, the wet scrubber is referred to as a caustic scrubber. Some of the caustic chemicals used are solutions of sodium hydroxide, sodium carbonate, or other strong bases that will absorb NO_x in the form of nitrate or nitrate salts. Although caustic scrubbing can be an effective control device, it is often not used due to its incurred high costs and the necessity to treat its spent scrubbing solution.

Comparatively small amounts of nitrogen oxides are also lost from acid concentrating plants. These losses (mostly NO_2) are from the condenser system, but the emissions are small enough to be controlled easily by inexpensive absorbers.

Acid mist emissions do not occur from the tail gas of a properly operated plant. The small amounts that may be present in the absorber exit gas streams are removed by a separator or collector prior to entering the catalytic reduction unit or expander.

The acid production system and storage tanks are the only significant sources of visible emissions at most nitric acid plants. Emissions from acid storage tanks may occur during tank filling.

The emission factors vary considerably with the type of control employed and with process conditions. For comparison purposes, the EPA New Source Performance Standard on nitrogen emissions expressed as NO_2 for both new and modified plants is 1.5 kilograms of NO_2 emitted per megagram (3.0 lb/ton) of 100 percent nitric acid produced. [3]

2.4 REVIEW OF SPECIFIC REFERENCES

Pacific Environmental Services (PES) contacted the following sources to obtain the most up-to-date information on process descriptions and emissions for this industry.

1) Alabama Air Division, ADEM, Montgomery, Alabama.
2) Arkansas Department of Pollution Control and Ecology Division of Air Pollution, Little Rock, Arkansas.
3) Chemical Manufacturers Association.
4) Florida Department of Environmental Regulation - Bureau of Air Quality Management, Tallahassee, Florida.

5) Georgia Department of Natural Resources - Environmental Protection Division, Atlanta, Georgia.
6) J.R. Simplot Company, Pocatello, Idaho.
7) Kansas Department of Health and Environment - Bureau of Air Quality, Topeka, Kansas.
8) Michigan Department of Natural Resources - Air Pollution Control Division, Lansing, Michigan.
9) Missouri Department of Natural Resources - Division of Environmental Quality, Jefferson City, Missouri.
10) Monsanto Company, Pensacola, Florida.
11) Ohio Environmental Protection Agency.
12) Pennsylvania Department of Environmental Resources, Harrisburg, Pennsylvania.

Responses were received from the J.R. Simplot Company and the Monsanto Company. No responses were received from the remaining sources. PES was unable to incorporate the information received from these two sources into the AP-42 section revision because the data contained in their reports are not complete. Additional details on the exclusion of these reports can be found in Section 4.1 of this report.

Reference 1: Alternative Control Techniques Document: Nitric and Adipic Acid Manufacturing Plants.

This reference provided the nitric acid process description. It details ammonia oxidation, nitric oxide oxidation, and absorption. Percent yields, temperatures, and pressures are a few of the details given by this reference. The dual-stage pressure system is also detailed.

Reference 2: North American Fertilizer Capacity Data.

This reference provided production capacities for the nitric acid plants located in the United States as of 1991. There were approximately 65 nitric acid manufacturing plants with a total capacity of 10 million megagrams (11 million tons) of acid per year.

Reference 3: Code of Federal Regulations.

This reference provided information on the industrial manufacture of nitric acid. High strength nitric acid (95 to 99 percent concentration) can be obtained by concentrating weak nitric acid (30 to 70 percent concentration). The New Source Performance Standard on nitric acid plant emissions was also located in the CFR. For both new and modified plants, approximately 1.5 kilograms of NO_2 is emitted per megagram (3.0 pounds/ton) of 100 percent nitric acid produced.

Reference 4: A Review of Standards of Performance for New Stationary Sources—Nitric Acid Plants.

This reference provided details on the control equipment used in nitric acid plants. This control equipment consists of extended absorption and catalytic reduction. This reference also provided information for weak nitric acid production; specifically for the first step of ammonia oxidation. There were several small differences between References 1 and 4; the values presented in this report are taken from the most current reference, Reference 1.

Reference 5: Unit Operations of Chemical Engineering.

This reference provides the equations necessary to evaluate the efficiency of increasing the number of absorber trays in an absorption tower, operating the absorber at higher pressures, or cooling the weak acid liquid in the absorber. This reference also gives equations to determine whether an existing tower should be replaced with a single tower of a larger diameter or if adding additional trays would be sufficient or whether utilizing a combination of these options would be more efficient.

2.5 REFERENCES FOR CHAPTER 2

1. Alternative Control Techniques Document: Nitric and Adipic Acid Manufacturing Plants. EPA-450/3-91-026. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC., December 1991.

2. North American Fertilizer Capacity Data, Tennessee Valley Authority, Muscle Shoals, AL, December 1991.

3. Code of Federal Regulations. "Standards of Performance for Nitric Acid Plants," 40 CFR 60., Subpart G, July 1, 1989.

4. Marvin Drabkin, A Review of Standards of Performance for New Stationary Sources—Nitric Acid Plants, EPA-450/3-79-013, U.S. Environmental Protection Agency, Research Triangle Park, NC, March 1979.

5. McCabe and Smith, Unit Operations of Chemical Engineering, 3rd Edition, McGraw-Hill, Inc. 1976, p. 701.

3.0 EMISSION DATA REVIEW AND ANALYSIS PROCEDURES

3.1 LITERATURE SEARCH AND SCREENING SOURCE TESTS

The first step in the investigative process involved a search of available literature relating to criteria and noncriteria pollutant emissions associated with nitric acid plants. This search included, but was not limited to, the following references:

1) AP-42 background files maintained by the Emission Factor and Methodologies Section provided the three references from the 1980 AP-42 and several source tests.
2) "Locating and Estimating" (L&E) reports (as applicable) published by the Emission Factor and Methodologies Section. Nitrogen oxides are the primary emission from nitric acid production, and there are no L&E reports based on nitrogen oxides (NO_x).
3) Handbook of Emission Factors, Parts I and II, Ministry of Housing, Physical Planning and Environment, The Netherlands, 1980/1983 provided NO_x emission factors for uncontrolled processes, catalytic reduction, and extended absortion of the tail gas from nitric acid processes. For additional details, see Chapter 4.1 of this report under the discussion for Reference 15.

To reduce the amount of literature collected to a final group of references pertinent to this report, the following general criteria were used:

1. Emissions data must be from a primary reference; i.e., the document must constitute the original source of test data. For example, a technical paper was not included if the original study was contained in the previous document.
2. The referenced study must contain test results based on more than one test run.
3. The report must contain sufficient data to evaluate the testing procedures and source operating conditions (e.g., one-page reports were generally rejected).

If no primary data were found and the previous update utilized secondary data, secondary data were still used and the Emission Factor Rating lowered, if needed. A final set of reference materials was compiled after a thorough review of the pertinent reports, documents, and information according to these criteria. The final set of reference materials is given in Chapter 4.5.

3.2 EMISSION DATA QUALITY RATING SYSTEM

As part of Pacific Environmental Services' analysis of the emission data, the quantity and quality of the information contained in the final set of reference documents were evaluated. The following data were always excluded from consideration:

1. Test series averages reported in units that cannot be converted to the selected reporting units;
2. Test series representing incompatible test methods (e.g., comparison of the EPA Method 5 front-half with the EPA Method 5 front- and back-half);
3. Test series of controlled emissions for which the control device is not specified;
4. Test series in which the source process is not clearly identified and described; and
5. Test series in which it is not clear whether the emissions were measured before or after the control device.

Data sets that were not excluded were assigned a quality rating. The rating system used was that specified by the OAQPS for the preparation of AP-42 sections. The data were rated as follows:

A Rating

Multiple tests performed on the same source using sound methodology and reported in enough detail for adequate validation. These tests do not necessarily conform to the methodology specified in either the inhalable particulate (IP) protocol documents or the EPA reference test methods, although these documents and methods were certainly used as a guide for the methodology actually used.

B Rating

Tests that were performed by a generally sound methodology but lack enough detail for adequate validation.

C Rating

Tests that were based on an untested or new methodology or that lacked a significant amount of background data.

D Rating

Tests that were based on a generally unacceptable method but may provide an order-of-magnitude value for the source.

The following criteria were used to evaluate source test reports for sound methodology and adequate detail:

1. Source operation. The manner in which the source was operated is well documented in the report. The source was operating within typical parameters during the test.
2. Sampling procedures. The sampling procedures conformed to a generally acceptable methodology. If actual procedures deviated from accepted methods, the deviations are well documented. When this occurred, an evaluation was made of the extent such alternative procedures could influence the test results.
3. Sampling and process data. Adequate sampling and process data are documented in the report. Many variations can occur unnoticed and without warning during testing. Such variations can induce wide deviations in sampling results. If a large spread between test results cannot be explained by information contained in the test report, the data are suspect and were given a lower rating.
4. Analysis and calculations. The test reports contain original raw data sheets. The nomenclature and equations used were compared to those (if any) specified by the EPA to establish equivalency. The depth of review of the calculations was dictated by the reviewer's confidence in the ability and conscientiousness of the tester, which in turn was based on factors such as consistency of results and completeness of other areas of the test report.

3.3 EMISSION FACTOR QUALITY RATING SYSTEM

The quality of the emission factors developed from analysis of the test data was rated utilizing the following general criteria:

A (Excellent)

Developed only from A-rated test data taken from many randomly chosen facilities in the industry population. The source category is specific enough so that variability within the source category population may be minimized.

B (Above average)

Developed only from A-rated test data from a reasonable number of facilities. Although no specific bias is evident, it is not clear if the facilities tested represent a random sample of the industries. As in the A-rating, the source category is specific enough so that variability within the source category population may be minimized.

C (Average)

Developed only from A and B-rated test data from a reasonable number of facilities. Although no specific bias is evident, it is not clear if the facilities tested represent a random sample of the industry. As in the A-rating, the source category is specific enough so that variability within the source category population may be minimized.

D (Below average)

The emission factor was developed only from A- and B-rated test data from a small number of facilities, and there is reason to suspect that these facilities do not represent a random sample of the industry. There also may be evidence of variability within the source category population. Limitations on the use of the emission factor are noted in the emission factor table.

E (Poor)

The emission factor was developed from C and D-rated test data, and there is reason to suspect that the facilities tested do not represent a random sample of the industry. There also may be evidence of variability within the source category population. Limitations on the use of these factors are always noted.

The use of these criteria is somewhat subjective and depends to an extent on the individual reviewer.

3.4 REFERENCES FOR CHAPTER 3

1. Technical Procedures for Developing AP-42 Emission Factors and Preparing AP-42 Sections. U.S. Environmental Protection Agency, Air Management Technology Branch, Office of Air Quality Planning and Standards, Research Triangle Park, NC, April 1992.

2. AP-42, Supplement A, Appendix C.2, "Generalized Particle Size Distributions." U.S. Environmental Protection Agency, October 1986.

4.0 POLLUTANT EMISSION FACTOR DEVELOPMENT

4.1 REVIEW OF SPECIFIC DATA SETS

Reference 1: La Roche Industries, Inc. Oxides of Nitrogen Emissions Test Report.

This test was performed in accordance with the EPA Reference Methods 1 through 4 and 7E. All of the required information as outlined in Chapter 3.2 of this report is provided and the results are consistent; therefore, this test is rated "A". No control device was used in this process. Production data are given in terms of short tons of 100 percent HNO_3 produced per day. Emission factors are given as pounds of NOx emitted per short ton of 100 percent HNO_3 produced. Emission rates were calculated by multiplying the emission factor by the production rate and any relevant conversion factors. Equivalent metric units were also calculated for the emissions data. CO_2 and O_2 emissions were also tested. The data state that zero percent CO_2 was emitted. Since the measuring device is not specified, the accuracy of these readings is not known.

Reference 2: Bison Nitrogen Products Co. Source Test Report. October 1978.

This test was performed in accordance with the EPA Reference Methods 1 through 4 and 7. All of the required information as outlined in Chapter 3.2 of this report is provided and the results are consistent; therefore, this test is rated "A". Extended absorption was used as a control device in this process. Production data are given in terms of short tons of 100 percent HNO_3 produced per day. Emission factors are given as kilograms of NO_x emitted per metric ton of 100 percent HNO_3 produced. These emission factors were converted into the desired units (pounds per short ton) using the appropriate conversion factors.

CO_2 emissions were also tested using an ORSAT. The CO_2 emissions were calculated by using the percent of CO_2 contained in the stack gas on a dry basis and dividing it by 100 to obtain a fractional value of CO_2. This fraction was then multiplied by the stack gas volumetric flow rate and any corresponding conversion factors to obtain the emission rate of CO_2 in terms of pounds of CO_2 emitted per hour. The production rates and emission factors were obtained as described in the preceding paragraph.

Reference 3: Agrico Chemical Company Source Test Report. May 1980.

This test was performed in accordance with the EPA Reference Methods 1 through 4 and 7. All of the required information as outlined in Chapter 3.2 of this report is provided and the results are consistent; therefore, this test is rated "A". Extended absorption with a caustic scrubber were used as control devices in this process. Production data are given in terms of short tons of 100 percent HNO_3 produced per day. Emission factors are given as pounds of NO_x emitted per short ton of 100 percent HNO_3 produced. PES calculated emission rates by multiplying the emission factor by the production rate. Equivalent metric units were also calculated for the emissions data. CO_2 emissions were also tested using gas chromatography. No emissions were detected.

Reference 4: Agrico Chemical Company Source Test Report. November 1976.

This test was performed in accordance with the EPA Reference Methods 1 through 4 and 7. All of the required information as outlined in Chapter 3.2 of this report is provided and the results are consistent; therefore, this test is rated "A". Extended absorption with a caustic scrubber were used as control devices in this process. Production data are given in terms of short tons of 100 percent HNO_3 produced per day. Emission factors are given as pounds of NO_x emitted per short ton of 100 percent HNO_3 produced. PES calculated emission rates by multiplying the emission factor by the production rate. Equivalent metric units were also calculated for the emissions data. CO_2 emissions were also tested using gas chromatography. No emissions were detected.

Reference 5: Agrico Chemical Company Source Test Report. June 1976.

This test was performed in accordance with the EPA Reference Methods 1 through 4 and 7. All of the required information as outlined in Chapter 3.2 of this report is provided and the results are consistent; therefore, this test is rated "A". A caustic scrubber was used as the control device in this process. Production data are given in terms of short tons of 100 percent HNO_3 produced per day. Emission factors are given as pounds of NO_x emitted per short ton of 100 percent HNO_3 produced. PES calculated emission rates by multiplying the emission factor by the production rate. Equivalent metric units were also calculated for the emissions data. CO_2 emissions were also tested using gas chromatography. No emissions were detected.

Reference 6: Bison Nitrogen Products Co. Source Test Report. November 1978.

This source test was classified as unusable to update the existing AP-42 section for the following reasons; no production data, no documentation of the EPA Reference Methods 1 through 4, and no documentation of the process tested.

Reference 7: J.R. Simplot Company Source Test Report. July 1987.

This source test was classified as unusable to update the existing AP-42 section for the following reasons; no documentation of the EPA Reference Methods 1 through 4 or the NO_x emissions sampling method, no documentation of the process tested, no equipment prep documentation, and no field data sheets.

Reference 8: J.R. Simplot Company Source Test Report. April 1990.

This source test was classified as unusable to update the existing AP-42 section for the following reasons; no production rate, no documentation of the EPA Reference Methods 1 through 4, no documentation of the process tested, no equipment prep documentation, and no field data sheets.

Reference 9: Air Products & Chemicals, Inc. Source Test Summary. April 1992.

This source test was classified as unusable to update the existing AP-42 section for the following reasons; no documentation of the EPA Reference Methods 1 through 4 or the NO_x emissions sampling method, no documentation of the process tested, no equipment prep documentation, and no field data sheets.

Reference 10: Air Products & Chemicals, Inc. Source Test Summary. April 1992.

This source test was classified as unusable to update the existing AP-42 section for the following reasons; no documentation of the EPA Reference Methods 1 through 4 or the NO_x emissions sampling method, no documentation of the process tested, no equipment prep documentation, and no field data sheets.

Reference 11: Monsanto Company Source Test Summary. April 1992.

This source test was classified as unusable to update the existing AP-42 section for the following reasons; no documentation of the EPA Reference Methods 1 through 4 or the NO_x

emissions sampling method, no documentation of the process tested, no equipment prep documentation, and no field data sheets.

Reference 12: J.R. Simplot Co. Emissions Summary. February 1990.

This source test was classified as unusable to update the existing AP-42 section for the following reasons; no documentation of the EPA Reference Methods 1 through 4 or the NO_x emissions sampling method, no documentation of the process tested, no documentation of control equipment and its efficiency, no equipment prep documentation, and no field data sheets.

Reference 13: J.R. Simplot Co. Emissions Summary. May 1990.

This source test was classified as unusable to update the existing AP-42 section for the following reasons; no documentation of the EPA Reference Methods 1 through 4 or the NO_x emissions sampling method, no documentation of the process tested, no documentation of control equipment and its efficiency, no equipment prep documentation, and no field data sheets.

Reference 14: J.R. Simplot Co. Emissions Summary. July 1990.

This source test was classified as unusable to update the existing AP-42 section for the following reasons; no documentation of the EPA Reference Methods 1 through 4 or the NO_x emissions sampling method, no documentation of the process tested, no documentation of control equipment and its efficiency, no equipment prep documentation, and no field data sheets.

Reference 15: Handbook of Emission Factors, Parts I and II, Ministry of Housing, Physical Planning and Environment.

This reference provides NO_x and NH_3 emission factor ranges for uncontrolled processes, catalytic reduction, and extended absortion of tail gas for the nitric acid process. The reducing agent used in the catalytic reduction is not specified. The units in the emissions table are in kilograms of emission per ton of 100 percent nitric acid produced. For comparison purposes, PES has converted these factors into units similar to those presented in the AP-42. Uncontrolled emissions from the tail gas are given as a range from 20 to 40 pounds of NO_x emitted per ton of 100 percent HNO_3 produced and 0.02 to 0.2 pounds of NH_3 emitted per ton of 100 percent HNO_3 produced. The revised uncontrolled emission factor in the revised AP-42 is 57 pounds of NO_x emitted per ton of 100 percent HNO_3 produced; NH_3 emissions are not given. The uncontrolled emissions in this reference (15) are lower than those reported in the revised AP-42. Since Reference 15 does not provide the raw test data used in developing these emission factors, the uncontrolled NO_x emission factor in the revised AP-42 will remain unchanged. For this same reason, none of the NH_3 emission factors will be added to the revised AP-42.

The catalytic reduction and extended aborption NO_x emission factors in the revised AP-42 fall within the ranges specified by Reference 15. However, since no raw test data are provided to support the emission ranges, the revised AP-42 will remain unchanged. Reference 15 did not specify whether the emissions resulted from a single-stage or dual-stage pressure process.

Reference 16: Control of Air Pollution from Nitric Acid Plants.

The 1980 AP-42 has this reference noted to be the source of the emission factor for hydrogen fueled catalytic reduction, natural gas/hydrogen fuel catalytic reduction, and a high strength acid plant. EPA performance tests on four nitric acid plants are used to provide results of NO_x emissions testing. It is unclear from this reference whether the reported emissions occur before or after a control device. It is also unclear what type of control device may be present. The emissions are given in parts per million by volume (ppmv). Since no stack gas flow rate is provided, there is no way of converting ppmv to pounds per ton (lb/ton) or kilogram per megagram (kg/Mg). Emissions in the 1980 AP-42 are given in these later units. It cannot be verify whether these emission values are the same as thoseing appear in the 1980 AP-42.

Reference 17: Atmospheric Emissions from Nitric Acid Manufacturing Process.

The 1980 AP-42 has this reference noted to be the source of the emission factors for uncontrolled systems, hydrogen fueled catalytic reduction, natural gas/hydrogen fuel catalytic reduction, and a high strength nitric acid plant.

Uncontrolled. Twelve plants were tested to provide uncontrolled NO_x emissions data from a single-stage pressure process. The average emission factor calculated the results of these tests is 57 pounds of NO_x emitted per ton of 100 percent HNO_3 produced with a range from 33 to 110 pounds per ton. The average production rate is 229 tons of HNO_3

produced per day, with a range from 55 to 750 tons per day at an average rated capacity of 97 percent with a range from 72 to 100 percent. This uncontrolled emission factor will replace the 1980 AP-42 uncontrolled emission factor. However, the emission factor rating will be lowered to an "E" rating.

Hydrogen fueled Catalytic Reduction. Three plants were tested for NO_x emissions from hydrogen fueled catalytic incinerators in a single-stage pressure process. One of the plant's results was not included in the average emission factor calculation. This plant's emissions were extremely high when compared to the other facilities which were tested on catalytic incineration. The 1980 AP-42 also excluded this plant's results. The revised AP-42 will leave this emission factor unchanged. However, the emission factor rating will be lowered to an "E" since there are no raw source test data to support the emission factor. The emission factor is based on data from two plants with an average production rate of 160 tons of 100 percent HNO_3 produced per day with a range of 120 to 209 tons per day at an average rated capacity of 98 percent (range of 95 to 100). The average absorber exit temperature is 85°F (29°C) with a range from 78 to 90°F and the average exit pressure is 85 psig (range of 80 to 94).

Natural gas/hydrogen fueled Catalytic Reduction. This emissions data was not included in the 1980 AP-42. Six plants were tested for NO_x emissions from natural gas/hydrogen fueled catalytic reduction in a single-stage pressure process. These tests were performed prior to the initiation of New Source Performance Standards (NSPS). Reference 18 provides NO_x emissions data for both single-stage and dual-stage pressure processes that were gathered after the initiation of NSPS. Testing performed after NSPS implementation will provide more accurate and detailed data. For this reason, the emissions from this reference will not be used to revise the AP-42 factors.

High Strength Acid Plant. A single unit was tested at a high strength acid plant for NO_2 emissions. The production rate was 3000 pounds of HNO_3 produced per hour (1.5 tons per hour) at a 100 percent rated capacity, of 98 percent nitric acid. The NO_2 emission factor reported is 5 pounds of NO_2 emitted per 1000 pounds of 100% HNO_3 produced. This factor has been converted to units of pounds per ton and kilograms per megagram in AP-

42. The AP-42 emission factor will remain unchanged. However, since there are no raw test data given to support this factor, the emission factor rating will be lowered to an "E".

This reference also provides emissions information for natural gas fueled catalytic reduction. However, the authors of the 1980 AP-42 chose not to include these emissions in developing the 1980 emission factors; instead, Reference 18, taken from the 1980 AP-42, provided the necessary emissions. It is uncertain why the emission factors contained in Reference 17 were not included. An assumption can make based upon the fact that since the testing was performed prior to NSPS, the authors assumed that testing data gathered after NSPS was initiated would provide more valid information to develop emission factors. Reference 18, taken from the 1980 AP-42, provides testing data completed after the initiation of NSPS. Emissions occuring after the NSPS should be better controlled than those occuring prior to the NSPS. For these reasons, the natural gas fueled catalytic reduction emission factor was left unchanged in the 1992 AP-42.

Reference 18: A Review of Standards of Performance for New Stationary Sources-Nitric Acid Plants.

The 1980 AP-42 lists this reference as providing emissions information for uncontrolled processes as well as natural gas fueled catalytic reduction, extended absorption, and chilled absorption with a caustic scrubber for nitric acid manufacturing processes. The following is a detailed description of the information available from this reference.

Uncontrolled. The uncontrolled emission factor given in the 1980 AP-42 is noted to originate from this reference. However, after reviewing this reference, PES could not verify that the emissions in the 1980 AP-42 originated from information contained in Reference 18. The only discussion on uncontrolled emissions provides a sentence stating a range of NO_x emissions from 20 to 28 kilograms of NO_x emitted per megagram of 100 percent HNO_3 produced. No further information is provided. For this reason, the uncontrolled emission factor presented in the revised AP-42 will be taken from Reference 17 of this report.

Natural Gas fueled Catalytic Reduction. The fuel for the catalytic incinerator is assumed to be natural gas as implied by this reference. Seven plants were tested for NO_x emissions. The average production rate was 341 tons of 100 percent HNO_3 produced per day with a range of 55 to 1077 tons per day. The emission factor in the 1992 AP-42 will remain the same; however, the emission factor rating will be lowered to an "E" since there are no raw test data provided for evaluation.

Extended Absorption. The extended absorption emission factor in the 1980 AP-42 is noted to originate from this reference. Five single-stage pressure process plants and three dual-stage pressure process plants were tested for NO_x emissions. The 1980 AP-42 did not differentiate between the two processes. The number of plants tested were noted incorrectly in the 1980 AP-42. The emission factor in the revised AP-42 will be corrected to reflect the two different processes. The single-stage pressure process plants had an average production rate of 542 tons of 100 percent HNO_3 produced per day with a range from 209 to 1049 tons per day. The dual-stage pressure process plants had an average production rate of 586 tons of 100 percent HNO_3 per day with a range from 315 to 937 tons per day. Since no raw test data is provided, the emission factors will be given a rating of "E".

Chilled Absorption with Caustic Scrubber. One plant was tested for NO_x emissions from a chilled absorption system with a caustic scrubber. This single-stage pressure process had a production rate of 692 tons of 100 percent HNO_3 produced per day. The emission factor will be added to the revised AP-42, and it will be given an emission factor rating of "E" since there are no raw test data available for review.

4.2 CRITERIA POLLUTANT EMISSIONS DATA

No data on emissions of volatile organic compounds, lead, sulfur dioxide, carbon monoxide, or particulate matter were found nor expected for the nitric acid process. The remaining criteria pollutant, nitrogen oxide, is discussed below.

Nitrogen oxides.

Fourteen source tests were received to update the AP-42 section. Only five tests contained sufficient information to qualify as valid reports. The other nine were omitted due to various reasons; no production data, no EPA sampling method specified or no process description. One of the valid source tests which had no control device contained lower emission factors than any of the other tests with control devices. After careful review, PES could not conclude why these factors were lower without any additional information. Emission data for the five source tests can be seen in Table 4.2-1, but were not used to revise existing emission factors since these tests may not be representative of the entire industry. Further details on all of these tests can be found in Chapter 4.1 of this report.

After careful evaluation of the existing emission factors for NO_x in the 1980 AP-42, PES concluded that several emission factors needed to be corrected. The uncontrolled emission factor, the natural gas/hydrogen combination fuel for catalytic reduction emissions, and the extended absorption emisson factor were corrected. The emission factor footnotes were corrected for each of the emission sources. For additional details on how all of these corrections were made, please see Chapter 4.1 of this report under the discussion for References 16, 17, and 18.

TABLE 4.2-1 (METRIC UNITS)
NITROGEN OXIDES

Source Test #	Test Rating	Test Method	Run #	Production Rate[a]	Emission Rate[b]	Emission Factor[c]
Control device: None						
1	A	7E	1	490	254	0.518
			2	490	202	0.432
			3	490	185	0.379
			Average	490	212	0.434
Control device: Extended Absorber						
2	A	7	1	192	209	1.089
			2	192	105	0.545
			3	192	31.3	0.163
			Average	192	113	0.590
Control device: Extended Absorber with Caustic Scrubber						
3	A	7	1	679	645	0.950
			2	679	605	0.890
			3	679	629	0.925
			Average	679	625	0.920
Control device: Extended Absorber with Caustic Scrubber						
4	A	7	1	632	512	0.810
			2	632	531	0.840
			3	632	762	1.210
			Average	632	594	0.940
Control device: Caustic Scrubber						
5	A	7	1	538	1921	3.57
			2	538	2055	3.82
			3	538	2351	4.37
			Average	538	2109	3.92

[a]Units in Mg (100% HNO_3)/day.
[b]Units in kg (NO_x)/day.
[c]Units in kg (NO_x)/Mg (100% HNO_3).

TABLE 4.2-1 (ENGLISH UNITS)
NITROGEN OXIDES

Source Test #	Test Rating	Test Method	Run #	Production Rate[a]	Emission Rate[b]	Emission Factor[c]
Control device: None						
1	A	7E	1	540	558.9	1.035
			2	540	446.0	0.863
			3	540	408.8	0.757
			Average	540	468.2	0.867
Control device: Extended Absorber						
2	A	7	1	212	461.5	2.177
			2	212	230.9	1.089
			3	212	69.1	0.326
			Average	212	249.9	1.179
Control device: Extended Absorber with Caustic Scrubber						
3	A	7	1	749	1423	1.90
			2	749	1333	1.78
			3	749	1386	1.85
			Average	749	1378	1.84
Control device: Extended Absorber with Caustic Scrubber						
4	A	7	1	697	1129	1.62
			2	697	1171	1.68
			3	697	1680	2.41
			Average	697	1310	1.88
Control device: Caustic Scrubber						
5	A	7	1	593	4234	7.14
			2	593	4530	7.64
			3	593	5183	8.74
			Average	593	4649	7.84

[a]Units in tons (100% HNO_3)/day.
[b]Units in lb (NO_x)/day.
[c]Units in lb (NO_x)/ton (100% HNO_3).

4.3 NONCRITERIA POLLUTANT EMISSIONS DATA

Hazardous Air Pollutants.

Hazardous Air Pollutants (HAPs) are defined in the 1990 Clean Air Act Amendments. No data on emissions of these pollutants were found for the nitric acid process.

Global Warming Gases.

Pollutants such as methane, carbon dioxide, and NO have been found to contribute to overall global warming. Nitrogen oxide can be classified within the NO_x category; however, no information was provided to distinguish the percent of NO contained in the NO_x data. Fourteen source tests were received for review to update AP-42 emission factors. These tests provided NO_x emissions data. Five of these tests contained enough data to use as valid source tests. The results of these tests can be seen in Table 4.2-1 in Chapter 4.2 under the NO_x section.

One of the valid source tests, Reference 2, also provided CO_2 emissions data. The other four tests stated that no CO_2 emissions were present. For details on how CO_2 emissions were calculated, see Chapter 4.1 under the Reference 2 discussion. The CO_2 emissions can be found in Table 4.3-1. One test does not provide sufficient data to establish emission values which are characteristic of the nitric acid industry.

TABLE 4.3-1 (METRIC UNITS)
CARBON DIOXIDE

Source Test #	Test Rating	Test Method	Run #	Production Rate[a]	Emission Rate[b]	Emission Factor[c]
Control device: Extended Absorption						
2	A	7	1	192	16264	84.7
			2	192	19574	102
			3	192	22415	117
			Average	192	19418	101

[a]Units in Mg (100% HNO_3)/day.
[b]Units in kg (CO_2)/day.
[c]Units in kg (CO_2)/Mg (100% HNO_3).

TABLE 4.3-1 (ENGLISH UNITS)
CARBON DIOXIDE

Source Test #	Test Rating	Test Method	Run #	Production Rate[a]	Emission Rate[b]	Emission Factor[c]
Control device: None						
2	A	7	1	212	35856	169
			2	212	43152	203
			3	212	49416	233
			Average	212	42808	202

[a]Units in tons (100% HNO_3)/day.
[b]Units in lb (CO_2)/day.
[c]Units in lb (CO_2)/ton (100% HNO_3).

Ozone Depletion Gases.

Chlorofluorocarbons have been found to contribute to ozone depletion. No data on emissions of these pollutants were found for the nitric acid process.

4.4 DATA GAP ANALYSIS

None of the emission factors in the AP-42 is based on primary source test data. Consequently, the emission factor ratings have been lowered to an "E". After review of the references used to create the AP-42 emissions, the emission factors have been redefined to reflect the nitric acid process more effectively. Although more definition has been given to the factors, more testing is necessary to determine if the values are indeed correct.

Three tests recieved to update the AP-42 utilized extended absorption for the control device. The emission factors calculated from these tests are below the emission factors specified in the revised AP-42. It seems that the AP-42 emission factors are valid for the extended absorption process. One test received used a caustic scrubber to control emissions from the tail gas. There is no emission factor in the AP-42 to compare its results. Only one test was received which contained no control device on the tail gas stream. This test provides surprising results in that its emission factor has the same magnitude of those facilities utilizing control devices. Without further information, it cannot be determined why these results occured.

4.5 REFERENCES FOR CHAPTER 4

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13. Emissions Summary. J.R. Simplot Company, Don Siding, ID. May 1990.

14. Emissions Summary. J.R. Simplot Company, Don Siding, ID. July 1990.

15. Handbook of Emission Factors, Parts I and II, Ministry of Housing, Physical Planning and Environment, The Netherlands, 1980/1983.

16. Control of Air Pollution from Nitric Acid Plants, Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency, Research Triangle Park, NC. August 1971. Unpublished.

17. Atmospheric Emissions from Nitric Acid Manufacturing Processes, 999-AP-27, U.S. Department of Health, Education, and Welfare, Cincinnati, OH. 1966.

18. Marvin Drabkin, A Review of Standards of Performance for New Stationary Sources - Nitric Acid Plants, EPA-450/3-79-013, U.S. Environmental Protection Agency, Research Triangle Park, NC. March 1979.

TABLE 4-4.
LIST OF CONVERSION FACTORS

Multiply:	**by:**	**To obtain:**
mg/dscm	4.37×10^{-4}	gr/dscf
m^2	10.764	ft^2
acm/min	35.31	acfm
m/s	3.281	ft/s
kg/hr	2.205	lb/hr
kPa	1.45×10^{-1}	psia
kg/Mg	2.0	lb/ton
Mg	1.1023	ton
l	1000	m^3
mg	1000	g
metric ton	0.001	kg

Temperature conversion equations:

Fahrenheit to Celsius:

$$°C = \frac{(°F - 32)}{1.8}$$

Celsius to Fahrenheit:

$$°F = 1.8(°C) + 32$$

APPENDIX A.

AP-42 SECTION 5.9.

[Not presented here. See instead current AP-42 Section 8.8.]