

## General Notices

**DEPARTMENT OF NATURAL RESOURCES AND ENVIRONMENTAL CONTROL**  
**CASE-BY-CASE NITROGEN OXIDES (NO<sub>x</sub>) REASONABLY AVAILABLE CONTROL**  
**TECHNOLOGY (RACT) DETERMINATIONS**

**DEPARTMENT OF NATURAL RESOURCES AND ENVIRONMENTAL CONTROL**  
**Division of Air and Waste Management**  
**Air Quality Management Section**

**1. TITLE OF THE REGULATIONS:**

Case-by-Case Nitrogen Oxides (NO<sub>x</sub>) Reasonably Available Control Technology (RACT) Determinations

**2. BRIEF SYNOPSIS OF THE SUBJECT, SUBSTANCE AND ISSUES:**

The Department is proposing to submit to the EPA for inclusion in the Delaware State Implementation Plan (SIP) four Case-by-Case NO<sub>x</sub> RACT determinations. These determinations have been made pursuant to Regulation No. 12, NO<sub>x</sub> RACT, of the State of Delaware "Regulations Governing the Control of Air Pollution." SPI Polyols, Inc., CitiSteel, and General Chemical Corporation are affected by these determinations.

**3. POSSIBLE TERMS OF THE AGENCY ACTION:**

None.

**4. STATUTORY BASIS OR LEGAL AUTHORITY TO ACT:**

7 Del. C., Chapter 60 and Regulation No. 12 of the State of Delaware "Regulations Governing the Control of Air Pollution."

**5. OTHER REGULATIONS THAT MAY BE AFFECTED BY THE PROPOSAL:**

None.

**6. NOTICE OF PUBLIC COMMENT:**

A public hearing will be held on these determinations on June 21, 2000 beginning at 6:00 p.m. in the Department's facility located at 715 Grantham Lane, New Castle Delaware. Comments may be made at the hearing, or submitted to the Department in writing not later than the close of business, June 30, 2000.

**7. PREPARED BY:**

Ronald A. Amirikian/(302)323-4542

**Case-by-Case Nitrogen Oxides (NO<sub>x</sub>) Reasonably Available Control Technology (RACT) Determinations under Regulation No. 12 of the State of Delaware "Regulations Governing the Control of Air Pollution."**

The air quality planning requirements for the reduction of NO<sub>x</sub> emissions through RACT are set out in section 182(f) of the federal Clean Air Act (CAA). Section 182(f) requires ozone nonattainment areas classified moderate or above to apply the same requirements to major stationary sources of NO<sub>x</sub> as are applied to major stationary sources of volatile organic compounds (VOCs).

Delaware is composed of three (3) air quality management areas: Kent, New Castle, and Sussex counties. Kent and New Castle Counties are classified as severe ozone nonattainment areas, and all three counties are located in the ozone transport region that was established under Section 184 of the

CAA. Section 182 of the CAA requires all major sources of VOCs (and thus NO<sub>x</sub>) in moderate or above ozone nonattainment areas, and in any ozone transport region to install RACT. This means that any major source of NO<sub>x</sub> emissions in Delaware must install RACT. The major source threshold for NO<sub>x</sub> is 25 tons per year (TPY) in Kent and New Castle counties and 100 TPY in Sussex county. Effective November 24, 1993 the Delaware Department of Natural Resources and Environmental Control (DNREC) promulgated Regulation No. 12 of the State of Delaware "Regulations Governing the Control of Air Pollution" as a means to define and impose NO<sub>x</sub> RACT requirements on major sources of NO<sub>x</sub> in Delaware. Regulation No. 12 defines RACT as "the lowest emission limit for NO<sub>x</sub> that a particular source is capable of meeting by the application of control technology that is reasonably available considering technological and economic feasibility."

Sections 3.2 through 3.6 of Regulation No. 12 prescribe RACT for most categories of combustion sources as a specific equipment requirement and/or an emission limitation. In addition, Sections 3.2 through 3.5 of Regulation No. 12 allow for the submission, evaluation, and approval of a case-by-case equivalent RACT determination that may replace the specific equipment requirement or emission limitation specified in those sections. The Department knows of no equivalent RACT determinations that must be processed under Section 3.2 through 3.5 of Regulation No. 12.

Sources not regulated under Sections 3.2 through 3.6 of Regulation No. 12, and not exempted under Section 4 of Regulation No. 12 are covered under Sections 3.8 and 6 of Regulation No. 12.

Section 3.8 required major NO<sub>x</sub> emitting sources to:

- a) Notify the Department of their applicability status, and
- b) Submit a determination as to what constitutes reasonably available control technology for the source including technical and economic support documentation, and
- c) Provide a schedule, acceptable to the Department, for implementing the RACT program as expeditiously as possible, but not later than May 31, 1995, including interim dates for the issuance of purchase orders, start and completion of modifications, and completion of compliance testing.

Section 6.1(b) requires sources subject to Section 3.8 of Regulation No. 12 to identify equipment or process additions, modifications, or adjustments to reduce NO<sub>x</sub> emissions, and to provide to the Department technical and economical data that supports the proposed RACT proposal.

Pursuant to Sections 3.8 and 6 of Regulation No. 12, the Department received case-by-case NO<sub>x</sub> RACT submissions for the following four (4) processes:

**Company      Process**

SPI Polyols, Inc.      Polyhydrate Alcohol's Catalyst

Regenerative Process

CitiSteel      Electric Arc Furnace

General Chemical Corp.      Sulfuric Acid Process and  
Interstage Absorption System

General Chemical Corp.      Metallic Nitrite Process

For each alternate RACT proposal received, Section 5.1 of Regulation No. 12 requires the Department to approve, deny, or modify the RACT determination proposed. Section 5.2 of Regulation No. 12 provides that upon receipt of notice of the Department's approval of the RACT proposal, the source shall begin implementing the RACT program according to the schedule established in the approved RACT plan. Finally Section 5.3 of Regulation No. 12 requires the Department to submit each RACT determination made under Section 5 of Regulation No. 12 to the Environmental Protection

Agency for approval as a revision to the State Implementation Plan (SIP).

On June 16, 1999 the Environmental Protection Agency (EPA) published in the federal register (Volume 64, Number 115, Pages 32187-32189) a final rule granting conditional limited approval of Delaware's 1993 request to include Regulation No. 12 into Delaware's SIP.

"Conditional" Nature of Approval: The EPA's June 16, 1999 final rule requires Delaware to submit to the EPA all alternative RACT determinations approved under Section 5 of Regulation No. 12, and to certify by no later than July 17, 2000 that it has submitted to the EPA all such determinations for all currently known subject sources. Once this is done, the "conditional" nature of EPA's approval will be removed.

"Limited" Nature of Approval: Once the EPA receives, in fulfillment of the requirement described above, and approves all alternative RACT determinations that the Department has approved under Section 5 of Regulation No. 12, the limited nature of the approval will be removed; and Regulation No. 12 will be fully approved.

Subparts F and Appendix V of 40 CFR Part 51 prescribe the procedure States are to follow when submitting to the EPA any revision to that State's SIP. Such procedures include the holding of a properly noticed public hearing, the submittal to the EPA of evidence showing the adherence to specific procedural requirements (e.g., evidence of legal authority, certification that a public hearing was held, etc.), and technical support documentation.

The following is a description of each of the four case-by-case NO<sub>x</sub> RACT determinations:

**SPI Polyols, Inc.**

**Atlas Point Site**

**321 Cherry Lane**

**New Castle, DE 19720**

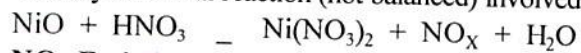
**Polyhydrate Alcohol's Catalyst Regenerative**

**Process with NO<sub>x</sub> Scrubber**

**Process Description**

This is a batch process involving the treatment of spent nickel catalyst from the sugar reduction process and its subsequent conversion to a "green catalyst" slurry that is filtered and dried for reuse. The preparation of this slurry involves several steps in which nitric acid is used. Among them are nickel metal dissolution for nickel makeup, nickel recovery from process waste streams and the digestion of spent catalyst. Of these, the last two are the ones mainly related to the formation of nitrogen oxides. The spent catalyst is initially reacted under controlled conditions of temperature, agitation and pH with nitric acid. During this first conversion, nickel nitrate (Ni(NO<sub>3</sub>)<sub>2</sub>) is formed once the nitric acid is added. During the course of this reaction nitrogen oxides are occasionally formed. Further steps take the nickel nitrate into a usable intermediate: nickel hydroxide (Ni(OH)<sub>2</sub>), which in turn is treated elsewhere for conversion to its active form before it is used in the process.

The key chemical reaction (not balanced) involved in the digestion process is as follows:



**NO<sub>x</sub> Emission Information**

NO<sub>x</sub> is given off from this process in the reaction between spent catalyst and nitric acid. The emission is predominately associated with the addition of nitric acid to the digester tanks.

Stack testing of the process was conducted on November 16 through 18, 1993. The Department witnessed and reviewed the results of this testing and determined that, while there were some deviations

from the test protocol, the results are credible and representative of NO<sub>x</sub> emissions. This testing indicated an average emission rate of 0.8 lb/hr, or 3.5 TPY of NO<sub>x</sub> based on continuous operation. This batch process is not in and of itself a major NO<sub>x</sub> emitting source, rather it is subject to RACT requirements because it is located at a facility that is a major NO<sub>x</sub> emitting source.

#### **RACT Analysis**

Control of NO<sub>x</sub> from the process is by two means: 1) process control and 2) operation of a counter flow packed column scrubber and a cross-flow spray scrubbing system.

Process Control: NO<sub>x</sub> formation occurs predominantly due to fuming in the digester tanks, which is associated with an exothermic reaction when nitric acid is added to a digester tank. Stack testing conducted in 1993 confirmed a high correlation between the addition of nitric acid to a digester tank and the emission of NO<sub>x</sub>. The formation of NO<sub>x</sub> is minimized by submerged nitric acid fill in the mixing zone of each digester tank, adding nitric acid to only one digester tank at a time, and by controlling the rate of nitric acid addition and digester tank temperature to a rate and temperature established in accordance with good air pollution control practices.

Scrubbing System: Off-gas swept from the digester tanks passes through a scrubbing system prior to release to the atmosphere. The scrubbing system consists of two water spray nozzles used to reduce the inlet temperature, a counter-current packed column scrubber with plastic packing, an air dilution valve to promote the oxidation of any NO to NO<sub>2</sub>, all followed by another water spray washer.

The Department believes that at the temperatures (70-120 °F), NO<sub>x</sub> concentrations (~5 to 350 ppmv) and flow rates (2000-9000 SCFM) present in the off gas system, the rate of reaction of NO to NO<sub>2</sub> is too slow to affect noticeable reductions of NO, beyond a slight removal by the various water contacts. However, the Department believes that because NO<sub>2</sub> is very soluble in water and that it decomposes to form nitric acid the removal of NO<sub>2</sub> is high. Measurements of the pH of the scrubber blow down show that the pH fluctuates between neutral or slightly acidic to strongly acidic. This indicates 1) NO<sub>x</sub> is not continuously generated throughout the batch process (see "process control" portion of RACT limitation above), and 2) the scrubbing system is reducing the quantity of NO<sub>x</sub> being emitted to the atmosphere (i.e., by promoting the reaction of NO<sub>2</sub> with the H<sub>2</sub>O to form HNO<sub>3</sub>).

#### **RACT Applicable Requirements**

##### Operational Limits

- A. Nitric acid shall be added using a submerged feed, in the mixing zone, and to only one digester tank at any particular time.
- B. The nitric acid addition rate to each digester tank shall not exceed a rate established in accordance with good air pollution control practices, accepted by the Department, and made federally enforceable.
- C. Nitric acid shall be added to a digester tank only when the temperature of the liquid in that digester tank is within a range established in accordance with good air pollution control practices, accepted by the Department, and made federally enforceable.
- D. All emissions to the atmosphere from any digester tank shall pass through a water scrubber that is operated and maintained in accordance with the manufacture's specification and in accordance with good air pollution control practices.
- E. The pressure drop across the scrubber shall not fall outside of a range established in accordance with good air pollution control practices, accepted by the Department, and made federally enforceable.
- F. There shall be no visible emissions from the water scrubber.

##### Compliance Method

Compliance with the visible emission limitation shall be determined by methods accepted by the Department and made Federally enforceable. Compliance with all other operational limitations shall be demonstrated based on monitoring and record keeping requirements.

#### Monitoring

- A. The flow rate of nitric acid to any digester tank shall be continuously monitored at all times when nitric acid is being added to that digester tank.
- B. The temperature of the liquid in any digester tank shall be continuously monitored at all times when nitric acid is being added to that digester tank.
- C. The Company shall install a gauge that indicates the pressure drop across the counter current packed column scrubber.
- D. The scrubber system exhaust stack shall be observed for visible emissions pursuant to a schedule accepted by the Department and made federally enforceable. Any such observations shall be conducted while nitric acid is being added to any digester tank.

#### Testing

- A. Inspect the NO<sub>x</sub> scrubber, scrubber packing and spray nozzles and demister, pursuant to the manufacturer's recommendation, but not less than annually.
- B. Calibrate pursuant to the manufacturer's recommendation, but not less than annually, each nitric acid flowmeter, each temperature monitor, and each differential pressure gauge.

#### Record Keeping

- A. The Company shall keep daily records that indicate the operating status of the catalyst regeneration process including whether or not the process operated that day and, if it did operate, the number of batches produced.
- B. For each batch, the Company shall continuously record the nitric acid addition rate, and the temperature of the liquid in each digester tank during nitric acid addition.
- C. At least once each day the catalyst regeneration process operates, the Company shall record the pressure drop across the scrubber.
- D. The Company shall maintain a log of all visible emissions observations made including the date, time, and results of each observation.
- E. The Company shall maintain records of any scheduled or non-scheduled maintenance and calibration data for the scrubber, the nitric acid flow monitor, the temperature monitor, or the differential pressure gauge.

#### Reporting

No reporting requirements beyond those of Regulation No. 30 are being imposed on this process under Regulation No. 12.

**CitiSteel USA, Inc.**

**4001 Philadelphia Pike**

**Claymont, Delaware 19703**

**Electric Arc Furnace (EAF)**

**Regulated Pollutants Affected:**

This determination only pertains to the regulation of the ozone precursor, nitrogen oxides (NO<sub>x</sub>).

#### **Process Description**

The EAF operated by CitiSteel USA, Inc. is a 150 tons per charge rated capacity, batch process which produces molten steel by melting steel scrap. It consists of a large steel cylindrical vessel

equipped with a removable roof through which three (3) retractable carbon electrodes are inserted. The electrodes are lowered through the roof of the furnace and are energized by an alternating current, creating arcs that melt the steel scrap charge with their heat. Additional heat is produced by the resistance of the metal in the arc paths. Temperatures inside the EAF reach 3,000 to 3,400 degrees Fahrenheit. The operation includes an oxygen-fuel door burner, specifically designed for preheating and cutting cold scrap in the EAF. The oxygen-fuel burner is rated at 14 MMBTU/hr and uses natural gas as fuel in conjunction with a pure oxygen supply. Once the melting cycle is completed, the carbon electrodes are raised, the roof is removed, and the vessel is tilted to pour the molten metal in a ladle pot.

#### **NO<sub>x</sub> Emission Information**

The predominate source of NO<sub>x</sub> is thermal NO<sub>x</sub> formed from nitrogen in the ambient air. To a much smaller extent, NO<sub>x</sub> is formed from the oxidation of nitrogen contained in the scrap steel charge, and the oxygen-fuel burner.

A Stack Test of the EAF conducted on April 24 and 25, 1996 quantified the emission rate of NO<sub>x</sub> to be an average of 0.36 lb. of NO<sub>x</sub> per ton of steel produced. Based on 0.36 lb/ton and 540,000 tons of steel produced per this equates to an annual NO<sub>x</sub> emission of 97.2 tons per year.

The EAF is in and of itself a major NO<sub>x</sub> emitting source, and is subject to the requirements of Regulation No. 12.

#### **RACT Analysis**

Typical controls practiced on fuel fired combustion equipment such as low NO<sub>x</sub> burners, flue gas recirculation, selective catalytic reduction, etc. are not transferable to an EAF because of the lack of typical burner assemblies, and the unstable gas temperature, air flow and high particulate concentrations. Several technical information sources were searched in an attempt to find NO<sub>x</sub> control information relative to EAF's. The results of this search are as follows:

A review of the EPA's Clean Air Technology Center RACT/BACT/LAER Clearinghouse revealed no information regarding application of NO<sub>x</sub> controls for EAF's.

The EPA has not published or proposed any new source performance standard (NSPS) for EAF's relative to control of NO<sub>x</sub> emissions.

EPA's document "Alternative Control Techniques Document - NO<sub>x</sub> Emissions from Iron and Steel Mills", Section 5.3.5, Electric Arc Furnaces, states "There is no information that NO<sub>x</sub> emissions controls have been installed on EAF's or that suitable controls are available."

No other information relevant to NO<sub>x</sub> emissions control of EAF's was identified.

Based on this information the Department agrees with CitiSteel's conclusion that NO<sub>x</sub> controls are not technologically feasible on EAF's, and that current operation represents RACT for the EAF.

#### **RACT Applicable Requirements**

The Department imposes no additional applicable requirements on the EAF under Regulation No. 12 of Delaware's "Regulations Governing the Control of Air Pollution."

#### **General Chemical Corporation**

**6300 Philadelphia Pike**

**Claymont, DE 19703**

#### **Sulfuric Acid Process and Interstage Absorption System**

#### **Regulated Pollutants Affected:**

This determination only pertains to the regulation of the ozone precursor, nitrogen oxides (NO<sub>x</sub>).

### **Process Description**

The sulfuric acid process and interstage absorption system (ISA) is a contact sulfuric acid manufacturing process. The three main sub-processes include 1) the burning of elemental sulfur, spent sulfuric acid, and hydrogen sulfide to generate  $\text{SO}_2$ , 2) the catalytic oxidation of the  $\text{SO}_2$  to  $\text{SO}_3$ , and 3) the absorption of  $\text{SO}_3$  into strong  $\text{H}_2\text{SO}_4$  solution to form  $\text{H}_2\text{SO}_4$ . The burning sub-process incorporates two burner/boilers with each having a rated heat input capacity of forty-six (46) MMBTU/hr.

### **$\text{NO}_x$ Emission Information**

$\text{NO}_x$  emissions are generated only during the combustion sub-process (i.e., the burning of elemental sulfur, spent sulfuric acid, and hydrogen sulfide).

Stack testing on May 5, 1999 indicated that the  $\text{NO}_x$  emission rate from the ISA was 10.44 lb/hr (26.74 ppm). This equates to an annual  $\text{NO}_x$  emission of forty-four (44) tons per year assuming continuous operation at this emission rate.

The ISA is in and of itself a major stationary source of  $\text{NO}_x$ , and is subject to the Requirements of Regulation No. 12.

### **RACT Analysis**

This combustion operation is not covered under Section 3.3 of Regulation No. 12 since Section 3.3 covers only fuel burning equipment whose primary purpose is to produce heat to be used; the primary purpose of burning the sulfur is to produce  $\text{SO}_2$ . Evidence of this is the need to cool the exhaust from the burners prior to the next step in the process and after other steps in the process (i.e., the oxidation and absorption steps are highly exothermic). Section 3.3 does not apply and the process must be evaluated under Section 3.8 of Regulation No. 12.

Under Section 3.8 of Regulation No. 12, the Department considered the feasibility of both minimizing the generation of  $\text{NO}_x$  and the installation and operation of post-combustion  $\text{NO}_x$  removal technologies.

### $\text{NO}_x$ Generation.

Sulfur provides the majority of heat input to the burners, and is by definition a low  $\text{NO}_x$  fuel (i.e., low fuel bound  $\text{NO}_x$ ). This means that all of the  $\text{NO}_x$  generated is thermal  $\text{NO}_x$ . Combustion occurs at 1,700 to 2,000 °F, which is a relatively low temperature with regard to thermal  $\text{NO}_x$  generation dynamics. Because of the low fuel  $\text{NO}_x$ , the low combustion temperature, and the fact that all of the combustion gases are an integral part of the ISA process, the Department agrees with General Chemical that combustion modifications are not feasible relative to RACT.

### Add-on $\text{NO}_x$ removal technologies.

Several technical information sources were searched in an attempt to find  $\text{NO}_x$  control information relative to sulfuric acid manufacturing. The results of this search are as follows:

A review of the EPA's Clean Air Technology Center RACT/BACT/LAER Clearinghouse revealed no information regarding application of  $\text{NO}_x$  controls to sulfuric acid manufacturing.

The EPA has not published or proposed any new source performance standard (NSPS) for sulfuric acid manufacturing relative to control of  $\text{NO}_x$  emissions.

No other information relevant to  $\text{NO}_x$  emissions control of sulfuric acid manufacturing was identified.

It is noted that approximately  $\frac{3}{4}$  of the  $\text{NO}_x$  produced passes through the converters, absorbers, and ISA, and that these process components remove a portion of the  $\text{NO}_x$  generated. While  $\text{SO}_3$  is absorbed in strong  $\text{H}_2\text{SO}_4$ , the  $\text{NO}_x$  in the gas stream is also absorbed to form nitrogen containing

compounds and impurities.

General Chemical evaluated several NO<sub>x</sub> removal technologies and, based on economics, conclude they were not feasible. Such evaluation addressed SCR and wet scrubbing. Relevant factors contributing to the high cost are the low concentration of NO<sub>x</sub> in the exhaust stream and the high flow (i.e., 26.74 ppm and 54,737 scfm from the 1999 stack test).

For comparison purposes, Table 1 of Regulation No. 12 defines RACT for combustion units with a maximum heat input capacity of equal to or greater than 100 MMBTU/hr and firing liquid fuel as 0.25 lb/MMBTU heat input; the NO<sub>x</sub> emission rate from this process is 0.20 lb/MMBTU. The Department believes this low emission rate is attributable to the fuel being combusted (i.e., liquid sulfur), the relatively low combustion temperature (i.e., 1,700 to 2,000 °F) and the NO<sub>x</sub> absorption in the ISA itself. Because of this information, and considering the Company's economic analysis that add-on NO<sub>x</sub> removal technology is not cost effective, the Department agrees with General Chemical that the current status of the process is RACT.

#### **RACT Applicable Requirements**

The Department imposes no additional applicable requirements on the Sulfuric Acid Process and Interstage Absorption System under Regulation No. 12 of Delaware's "Regulations Governing the Control of Air Pollution."

#### **General Chemical Corporation**

**6300 Philadelphia Pike**

**Claymont, DE 19703**

**Metallic Nitrite Process**

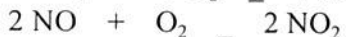
**with Caustic Scrubber**

#### **Regulated Pollutants Affected:**

This determination only pertains to the regulation of the ozone precursor, nitrogen oxides (NO<sub>x</sub>).

#### **Process Description**

This process is a batch process that produces potassium nitrite (50% solution). The process involves reacting a controlled mixture of air and ammonia over a catalyst. The catalyst converts the air-ammonia mixture into nitric oxide, nitrogen dioxide, and water vapor. This mixture is absorbed into potassium hydroxide circulating through an absorbing tower to form potassium nitrite. The reactions are as follows:



The potassium nitrite solution is stored, filtered, and used to make crystal.

#### **NO<sub>x</sub> Emission Information**

NO<sub>x</sub> emissions are generated in the reaction of the air/ammonia mixture over a catalyst.

Based on a 1982 stack test, General Chemical estimates the maximum controlled NO<sub>x</sub> emission rate is 10 lb/hr and the potential to emit NO<sub>x</sub> is 43.8 tons per year.

The metallic nitrite process is in and of itself a major NO<sub>x</sub> emitting source, and is subject to the requirements of Regulation No. 12.

#### **RACT Analysis**

Control of NO<sub>x</sub> from this process is by two means: 1) process control, and 2) operation of a counter flow packed column scrubber.

Process Control:



The rate that  $\text{NO}_x$  forms is proportional to the rate of the air/ammonia mixture fed to the process. Early in the batch when the free alkalinity in the absorption tray tower is high, the majority of the  $\text{NO}_x$  formed is absorbed by the process in the absorption tray tower. As the batch progresses, the free alkalinity in the tray tower liquid decreases, and the  $\text{NO}_x$  feed rate to the scrubber increases. Towards the end of each batch the free alkalinity in the absorption tray tower is near zero, and practically all of the  $\text{NO}_x$  generated passes through to the scrubber. Because of this, the  $\text{NO}_x$  inlet rate to the process (i.e., the air/ammonia mixture feed rate) is a particular concern.

The Department has determined that control of the air/ammonia feed rate(s) to the process is a necessary part of  $\text{NO}_x$  RACT for this process.

#### Scrubber:

The process off-gas treatment system incorporates a single stage packed tower scrubber which uses KOH as a scrubbing liquor. In the scrubber the KOH effectively reacts with the residual  $\text{NO}_x$  in the exhaust stream to form  $\text{KNO}_2$  and  $\text{KNO}_3$ . Note that the use of KOH as a scrubber liquor in this process overcomes the problem of disposal of the alkali nitric salts that other facilities might experience using this technology, since the liquor is used as feed for the next batch.

The Department has determined that operation of the KOH scrubber, to include monitoring and control of the free alkalinity in the scrubber liquor is a necessary part of  $\text{NO}_x$  RACT for this process.

As indicated above, the Department has determined that both the control of air/ammonia feed rate(s) to the process and the operation of a single stage packed tower scrubber which uses KOH as a scrubbing liquor constitute  $\text{NO}_x$  RACT for this process.

#### **RACT Applicable Requirements**

##### Operational Limits

- A. All emissions to the atmosphere from the metallic nitrite process shall pass through a KOH scrubber that is operated and maintained in accordance with the manufacturer's specifications and in accordance with good air pollution control practices.
- B. The free alkalinity of the scrubber liquor shall not fall below a level(s) established in accordance with good air pollution control practices, accepted by the Department and made federally enforceable.
- C. The pressure drop across the scrubber shall not fall outside of a range established in accordance with good air pollution control practices, accepted by the Department, and made federally enforceable.
- D. The air/ammonia feed rate to the process shall not exceed a rate(s) established in accordance with good air pollution control practices, accepted by the Department, and made federally enforceable. In implementing this provision separate feed rate(s) may be established for distinct phases of the process, for example, one rate may be established for all times except those times when the free alkalinity in the absorption tray tower falls below some value, at which time a lower rate may apply.
- E. There shall be no visible emissions from the scrubber outlet.

##### Compliance Method

Compliance with the visible emission limitation shall be determined by methods accepted by the Department and made Federally enforceable. Compliance with all other operational limitations shall be demonstrated based monitoring and record keeping requirements.

##### Monitoring

- A. The free alkalinity of the scrubber liquor shall be determined on a frequency established in accordance with good air pollution control practices, accepted by the Department, and made federally enforceable.

- B. The Company shall install and maintain a gauge that indicates the pressure drop across the scrubber.
- C. The air/ammonia feed rate to the process shall be continuously monitored at all times the metallic nitrite process operates.
- D. The free alkalinity in the absorption tower liquor shall be determined on a frequency established in accordance with good air pollution control practices, accepted by the Department, and made federally enforceable.
- E. The scrubber system exhaust stack shall be observed for visible emissions pursuant to a schedule accepted by the Department and made federally enforceable. Such observations shall be conducted towards the end of any batch when possible.

Testing

- A. Inspect the NO<sub>x</sub> scrubber, scrubber packing and spray nozzles, pursuant to the manufacturer's recommendation, but not less than annually.
- B. Calibrate pursuant to the manufacturer's recommendations, but not less than annually, the differential pressure gauge.

Record Keeping

- A. The Company shall maintain records of all measurements of the free alkalinity of the scrubber liquor and of the free alkalinity of the liquor in the absorption tower.
- B. At least once each day that the metallic nitrite process operates, the Company shall maintain records of the differential pressure across the scrubber.
- C. The Company shall continuously record the air/ammonia feed rate to the process at all times the metallic nitrite process operates.
- D. The Company shall maintain a log of all visible emissions observations made, to include the date, time, and results of each observation.
- E. The Company shall maintain records of any scheduled or non-scheduled maintenance and calibration data for the scrubber, or the differential pressure gauge.

Reporting

No reporting requirements beyond those of Regulation No. 30 are being imposed on this process under Regulation No. 12.

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None.

**6. NOTICE OF PUBLIC COMMENT:**

A public hearing will be held on these determinations on June 21, 2000 beginning at 6:00 p.m. in the Department's facility located at 715 Grantham Lane, New Castle Delaware. Comments may be made at the hearing, or submitted to the Department in writing not later than the close of business, June 30, 2000.

**7. PREPARED BY:**

Ronald A. Amirikian/(302)323-4542

**Case-by-Case Nitrogen Oxides (NO<sub>x</sub>) Reasonably Available Control Technology (RACT) Determinations under Regulation No. 12 of the State of Delaware "Regulations Governing the Control of Air Pollution."**

The air quality planning requirements for the reduction of NO<sub>x</sub> emissions through RACT are set out in section 182(f) of the federal Clean Air Act (CAA). Section 182(f) requires ozone nonattainment areas classified moderate or above to apply the same requirements to major stationary sources of NO<sub>x</sub> as are applied to major stationary sources of volatile organic compounds (VOCs).

Delaware is composed of three (3) air quality management areas: Kent, New Castle, and Sussex counties. Kent and New Castle Counties are classified as severe ozone nonattainment areas, and all three counties are located in the ozone transport region that was established under Section 184 of the

CAA. Section 182 of the CAA requires all major sources of VOCs (and thus NO<sub>x</sub>) in moderate or above ozone nonattainment areas, and in any ozone transport region to install RACT. This means that any major source of NO<sub>x</sub> emissions in Delaware must install RACT. The major source threshold for NO<sub>x</sub> is 25 tons per year (TPY) in Kent and New Castle counties and 100 TPY in Sussex county. Effective November 24, 1993 the Delaware Department of Natural Resources and Environmental Control (DNREC) promulgated Regulation No. 12 of the State of Delaware "Regulations Governing the Control of Air Pollution" as a means to define and impose NO<sub>x</sub> RACT requirements on major sources of NO<sub>x</sub> in Delaware. Regulation No. 12 defines RACT as "the lowest emission limit for NO<sub>x</sub> that a particular source is capable of meeting by the application of control technology that is reasonably available considering technological and economic feasibility."

Sections 3.2 through 3.6 of Regulation No. 12 prescribe RACT for most categories of combustion sources as a specific equipment requirement and/or an emission limitation. In addition, Sections 3.2 through 3.5 of Regulation No. 12 allow for the submission, evaluation, and approval of a case-by-case equivalent RACT determination that may replace the specific equipment requirement or emission limitation specified in those sections. The Department knows of no equivalent RACT determinations that must be processed under Section 3.2 through 3.5 of Regulation No. 12.

Sources not regulated under Sections 3.2 through 3.6 of Regulation No. 12, and not exempted under Section 4 of Regulation No. 12 are covered under Sections 3.8 and 6 of Regulation No. 12.

Section 3.8 required major NO<sub>x</sub> emitting sources to:

- a) Notify the Department of their applicability status, and
- b) Submit a determination as to what constitutes reasonably available control technology for the source including technical and economic support documentation, and
- c) Provide a schedule, acceptable to the Department, for implementing the RACT program as expeditiously as possible, but not later than May 31, 1995, including interim dates for the issuance of purchase orders, start and completion of modifications, and completion of compliance testing.

Section 6.1(b) requires sources subject to Section 3.8 of Regulation No. 12 to identify equipment or process additions, modifications, or adjustments to reduce NO<sub>x</sub> emissions, and to provide to the Department technical and economical data that supports the proposed RACT proposal.

Pursuant to Sections 3.8 and 6 of Regulation No. 12, the Department received case-by-case NO<sub>x</sub> RACT submissions for the following four (4) processes:

**Company      Process**

SPI Polyols, Inc.      Polyhydrate Alcohol's Catalyst  
Regenerative Process

CitiSteel      Electric Arc Furnace

General Chemical Corp.      Sulfuric Acid Process and  
Interstage Absorption System

General Chemical Corp.      Metallic Nitrite Process

For each alternate RACT proposal received, Section 5.1 of Regulation No. 12 requires the Department to approve, deny, or modify the RACT determination proposed. Section 5.2 of Regulation No. 12 provides that upon receipt of notice of the Department's approval of the RACT proposal, the source shall begin implementing the RACT program according to the schedule established in the approved RACT plan. Finally Section 5.3 of Regulation No. 12 requires the Department to submit each RACT determination made under Section 5 of Regulation No. 12 to the Environmental Protection

Agency for approval as a revision to the State Implementation Plan (SIP).

On June 16, 1999 the Environmental Protection Agency (EPA) published in the federal register (Volume 64, Number 115, Pages 32187-32189) a final rule granting conditional limited approval of Delaware's 1993 request to include Regulation No. 12 into Delaware's SIP.

"Conditional" Nature of Approval: The EPA's June 16, 1999 final rule requires Delaware to submit to the EPA all alternative RACT determinations approved under Section 5 of Regulation No. 12, and to certify by no later than July 17, 2000 that it has submitted to the EPA all such determinations for all currently known subject sources. Once this is done, the "conditional" nature of EPA's approval will be removed.

"Limited" Nature of Approval: Once the EPA receives, in fulfillment of the requirement described above, and approves all alternative RACT determinations that the Department has approved under Section 5 of Regulation No. 12, the limited nature of the approval will be removed; and Regulation No. 12 will be fully approved.

Subparts F and Appendix V of 40 CFR Part 51 prescribe the procedure States are to follow when submitting to the EPA any revision to that State's SIP. Such procedures include the holding of a properly noticed public hearing, the submittal to the EPA of evidence showing the adherence to specific procedural requirements (e.g., evidence of legal authority, certification that a public hearing was held, etc.), and technical support documentation.

The following is a description of each of the four case-by-case NO<sub>x</sub> RACT determinations:

**SPI Polyols, Inc.**

**Atlas Point Site**

**321 Cherry Lane**

**New Castle, DE 19720**

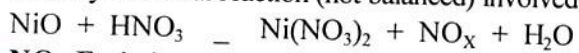
**Polyhydrate Alcohol's Catalyst Regenerative**

**Process with NO<sub>x</sub> Scrubber**

**Process Description**

This is a batch process involving the treatment of spent nickel catalyst from the sugar reduction process and its subsequent conversion to a "green catalyst" slurry that is filtered and dried for reuse. The preparation of this slurry involves several steps in which nitric acid is used. Among them are nickel metal dissolution for nickel makeup, nickel recovery from process waste streams and the digestion of spent catalyst. Of these, the last two are the ones mainly related to the formation of nitrogen oxides. The spent catalyst is initially reacted under controlled conditions of temperature, agitation and pH with nitric acid. During this first conversion, nickel nitrate (Ni(NO<sub>3</sub>)<sub>2</sub>) is formed once the nitric acid is added. During the course of this reaction nitrogen oxides are occasionally formed. Further steps take the nickel nitrate into a usable intermediate: nickel hydroxide (Ni(OH)<sub>2</sub>), which in turn is treated elsewhere for conversion to its active form before it is used in the process.

The key chemical reaction (not balanced) involved in the digestion process is as follows:



**NO<sub>x</sub> Emission Information**

NO<sub>x</sub> is given off from this process in the reaction between spent catalyst and nitric acid. The emission is predominately associated with the addition of nitric acid to the digester tanks.

Stack testing of the process was conducted on November 16 through 18, 1993. The Department witnessed and reviewed the results of this testing and determined that, while there were some deviations

from the test protocol, the results are credible and representative of NO<sub>x</sub> emissions. This testing indicated an average emission rate of 0.8 lb/hr, or 3.5 TPY of NO<sub>x</sub> based on continuous operation. This batch process is not in and of itself a major NO<sub>x</sub> emitting source, rather it is subject to RACT requirements because it is located at a facility that is a major NO<sub>x</sub> emitting source.

#### **RACT Analysis**

Control of NO<sub>x</sub> from the process is by two means: 1) process control and 2) operation of a counter flow packed column scrubber and a cross-flow spray scrubbing system.

Process Control: NO<sub>x</sub> formation occurs predominantly due to fuming in the digester tanks, which is associated with an exothermic reaction when nitric acid is added to a digester tank. Stack testing conducted in 1993 confirmed a high correlation between the addition of nitric acid to a digester tank and the emission of NO<sub>x</sub>. The formation of NO<sub>x</sub> is minimized by submerged nitric acid fill in the mixing zone of each digester tank, adding nitric acid to only one digester tank at a time, and by controlling the rate of nitric acid addition and digester tank temperature to a rate and temperature established in accordance with good air pollution control practices.

Scrubbing System: Off-gas swept from the digester tanks passes through a scrubbing system prior to release to the atmosphere. The scrubbing system consists of two water spray nozzles used to reduce the inlet temperature, a counter-current packed column scrubber with plastic packing, an air dilution valve to promote the oxidation of any NO to NO<sub>2</sub>, all followed by another water spray washer.

The Department believes that at the temperatures (70-120 °F), NO<sub>x</sub> concentrations (~5 to 350 ppmv) and flow rates (2000-9000 SCFM) present in the off gas system, the rate of reaction of NO to NO<sub>2</sub> is too slow to affect noticeable reductions of NO, beyond a slight removal by the various water contacts. However, the Department believes that because NO<sub>2</sub> is very soluble in water and that it decomposes to form nitric acid the removal of NO<sub>2</sub> is high. Measurements of the pH of the scrubber blow down show that the pH fluctuates between neutral or slightly acidic to strongly acidic. This indicates 1) NO<sub>x</sub> is not continuously generated throughout the batch process (see "process control" portion of RACT limitation above), and 2) the scrubbing system is reducing the quantity of NO<sub>x</sub> being emitted to the atmosphere (i.e., by promoting the reaction of NO<sub>2</sub> with the H<sub>2</sub>O to form HNO<sub>3</sub>).

#### **RACT Applicable Requirements**

##### Operational Limits

- A. Nitric acid shall be added using a submerged feed, in the mixing zone, and to only one digester tank at any particular time.
- B. The nitric acid addition rate to each digester tank shall not exceed a rate established in accordance with good air pollution control practices, accepted by the Department, and made federally enforceable.
- C. Nitric acid shall be added to a digester tank only when the temperature of the liquid in that digester tank is within a range established in accordance with good air pollution control practices, accepted by the Department, and made federally enforceable.
- D. All emissions to the atmosphere from any digester tank shall pass through a water scrubber that is operated and maintained in accordance with the manufacture's specification and in accordance with good air pollution control practices.
- E. The pressure drop across the scrubber shall not fall outside of a range established in accordance with good air pollution control practices, accepted by the Department, and made federally enforceable.
- F. There shall be no visible emissions from the water scrubber.

##### Compliance Method

Compliance with the visible emission limitation shall be determined by methods accepted by the Department and made Federally enforceable. Compliance with all other operational limitations shall be demonstrated based on monitoring and record keeping requirements.

Monitoring

- A. The flow rate of nitric acid to any digester tank shall be continuously monitored at all times when nitric acid is being added to that digester tank.
- B. The temperature of the liquid in any digester tank shall be continuously monitored at all times when nitric acid is being added to that digester tank.
- C. The Company shall install a gauge that indicates the pressure drop across the counter current packed column scrubber.
- D. The scrubber system exhaust stack shall be observed for visible emissions pursuant to a schedule accepted by the Department and made federally enforceable. Any such observations shall be conducted while nitric acid is being added to any digester tank.

Testing

- A. Inspect the NO<sub>x</sub> scrubber, scrubber packing and spray nozzles and demister, pursuant to the manufacturer's recommendation, but not less than annually.
- B. Calibrate pursuant to the manufacturer's recommendation, but not less than annually, each nitric acid flowmeter, each temperature monitor, and each differential pressure gauge.

Record Keeping

- A. The Company shall keep daily records that indicate the operating status of the catalyst regeneration process including whether or not the process operated that day and, if it did operate, the number of batches produced.
- B. For each batch, the Company shall continuously record the nitric acid addition rate, and the temperature of the liquid in each digester tank during nitric acid addition.
- C. At least once each day the catalyst regeneration process operates, the Company shall record the pressure drop across the scrubber.
- D. The Company shall maintain a log of all visible emissions observations made including the date, time, and results of each observation.
- E. The Company shall maintain records of any scheduled or non-scheduled maintenance and calibration data for the scrubber, the nitric acid flow monitor, the temperature monitor, or the differential pressure gauge.

Reporting

No reporting requirements beyond those of Regulation No. 30 are being imposed on this process under Regulation No. 12.

**CitiSteel USA, Inc.**

**4001 Philadelphia Pike**

**Claymont, Delaware 19703**

**Electric Arc Furnace (EAF)**

**Regulated Pollutants Affected:**

This determination only pertains to the regulation of the ozone precursor, nitrogen oxides (NO<sub>x</sub>).

**Process Description**

The EAF operated by CitiSteel USA, Inc. is a 150 tons per charge rated capacity, batch process which produces molten steel by melting steel scrap. It consists of a large steel cylindrical vessel

equipped with a removable roof through which three (3) retractable carbon electrodes are inserted. The electrodes are lowered through the roof of the furnace and are energized by an alternating current, creating arcs that melt the steel scrap charge with their heat. Additional heat is produced by the resistance of the metal in the arc paths. Temperatures inside the EAF reach 3,000 to 3,400 degrees Fahrenheit. The operation includes an oxygen-fuel door burner, specifically designed for preheating and cutting cold scrap in the EAF. The oxygen-fuel burner is rated at 14 MMBTU/hr and uses natural gas as fuel in conjunction with a pure oxygen supply. Once the melting cycle is completed, the carbon electrodes are raised, the roof is removed, and the vessel is tilted to pour the molten metal in a ladle pot.

#### **NO<sub>x</sub> Emission Information**

The predominate source of NO<sub>x</sub> is thermal NO<sub>x</sub> formed from nitrogen in the ambient air. To a much smaller extent, NO<sub>x</sub> is formed from the oxidation of nitrogen contained in the scrap steel charge, and the oxygen-fuel burner.

A Stack Test of the EAF conducted on April 24 and 25, 1996 quantified the emission rate of NO<sub>x</sub> to be an average of 0.36 lb. of NO<sub>x</sub> per ton of steel produced. Based on 0.36 lb/ton and 540,000 tons of steel produced per this equates to an annual NO<sub>x</sub> emission of 97.2 tons per year.

The EAF is in and of itself a major NO<sub>x</sub> emitting source, and is subject to the requirements of Regulation No. 12.

#### **RACT Analysis**

Typical controls practiced on fuel fired combustion equipment such as low NO<sub>x</sub> burners, flue gas recirculation, selective catalytic reduction, etc. are not transferable to an EAF because of the lack of typical burner assemblies, and the unstable gas temperature, air flow and high particulate concentrations. Several technical information sources were searched in an attempt to find NO<sub>x</sub> control information relative to EAF's. The results of this search are as follows:

A review of the EPA's Clean Air Technology Center RACT/BACT/LAER Clearinghouse revealed no information regarding application of NO<sub>x</sub> controls for EAF's.

The EPA has not published or proposed any new source performance standard (NSPS) for EAF's relative to control of NO<sub>x</sub> emissions.

EPA's document "Alternative Control Techniques Document - NO<sub>x</sub> Emissions from Iron and Steel Mills", Section 5.3.5, Electric Arc Furnaces, states "There is no information that NO<sub>x</sub> emissions controls have been installed on EAF's or that suitable controls are available."

No other information relevant to NO<sub>x</sub> emissions control of EAF's was identified.

Based on this information the Department agrees with CitiSteel's conclusion that NO<sub>x</sub> controls are not technologically feasible on EAF's, and that current operation represents RACT for the EAF.

#### **RACT Applicable Requirements**

The Department imposes no additional applicable requirements on the EAF under Regulation No. 12 of Delaware's "Regulations Governing the Control of Air Pollution."

#### **General Chemical Corporation**

**6300 Philadelphia Pike**

**Claymont, DE 19703**

#### **Sulfuric Acid Process and Interstage Absorption System**

#### **Regulated Pollutants Affected:**

This determination only pertains to the regulation of the ozone precursor, nitrogen oxides (NO<sub>x</sub>).



## **Process Description**

The sulfuric acid process and interstage absorption system (ISA) is a contact sulfuric acid manufacturing process. The three main sub-processes include 1) the burning of elemental sulfur, spent sulfuric acid, and hydrogen sulfide to generate  $\text{SO}_2$ , 2) the catalytic oxidation of the  $\text{SO}_2$  to  $\text{SO}_3$ , and 3) the absorption of  $\text{SO}_3$  into strong  $\text{H}_2\text{SO}_4$  solution to form  $\text{H}_2\text{SO}_4$ . The burning sub-process incorporates two burner/boilers with each having a rated heat input capacity of forty-six (46) MMBTU/hr.

## **$\text{NO}_x$ Emission Information**

$\text{NO}_x$  emissions are generated only during the combustion sub-process (i.e., the burning of elemental sulfur, spent sulfuric acid, and hydrogen sulfide).

Stack testing on May 5, 1999 indicated that the  $\text{NO}_x$  emission rate from the ISA was 10.44 lb/hr (26.74 ppm). This equates to an annual  $\text{NO}_x$  emission of forty-four (44) tons per year assuming continuous operation at this emission rate.

The ISA is in and of itself a major stationary source of  $\text{NO}_x$ , and is subject to the Requirements of Regulation No. 12.

## **RACT Analysis**

This combustion operation is not covered under Section 3.3 of Regulation No. 12 since Section 3.3 covers only fuel burning equipment whose primary purpose is to produce heat to be used; the primary purpose of burning the sulfur is to produce  $\text{SO}_2$ . Evidence of this is the need to cool the exhaust from the burners prior to the next step in the process and after other steps in the process (i.e., the oxidation and absorption steps are highly exothermic). Section 3.3 does not apply and the process must be evaluated under Section 3.8 of Regulation No. 12.

Under Section 3.8 of Regulation No. 12, the Department considered the feasibility of both minimizing the generation of  $\text{NO}_x$  and the installation and operation of post-combustion  $\text{NO}_x$  removal technologies.

## **$\text{NO}_x$ Generation.**

Sulfur provides the majority of heat input to the burners, and is by definition a low  $\text{NO}_x$  fuel (i.e., low fuel bound  $\text{NO}_x$ ). This means that all of the  $\text{NO}_x$  generated is thermal  $\text{NO}_x$ . Combustion occurs at 1,700 to 2,000 °F, which is a relatively low temperature with regard to thermal  $\text{NO}_x$  generation dynamics. Because of the low fuel  $\text{NO}_x$ , the low combustion temperature, and the fact that all of the combustion gases are an integral part of the ISA process, the Department agrees with General Chemical that combustion modifications are not feasible relative to RACT.

## **Add-on $\text{NO}_x$ removal technologies.**

Several technical information sources were searched in an attempt to find  $\text{NO}_x$  control information relative to sulfuric acid manufacturing. The results of this search are as follows:

A review of the EPA's Clean Air Technology Center RACT/BACT/LAER Clearinghouse revealed no information regarding application of  $\text{NO}_x$  controls to sulfuric acid manufacturing.

The EPA has not published or proposed any new source performance standard (NSPS) for sulfuric acid manufacturing relative to control of  $\text{NO}_x$  emissions.

No other information relevant to  $\text{NO}_x$  emissions control of sulfuric acid manufacturing was identified.

It is noted that approximately  $\frac{3}{4}$  of the  $\text{NO}_x$  produced passes through the converters, absorbers, and ISA, and that these process components remove a portion of the  $\text{NO}_x$  generated. While  $\text{SO}_3$  is absorbed in strong  $\text{H}_2\text{SO}_4$ , the  $\text{NO}_x$  in the gas stream is also absorbed to form nitrogen containing

compounds and impurities.

General Chemical evaluated several NO<sub>x</sub> removal technologies and, based on economics, conclude they were not feasible. Such evaluation addressed SCR and wet scrubbing. Relevant factors contributing to the high cost are the low concentration of NO<sub>x</sub> in the exhaust stream and the high flow (i.e., 26.74 ppm and 54,737 scfm from the 1999 stack test).

For comparison purposes, Table 1 of Regulation No. 12 defines RACT for combustion units with a maximum heat input capacity of equal to or greater than 100 MMBTU/hr and firing liquid fuel as 0.25 lb/mmBTU heat input; the NO<sub>x</sub> emission rate from this process is 0.20 lb/mmBTU. The Department believes this low emission rate is attributable to the fuel being combusted (i.e., liquid sulfur), the relatively low combustion temperature (i.e., 1,700 to 2,000 °F) and the NO<sub>x</sub> absorption in the ISA itself. Because of this information, and considering the Company's economic analysis that add-on NO<sub>x</sub> removal technology is not cost effective, the Department agrees with General Chemical that the current status of the process is RACT.

#### **RACT Applicable Requirements**

The Department imposes no additional applicable requirements on the Sulfuric Acid Process and Interstage Absorption System under Regulation No. 12 of Delaware's "Regulations Governing the Control of Air Pollution."

#### **General Chemical Corporation**

**6300 Philadelphia Pike**

**Claymont, DE 19703**

**Metallic Nitrite Process**

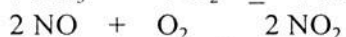
**with Caustic Scrubber**

#### **Regulated Pollutants Affected:**

This determination only pertains to the regulation of the ozone precursor, nitrogen oxides (NO<sub>x</sub>).

#### **Process Description**

This process is a batch process that produces potassium nitrite (50% solution). The process involves reacting a controlled mixture of air and ammonia over a catalyst. The catalyst converts the air-ammonia mixture into nitric oxide, nitrogen dioxide, and water vapor. This mixture is absorbed into potassium hydroxide circulating through an absorbing tower to form potassium nitrite. The reactions are as follows:



The potassium nitrite solution is stored, filtered, and used to make crystal.

#### **NO<sub>x</sub> Emission Information**

NO<sub>x</sub> emissions are generated in the reaction of the air/ammonia mixture over a catalyst.

Based on a 1982 stack test, General Chemical estimates the maximum controlled NO<sub>x</sub> emission rate is 10 lb/hr and the potential to emit NO<sub>x</sub> is 43.8 tons per year.

The metallic nitrite process is in and of itself a major NO<sub>x</sub> emitting source, and is subject to the requirements of Regulation No. 12.

#### **RACT Analysis**

Control of NO<sub>x</sub> from this process is by two means: 1) process control, and 2) operation of a counter flow packed column scrubber.

Process Control:

The rate that  $\text{NO}_x$  forms is proportional to the rate of the air/ammonia mixture fed to the process. Early in the batch when the free alkalinity in the absorption tray tower is high, the majority of the  $\text{NO}_x$  formed is absorbed by the process in the absorption tray tower. As the batch progresses, the free alkalinity in the tray tower liquid decreases, and the  $\text{NO}_x$  feed rate to the scrubber increases. Towards the end of each batch the free alkalinity in the absorption tray tower is near zero, and practically all of the  $\text{NO}_x$  generated passes through to the scrubber. Because of this, the  $\text{NO}_x$  inlet rate to the process (i.e., the air/ammonia mixture feed rate) is a particular concern.

The Department has determined that control of the air/ammonia feed rate(s) to the process is a necessary part of  $\text{NO}_x$  RACT for this process.

#### Scrubber:

The process off-gas treatment system incorporates a single stage packed tower scrubber which uses KOH as a scrubbing liquor. In the scrubber the KOH effectively reacts with the residual  $\text{NO}_x$  in the exhaust stream to form  $\text{KNO}_2$  and  $\text{KNO}_3$ . Note that the use of KOH as a scrubber liquor in this process overcomes the problem of disposal of the alkali nitric salts that other facilities might experience using this technology, since the liquor is used as feed for the next batch.

The Department has determined that operation of the KOH scrubber, to include monitoring and control of the free alkalinity in the scrubber liquor is a necessary part of  $\text{NO}_x$  RACT for this process.

As indicated above, the Department has determined that both the control of air/ammonia feed rate(s) to the process and the operation of a single stage packed tower scrubber which uses KOH as a scrubbing liquor constitute  $\text{NO}_x$  RACT for this process.

#### **RACT Applicable Requirements**

##### Operational Limits

- A. All emissions to the atmosphere from the metallic nitrite process shall pass through a KOH scrubber that is operated and maintained in accordance with the manufacturer's specifications and in accordance with good air pollution control practices.
- B. The free alkalinity of the scrubber liquor shall not fall below a level(s) established in accordance with good air pollution control practices, accepted by the Department and made federally enforceable.
- C. The pressure drop across the scrubber shall not fall outside of a range established in accordance with good air pollution control practices, accepted by the Department, and made federally enforceable.
- D. The air/ammonia feed rate to the process shall not exceed a rate(s) established in accordance with good air pollution control practices, accepted by the Department, and made federally enforceable. In implementing this provision separate feed rate(s) may be established for distinct phases of the process, for example, one rate may be established for all times except those times when the free alkalinity in the absorption tray tower falls below some value, at which time a lower rate may apply.
- E. There shall be no visible emissions from the scrubber outlet.

##### Compliance Method

Compliance with the visible emission limitation shall be determined by methods accepted by the Department and made Federally enforceable. Compliance with all other operational limitations shall be demonstrated based monitoring and record keeping requirements.

##### Monitoring

- A. The free alkalinity of the scrubber liquor shall be determined on a frequency established in accordance with good air pollution control practices, accepted by the Department, and made federally enforceable.

- B. The Company shall install and maintain a gauge that indicates the pressure drop across the scrubber.
- C. The air/ammonia feed rate to the process shall be continuously monitored at all times the metallic nitrite process operates.
- D. The free alkalinity in the absorption tower liquor shall be determined on a frequency established in accordance with good air pollution control practices, accepted by the Department, and made federally enforceable.
- E. The scrubber system exhaust stack shall be observed for visible emissions pursuant to a schedule accepted by the Department and made federally enforceable. Such observations shall be conducted towards the end of any batch when possible.

Testing

- A. Inspect the NO<sub>x</sub> scrubber, scrubber packing and spray nozzles, pursuant to the manufacturer's recommendation, but not less than annually.
- B. Calibrate pursuant to the manufacturer's recommendations, but not less than annually, the differential pressure gauge.

Record Keeping

- A. The Company shall maintain records of all measurements of the free alkalinity of the scrubber liquor and of the free alkalinity of the liquor in the absorption tower.
- B. At least once each day that the metallic nitrite process operates, the Company shall maintain records of the differential pressure across the scrubber.
- C. The Company shall continuously record the air/ammonia feed rate to the process at all times the metallic nitrite process operates.
- D. The Company shall maintain a log of all visible emissions observations made, to include the date, time, and results of each observation.
- E. The Company shall maintain records of any scheduled or non-scheduled maintenance and calibration data for the scrubber, or the differential pressure gauge.

Reporting

No reporting requirements beyond those of Regulation No. 30 are being imposed on this process under Regulation No. 12.

Eng. No.	Eng. No.	Imp. Est.
Ave. 406	Ave. 406	Avalon