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FINAL ENVIRONMENTAL ASSESSMENT

NOxOUT SELECTIVE NONCATALYTIC REDUCTION DEMONSTRATION JOHNSONVILLE FOSSIL PLANT - UNIT 1 Humphreys County, Tennessee

TENNESSEE VALLEY AUTHORITY

APRIL 2005

Direct Comments to:

Diedre Nida
NEPA Administration
Tennessee Valley Authority
1101 Market Street, MR 2T
Chattanooga, TN 37402-2801
Phone: (423) 751-4430
Fax: (423) 751-3230
e-mail: dbnida@tva.gov

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Proposed project: NOxOUT Selective Noncatalytic Reduction Demonstration
Johnsonville Fossil Plant – Unit 1
Humphreys County, Tennessee

**For further information,
contact:**

Diedre Nida
Senior NEPA Specialist
Tennessee Valley Authority
1101 Market Street (MR 2T)
Chattanooga, TN 37402-2801
Phone: 423-751-4430
Fax: 423-751-3230
e-mail: dbnida@tva.gov

Abstract: Tennessee Valley Authority (TVA) is proposing to install and evaluate equipment for removal of nitrogen oxides (NOx) from coal combustion flue gas, utilizing selective noncatalytic reduction on Unit 1 at Johnsonville Fossil Plant. This action would help TVA meet its systemwide goal of reducing NOx emissions by over 78 percent. NOx emissions are a major factor in causing air pollution, including acid rain and high ground-level ozone concentrations. Reductions of NOx emissions are necessary to meet air regulatory requirements under Section 110 of the Clean Air Act.

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CHAPTER 1

1. PURPOSE OF AND NEED FOR ACTION

1.1. The Decision

Tennessee Valley Authority (TVA) is proposing to install and evaluate equipment for removal of nitrogen oxides (NO_x) from coal combustion flue gas, utilizing selective noncatalytic reduction (SNCR) on Unit 1 at Johnsonville Fossil Plant (JOF). This action would help TVA to meet its systemwide goal of reducing NO_x emissions by over 78 percent. NO_x emissions are a major factor in causing air pollution, including acid rain and high ground-level ozone concentrations. Reductions of NO_x emissions are necessary to meet air regulatory requirements under Section 110 of the Clean Air Act.

1.2. Background

1.2.1. NO_xOUT SNCR – General Description of Process

NO_xOUT SNCR is a patented, urea-based NO_x reduction technology that is derived from research conducted in the early 1970s by the Electric Power Research Institute. NO_xOUT SNCR is an in-furnace, post-combustion NO_x reduction technology that relies on the finely controlled distribution of urea to effect a selective reaction of gas-phase ammonia with NO_x within a specific temperature region in the upper furnace. For this application, the urea is delivered and stored as a 40 to 50 percent aqueous solution that is continuously circulated through the SNCR system-piping loop. Using plant raw water, a metering module further dilutes the reagent to a predetermined concentration and precisely controls the flow of diluted reagent to distribution modules. The distribution modules provide the final control of diluted reagent and atomizing/cooling (plant) air being delivered to each injector into the boiler, where droplet size and trajectory for each injector have been determined through advanced computer modeling. The final spray characteristics and flow rate of diluted reagent for each injector are fine-tuned during system optimization and startup to correspond to specific boiler operating loads and NO_x concentration. Figure 1-1 shows a typical conceptual layout for a multiple-level SNCR system installed on a single boiler.

SNCR is an in-furnace NO_x reduction process that has been applied to a variety of boiler and furnace types burning a wide range of fuels. Because SNCR is a post-combustion NO_x reduction technology, the type of furnace and fuel being burned are much less critical than the flue gas composition, temperature downstream of the combustion zone, and other operating conditions. In a coal-fired application, the important process design parameters, beyond temperature and residence time, are the carbon monoxide concentration in the upper furnace region and the sulfur trioxide (SO₃) concentration at the air preheater (APH) inlet. All of these factors must be taken into account in the final SNCR system design.

1.2.2. Site Description

Johnsonville Fossil Plant (JOF) is located on 720 acres of land on the Tennessee River's Kentucky Lake. It is named for the town of Johnsonville, which was flooded during the formation of Kentucky Lake. The town was relocated several miles south and was renamed New Johnsonville. The plant has ten generating units with a combined capacity of 1,350 megawatts. Plant construction began in May 1949. The first generating unit went into operation in October 1951. By August 20, 1959, all ten of the plant's coal units were

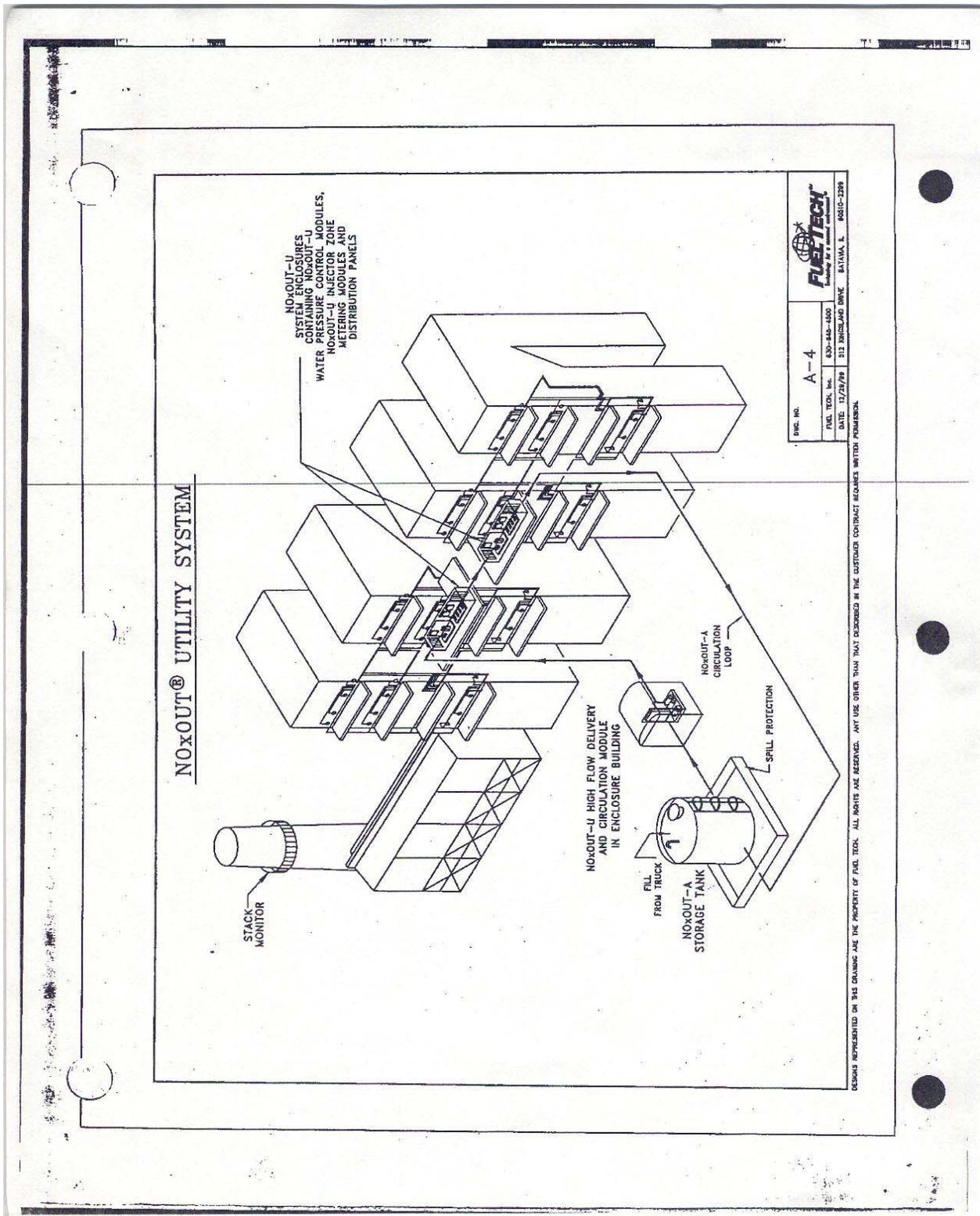


Figure 1-1. Typical Conceptual Layout for a Multiple-Level Selective Noncatalytic Reduction System Installed on a Single Boiler

generating power. JOF consumes some 9,600 tons of coal per day, and generates about 550 million kilowatt-hours of electricity a year, enough to supply 40,000 homes. JOF supplies their neighboring industry, DuPont, with process steam for the manufacture of titanium dioxide. See Figure 1-2 for site map.

1.2.3. Johnsonville - Installation of a Flue Gas Conditioning System

In October 2004, TVA prepared an Environmental Assessment (EA) (TVA, 2004) for addition of a Flue Gas Condition (FGC) system that would switch all ten units at JOF to a lower sulfur coal. The proposed installation of an FGC system would require the on-site storage and use of anhydrous ammonia. This project was scheduled to start in the spring of 2005 but has been deferred until 2007. There is a potential that the proposed SNCR system and the FGC system could not be operated concurrently due to discharge limitations for ammonia. If TVA decided there was a need to operate these two systems concurrently, an environmental review would be performed at that time.

1.3. Other Pertinent Environmental Reviews or Documentation

Tennessee Valley Authority. 2005a. NOxOUT Selective Noncatalytic Reduction Demonstration, Shawnee Fossil Plant - Unit 1 Environmental Assessment. April 2005.

Tennessee Valley Authority. 2004. Installation of a Flue Gas Conditioning System, Johnsonville Steam Plant Environmental Assessment. October 2004.

Tennessee Valley Authority. 2002. Development of Long-Term Ash Management Strategy, Kentucky Reservoir, Humphreys County Environmental Assessment. February 2002.

Tennessee Valley Authority. 1995. Energy Vision 2020 - Integrated Resource Plan Environmental Impact Statement. December 1995.

1.4. The Scoping Process

A TVA interdisciplinary team reviewed the proposed project for potential direct, indirect, and cumulative effects of Alternative A, the No Action Alternative, and Alternative B, Demonstration of NOxOUT SNCR System on JOF Unit 1. Potentially affected resources include air, water (industrial wastewater, surface water, and groundwater), solid waste, aquatic ecology, and protected aquatic species.

1.5. Necessary Federal Permits, Licenses, or Notifications

Action Alternative B would require the following to be obtained:

- An asbestos removal notification would be obtained for boiler penetration work.
- A National Pollutant Discharge Elimination System (NPDES) permit modification could be required for ammoniated wastewater discharge from Outfall 001.



Figure 1-2. Johnsonville Fossil Plant Site Map With Expansion of Unit 1 and Area for the Proposed Location of the Temporary Frac Tank and Circulation Module

CHAPTER 2

2. ALTERNATIVES INCLUDING THE PROPOSED ACTION

This chapter describes the No Action and Action Alternatives, and discusses the environmental consequences of each.

2.1. Alternatives

This EA evaluated two alternatives: Alternative A, the No Action Alternative, and Alternative B (the Action Alternative), Demonstration of NO_xOUT SNCR System on JOF Unit 1.

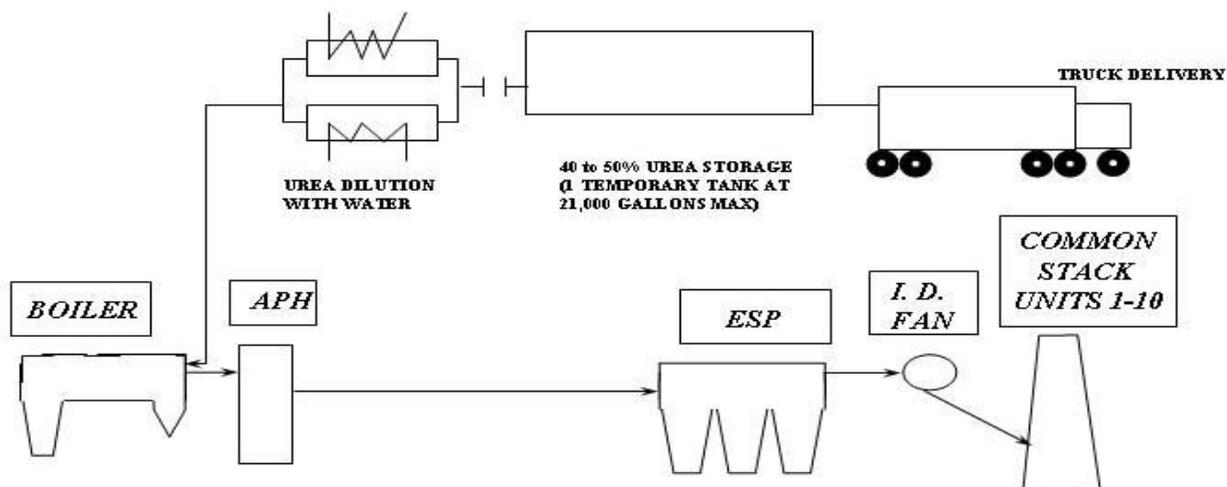
2.1.1. *Alternative A – The No Action Alternative*

Under Alternative A, the plant would not install and demonstrate the NO_xOUT SNCR system on Unit 1 at JOF. Under Alternative A, there would be no physical or operational changes to JOF.

2.1.2. *Alternative B – Demonstration of NO_xOUT SNCR System on JOF Unit 1*

Under Alternative B, the plant would install and demonstrate the NO_xOUT SNCR system. This demonstration would be conducted on JOF Unit 1 during 2005 and 2006. If the demonstration proved successful, another environmental review would be conducted to determine if SNCR could be placed on additional units at JOF.

Under Alternative B, there would be minor physical additions outside and inside the powerhouse. Alternative B would add a temporary 21,000-gallon frac tank to store the 40 to 50 percent urea solution (see Appendix A for the Material Safety Data Sheets for urea), a circulating module inside an enclosed modular building, and associated piping outside the powerhouse at the north end by the insulator trailer. See Figure 1-2 for location. The metering module (east of Unit 1) at elevation 428 feet; the distribution modules (1 [east of Unit 1] at elevation 430 feet and 2 [east of Unit 1] at elevation 413 feet); and the 19 injectors (12 [4 in front, 4 in back, and 2 on each side] at elevation 414 feet 2 inches, 2 [1 one each side] at elevation 424 feet, and 5 [4 in front and 1 on left side] at elevation 434 feet 6 inches) would be located inside the powerhouse. See Figure 1-1 for a visual description of equipment. See Figure 2-1 for a proposed SNCR treatment train for JOF Unit 1. The general SNCR process is described under Section 1.2 of this EA.



% = Percent
 APH = Air Preheater
 ESP = Electrostatic Precipitator
 I.D. Fan = Induced Draft Fan
 Max = Maximum

Figure 2-1. Proposed Selective Noncatalytic Reduction Treatment Train at Johnsonville Fossil Plant Unit 1

2.2. Comparison of Alternatives

For a comparison of environmental impacts under each alternative, see Table 2-1.

Table 2-1. Comparison of Potential Environmental Impacts

Resource Area or Environmental Issue	Alternative A No Action	Alternative B Demonstration of NOxOUT SNCR System on JOF Unit 1
Air	None	<ul style="list-style-type: none"> • Transient air pollutant emissions would occur during the construction phase of this project. • Land clearing, site preparation, and vehicular traffic over unpaved roads and construction sites would result in the emission of fugitive dust particulate matter (PM) during site preparation and active construction periods. • Combustion of gasoline and diesel fuel by internal combustion engines (vehicles, generators, construction equipment, etc.) would generate local emissions of PM, NOx, carbon monoxide, volatile organic compounds (VOCs), and sulfur dioxide (SO₂) throughout the site preparation and construction period.

Resource Area or Environmental Issue	Alternative A No Action	Alternative B Demonstration of NOxOUT SNCR System on JOF Unit 1
		<ul style="list-style-type: none"> • There would be the possibility of slight increases in ammonia concentrations downwind of the plant site. • The overall effect of the change in ambient ozone concentration (or the frequency of that change) at a specific place due to NOx emission reductions at JOF during operation would be to reduce the amount of ozone produced in the atmosphere. • Allowing ammonia to slip through the system without reacting could lead to the formation of particulate, which could lead to a slight increase in the atmospheric particulate burden.
Wastewater	None	<ul style="list-style-type: none"> • Using a 20-parts per million by volume (ppmv) ammonia slip rate and assuming all the ammoniated steam cleaning waste from the twice weekly Unit 1 APH cleaning is being discharged to the ash pond simultaneously, the ammonia concentration at Outfall 001 is estimated to be 1.09 milligrams (mg) of ammonia nitrogen per liter (NH₃-N/L), which is less than the criterion maximum concentration (CMC) for the allowable pH range. • If the ammoniated fly ash sluice water and ammoniated Unit 1 APH steam cleaning waste were discharged directly to the Tennessee River during the 1Q10 low flow conditions, the ammonia concentration calculated for a 20-ppmv slip rate is 0.008 mg NH₃-N/L, which would be well below the chronic criterion concentration (CCC) under normal conditions. • The largest ammonia loading to the ash pond would occur during the Unit 1 APH cleaning, assuming the wastewater would be discharged directly to the ash pond, as is the current practice. Using an 11-month buildup of ammonia on the APH surfaces prior to being washed, a loading of approximately 6,468 to 25,914 pounds would occur (based on ammonia slip rate of 5 to 20 ppmv, respectively). Under these conditions, the CMC would only be met within specific pH ranges at Outfall 001 for the 6,468-pound load and would not be met for the 25,914-pound load. Therefore, the Unit 1 APH wash wastewater would be contained, and the ammonia concentration would be determined. Based on the

Resource Area or Environmental Issue	Alternative A No Action	Alternative B Demonstration of NOxOUT SNCR System on JOF Unit 1
		<p>ammonia concentration, the wash wastewater would be released into the ash pond at a controlled rate to ensure the effluent ammonia concentration meets the CMC for the pond and the CCC for the Tennessee River.</p>
Surface Water	None	<ul style="list-style-type: none"> Construction impacts, temporary erosion, and sedimentation would be minimized by implementing Best Management Practices (BMPs) to control erosion during construction, stabilizing disturbed areas after completion of construction, and routing surface runoff to existing treatment facilities that meet regulatory requirements.
Groundwater	None	<ul style="list-style-type: none"> Since the ash pond is situated on an island artificially created within the reservoir, all pond seepage entering the underlying groundwater system would ultimately discharge as seepage into the Tennessee River. Effects of ammoniated leachate seepage on river water quality are expected to be negligible.
Solid Waste	None	<ul style="list-style-type: none"> All fly ash and bottom ash produced at JOF is sluiced to the main ash pond for handling. Ammonia on fly ash is highly water soluble and should dissolve into the sluice water as the ash is pumped to the pond. Therefore, fly ash removed from the pond and hauled off site should not contain any ammonia.
Aquatic Ecology	None	<ul style="list-style-type: none"> The storage, handling, and use of urea solutions for the proposed NOxOUT SNCR system would result in the potential for ammonia or other nitrogenous compound contamination of surface water and impacts to aquatic life. One pathway for impacts would be a direct accidental release of urea to surface water. The engineered features of the urea storage system include a retention basin for spills to minimize this risk. Another pathway for surface water impacts would be ammonia contamination of combustion byproducts, such as fly ash. No significant impacts on the water quality of the Tennessee River would be anticipated, as discharges from the ash pond would be required to meet the acute criterion for ammonia and NPDES permit limits designed to prevent degradation of the receiving stream.

Resource Area or Environmental Issue	Alternative A No Action	Alternative B Demonstration of NOxOUT SNCR System on JOF Unit 1
		<ul style="list-style-type: none"> Management of water treatment system flows and other appropriate mitigation measures, as necessary, would maintain discharge ammonia concentrations at levels that would safeguard water quality and protect aquatic life.
Protected Aquatic Species	None	<ul style="list-style-type: none"> Due to the possibility of the release of ammonia to surface waters or through groundwater migration to the Tennessee River, there exists a potential to affect individuals or populations of pink mucket. However, with mitigation safeguards to minimize ammonia in the discharge, there would be no impacts to listed aquatic species. Conservative modeling estimates place both the potential ammonia discharge from the ash pond outfall and the potential leachate effects of ammonia in the Tennessee River below levels that would result in acute or chronic toxicity to aquatic animals.

2.3. The Preferred Alternative

TVA's preferred alternative is Alternative B, Installation and Demonstration of the NOxOUT SNCR System on JOF Unit 1.

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CHAPTER 3

3. AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

JOF staff conducted a preliminary examination of the scope of this project and discussed issues of environmental concern. Several media and resource areas were determined to have no impacts, i.e., archaeology, terrestrial ecology, visual, and noise impacts. However, a few media and resource areas had uncertainties regarding the potential for impacts. The JOF staff determined that these areas needed a greater degree of evaluation. Subsequently, an EA was initiated. The media and resource areas evaluated and discussed in greater detail in this EA are air, water (industrial wastewater, surface water, and groundwater), solid waste, aquatic ecology, and protected aquatic species.

3.1. Air

3.1.1. *Affected Environment*

The air quality in the vicinity of JOF is generally good, with the area in compliance with all air quality standards. Regionally, air quality is also generally good. The new 8-hour ozone standard promulgated by the United States Environmental Protection Agency (USEPA) in 1997 is more stringent than the old ozone standard, and many areas are having difficulty meeting attainment of the new standard. In addition, some areas, including Humphreys County, could experience periods when fine particulate concentrations will be above the recently adopted annual PM_{2.5} standard.

3.1.2. *Environmental Consequences*

3.1.2.1. **Alternative A - No Action**

Under the No Action Alternative, current air quality in the vicinity of JOF is expected to continue.

3.1.2.2. **Alternative B - Demonstration of NO_xOUT SNCR System on JOF Unit 1**

Construction Impacts

Under Alternative B, transient air pollutant emissions would occur during the construction phase of this project. Since the JOF site has already been developed as an industrial site, construction-related emissions would be relatively less than for a new site. Construction-related air quality impacts are primarily related to land clearing, site preparation, and the operation of internal combustion engines.

Vehicle Emissions and Excavation Dust

Land clearing, site preparation, and vehicular traffic over unpaved roads and construction sites would result in the emission of fugitive dust particulate matter (PM) during site preparation and active construction periods. The largest-size fraction (greater than 95 percent by weight) of fugitive dust emissions would be deposited within the construction site boundaries. The remaining fraction of PM would be subject to longer-range transport. If necessary, open construction areas and unpaved roads would be sprinkled with water to reduce fugitive dust emissions by as much as 50 percent.

Combustion of gasoline and diesel fuel by internal combustion engines (vehicles, generators, construction equipment, etc.) would generate local emissions of PM, NO_x, carbon monoxide, VOCs, and SO₂ throughout the site preparation and construction period. The total amount of these emissions would be small and would result in minimal off-site impacts.

Air quality impacts from construction activities would be temporary and dependent on both man-made factors (e.g., intensity of activity, control measures, etc.) and natural factors (e.g., wind speed, wind direction, soil moisture, etc.). However, even under unusually adverse conditions, these emissions would have, at most, a minor, transient impact on off-site air quality that would not exceed or violate any applicable ambient air quality standard. Overall, the air quality impact of construction-related activities for the project would not be significant.

Operational Impacts

Alternative B operational impacts would not adversely impact local air quality. There would be the possibility of slight increases in ammonia concentrations downwind of the plant site. This possibility is discussed below. Overall, operation of Unit 1 with the SNCR would improve air quality.

Ozone-Scavenging Losses

Ozone concentrations below background levels occur immediately downwind of NO_x sources, such as power plants, due to ozone scavenging, i.e., nitric oxide emissions consuming ozone. Significant ozone production does not occur until 20 to 80 kilometers (km) downwind of the NO_x source. The proposed SNCR reduction of NO_x emissions might reduce the size of the area in which ozone scavenging occurs. While ozone concentrations might increase slightly in areas previously affected by ozone scavenging, they would not be expected to increase above background ozone levels.

Plume Opacity and Plume Blight

Plume opacity is determined by the amount of nitrogen dioxide (NO₂) and PM emitted. Due to the optical properties of NO₂, it tends to give a plume a slight reddish-brown color when viewed against a clear sky. Since Alternative B would greatly reduce NO_x emissions, it would also be expected to reduce plume opacity and plume blight.

Regional Impacts

The primary purpose of Alternative B would be to reduce emissions of NO_x, a pollutant that can, in combination with VOCs and sunlight, lead to the production of ozone. The purpose of this section is to describe the nature of ozone and the impacts that reducing NO_x emissions from JOF would have on ambient ozone levels. In addition, the potential impact of Alternative B on secondary particulate formation and regional haze is described.

Ozone

Ozone forms in the atmosphere as a result of a mixture of NO_x and VOCs being exposed to sunlight. Both NO_x and VOCs have natural and anthropogenic (man-made) emissions sources. For example, isoprene (a VOC important in ozone formation) is primarily emitted from trees and crops. Other VOCs, however, are emitted into the atmosphere as the consequence of human activity, such as the use of solvents or the operation of motor vehicles. While there are also natural sources of NO_x, they are relatively small compared to the NO_x emitted from motor vehicles and other forms of fuel combustion. Since large

utility boilers burn large quantities of fossil fuel, they are a major source of the NO_x emitted into the atmosphere.

Ozone levels in the TVA region have historically been less than the National Ambient Air Quality Standards (with the exception of a few urban centers). With the recent revision of the ozone standard from a 1-hour average concentration of 120 parts per billion (ppb) to an 8-hour average concentration of 80 ppb, more areas in the TVA region are expected to experience ozone concentrations exceeding the standard. Furthermore, it is anticipated that a number of urban areas and even some remote, rural areas in the Appalachian Mountains, which barely met the former 1-hour standard, will experience ozone concentrations above the 8-hour standard.

Although it is not possible to quantify the change in ambient ozone concentration (or the frequency of that change) at a specific place due to NO_x emission reductions at JOF, it is known from previous modeling and air quality research that the overall effect would be to reduce the amount of ozone produced in the atmosphere. It is also known that the area that would benefit the most would be the area within about 150 km downwind from JOF.

Secondary Particulate and PM₁₀/PM_{2.5}

Although almost all of the urea would be chemically converted to nitrogen and water in the reactions that would be responsible for the reduction in NO_x emissions, there would be a possibility that some ammonia would be emitted from the stack. Since ammonia is associated with the formation of particulate in the atmosphere, any ammonia that would be emitted has the potential to result in the formation of additional atmospheric particulate. Therefore, allowing ammonia to slip through the system without reacting could lead to the formation of particulate, which could lead to a slight increase in the atmospheric particulate burden. However, since this demonstration project would only have an SNCR on one unit and there are ten units exhausting to a common stack, there is sufficient SO₃ in the exhaust gases from the other units to react with any excess ammonia slip, even at the highest potential ammonia slip rate, when the exhaust gases are mixed before being released from the common stack.

3.2. Industrial Wastewater

3.2.1. Affected Environment

Existing Coal Combustion Byproducts Wastewater Treatment Facilities

JOF has ten operating pulverized coal combustion units. These units are expected to burn between 3.9 and 4.2 million tons of coal annually through at least calendar year 2009. Total pulverized coal ash production will range from approximately 260,000 to 300,000 tons of ash per year. The 4-year average fly ash production for individual units at JOF (2001-2004) is approximately 22,500 tons per year. The fly ash is fine enough and light enough to be entrained in the flue gas stream exiting the boiler. The bottom ash is coarser and heavier and collects in the bottom of the boiler. Both the fly ash and bottom ash are wet-slurried to the ash pond. As described in the following paragraphs, the coal combustion byproducts handling system at JOF utilizes a central ash disposal area that receives and treats wastewater effluents.

Ash Pond

The ash pond is permitted to receive combined wastewaters of ash transport water, treated chemical and nonchemical metal cleaning wastes, untreated nonchemical metal cleaning wastes, APH cleaning wastes, station sump discharges, groundwater flows, coal pile runoff,

and storm water runoff among other flows. The ash pond inflow sources and flow rates are listed in Table 3-1. The ash pond effluent is discharged to the Tennessee River at an average rate of 22.8 million gallons per day (mgd).

All fly ash and bottom ash produced at JOF is sluiced to the ash pond for handling. In the pond, bottom ash is continuously removed from the ash sluice channel by “dipping” using either a dragline or a track hoe to keep the channel open. Fly ash, which is lighter, is carried past the bottom ash settling area into the main section of the ash pond. The fly ash is routinely removed and hauled to an off-site area, along with bottom ash, for use in developing a 60-acre industrial site.

The APHs are washed during plant outages, typically once every 3 years. The wastewater from the cleaning of the APHs is currently discharged directly to the ash pond. In addition, the APHs are steam cleaned twice per week, removing an estimated 10 percent of the waste that is collected on the interior surfaces. Wastes from the steam cleaning are disposed of in the ash pond.

According to the current JOF NPDES permit, TVA is required to meet the ash pond effluent limits presented in Table 3-2. These requirements do not include limitations for ammonia concentrations in the effluent, but do include limits for acute toxicity. Within the ash pond, the stilling pond has permanent baffles to increase retention time and mixing. The ash pond is also equipped with a carbon dioxide system used to regulate pH conditions at the discharge to maintain compliance with the NPDES permit requirements.

Table 3-1. Inflow Sources to Ash Pond

Source	Inflow to Ash Pond (mgd)
Ash sluice water	17.1345
Station sumps and nonthermal sump	5.4909
Coal yard drainage pumping basin	0.3318
Intermittent Flows:	
Metal cleaning waste treatment pond	0.0869
Nonchemical metal cleaning waste	0.0035
Precipitation	0.2352
Proposed dredge pump ash sluice water	- 0.4519
Evaporation	- 0.0670
Total	22.7639

mgd = million gallons per day

Source: Wastewater Flow Schematic NPDES Permit Number TN0005444 effective April 1, 2005,

Table 3-2. Discharge Serial Number 001 Discharge Requirements

Effluent Characteristics	Effluent Limitations				Monitoring Requirements	
	Monthly Average		Daily Maximum		Measurement Frequency	Sample Type
	Average Concentration	Average Amount	Average Concentration	Average Amount		
	(mg/L)	(lb/day)	(mg/L)	(lb/day)		
Flow	Report (mgd)		Report (mgd)			
pH	Range 6.0 – 9.0 (s.u.)				1/Week	Grab
Total Suspended Solids	30	--	86.6	--	30	--
Oil and Grease	14	--	19	--	14	--
Aluminum (total)	--	--	Report	--	--	--
Arsenic (total)	--	--	Report	--	--	--
Iron (total)	--	--	Report	--	--	--
Lead (total)	--	--	Report	--	--	--
Silver (total)	--	--	Report	--	--	--

lb/day = pounds per day

LC₅₀ = An estimate of the effluent concentration which is lethal to 50 percent of the test organisms in the time period prescribed by the test, expressed as the LC₅₀

mgd = million gallons per day

mg/L = milligrams per liter

s.u. = standard unit

Source: NPDES Permit Number TN0005444 effective April 1, 2005

Metal Waste Cleaning Pond (Outfall 005)

JOF is authorized by its NPDES permit to discharge chemical and nonchemical metal cleaning wastewaters from the metal waste cleaning pond through internal monitoring point 005 to the ash pond. Both APH wash wastewater and boiler cleaning waste have been discharged to the metal waste cleaning pond. The waste is pumped from the metal waste cleaning pond to the ash pond. The metal waste cleaning pond has discharge limitations for total copper and total iron and requirements for reporting flow measurements for each batch. The working capacity of the metal waste cleaning pond is estimated to be 4.2 million gallons (personal communication, Anthony Dillon, TVA JOF, February 10, 2005).

3.2.2. Environmental Consequences

3.2.2.1. Alternative A - No Action

TVA would continue to operate JOF without the NO_xOUT SNCR demonstration on Unit 1, and no impacts to industrial wastewater are anticipated beyond the effects of existing and future activities associated with routine operation of the plant.

3.2.2.2. Alternative B - Demonstration of NO_xOUT SNCR System on JOF Unit 1

Operational Impacts

Ammonia Slip

As stated in Section 1.2, the NO_xOUT SNCR system is an in-furnace, post-combustion NO_x reduction technology that relies on the finely controlled distribution of urea to effect a selective reaction of gas-phase ammonia with NO_x. Ammonia slip, the emission of unreacted ammonia (NH₃), is caused by the incomplete reaction of the ammonia with NO_x present in the flue gas. The unreacted NH₃ could react with available gaseous sulfuric acid to form ammonium bisulfate (NH₄HSO₄), which is a very sticky substance. Ammonia slip tends to adhere to or commingle with the fly ash and/or build up on the APH interior

surfaces. Formation of NH₄HSO₄ could accelerate the buildup inside the APHs and make the periodic cleaning of the APHs more difficult.



European experience with selective catalytic reduction (SCR) NO_x control systems at facilities using low-sulfur coals led to a recent study conducted by ABB Environmental. The study concluded that about 20 percent of the NH₃ slip adhered to the heating surfaces in the APH, and about 80 percent adhered to the fly ash (ABB Environmental, 2000). No known ammonia partitioning study for SNCRs has been performed. This EA assumes that the partitioning would be similar to the ABB SCR study. Until there is further experience with United States coal types, the partitioning of ammonia slip between fly ash and APH heating surfaces will be based on professional judgments.

The amount of ammonia slip would depend on unit operation. The ammonia slip rate would vary during the demonstration to determine the optimum operational settings. Since there would be no catalyst subjected to fouling, the slip rate would be assumed to be constant during SNCR operations, unless the urea injection rate changed. Initially the expected slip rate would be 5 ppmv, but could be 20 ppmv or higher. For this EA, slip rates of 5 ppmv and 20 ppmv will be discussed to provide information to determine if significant environmental impacts are likely.

Air Preheater Cleaning

The Unit 1 APHs are steam cleaned twice weekly while the unit is online (personal communication, Anthony Dillon, TVA JOF, February 18, 2005). The ammonia removed during the steam cleaning is estimated to be 10 percent of the ammonia accumulated in the Unit 1 APHs. Steam cleaning waste is discharged to the ash pond.

Currently, once every 3 years, the two Unit 1 APHs are thoroughly washed during the Unit 1 outages. Approximately 100,000 gallons of water are used to clean the APHs during a 24-hour period (personal communications with Anthony Dillon, TVA JOF, February 8, 2005, and Kenneth Mullinax, TVA JOF, March 1, 2005). Formation of ammonium bisulfate due to ammonia reacting with sulfuric acid in the flue gas could build up on the interior surfaces of the Unit 1 APHs. Additional wash water and/or more frequent washings might be required to remove the sticky ammonium bisulfate and eliminate plugging. For the purposes of this EA, the volume of water used to clean the Unit 1 APHs is assumed to be 100,000 gallons, which provides the least amount of dilution. For the worst-case scenario analyzed for this EA, the SNCR would operate continuously during a portion of the ozone season in 2005 (July through October), and before, during, and after the ozone season in 2006 (mid-April through October). The Unit 1 APH cleaning is assumed to occur after the 2-year demonstration, which provides the worst-case condition for buildup of ammoniated material on the APHs. In addition, the APH wash wastewater will be assumed to be discharged directly to the ash pond, as is the current practice.

Bottom Ash

Bottom ash sluice water would not be anticipated to be affected by ammonia slip. The SNCR operation is an in-furnace, post-combustion NO_x reduction technology where the urea is injected into the flue gas. The bottom ash is collected in the bottom of the boiler prior to the point where the urea would be injected. Therefore, any ammonia slip would be entrained in the flue gas and would have no contact with the bottom ash. The ammonia slip would be accounted for on the fly ash and on the interior surfaces of the Unit 1 APHs,

presumably 80 percent with the fly ash and 20 percent with the APHs (ABB Environmental, 2000).

Ammonia Loading to the Ash Pond

Ammonia Criteria

The current JOF NPDES permit requirements for the Outfall 001 discharge do not include limitations for ammonia concentrations; however, acute toxicity testing and reporting are required, and there are existing water quality criteria for ammonia. The acute criterion (criterion maximum concentration or CMC) for protection of aquatic life ammonia toxicity is defined as the 1-hour average concentration of total ammonia nitrogen (in milligrams of nitrogen per liter [mg N/L]) that should not be exceeded more than once every 3 years on average. The CMC is not affected by temperature but does vary with pH. As the pH increases, the CMC decreases (Table 3-3). The CMC for ammonia must be met at the Outfall 001 discharge point in accordance with regulations and NPDES permit requirements.

Table 3-3. Maximum Allowable Ammonia Concentrations to Protect Aquatic Life From Acute Effects at Typical pH Levels

Acute Criterion (mg NH₃-N/L)						
pH 6.0	pH 6.5	pH 7.0	pH 7.5	pH 8.0	pH 8.5	pH 9.0
54.99	48.83	36.09	19.89	8.41	3.20	1.32

Note: Assumes salmonids are absent

Similarly, the chronic criterion concentration (CCC) for ammonia must be met in the receiving stream to protect the aquatic biota of the Tennessee River. The CCC is defined as the 30-day average concentration not to be exceeded more than once every 3 years. In addition, the highest 4-day average within the 30-day period should not exceed 2.5 times the CCC. The CCC is dependent on both temperature and pH. As temperature and/or pH increases, the CCC decreases (Table 3-4).

Table 3-4. Thirty-Day Average Allowable Ammonia Concentrations to Protect Aquatic Life From Chronic Effects at Selected pH Levels

Chronic Criterion Concentration (CCC) (mg NH₃-N/L)				
Temperature (°F)	pH 7.5	pH 8.0	pH 8.5	pH 9.0
70	2.85	1.59	0.71	0.32
75	2.38	1.33	0.6	0.27
80	1.99	1.11	0.5	0.22
82	1.86	1.03	0.46	0.21
84	1.73	0.96	0.43	0.19
86	1.61	0.90	0.4	0.18

°F = Degrees Fahrenheit

Note: Assumes salmonids are absent

Fly Ash Sluice Water Loading

Ammoniated fly ash would be wet sluiced to the ash pond during normal operation of the SNCR on Unit 1. The fly ash is assumed to mix completely with the ash pond inflow and, due to short-circuiting, mix with only 50 percent of the ash pond free water volume. In addition, no volatilization, chemical degradation, or biological uptake of the ammonia is assumed for the purposes of estimating the ammonia discharges. Using a 20-ppmv ammonia slip rate and assuming all of the ammoniated steam cleaning waste from the twice weekly Unit 1 APH cleaning is being discharged to the ash pond simultaneously, the ammonia concentration at Outfall 001 is estimated to be 1.08 mg NH₃-N/L, which is less than the CMC for the allowable pH range (Table 3-3). The impact of the ammoniated discharge produced by the sluiced fly ash and Unit 1 APH steam cleaning waste loading to the ash pond during normal operation of the Unit 1 SNCR is determined to be insignificant only if the ammonia concentration discharged from Outfall 001 meets the CMC.

Even if the ammoniated fly ash sluice water and ammoniated Unit 1 APH steam cleaning waste were discharged directly to the Tennessee River during the 1Q10 low flow conditions (disregarding mixing that would occur in the inflow to the ash pond and in the ash pond itself, and assuming no volatilization, degradation and/or biological uptake of the ammonia), the ammonia concentration calculated for a 20-ppmv slip rate is 0.008 mg NH₃-N/L, which would be well below the CCC under normal conditions (Table 3-4). Therefore, the ammonia loading from the sluiced fly ash and ammoniated APH steam cleaning waste discharged to the ash pond during normal operation of the Unit 1 SNCR is expected to have an insignificant toxicity impact to the receiving stream.

APH Cleaning Wastewater Loading

The largest ammonia loading to the ash pond would occur during the Unit 1 APH cleaning, assuming the wastewater would be discharged directly to the ash pond, as is the current procedure. The Unit 1 APH wash scenario analyzed for this EA assumes that there would be an 11-month buildup of ammonia on the APH surfaces (from the 2-year SNCR demonstration) prior to being washed. This buildup would result in ammonia loading of approximately 6,478 to 25,914 pounds, assuming an ammonia slip rate of 5 to 20 ppmv, respectively. Steady release of the ammoniated material is assumed throughout the washing process; although, it is likely that a more concentrated release would occur over a shorter time span at the beginning of the washing process.

Like the fly ash sluice water, the Unit 1 APH cleaning waste is assumed to mix completely with the ash pond inflow and, due to short-circuiting, mix with only 50 percent of the ash pond free water volume. In addition, no volatilization, chemical degradation, or biological uptake of the ammonia is assumed for purposes of estimating the ammonia discharges.

As presented in Table 3-5, under these conditions for the direct release of the Unit 1 APH wash wastewater to the ash pond, the CMC would only be met within specific pH ranges at Outfall 001 for the 5-ppmv slip rate and would not meet the CMC criteria for the allowable pH range (6.0-9.0 s.u.) if the slip rate were 20 ppmv. Even if the slip rate were maintained at 5 ppmv, the pH would have to be 7.62 s.u. or less to meet the CMC at Outfall 001. During the period of April 5, 2000, through December 29, 2004, 302 pH measurements were recorded at Outfall 001, 174 of which were recorded during mid-April through October 31, which coincides with the time frame of the SNCR demonstration. Ninety percent of the pH measurements during the mid-April through October time frame were greater than 7.62 s.u. Although the ash pond does have a pH control system, under all operating conditions, the pH might not be able to be maintained below 7.62 pH (or lower if the slip rate becomes greater than 5 ppmv) during the Unit 1 APH cleaning. Therefore, the

Unit 1 APH wash wastewater should be contained (in a pond, frac tanks, etc.), and the ammonia concentration should be determined. Then, the wash wastewater could be released into the ash pond at a controlled rate allowing sufficient dilution to meet the ammonia discharge criterion at Outfall 001. If the Unit 1 APH wash wastewater were contained then released in stages to ensure the effluent ammonia concentration meets the CMC, no significant toxicity impacts would be expected at the Outfall 001 discharge.

Assuming the Unit 1 APH wash wastewater were discharged directly to the ash pond, after mixing with the 1Q10 low flow of the Tennessee River (4,987.5 mgd according to the current JOF NPDES permit), the ammonia concentration in the river would be calculated as 0.07 mg NH₃-N/L for a slip rate of 5 ppmv and 0.30 mg NH₃-N/L for a slip rate of 20 ppmv (Table 3-5). For the period of record from June 1, 2000, through December 31, 2004, the highest recorded water temperature at the plant intake was 31.8 degrees Celsius (°C), which is over 89 degrees Fahrenheit (°F), and the highest recorded pH at Outfall 001 was 9.0 s.u. At a water temperature of 31.8°C and a pH of 9.0 s.u., the CCC would be 0.16 mg NH₃-N/L, which is higher than the ammonia concentration calculated for the 5-ppmv slip rate, but lower than the ammonia concentration calculated for the 20-ppmv slip rate. To meet the CCC for the 20-ppmv slip rate at a temperature of 31.8°C, the pH would have to be 8.6 s.u. or lower. However, if the Unit 1 APH wash wastewater were contained and then released in stages as required to meet the CMC at Outfall 001 (see previous paragraph), then the CCC should be easily be met in the Tennessee River. Therefore, no significant toxicity impacts would be expected in the Tennessee River due to the discharge of APH wash wastewater if the wash water were contained and released in stages to ensure both the CMC at Outfall 001 and the CCC in the river were met.

Table 3-5 Unit 1 Air Preheater Wash Wastewater Ammonia Concentrations

Ammonia Slip Rate (ppmv)	Ammonia Concentration Outfall 001 (mg NH ₃ -N/L)	Ammonia Concentration in the Tennessee River (mg NH ₃ -N/L)
5	16.43	0.07
20	65.72	0.30

Monitoring

As compounds containing ammonia dissolve, and as natural microbial and algal processes for assimilating ammonia proceed, pH changes can occur. To ensure that the ash pond discharge would meet the NPDES permit limits for both pH and acute toxicity, and to ensure that the effluent being discharged to the Tennessee River would not exceed the CCC for ammonia, the existing carbon dioxide (CO₂) system would be utilized to control the pH.

TVA would monitor the ammonia concentration and pH at the ash pond inflow, at an intermediate midpond site, and at the discharge on a weekly basis during operation of the SNCR. During the Unit 1 APH cleaning, the wash wastewater would be contained, and ammonia concentration and pH would be determined. If the ammonia concentration were too high to discharge the wastewater directly to the ash pond, for the duration of the staged release, monitoring at the ash pond inflow, intermediate midpond site, and discharge would be conducted daily for ammonia and pH. The frequency of sample collection and analysis could be reduced if plant operations remain the same and the results indicate that there is no change in the ammonia concentrations and/or no threat of a significant impact.

TVA would ensure that all NPDES permit and other regulatory requirements for Outfall 001 are met. As necessary, mitigation measures like staging releases or ensuring pond mixing would be activated to ensure that any ammonia released through Outfall 001 would remain below the CMC.

Staging Releases of the Unit 1 APH Wash Wastewater to the Ash Pond

To reduce the NH₃-N concentration at the ash pond discharge (Outfall 001), the Unit 1 APH cleaning waste would be retained in a pond (such as the metal waste cleaning pond), basin, frac tanks, or other containment. The ammonia concentration would be measured, and based on concentration results, the containment would be slowly released to the ash pond. The number of days required for the staged release would depend on the ammonia concentration of the Unit 1 APH wash wastewater. The higher the ammonia concentration, more days would be required to meter the waste to ensure the ammonia concentration at the Outfall 001 discharge would meet the CMC and the ammonia concentration in the Tennessee River would meet the CCC.

If utilized, the containment pond/basin should be checked to ensure there was enough free volume to accept the Unit 1 APH cleaning waste. If needed, the pond/basin would be pumped down prior to receiving the waste. Pumps would also be utilized to achieve mixing of the APH wastewater in the containment pond/basin.

Mixing of the Ash Pond Inflow

If monitoring results for ammonia were trending toward the CMC limits for Outfall 001, installation of additional baffles in the ash pond (currently there are baffles in the stilling pond) could improve mixing of the ash pond inflow with the free water volume of the pond. Baffling the pond would increase the retention time of the water, which would improve mixing, and allow more time for chemical degradation and/or biological uptake of the ammonia.

Whenever needed, a combination of the above mitigation methods (monitoring, staging release, and mixing of the pond inflow) could be used to control the ammonia concentrations effectively at Outfall 001. There are also other mitigation options (listed here but not explained in detail) that could be utilized to control the ammonia concentrations at Outfall 001. These options are passive treatment systems such as constructed wetlands, addition of media for enhancing growth of nitrifying microorganisms in the ash pond, installation of aeration devices to improve dissolved oxygen concentrations to enhance aerobic microbial degradation of ammonia, installation of conventional treatment systems such as air stripping, trickling filters, recirculation sand filters, or biological treatment systems.

3.3. Surface Water

3.3.1. Affected Environment

The current ash disposal method is described in Section 3.5. An outside firm is trucking ash to an off-site location; however, most of the ash is still sent to settling ponds and the water is ultimately discharged from Outfall 001 to the Tennessee River at Tennessee River Mile 100.2. This discharge also includes other components as described in Table 3-1 of Section 3.2.

Tennessee River

Water quality in the lower Kentucky Reservoir watershed in the vicinity of Tennessee River Mile 100 is listed on the 2004 Tennessee Department of Environment and Conservation (TDEC) 305(b) list as fully supporting its designated uses (TDEC, 2004a). The 2002 303(d) list of waters (TDEC, 2004b) shows this area of the Tennessee River as supporting. The only water body in the area on the 303(d) list was Trace Creek, which is approximately 3 miles downstream of the plant. Trace Creek is on the 303(d) list for siltation, organic enrichment/low-dissolved oxygen, and other habitat alterations and is listed as partially supporting. Water quality on Trace Creek is considered to be impacted moderately and the criteria listed above are exceeded on some frequency.

Wetlands

A review of the National Wetland Inventory data, the Humphreys County Soil Survey (Welles et al., 1948) and TVA site photographs was performed. The National Wetland Inventory does not indicate wetlands in the project area. The Humphreys County Soil Survey indicates small areas of hydric soils within the area of the JOF plant site prior to its construction. This hydric soil area represents historic wetland areas that have been previously filled or converted and are no longer functioning as wetlands. The project location is in a highly developed area that is unlikely to contain wetlands. Ditches and/or ponds that could be used to convey spills or wastewater discharges may contain small areas of wetland vegetation; however, the ditches and ponds are part of a created wastewater treatment system. Because wastewater treatment systems designed to meet NPDES requirements are not considered "waters of the U.S.," any wetlands or wetland vegetation that have developed in the ponds would not be regulated under Section 404 of the Clean Water Act.

3.3.2. Environmental Consequences

3.3.2.1. Alternative A - No Action

TVA would continue to operate JOF without the NO_xOUT SNCR demonstration on Unit 1, and no impacts to surface water are anticipated beyond the effects of existing and future activities associated with routine operation of the plant.

3.3.2.2. Alternative B - Demonstration of NO_xOUT SNCR System on JOF Unit 1

Construction Impacts

No impacts to surface water would be expected from construction and installation of the SNCR equipment, storage tank, and related systems. JOF is already an industrial facility with existing Best Management Practices (BMPs) in place. Any additional BMPs to prevent erosion and the discharge of sediment or other polluting materials in the runoff to surface waters would be implemented in the JOF Integrated Pollution Prevention Plan as needed to ensure that potential effects would be minimized. Appropriate BMPs would be implemented, and all construction activities would be conducted in a manner that ensures waste materials would be contained and no pollution materials would be introduced to the receiving stream.

Construction Workforce Domestic Sewage Disposal

Portable toilets or existing facilities would be made available to the construction workforce. Portable toilets would be pumped out regularly, and the sewage would be transported by tanker truck to a publicly owned treatment works.

Operational Impacts

No significant impacts to surface water are anticipated due to spills or leaks. The urea storage tank (maximum tank size is 21,000 gallons) would be placed within a secondary containment. During the transfer of urea from tanker truck to holding tank, all normal BMPs would be applied to the unloading operation. All area storm drains would be blocked, containers would be placed under all connections, and all Department of Transportation requirements would be followed. The driver would be within 25 feet of the truck, awake, have an unobstructed view of the tanker, and be able to move the tanker should an emergency situation require it to be moved.

Leaks or spills from the piping inside the powerhouse would be routed to the ash pond via the station sump where the urea could be contained and cleaned up. The outside piping between the tank and the powerhouse would be a short section, which should minimize the risk for leaks to occur there. To reduce the risk of a leak in the outside piping further, the piping would be welded. Depending on the location and route of the piping, diversionary containment would be required.

No significant impacts on the water quality of the Tennessee River would be anticipated, since discharges from the ash pond would be required to meet the CMC for ammonia and NPDES permit limits designed to prevent degradation of the receiving stream. Leachate seepage from the ash pond is low enough (see Section 3.4) that effects on surface waters would be negligible.

The average discharge flow from Outfall 001 is very small compared to the average flow in the Tennessee River in the vicinity of JOF, roughly a 200:1 ratio. For a slip rate as high as 20 ppmv, the calculated ammonia-nitrogen concentration in the river is 0.008 mg NH₃-N/L, which is 20 times lower than the CCC for the extreme conditions of pH 9.0 and water temperatures of 90°F (Table 3-4). In addition, there would be a commitment to contain and release the Unit 1 APH wash wastewater in a manner that would ensure that the CMC would be met at the Outfall 001 discharge (see Section 3.2).

3.4. Groundwater

3.4.1. Affected Environment

Previous subsurface investigations (e.g., Kellberg, 1948; Boggs, 1980; Lindquist et al., 1995), have shown that the Johnsonville plant site is underlain in descending stratigraphic order by unconsolidated alluvial and residual soil deposits (ranging from Pleistocene to Holocene age), the Fort Payne Formation (Mississippian age), the Chattanooga Shale (Devonian age), and the Camden Chert (Devonian age). Alluvial deposits ranging up to 45 feet in thickness and consisting of heterogeneous lenses and layers of clay, silt, sand, and gravel cover most of the plant site. Residual soils composed primarily of clay and silt are also present in some areas below the alluvial sediments. The Fort Payne Formation is composed of thinly bedded, cherty limestone with occasional clay seams. Thickness of the Fort Payne ranges up to 40 feet along the eastern boundary of the plant reservation, but the formation thins to the west, becoming completely absent over the western part of the reservation. The underlying Chattanooga Shale consists of 25 to 30 feet of black fissile carbonaceous shale. Kellberg (1948) encountered the Chattanooga Shale in thicknesses ranging from 7 to 75 feet across the plant site. Variations in thickness observed in boreholes are attributed to folding and repetition by faulting in the areas where thickness exceeds 30 feet, and to partial removal by erosion in areas exhibiting thicknesses less than

30 feet. Below the Chattanooga Shale lie 100+ feet of the Camden Chert. The Camden is composed of thinly bedded and highly brecciated chert with occasional thin clay seams.

Bedrock strata beneath the plant reservation are essentially flat lying, although complex small-scale structure is evident in the Camden Chert and the Chattanooga Shale. The presence of several northwest-striking, southwest-dipping, low-displacement thrust faults were identified by Kellberg (1948) at the site on the basis of drilling results and local bedrock exposures.

The first occurrence of groundwater beneath the site is generally within the basal portion of the alluvial and residual overburden. Given their limited saturated thickness and relatively low hydraulic conductivity, the overburden deposits represent a marginal aquifer, at best. The Fort Payne Formation is not a usable aquifer in the plant vicinity because of its limited thickness. The Camden Chert represents the principal aquifer in the plant vicinity and is the source of water for numerous wells in the region. The Chattanooga Shale acts as an aquitard separating the Camden aquifer from the overlying overburden and, where present, the Fort Payne Formation. Local groundwater movement at the plant site is generally from east to west toward the Tennessee River. Groundwater recharge occurs by local infiltration of precipitation at ground surface and laterally from upland areas east of the site. Groundwater passing beneath the site ultimately discharges to the Tennessee River.

Table 3-6 presents the results of a well survey conducted in year 2000 that identified nine water wells within approximately 2 miles of the plant (Boggs, 2000). DuPont owns six of these wells, five of which are no longer in use. All off-site wells are situated upgradient (east) of the plant. No public wells or spring water supplies were identified within 2 miles of the site.

Table 3-6. Inventory of Private Wells Within 2 Miles of the Johnsonville Fossil Plant

Owner	Owner's Number	Distance from Plant (miles)	Use	Status
DuPont	PH	0.9	industrial	inactive
DuPont	5W1	0.9	industrial	inactive
DuPont	5W2	1.0	industrial	inactive
DuPont	6W	1.2	industrial	inactive
DuPont	JERA	1.3	irrigation	active
DuPont	JVSMW-1	1.6	industrial	inactive
--	--	1.9	domestic	active
--	--	1.9	domestic	active
--	--	2.0	domestic	active

Note: Table adapted from Boggs, 2000.

3.4.2. Environmental Consequences

3.4.2.1. Alternative A - No Action

Construction Impacts

There would be no groundwater resource impacts associated with this alternative.

Operational Impacts

There would be no groundwater resource impacts associated with this alternative beyond those generally associated with plant waste disposal operations.

3.4.2.2. Alternative B - Demonstration of NOxOUT SNCR System on JOF Unit 1

Construction Impacts

SNCR construction would not require excavations or other activities having the potential to affect local groundwater resources adversely.

Operational Impacts

Disposal of ammoniated ash and APH wash water in Ash Pond D would result in circulation of ammonia-laden sludge water through the pond. The majority of ammoniated sludge water (i.e., approximately 17.1 mgd) would discharge at pond Outfall 001, while a small portion would infiltrate into the unconsolidated soil fill and alluvial deposits beneath the pond. Since the ash pond is situated on an island artificially created within the reservoir, all pond seepage entering the underlying groundwater system would ultimately discharge as seepage into the Tennessee River. No off-site groundwater transport of ammonia from the ash pond to adjacent property would occur. Consequently, there would be no impacts to existing or future groundwater users in the site vicinity.

Effects of ammoniated-leachate seepage on river water quality are expected to be negligible. Betson et al. (1986) conservatively estimated the seepage rate from Ash Pond D to the reservoir to be approximately 0.075 mgd. This represents about 0.3 percent of the average effluent discharge (22.8 mgd) from Outfall 001. Assuming a worst-case ammonia slip of 20 ppmv, the NH₃-N concentration in the ash pond under routine sluicing operations is conservatively estimated to be approximately 1.08 mg/L (see Section 3.2). Somewhat higher ammonia concentrations might occur during discharge of APH wash water to the ash pond at the conclusion of the SNCR demonstration. However, wash water would be released into the ash pond at a controlled rate allowing sufficient dilution to meet ammonia discharge limits at Outfall 001. Assuming an average NH₃-N concentration for pond seepage of 1.08 mg/L, the NH₃-N loading to the reservoir via groundwater would be approximately 0.31 kilograms per day. The NH₃-N concentration increase resulting from leachate seepage would be negligibly small compared to concentrations predicted at Outfall 001, which were shown in Section 3.2 to be below aquatic limits.

3.5. Solid Waste

3.5.1. Affected Environment

Coal Combustion Byproduct Generation, Marketing, and Handling

JOF operates ten pulverized coal combustion units. These units are expected to burn between 3.9 and 4.2 million tons of coal annually through at least 2009. These units burn various percentages of Powder River Basin (PRB) subbituminous, Colorado bituminous, and Illinois Basin bituminous coals. The latest ash content for these coals averages about 4.8 percent for PRB coals, 8.8 percent for Colorado coals, and 7.2 percent for Illinois Basin coals. The coals are delivered to the site by barge and are blended at the shipping terminals. Blends are anticipated to range from 70-80 percent PRB and 20-30 percent bituminous coals from either Illinois Basin or Colorado sources from 2005 through 2009. Until recently, the predominant coal sources were bituminous sources, which resulted in a Class "F" fly ash. As JOF continues to increase the amount of PRB coal burned, the

calcium content of the fly ash and the pH of the fly ash will increase, and the fly ash will approach Class “C” fly ash characteristics.

Total pulverized coal ash production will range from approximately 260,000 to 300,000 tons of ash per year. The ash is collected as either fly ash, which is fine enough and light enough to be carried with the flue gas stream exiting the boiler, or as bottom ash, which is coarser and heavier and falls to the bottom of the boiler. The fly ash/bottom ash split is about 80 percent fly ash and 20 percent bottom ash. The 4-year average fly ash production for individual units at JOF (2001-2004) is approximately 22,500 tons per year.

All fly ash and bottom ash produced at JOF is sluiced to the main ash pond for handling. In the main ash pond, bottom ash is continuously removed from the main ash sluice channel by “dipping” using either a dragline or a track hoe to keep the channel open. Fly ash, which is lighter, is carried past the dipping area either into the main pond area or directly into one of two cells that have been developed in the main ash pond to facilitate dewatering and removal of the fly ash. Fly ash that is not sluiced directly into one of the cells is dredged back into the cells once or twice per year in order to maintain NPDES-required free water volume in the ash pond. Since all of the fly ash is handled wet, there are few opportunities for marketing the material.

Fly ash is removed from these cells by alternating filling, dewatering, and cleanout of the cells at least twice annually. Plans are to continue removal of between 350,000 to 750,000 tons of fly ash annually from the pond using this method through at least 2007. The fly ash is currently hauled to an off-site area for use in developing a 60-acre site for industrial use (TVA, 2002). After 2007, either the industrial site development would be expanded or a new utilization or disposal site would be developed. The expansion of the existing site or the building of a new disposal site would be subject to an appropriate National Environmental Policy Act (NEPA) review.

Bottom ash production ranges from 50,000 to 60,000 tons annually. Most bottom ash reclaimed within the pond is currently used to help prep cells during the dewatering process. Ultimately, it is hauled with the reclaimed fly ash for use in the industrial park development. Small amounts of bottom ash are also used by a number of local counties for snow and ice control during the winter.

3.5.2. Environmental Consequences

3.5.2.1. Alternative A - No Action

TVA would continue to operate JOF without the NO_xOUT SNCR demonstration on Unit 1, and no impacts to solid waste are anticipated beyond the effects of existing and future activities associated with routine operation of the plant.

3.5.2.2. Alternative B - Demonstration of NO_xOUT SNCR System on JOF Unit 1

Fly Ash

Potential impacts of “ammonia slip” or excess unreacted ammonia as a result of the installation of SNCR on Unit 1 at JOF would be that ammonia levels present on the fly ash could be up to 500 ppm deposited on the fly ash (TVA, 2005b). Since ammonia on fly ash would be highly water soluble, all of this ammonia should dissolve into the sluice water as the ash is pumped to the ash pond. Due to the alkaline pH of the fly ash and sluice water, some ammonia may volatilize at the ash pond resulting in noticeable odors. However,

ammonia would be completely flushed or volatilized from any ash destined for use in the industrial park development and should not cause noticeable problems at the site.

Bottom Ash

Bottom ash is not expected to be impacted by the SNCR installation at JOF, since the bottom ash is collected in the boiler prior to urea injection.

3.6. Aquatic Ecology

3.6.1. Affected Environment

TVA began a program to monitor the ecological conditions of its reservoirs systematically in 1990. Reservoir (and stream) monitoring programs were combined with TVA's fish tissue and bacteriological studies to form an integrated Vital Signs Monitoring Program. Vital signs monitoring activities focus on (1) physical/chemical characteristics of waters; (2) physical/chemical characteristics of sediments; (3) benthic macroinvertebrate (i.e., bottom-dwelling, nonmicroscopic animals without backbones) community sampling; and (4) fish assemblage sampling (Dycus and Baker, 2001).

Benthic macroinvertebrates are included in aquatic monitoring programs because of their importance to the aquatic food chain and because they have limited capability of movement, thereby preventing them from avoiding undesirable conditions. Sampling and data analysis were based on seven parameters that include species diversity, presence of selected taxa that are indicative of good water quality, occurrence of long-lived organisms, total abundance of all organisms except those indicative of poor water quality, proportion of total abundance comprised by pollution-tolerant oligochaetes, proportion of total abundance comprised by the two most abundant taxa, and proportion of samples with no organisms present. Compared to the stations of other TVA run-of-the-river reservoirs, monitoring results for bottom life in 2003 were generally similar to previous years, with two sites rating good and two sites rating fair.

TVA monitored Kentucky Reservoir annually from 1991 through 1995 to establish baseline data on the reservoir's ecological health under a range of weather and flow conditions. Kentucky is now monitored every other year.

The ecological health of Kentucky Reservoir rated good in 2003. Since 1991, the rating for Kentucky has been either fair or good, with only small changes among indicators. The fish community rated good at the forebay and midreservoir monitoring locations and fair at the Big Sandy embayment and inflow. Prior to 2001, the fish community typically rated fair at all locations. In 2001 and 2003, a larger number and variety of fish were collected at the forebay and midreservoir than in previous years, resulting in good ratings.

In 2002, improvements were made in the method of assessing the condition of reservoir fish. These improvements were applied to all past assessments, resulting in changes to some previously reported reservoir scores.

3.6.2. Environmental Consequences

3.6.2.1. Alternative A - No Action

Under the No Action Alternative, no NOx emissions reduction equipment would be installed or operated, so no impacts to aquatic life would result.

3.6.2.2. Alternative B - Demonstration of NO_xOUT SNCR System on JOF Unit 1

Installation and operation of the proposed NO_x emissions reduction system could potentially impact aquatic communities in the Tennessee River (Kentucky Reservoir). However, appropriate mitigation measures such as those described in Section 3.2 would make these potential impacts insignificant.

Construction Impacts

Under Alternative B, potential construction impacts to the Tennessee River (Kentucky Reservoir) would include temporary erosion and siltation resulting from construction of the NO_xOUT SNCR system. These areas have previously been disturbed by plant construction and modification activities. Construction impacts would be minimized by implementing BMPs to control erosion during construction, stabilizing disturbed areas after completion of construction, and routing surface runoff to existing treatment facilities that meet regulatory requirements. Implementation of these measures would substantially reduce the potential impacts in the Tennessee to the point of causing only minor and temporary effects on fish and other aquatic life.

Operational Impacts

The storage, handling, and use of urea solutions for the proposed NO_xOUT system would result in the potential for ammonia or other nitrogenous compound contamination of surface water and impacts to aquatic life. One pathway for impacts would be a direct accidental release of urea to surface water. The engineered features of the urea storage system include a retention basin for spills to minimize this risk. Another pathway for surface water impacts would be ammonia contamination of combustion byproducts, such as fly ash. No significant impacts on the water quality of the Tennessee River would be anticipated, as discharges from the ash pond would be required to meet the acute criterion for ammonia and NPDES permit limits designed to prevent degradation of the receiving stream. Leachate seepage from the ash pond is low enough (see Section 3.4) that effects on surface waters would be negligible.

The average discharge flow from Outfall 001 is very small compared to the average flow in the Tennessee River in the vicinity of JOF, roughly a 200:1 ratio. For a slip rate as high as 20 ppmv, the calculated ammonia-nitrogen concentration in the river is 0.008 mg NH₃-N/L, which is 20 times lower than the CCC for the extreme conditions of pH 9.0 and water temperatures of 90°F (Table 3-4). In addition, there would be a commitment to contain and release the Unit 1 APH wash wastewater in a manner that would ensure that the CMC would be met at the Outfall 001 discharge (see Section 3.2).

Operation of the NO_xOUT system on Unit 1 at JOF would not result in significant impacts to aquatic resources in the Tennessee River (Kentucky Reservoir).

Groundwater Effects

As discussed in Section 3.4.2.2, the NH₃-N concentration increase resulting from leachate seepage would be negligibly small compared to concentrations predicted at Outfall 001, which were shown in Section 3.2 to be below aquatic toxicity limits.

3.7. Protected Aquatic Species

3.7.1. Affected Environment

Review of the TVA Natural Heritage database indicated that three federally and state-listed endangered mussel species--pink mucket (*Lampsilis abrupta*), rough pigtoe (*Pleurobema plenum*), and orangefoot pimpleback (*Plethobasus cooperianus*)--are historically known from the main channel of the Tennessee River (Kentucky Reservoir) adjacent to JOF. The only one of these three mussels to be collected recently from the area is the pink mucket. Rough pigtoe and orangefoot pimpleback are not likely to occur in the vicinity of JOF. No other federally or state-listed aquatic animal species are likely to occur in the vicinity of this proposed activity. Discharge points and groundwater from the ash pond at JOF can affect water quality in the Tennessee River (Kentucky Reservoir).

3.7.2. Environmental Consequences

3.7.2.1. Alternative A - No Action

Under the No Action Alternative, no NOx emissions reduction equipment would be installed or operated, so no impacts to aquatic life would result.

3.7.2.2. Alternative B - Demonstration of NOxOUT SNCR System on JOF Unit 1

Installation and operation of the proposed NOx emissions reduction systems could potentially impact individuals or population of listed aquatic animal species in the Tennessee River. As stated above in Section 3.6.1, only one federally listed aquatic animal species; pink mucket, is currently known from the Tennessee River in the vicinity of JOF. Due to the possibility of the release of ammonia to surface waters or through groundwater migration to the Tennessee River, there exists a potential to affect individuals or populations of pink mucket. However, appropriate mitigation measures such as those described in Section 3.2 would ensure that listed aquatic species would not be affected.

Construction Impacts

Under Alternative B, potential construction impacts to the Tennessee River would include temporary erosion and siltation resulting from construction of the NOxOUT SNCR system. These areas have previously been disturbed by plant construction and modification activities. These impacts would be minimized by implementation of BMPs to control erosion during construction and stabilize disturbed areas after construction is complete and by routing surface runoff to existing treatment facilities that meet regulatory requirements. These measures would substantially reduce the potential impacts in the Tennessee River to the point of causing only minor and temporary effects on fish and other aquatic life. Construction impacts would likely cause no impacts to protected aquatic animals or their habitats in the Tennessee River.

Operational Impacts

As described in Sections 3.2 and 3.3 of this document, there would be a potential for impacts from ammonia to surface water in the Tennessee River. Conservative modeling estimates place both the potential ammonia discharge from the ash pond outfall and the potential leachate effects of ammonia in the Tennessee River below levels that would result in acute or chronic toxicity to aquatic animals. With mitigation safeguards to minimize ammonia in the discharge, there would be no direct or indirect impacts to individuals or populations of the pink mucket.

3.8. Cumulative Impacts

3.8.1. *Alternative A - No Action*

TVA would continue to operate JOF without the NOxOUT SNCR demonstration on Unit 1, and TVA's goal to reduce NOx emissions from its coal-fired power plant by 75,000 tons during the ozone season (May to September) beginning in 2006 would not be achieved. To meet Clean Air Act Title IV requirements, low-NOx burners have already been installed on 34 TVA boilers; staged over-fire air has been installed on 6 units; and combustion optimization has been installed on an additional 18 units. If the SNCR demonstration does not take place, further reductions in NOx would not be achieved.

3.8.2. *Alternative B - Demonstration of NOxOUT SNCR System on JOF Unit 1*

TVA's Proposed NOx Control Strategy

TVA has installed, is in the process of installing, or is considering the installation of additional NOx controls, using SCR, SNCR, or other NOx reduction technologies, at up to nine other coal-fired power plants (Allen, Bull Run, Colbert, Cumberland, John Sevier, Kingston, Paradise, Shawnee, and Widows Creek). Table 3-7 lists all units being considered including the proposed action at JOF. This strategy would reduce TVA coal-fired power plant NOx emissions by 75,000 tons during the ozone season (May to September) beginning in 2006. When combined with other controls already planned to meet the acid rain requirements under the Clean Air Act Title IV, the total NOx reduction during the 2006 ozone season would be nearly 180,000 tons. The strategy identified above would reduce TVA's seasonal NOx emissions roughly 80 percent below 1995 levels.

The new controls would help reduce local and regional ozone levels and would help prevent violations of the new more stringent 8-hour ozone standard that was promulgated by USEPA in 1997. The strategy is also consistent with the types of controls that would be needed to comply with USEPA's proposed rule for ozone transport, known as the Ozone Transport State Implementation Plan call.

NOx emitted into the atmosphere leads to the formation of ozone and fine particulate and contributes to increased acidity of precipitation. Thus, the cumulative impact on air quality (due to a reduction in NOx emissions) would be beneficial.

Table 3-7. TVA Fossil Plant Units With SCR Systems or Other NOx Reduction Technologies Installed or Planned for Installation

Unit	State	Generation Capacity (megawatts)	Year Installed or Estimated to be Completed
Paradise 2	Kentucky	704	2000
Paradise 1	Kentucky	704	2001
Paradise 3	Kentucky	1,050	2003
Allen 2	Tennessee	330	2002
Allen 3	Tennessee	330	2002
Allen 1	Tennessee	330	2003
Widows Creek 7	Alabama	575	2003
Widows Creek 8	Alabama	550	2004
Cumberland 2	Tennessee	1,300	2004
Cumberland 1	Tennessee	1,300	2003
Bull Run	Tennessee	950	2003
Kingston 1-4, 7-8	Tennessee	1,300	2004
Kingston 5-6	Tennessee	400	2005
Colbert 5	Alabama	500	2004
Colbert 1-4	Alabama	800	2011
John Sevier 1-4	Tennessee	800	2008
Johnsonville 1	Tennessee	125	2005
Shawnee 1	Kentucky	175	2005

Ozone Reduction

Precise quantification of ozone changes due to the proposed action is not practical or possible due to daily variations in meteorology and operating conditions. It is possible, however, to assess the overall impact of the proposed action in combination with anticipated NOx reductions at other TVA fossil plants. This assessment is possible by comparing the results of photochemical modeling performed with and without consideration of TVA's overall NOx reduction strategy. Specifically, modeling was performed as part of the effort of the Ozone Transport Assessment Group's work that considered the NOx and VOC emissions in the eastern half of the United States projected to the year 2007. Photochemical modeling was performed with the Ozone Transport Assessment Group's emissions databases modified to reflect the effect of TVA's NOx strategy. Although modeling was limited to a single 10-day episode in 1995, the results are illustrative of the effect of TVA's NOx reduction strategy on atmospheric ozone. Within Alabama, Kentucky, and Tennessee, the modeling indicated that TVA's NOx reduction strategy would decrease the overall peak 1-hour ozone in the ambient atmosphere by 2, 4, and 4 percent, respectively, and the peak 8-hour ozone burden would be decreased by 2, 3, and 4 percent, respectively. This modeling did not include the additional NOx emission reductions that would occur at John Sevier Fossil Plant, JOF, and Shawnee Fossil Plant, since the modeling was performed prior to consideration of installing NOx reduction equipment at these three plants. In addition, it is important to note that the modeling did not account for additional NOx emission reductions that are likely to occur from other utilities as a

consequence of recent USEPA action establishing statewide NO_x budgets in the eastern states.

3.9. Commitments and Mitigation Measures

3.9.1. Routine and Compliance Measures

- Construction impacts to the air and surface water would be minimized by implementing BMPs as necessary to control erosion and fugitive dust during construction, to stabilize disturbed areas after completion of construction, and to route surface runoff to existing treatment facilities that meet regulatory requirements. These BMPs would be implemented according to the JOF Integrated Pollution Prevention Plan.
- The urea storage tank (maximum tank size would be 21,000 gallons) would be placed within a partial secondary containment to contain overflow spills. During the transfer of urea from tanker truck to holding tank, all area storm drains would be blocked, and containers would be placed under all connections. All Department of Transportation requirements would be followed. The driver would be within 25 feet of the truck, awake, have an unobstructed view of the tanker, and be able to move the tanker should an emergency situation require it to be moved.

3.9.2. Special Mitigation Measures

- To ensure that the ammonia concentration at the Outfall 001 discharge remained at or below the CMC (Table 3-3) and CCC (Table 3-4) limitations that would safeguard water quality, protect aquatic life, and ensure there were no impacts to listed species, the Unit 1 APH cleaning waste would be retained in a pond (such as the chemical treatment pond), basin, frac tanks, or other containment; the ammonia concentration would be determined; and then the water would be slowly released to the ash pond to ensure adequate mixing. The number of days required for the staged release would depend on the ammonia concentration of the Unit 1 APH wash wastewater.
- In order to (1) obtain more precise information on SNCR impacts during the demonstration of the technology on Unit 1, (2) to ensure the ash pond discharge met the NPDES permit limits for both pH and acute toxicity, and (3) to safeguard water quality, protect aquatic life, and ensure no impacts to listed species, TVA would monitor the ammonia concentration and pH in the ash pond inflow, midpoint, and discharge on a weekly basis during operation of the SNCR. If needed, the existing CO₂ system would be utilized to control the pH and to ensure the ammonia concentration would be below the CMC (Table 3-3) and CCC (Table 3-4) limitations. The frequency of sample collection and analysis could be reduced if plant operations remain the same and the results indicate that there is no change in the ammonia concentrations and/or no threat of a significant impact.

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CHAPTER 4

4. LIST OF PREPARERS

Preparer	Contribution
Anne Aiken	Surface Water and Industrial Wastewater
Barry Barnard	Air Quality
John (Bo) Baxter	Aquatic Ecology
Mark Boggs	Groundwater
Stephanie Chance	Protected Aquatic Animals
Anthony Dillon	Technical Advisor, Johnsonville Fossil Plant
Don Kachelman	Air Quality and Cumulative Impacts
Darlene Keller	NEPA Advisor, Environmental Affairs
Cheri Miller	Solid Waste
Jennifer Moses	Toxicity (Wastewater Section)
Diedre Nida	NEPA Advisor, EA Project Management
Rusty Smith	Project Coordinator, Resource Stewardship
Robert Wilson	Site Map

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CHAPTER 5

5. LIST OF AGENCIES CONSULTED

Federal Agency

U.S. Fish and Wildlife Service
Cookeville, Tennessee

State Agency

Tennessee Department of Environment and Conservation
Water Division
Nashville, Tennessee

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CHAPTER 6

6. SUPPORTING INFORMATION

6.1. Literature Cited

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- Boggs, J. M. 2000. Johnsonville Fossil Plant – Hydrogeologic Evaluation of Proposed North Railroad Loop Ash Disposal Facility. TVA Report WR2000-1-30-114.
- Dycus, D. L., and T. F. Baker. 2001. Aquatic Ecological Health Determinations for TVA Reservoirs-2000 - An Informal Summary of 2000 Vital Signs Monitoring Results and Ecological Health Determination Methods. Unpublished Report, Tennessee Valley Authority, Resource Stewardship, September 2001.
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Tennessee Valley Authority. 2005b. John Sevier Fossil Plant Units 1 Through 4 Reduction Systems for Control of Nitrogen Oxides Draft Environmental Assessment (in preparation).

Welles, G. M., N. V. Robbins, M. J. Edwards, and C. B. Beadles. 1948. Soil Survey of Humphreys County, Tennessee. United States Department of Agriculture Soil Conservation Service in Cooperation With Tennessee Agricultural Experiment Station and the Tennessee Valley Authority.

6.2. Abbreviations, Acronyms, and Symbols

°F	Degree Fahrenheit
°C	Degree Celsius
1Q10	The minimum 1-day low flow that occurs once in 10 years
APH	Air Preheater
BMP	Best Management Practice
CCC	Chronic Criterion Concentration
CMC	Criterion Maximum Concentration
CO ₂	Carbon Dioxide
EA	Environmental Assessment
et al.	Latin term, et alii (masculine), et aliae (feminine), or et alia (neutral) meaning “and others”
H ₂ O	Water
i.e.	Latin term, id est, meaning “that is”
JOF	Johnsonville Fossil Plant
km	Kilometer
L	Liter
lb	Pound
mg	Milligram
mgd	Million Gallons per Day
mg/L	Milligrams per Liter
NEPA	National Environmental Policy Act
NH ₃	Ammonia
NH ₃ -N	Ammonia Nitrogen
NH ₄ HSO ₄	Ammonium Bisulfate
NO ₂	Nitrogen Dioxide
NO _x	Nitrogen Oxide
NPDES	National Pollutant Discharge Elimination System
PM	Particulate Matter
PM _{2.5}	Particulate Matter With a Diameter Less Than or Equal to 2.5 Micrometers
PM ₁₀	Particulate Matter With a Diameter Less Than or Equal to 10 Micrometers
ppb	Parts per Billion
ppm	Parts per Million
ppmv	Parts per Million by Volume
PRB	Powder River Basin
SCR	Selective Catalytic Reduction
SNCR	Selective Noncatalytic Reduction
SO ₂	Sulfur Dioxide
SO ₃	Sulfur Trioxide
s.u.	Standard Unit
TVA	Tennessee Valley Authority
U.S.	United States
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound

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APPENDIX A – MATERIAL SAFETY DATA SHEETS FOR NO_xOUT

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MATERIAL SAFETY DATA SHEET

PRODUCT
NOxOUT® A

Emergency Telephone Number
CHEMTREC - 1.800.424.9300 (24 hours)

SECTION 1 - PRODUCT IDENTIFICATION

Trade Name: NOxOUT® A

Description: An aqueous solution of an amide

NFPA 704M/HMIS Rating: 1/1 Health 0/0 Flammability 0/0 Reactivity 0/Other
0=Insignificant 1=Slight 2=Moderate 3=High 4=Extreme

SECTION 2 - COMPOSITION / INGREDIENT INFORMATION

Our hazard evaluation of the ingredient(s) under OSHA's Hazard Communication Rule, 29 CFR 1910.1200 has found none of the ingredient(s) hazardous.

SECTION 3 - HAZARD IDENTIFICATION

EMERGENCY OVERVIEW:

Caution: May cause irritation to skin and eyes. Avoid contact with skin, eyes, and clothing. Avoid prolonged or repeated breathing of vapor. Use with adequate ventilation. Do not take internally.

Empty containers may contain residual product. Do not reuse container unless properly reconditioned.

Primary Route(s) of Exposure: Eye, Skin, Inhalation

Eye Contact: Can cause mild, short-lasting irritation.

Skin Contact: May cause irritation with prolonged contact.

Inhalation: May cause irritation to the respiratory tract and lungs.

SYMPTOMS OF EXPOSURE:

A review of available data does not identify any symptoms from exposure not previously mentioned.

Aggravation of Existing Conditions: A review of available data does not identify any worsening of existing conditions.

SECTION 4 - FIRST AID INFORMATION

Eyes: Flush with water for 15 minutes. Call a physician.

Skin: Wash thoroughly with soap and rinse with water. Call a physician.

Ingestion: Do not induce vomiting. Give water. Call a physician.

Inhalation: Remove to fresh air. Treat symptoms. Call a physician.

Note To Physician: Based on the individual reactions of the patient, the physician's judgment should be used to control symptoms and clinical condition.

Caution: If unconscious, having trouble breathing or in convulsions, do not induce vomiting or give water.

SECTION 5 - FIRE FIGHTING

Flash Point: None

Extinguishing Media: This product would not be expected to burn unless all the water is boiled away. The remaining organics may be ignitable. Use water to cool containers exposed to fire.

Unusual Fire and Explosion Hazard: May evolve CO, CO₂, NO_x, ammonia, and cyanuric acid under fire conditions.



MATERIAL SAFETY DATA SHEET

PRODUCT
NOxOUT® A

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CHEMTREC - 1.800.424.9300 [24 hours]

SECTION 6 - ACCIDENTAL RELEASE MEASURES

In case of transportation accidents, call the following 24-hour telephone number: 1.800.424.9300 (CHEMTREC).

SPILL CONTROL AND RECOVERY:

Small Liquid Spills: Contain with absorbent material, such as clay, soil or any commercially available absorbent. Shovel reclaimed liquid and absorbent into recovery or salvage drums for disposal. Refer to CERCLA in Section 15.

Large Liquid Spills: Dike to prevent further movement and reclaim into recovery or salvage drums or tank truck for disposal. Refer to CERCLA in Section 15.

SECTION 7 - HANDLING AND STORAGE

Storage: Keep container closed when not in use.

SECTION 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

Respiratory Protection: Respiratory protection not normally needed. If significant dusting occurs, wear a NIOSH approved or equivalent dust respirator.

For large spills, entry into large tanks, vessels or enclosed small spaces with inadequate ventilation, a positive pressure, self-contained breathing apparatus is recommended.

Ventilation: General ventilation is recommended.

Protective Equipment: Use impermeable gloves and chemical splash goggles when attaching feeding equipment, doing maintenance or handling product. Examples of impermeable gloves available on the market are neoprene, nitrile, PVC, natural rubber, viton and butyl (compatibility studies havenot been performed).

The availability of an eye wash fountain and safety shower is recommended.

If clothing is contaminated, remove clothing and thoroughly wash the affected area. Launder contaminated clothing before reuse.

Human Exposure Characterization: Based on Fuel Tech's recommended product application and our recommended personal protective equipment, the potential human exposure is: LOW.

SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES

Color:	Clear golden	
Form:	Liquid	
Density:	9.5 lbs/gal.	
Specific Gravity:	1.14 @ 77 Degrees F	ASTM D-1298
Ph (NEAT) =	9.5	ASTM E-70
Viscosity:	4 cps @ 72 Degrees F	ASTM D-2983
Flash Point:	None	
Crystallization Point:	60 Degrees F	

Note: These physical properties are typical values for this product.



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SECTION 10 - STABILITY AND REACTIVITY

Incompatibility: Avoid contact with strong oxidizers (eg. chlorine, peroxides, chromates, nitric acid, perchlorates, concentrated oxygen, permanganates) which can generate heat, fires, explosions and the release of toxic fumes.

Thermal Decomposition Products: In the event of combustion CO, CO₂, NO_x, ammonia, and cyanuric acid may be formed. Do not breathe smoke or fumes. Wear suitable protective equipment.

SECTION 11 - TOXICOLOGICAL INFORMATION

Toxicity Studies: No toxicity studies have been conducted on this product.

Human Hazard Characterization: Based on our hazard characterization, the potential human hazard is: LOW

SECTION 12 - ECOLOGICAL INFORMATION

If released into the environment, see CERCLA in Section 15.

Environmental Hazard and Exposure Characterization: Based on our Hazard Characterization, the potential environmental hazard is: MODERATE. Based on Fuel Tech's recommended product application and the product's characteristics, the potential environmental exposure is: LOW.

SECTION 13 - DISPOSAL CONSIDERATIONS

Disposal: If this product becomes a waste, it does not meet the criteria of a hazardous waste as defined under the Resource Conservation and Recovery Act (RCRA) 40 CFR 261, since it does not have the characteristics of Subpart C, nor is it listed under Subpart D.

As a non-hazardous liquid waste, it should be solidified with stabilizing agents (such as sand, fly ash, or cement) so that no free liquid remains before disposal to an industrial waste landfill. A non-hazardous liquid waste can also be incinerated in accordance with local, state and federal regulations.

SECTION 14 - TRANSPORTATION INFORMATION

Proper shipping name/hazard class may vary by packaging, properties, and mode of transportation. Typical proper shipping names for this product are:

All Transportation Modes: Product is not regulated during transportation.

SECTION 15 - REGULATORY INFORMATION

The following regulations apply to this product.

FEDERAL REGULATIONS:

OSHA Hazard Communication Rule, 29 CFR 1910.1200:

Based on our hazard evaluation, none of the ingredients in this product are hazardous.

CERCLA/Superfund, 40 CFR 117, 302:

Notification of spills of this product is not required.

SARA/Superfund Amendments and Reauthorization Act of 1986 (Title III) - Sections 302, 311, 312 and 313:

Section 302 - Extremely Hazardous Substances (40 CFR 355):

This product does not contain ingredients listed in Appendix A and B as an Extremely Hazardous Substance.

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FUEL TECH, INC. ♦ 512 KINGSLAND DR. ♦ BATAVIA, ILLINOIS 60510-2299
630.845.4500 or 800.666.9688



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Sections 311 and 312 - Material Safety Data Sheet Requirements (40 CFR 370):

Our hazard evaluation has found that this product is not hazardous under 29 CFR 1910.1200. Under SARA 311 and 312, the EPA has established threshold quantities for the reporting of hazardous chemicals. The current thresholds are: 500 pounds or the threshold planning quantity (TPQ), whichever is lower, for extremely hazardous substances and 10,000 pounds for all other hazardous chemicals.

Section 313 - List of Toxic Chemicals (40 CFR 372):

This product does not contain ingredients on the List of Toxic Chemicals.

Toxic Substances Control Act (TSCA):

The chemical ingredients in this product are on the 8(b) Inventory List (40 CFR 710).

Resource Conservation and Recovery Act (RCRA), 40 CFR 261 Subpart C & D:

Consult Section 13 for RCRA classification.

Federal Water Pollution Control Act, Clean Water Act, 40 CFR 401.15 / Formerly Sec. 307, 40 CFR 116 / Formerly Sec. 311:

None of the ingredients are specifically listed.

Clean Air Act, Sec. 111 (40 CFR 60), Sec. 112 (40 CFR 61, 1990 Amendments), Sec. 611 (40 CFR 82, Class I and II Ozone Depleting Substances):

This product contains the following ingredients covered by the Clean Air Act: Urea - Section 111

STATE REGULATIONS:

California Proposition 65:

This product does not contain any chemicals which require warning under California Proposition 65.

Michigan Critical Materials:

This product does not contain ingredients listed on the Michigan Critical Materials Register.

State Right to Know Laws:

This product does not contain ingredients listed by State Right To Know Laws.

SECTION 16 - RISK CHARACTERIZATION

Due to our commitment to Product Stewardship, we have evaluated the human and environmental hazards and exposures of this product. Based on our recommended use of this product, we have characterized the product's general risk. This information should provide assistance for your own risk management practices. We have evaluated our product's risk as follows:

* The human risk is: LOW.

* The environmental risk is: LOW.

Any use inconsistent with Fuel Tech's recommendations may affect our risk characterization. Our sales representative will assist you to determine if your product application is consistent with our recommendations. Together we can implement an appropriate risk management process.

This product material safety data sheet provides health and safety information. The product is to be used in applications consistent with our product literature. Individuals handling this product should be informed of the recommended safety precautions and should have access to this information. For any other uses, exposures should be evaluated so that appropriate handling practices and training programs can be established to insure safe workplace operations. Please consult your local sales representative for any further information.



MATERIAL SAFETY DATA SHEET

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Fuel Tech, Inc. provides the above information in good faith. Fuel Tech, Inc. provides the above information "AS IS" and makes no representations or warranties of any kind, express or implied, by fact or by law. **FUEL TECH, INC. SPECIFICALLY DISCLAIMS ALL WARRANTIES, INCLUDING THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.**

SECTION 17 - REFERENCES

Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices, American Conference of Governmental Industrial Hygienists, OH.

Hazardous Substances Data Bank, National Library of Medicine, Bethesda, Maryland (CD-ROM version), Micromedex, Inc., Englewood, CO.

IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Man, Geneva: World Health Organization, International Agency for Research on Cancer.

Integrated Risk Information System, U.S. Environmental Protection Agency, Washington, D.C. (CD-ROM version), Micromedex, Inc., Englewood, CO.

Annual Report on Carcinogens, National Toxicology Program, U.S. Department of Health and Human Services, Public Health Service.

Title 29 Code of Federal Regulations, Part 1910, Subpart Z, Toxic and Hazardous Substances, Occupational Safety and Health Administration (OSHA).

Registry of Toxic Effects of Chemical Substances, National Institute for Occupational Safety and Health, Cincinnati, Ohio (CD-ROM version), Micromedex, Inc., Englewood, CO.

Shepard's Catalog of Teratogenic Agents (CD-ROM version), Micromedex, Inc., Englewood, CO.

Suspect Chemicals Sourcebook (a guide to industrial chemicals covered under major regulatory and advisory programs), Roytech Publications (a Division of Ariel Corporation), Bethesda, MD.

The Teratogen Information System, University of Washington, Seattle, Washington (CD-ROM version), Micromedex, Inc., Englewood, CO.

REVISED: 03/15/00



MATERIAL SAFETY DATA SHEET
PRODUCT
NOxOUT® HP

Emergency Telephone Number:
CHEMTREC - 1.800.424.9300 [24 hours]

SECTION 1 - PRODUCT IDENTIFICATION

Trade Name: NOXOUT HP

Description: An aqueous solution of an amide

NFPA 704M/HMIS Rating: 1/1 Health 0/0 Flammability 0/0 Reactivity 0/Other
0=Insignificant 1=Slight 2=Moderate 3=High 4=Extreme

SECTION 2 - COMPOSITION / INGREDIENT INFORMATION

Our hazard evaluation of the ingredient(s) under OSHA's Hazard Communication Rule, 29 CFR 1910.1200 has found none of the ingredient(s) hazardous.

SECTION 3 - HAZARD IDENTIFICATION

EMERGENCY OVERVIEW:

Caution: May cause irritation to skin and eyes. Avoid contact with skin, eyes, and clothing. Avoid prolonged or repeated breathing of vapor. Use with adequate ventilation. Do not take internally.

Empty containers may contain residual product. Do not reuse container unless properly reconditioned.

Primary Route(s) of Exposure: Eye, Skin, Inhalation

Eye Contact: Can cause mild, short-lasting irritation

Skin Contact: May cause irritation with prolonged contact

Inhalation: May cause irritation to the respiratory tract and lungs

SYMPTOMS OF EXPOSURE:

A review of available data does not identify any symptoms from exposure not previously mentioned.

Aggravation of Existing Conditions: A review of available data does not identify any worsening of existing conditions.

SECTION 4 - FIRST AID INFORMATION

Eyes: Flush with water for 15 minutes. Call a physician.

Skin: Wash thoroughly with soap and rinse with water. Call a physician.

Ingestion: Do not induce vomiting. Give water. Call a physician.

Inhalation: Remove to fresh air. Treat symptoms. Call a physician.

Note To Physician: Based on the individual reactions of the patient, the physician's judgment should be used to control symptoms and clinical condition.

Caution: If unconscious, having trouble breathing or in convulsions, do not induce vomiting or give water.

SECTION 5 - FIRE FIGHTING

Flash Point: None

Extinguishing Media: This product would not be expected to burn unless all the water is boiled away. The remaining organics may be ignitable. Use water to cool containers exposed to fire.

Unusual Fire and Explosion Hazard: May evolve CO, CO₂, NO_x, ammonia, and cyanuric acid under fire conditions.



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SECTION 6 - ACCIDENTAL RELEASE MEASURES

In case of transportation accidents, call the following 24-hour telephone number: 1.800.424.9300 (CHEMTREC).

SPILL CONTROL AND RECOVERY:

Small Liquid Spills: Contain with absorbent material, such as clay, soil or any commercially available absorbent. Shovel reclaimed liquid and absorbent into recovery or salvage drums for disposal. Refer to CERCLA in Section 15.

Large Liquid Spills: Dike to prevent further movement and reclaim into recovery or salvage drums or tank truck for disposal. Refer to CERCLA in Section 15.

SECTION 7 - HANDLING AND STORAGE

Handling: Avoid contact with skin, eyes, and clothing.

Storage: Keep container closed when not in use.

SECTION 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

Respiratory Protection: Respiratory protection is not normally needed since the volatility and toxicity are low. If significant mists are generated, use either chemical cartridge respirator with a dust/mist prefilter or supplied air.

For large spills, entry into large tanks, vessels or enclosed small spaces with inadequate ventilation, a positive pressure, self-contained breathing apparatus is recommended.

Ventilation: General ventilation is recommended.

Protective Equipment: Use impermeable gloves and chemical splash goggles when attaching feeding equipment, doing maintenance or handling product. Examples of impermeable gloves available on the market are neoprene, nitrile, PVC, natural rubber, viton and butyl (compatibility studies have not been performed).

The availability of an eye wash fountain and safety shower is recommended.

If clothing is contaminated, remove clothing and thoroughly wash the affected area. Launder contaminated clothing before reuse.

SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES

Color:	Clear, colorless	
Form:	Liquid	
Density:	9.5 lbs/gal.	
Specific Gravity:	1.14 @ 77 Degrees F	ASTM D-1298
Ph (NEAT) =	9.7	ASTM E-70
Viscosity:	3 cps @ 72 Degrees F	ASTM D-2983
Flash Point:	None	
Crystallization Point:	60 Degrees F	

Note: These physical properties are typical values for this product.



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SECTION 10 - STABILITY AND REACTIVITY

Incompatibility: Avoid contact with strong oxidizers (eg. chlorine, peroxides, chromates, nitric acid, perchlorates, concentrated oxygen, permanganates) which can generate heat, fires, explosions and the release of toxic fumes.

Thermal Decomposition Products: In the event of combustion CO, CO₂, NO_x, ammonia, and cyanuric acid may be formed. Do not breathe smoke or fumes. Wear suitable protective equipment.

SECTION 11 - TOXICOLOGICAL INFORMATION

Toxicity Studies: No toxicity studies have been conducted on this product.

SECTION 12 - ECOLOGICAL INFORMATION

If released into the environment, see CERCLA in Section 15.

SECTION 13 - DISPOSAL CONSIDERATIONS

Disposal: If this product becomes a waste, it does not meet the criteria of a hazardous waste as defined under the Resource Conservation and Recovery Act (RCRA) 40 CFR 261, since it does not have the characteristics of Subpart C, nor is it listed under Subpart D.

As a non-hazardous liquid waste, it should be solidified with stabilizing agents (such as sand, fly ash, or cement) so that no free liquid remains before disposal to an industrial waste landfill. A non-hazardous liquid waste can also be incinerated in accordance with local, state and federal regulations.

SECTION 14 - TRANSPORTATION INFORMATION

Proper shipping name/hazard class may vary by packaging, properties, and mode of transportation. Typical proper shipping names for this product are:

All Transportation Modes: product is not regulated during transportation.

SECTION 15 - REGULATORY INFORMATION

The following regulations apply to this product.

FEDERAL REGULATIONS:

OSHA Hazard Communication Rule, 29 CFR 1910.1200:

Based on our hazard evaluation, none of the ingredients in this product are hazardous.

CERCLA/Superfund, 40 CFR 117, 302:

Notification of spills of this product is not required.

Sara/Superfund Amendments and Reauthorization Act of 1986 (Title III) - Sections 302, 311, 312 and 313:

Section 302 - Extremely Hazardous Substances (40 CFR 355):

This product does not contain ingredients listed in Appendix A and B as an Extremely Hazardous Substance.

Sections 311 and 312 - Material Safety Data Sheet Requirements (40 CFR 370):

Our hazard evaluation has found that this product is not hazardous under 29 CFR 1910.1200.



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Under SARA 311 and 312, the EPA has established threshold quantities for the reporting of hazardous chemicals. The current thresholds are: 500 pounds or the threshold planning quantity (TPQ), whichever is lower, for extremely hazardous substances and 10,000 pounds for all other hazardous chemicals.

Section 313 - List of Toxic Chemicals (40 CFR 372):

This product does not contain ingredients on the List of Toxic Chemicals.

Toxic Substances Control Act (TSCA):

The chemical ingredients in this product are on the 8(b) Inventory List (40 CFR 710).

Resource Conservation and Recovery Act (RCRA), 40 CFR 261 Subpart C & D:

Consult Section 13 for RCRA classification.

Federal Water Pollution Control Act, Clean Water Act, 40 CFR 401.15/ Formerly Sec. 307, 40 CFR 116/formerly Sec. 311:

None of the ingredients are specifically listed.

Clean Air Act, Sec. 111 (40 CFR 60), Sec. 112 (40 CFR 61, 1990 Amendments), Sec. 611 (40 CFR 82, Class I and II Ozone Depleting Substances):

This product contains the following ingredients covered by the Clean Air Act:

Urea - Section 111

STATE REGULATIONS:

California Proposition 65:

This product does not contain any chemicals which require warning under California Proposition 65.

Michigan Critical Materials:

This product does not contain ingredients listed on the Michigan Critical Materials Register.

State Right to Know Laws:

This product does not contain ingredients listed by State Right To Know Laws.

International Regulations:

This is not a WHMIS controlled product under The House of Commons of Canada Bill C-70.

SECTION 16 - RISK CHARACTERIZATION

Our Risk Characterization is being determined.

This product material safety data sheet provides health and safety information. The product is to be used in applications consistent with our product literature. Individuals handling this product should be informed of the recommended safety precautions and should have access to this information. For any other uses, exposures should be evaluated so that appropriate handling practices and training programs can be established to insure safe workplace operations. Please consult your local sales representative for any further information.

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SECTION 17 - REFERENCES

Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices, American Conference of Governmental Industrial Hygienists, OH.

Hazardous Substances Data Bank, National Library of Medicine, Bethesda, Maryland (CD-ROM version), Micromedex, Inc., Englewood, CO.

IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Man, Geneva: World Health Organization, International Agency for Research on Cancer.

Integrated Risk Information System, U.S. Environmental Protection Agency, Washington, D.C. (CD-ROM version), Micromedex, Inc., Englewood, CO.

Annual Report on Carcinogens, National Toxicology Program, U.S. Department of Health and Human Services, Public Health Service.

Title 29 Code of Federal Regulations, Part 1910, Subpart Z, Toxic and Hazardous Substances, Occupational Safety and Health Administration (OSHA).

Registry of Toxic Effects of Chemical Substances, National Institute for Occupational Safety and Health, Cincinnati, Ohio (CD-ROM version), Micromedex, Inc., Englewood, CO.

Shepard's Catalog of Teratogenic Agents (CD-ROM version), Micromedex, Inc., Englewood, CO.

Suspect Chemicals Sourcebook (a guide to industrial chemicals covered under major regulatory and advisory programs), Roytech Publications (a Division of Ariel Corporation), Bethesda, MD.

The Teratogen Information System, University of Washington, Seattle, Washington (CD-ROM version), Micromedex, Inc., Englewood, CO.

REVISED: 03/15/00