

ULTRA[®] Systems

On-Site Ammonia Generation

Safe and simple ... provides on-site ammonia generation for SCR Systems without the risks of dangerous chemical handling

Selective catalytic reduction (SCR) has become the standard for attaining the most stringent NO_x reduction requirements for power generating facilities. Until recently, NO_x reduction using ammonia (NH₃) as the reducing agent, requiring owners of these systems to contend with transportation, safety, and costs associated with handling hazardous ammonia.

Fuel Tech's patented ULTRA[®] process is an innovative approach for on-site ammonia generation from urea. Available for new and retrofit SCR systems, the ULTRA system is a safe, cost-effective solution that simplifies SCR operation.

How it Works: Simple Urea Decomposition

The ULTRA process generates low pressure, dilute ammonia for SCR systems and flue gas conditioning applications by thermally decomposing urea. The diluted ammonia is fed through the ammonia injection grid (AIG) to the SCR. The ULTRA process controls ammonia generation by metering urea into a decomposition chamber. The generation rate responds rapidly based on urea flow rate. The ULTRA system is simple, consisting of a blower, heat source, decomposition chamber, urea storage, urea metering and process controls.

Commercial systems range in size from 1 to 1,200 lb/hr of ammonia reagent, systems are equipped with a sophisticated injection and flow control mechanisms to continuously and rapidly respond to varying ammonia demand for smooth and steady operations or rapidly stop ammonia generation in case of emergency.

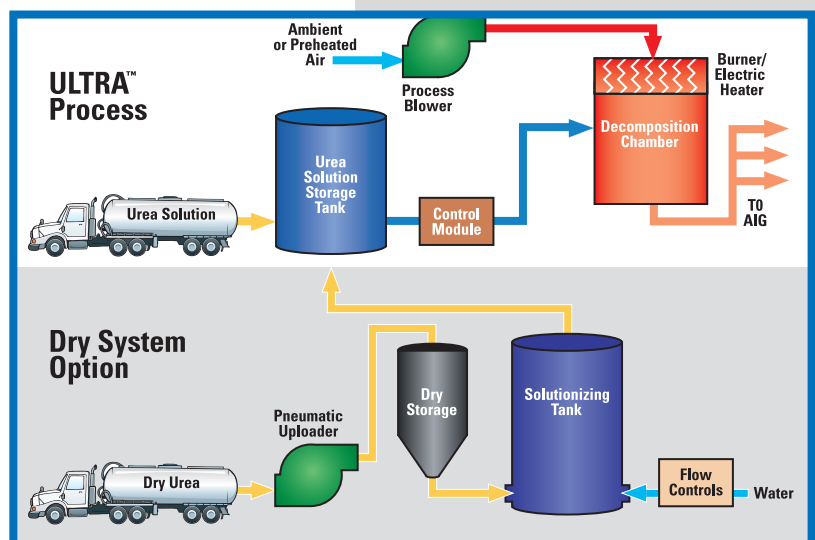
System Options

The ULTRA system can be customized for each application. In addition to natural gas, potential heat sources include electric heaters for small systems, and fuel oil or propane for larger systems. Where energy efficiency is critical, we can use pre-heated combustion air directly or in conjunction with a heat exchanger to preheat ambient air. Aqueous urea can be delivered to the site or created on-site using granular or concentrated urea solutions by adding condensate or demineralized water. It is important that quality requirements of the water being used to create the urea solution are followed to ensure no negative impacts on the SCR catalyst performance.



1,200 lb/hr ULTRA System

**Global Experience
of Over 230 Systems
Operating 57,000 MW**



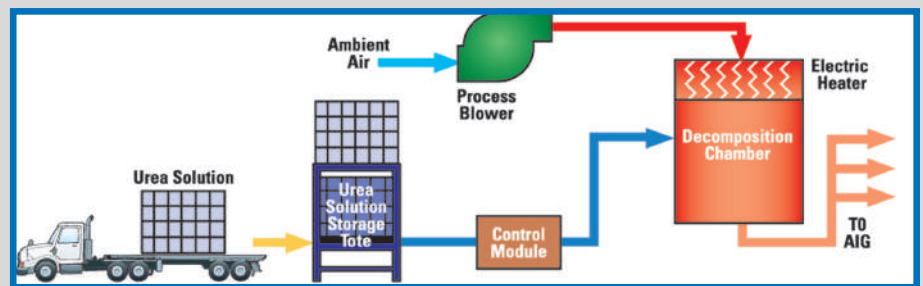
ULTRA 5[®] & ULTRA 1[™] Process

The ULTRA 5 and ULTRA 1 systems are modular and compact for reagent demand rates of 5 lb/hr or less. The ULTRA 1 system consists of a single skid (4' x 8' footprint) containing both the control module and decomposition chamber. For the ULTRA 5 systems, the chamber is typically separate from the control module.

The urea solution storage tote assembly has a 4' x 4' footprint, with a tote capacity of 275 gallons. This assembly can be used for both ULTRA 1 and ULTRA 5 systems. These systems have a proven standardized design which provide low capital cost and quick delivery.



Urea solution is delivered in convenient totes.



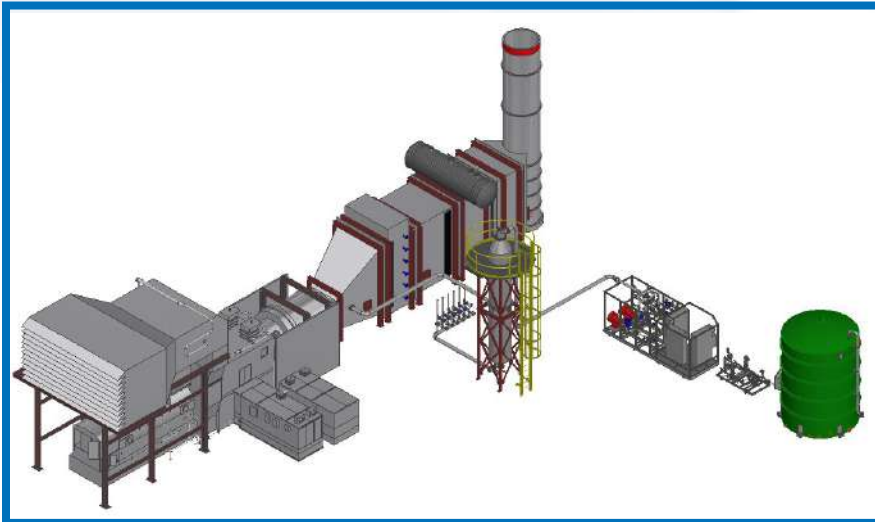
Eliminate need for hazardous ammonia

These compact systems offer a cost effective, simple solution for providing on-site ammonia generation of 1 to 5 lbs per hour. From package boilers to combined heat and power (CHP) facilities, ULTRA may be applied to new and retrofit SCR systems.

Many small SCR applications may be located indoors. Anhydrous ammonia in bottles or 19% aqueous ammonia systems are often used for the SCR reagent feed. The storage of ammonia in confined spaces creates safety concerns of noxious fumes and fire hazards should leaks occur.

ULTRA-EX™

Hot Gas Turbine Exhaust as Heat Source



High temperature exhaust gas from the combustion turbine is extracted from the HRSG, directed to the Decomposition Chamber, and returned to the flue gas path. The extracted flue gas, which is drawn from the HRSG using a high temperature blower, thermally decomposes the concentrated urea solution that is injected and distributed in the ULTRA chamber. The temperature of the flue gas typically is greater than 800°F and it is particulate free. As with our other ULTRA systems, the urea injection rate is varied in response to ammonia demand changes, but the total flow rate of the NH₃/air mixture remains relatively steady.

An electric heater is provided to ensure that the minimum injection temperature is maintained for specific operating cases, and may be used to accelerate the heating of ULTRA system components during a cold startup or in a standby mode when the high temperature exhaust is not available. The heater is off during normal operation.

ULTRA-QS™

Quick start for SCR operation within minutes

ULTRA-QS™ has the ability to rapidly respond to changes in ammonia demand rate for combustion units using SCR technology to control NO_x emissions. The system can be injecting urea and producing ammonia for the SCR within 10 minutes of receiving the operating permissive. This duration is acceptable for most GT/HRSG applications to avoid thermal stress on SCR and HRSG tubes from rapid temperature increase. The typical power cost of operating ULTRA-QS in standby mode is only \$20 to \$25 per day.

SCR Applications

- Combined Heat and Power Plants
- GT and HRSG Application
- Industrial Package Boilers (Steam and Hot Water)
- Distributed Generation
- Petrochemical Facilities
- Airports
- Hospitals
- Universities and Colleges
- Peaking Plants
- Coal Fired Boilers
- Stationary Engines

ESP Applications

- Ammonia generation for flue gas conditioning

Advantages

- Simplicity
- Safe urea reagent
- Low pressure operation
- Process controls follow load with minimal lag time
- Integrated systems applicable to retrofit and greenfield applications



Urea solution storage tank

Safety Benefits

- Customized solution for each application
- No DOT or DHS restrictions on the transportation or handling of urea
 - Avoid tight regulations on ammonia transportation from DOT and Rail Safety Act
 - Ammonia has been cited by DHS as a chemical of interest under Anti-Terrorism Standards
- Low pressure operation
- Immediate response for system shutdown

Problems with Other Urea Conversion Systems

Other urea-to-ammonia conversion systems on the market work by hydrolyzing urea. These processes often require higher priced specialty-solutions, are complex and operate under high pressures and require significant steam consumption. These systems must shutdown for maintenance due to internal buildup or incorporate a volatile ammonia-laden “blowdown” system that requires disposal. Upon shut down of the hydrolysis system, the purge cycle of ammonia can take a significant period of time. Hydrolytic systems which may contribute unwanted polymerized formaldehyde by-products and frequent maintenance outages.

Fuel Tech is the world’s leading supplier of NOx reduction and urea reagent technologies. The ULTRA conversion process and systems are designed by experienced in-house engineering personnel and backed with significant commercial experience. The systems are manufactured to ensure quality and longevity while providing a reliable, safe, and easy to use system for the on-site generation of ammonia.

Issues with Ammonia Systems

Regulation (per MSDS)	Anhydrous Ammonia	19% Aqueous Ammonia	32.5 or 40% Aqueous Urea
OSHA	Considered Hazardous Chemical under Standard 29 CFR 1910	Considered Hazardous Chemical under Standard 29 CFR 1910	N/A
SARA TITLE III	Extremely Hazardous Substance	Subject to reporting requirements of Section 313	N/A
CERCLA Hazardous Substances List	Reportable Quantity is 100 lbs	Reportable Quantity is 1,000 lbs	N/A
TSCA Inventory	Listed	N/A	N/A

Anhydrous and aqueous ammonia are classified as hazardous chemicals per the Clean Air Act (CAA) Section 112(r). In densely populated or confined areas, ammonia requires additional procedures to protect personnel, neighboring communities and the environment from potential noxious fumes and fire hazard.