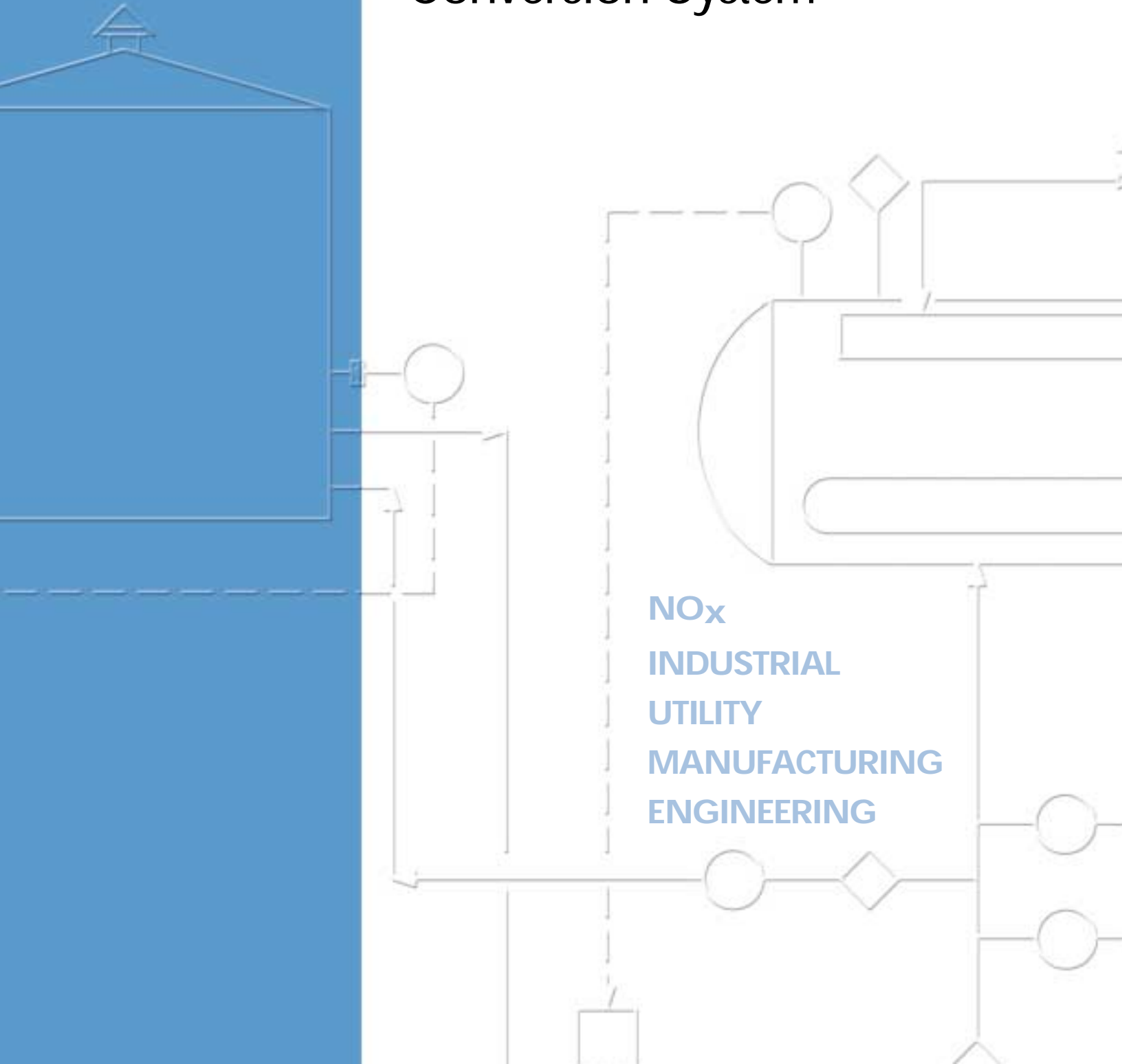




U<sub>2</sub>A™

# On-site Urea-to-Ammonia Conversion System



NO<sub>x</sub>  
INDUSTRIAL  
UTILITY  
MANUFACTURING  
ENGINEERING



## Avoiding The Ammonia Trap.

### The Trap

Ammonia is critical for many processes, including post combustion NOx reduction. However, transporting it to your site is not only difficult and costly, but is covered by strict regulations. Trying to comply can lead to runaway permitting expenses and delays; and ammonia raises concerns in surrounding communities.

### The Remedy

You **can** use ammonia without the environmental hazards and community pressures. And without the need for extensive evacuation planning and permitting processes.

Wahlco's Urea to Ammonia Generation System (U2A™) makes it easy. It is a proven, patented system that converts the benign chemical, urea, into small amounts of ammonia as needed. So you eliminate virtually all current ammonia-related hazards and hassles, do away with ammonia-based evacuation planning, and streamline the permit process.



THE BUSINESS END: Ammonia Flow Control Unit (AFCU) for 1850 lb/hr U2A system ready to leave Wahlco's Santa Ana Facility. Designed for tight quarters, this AFCU skid will be nestled between ducts on the sides and platforms top and bottom.

### Wahlco's U2A System Solves Major Ammonia Challenges.

#### Challenge:

Compliance with strict Environmental Protection Agency (EPA) and Occupational Safety and Health Agency (OSHA) regulations. The EPA classifies both anhydrous and aqueous ammonia as toxic substances at concentrations down to 20% (40 CFR Parts 9 and 68) (EPA, 1994). OSHA classifies anhydrous ammonia as a highly hazardous chemical under OSHA 29 CFR Part 1910.

#### Solved.

The Urea to Ammonia Generation System nearly eliminates on-site ammonia storage. Urea is a benign chemical that can be stored safely in large quantity and is converted to small amounts of ammonia as needed.

#### Challenge:

Burdensome requirements which demand detailed dispersion models and extensive safety and evacuation plans in order to gain permits to site ammonia. Compliance with local, state, and federal regulations, and dealing with citizen group concerns, can add uncontrolled costs and project delays. Anhydrous permitting can cost several hundred thousand dollars.

#### Solved.

U2A simplifies permitting and, unlike anhydrous ammonia, meets with practically no opposition. U2A also simplifies dispersion modeling, as the evacuation area is reduced from miles to yards, and paperwork is reduced from mountains to molehills.

### Challenge:

Addressing growing community concern about locally storing and transporting ammonia. News reports of evacuations due to transportation accidents, spills and leaks strengthen opposition to ammonia use near residential communities.

### Solved.

Transporting and storing urea eliminates the headaches of handling ammonia and represents a "good neighbor" gesture to the community. The ammonia within the U2A system is usually below the EPA reportable spill threshold (total on-site storage of ammonia is less than 1/100 of a normal 15 day supply).

### How U2A Works

The U2A Generation System reverses the chemical process of synthesizing urea from ammonia and CO<sub>2</sub>. The resulting gas contains only CO<sub>2</sub>, NH<sub>3</sub> and H<sub>2</sub>O and trace amounts of formaldehyde (used to harden urea). Formaldehyde is then destroyed on the NOx reduction catalyst. For technical specifications and a more detailed look at how the U2A system works, see [www.wahlco.com](http://www.wahlco.com) or call Wahlco at 714-979-7300.

### Cost-Effective And Hassle-Free.

- The U2A uses a standard urea dissolution system — the same already in use throughout the liquid urea supply industry.
- The U2A system converts urea to ammonia in a stainless steel ASME hydrolyzer vessel at moderate temperature and pressure.
- The reaction is allowed to find its own equilibrium, simplifying the process control and leading to a stable, predictable system.
- The hydrolyzer feed pump keeps a constant liquid level in the vessel.



- Indirect heat exchange isolates the system chemistry from plant operations.
- And, since this is a once-through process, there is no dissolution water recycling, so the U<sub>2</sub>A system avoids ammonia odor.

### Accommodates Boiler Load Swings Easily.

The U<sub>2</sub>A follows boiler load swings closely. It ensures there is always sufficient ammonia vapor and dissolved ammonia reserve in the hydrolyzer liquid to respond to sudden increases in demand. Since small additions of heat cause rapid hydrolysis rate increases, the process quickly catches up with the demand. During turndown, the vapor reservoir in the hydrolyzer is sufficient to absorb any excess ammonia production.

### End-To-End Simplicity.

From raw materials delivery through final product, the U<sub>2</sub>A system makes operation easy. Here is what you can expect:

1. Urea is delivered to the dissolver from super sacks, truck, or on-site silos, then dissolved in de-ionized water.
2. A 40-50% urea solution is pumped into a standard pressure vessel at a controlled flow rate.
3. Equilibrium conditions are maintained in the hydrolyzer.
4. The hydrolyzer produces a gaseous mixture of ammonia, carbon dioxide and water vapor.
5. Process dynamics are met by adjusting heat to control vessel pressure and pumping rate to control level.
6. Hydrolyzer offtake gas may be diluted with air at an AFCU skid or directly injected into the flue gas without creating a flammable mixture.

### Economical Operation.

#### Compared to 19% Aqueous:

In densely populated or highly sensitive communities, the typical alternative to anhydrous ammonia is 19% aqueous ammonia. However, when you add in costs associated with reagent cost, transportation, and vaporization for 19% aqueous ammonia, urea hydrolysis is less expensive. In fact, U<sub>2</sub>A return-on-investment is 2-4 years depending on the length of the NO<sub>x</sub> season.

#### Compared to 29% Aqueous:

While more economical to purchase and vaporize than 19% aqueous ammonia, 29% aqueous ammonia still poses significant permitting and transportation problems, making U<sub>2</sub>A a favorable choice at about equal operating expense. In addition, the U<sub>2</sub>A system can be tuned to extract higher efficiency — generally not an option when vaporizing aqueous ammonia.

### Built For Exceptional Safety.

The U<sub>2</sub>A is designed with three built-in safety levels to prevent even the smallest amount of stored ammonia from escaping. The first level of defense shuts the system down when hydrolyzer temperature, pressure, or liquid level rises too high. Secondly, a patented safety protocol responds to pressures above the high level (well below the vessel-rated capacity) by rapidly cooling and stopping the reaction. Finally, a pressure relief valve set just below the ASME pressure rating will discharge the contents of a hydrolyzer to a large reservoir of cold urea, stopping the reaction and capturing the contents for reintroduction into the hydrolyzer when the condition is cleared.

### Learn more about A Safer, More Efficient System Today.

Wahlco's innovative U<sub>2</sub>A generation system expands your options. It opens the window to a proven system that is a safer, easier, cost effective

alternative to ammonia. And its available today. Find out how easy it is to put it to work for you.

For more information, visit [www.wahlco.com](http://www.wahlco.com) or call us toll-free in the U.S. at 800-423-5432 or outside the U.S. at 714-979-7300.



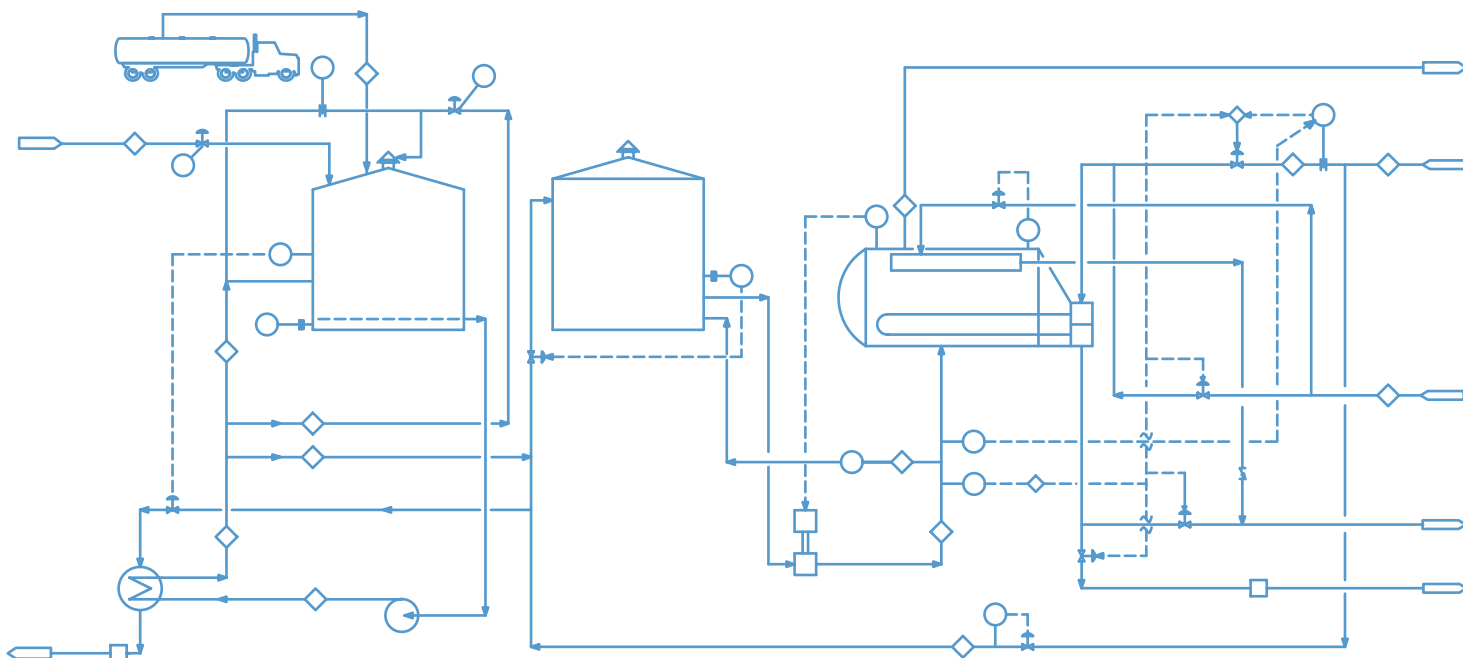
The heart of the system: 4,000 lb/hr U<sub>2</sub>A hydrolyzer is lowered into place in West Virginia. This versatile process has been scaled from 2 lb/hr to over 10,000 lb/hr capacity in field installations.



Hydrolyzer feed pump maintains constant solution level in the hydrolyzer.



In place and doing its job: a complete U<sub>2</sub>A system operating at Huntington Beach, California





## ADVANTAGES OF UREA

- |   |
|---|
| Classified as non-toxic, non-flammable                            |
| Practically no restrictions on transportation, use and storage    |
| Permitting process is easier, with minimal governmental oversight |
| Usually avoids dispersion studies                                 |
| Available in supersacks, by truck or by railcar                   |
| Poses almost no risk in the workplace                             |
| Can be stored in solution or as a solid in silos                  |

## U<sub>2</sub>A™ ADVANTAGES

- |   |
|---|
| Simple, patented process; low maintenance cost  |
| Urea is the only solution stored; eliminates ammonia odor                                     |
| Indirect heat exchange; protects condensate integrity   |
| Closed water balance; simplifies process tracking   |
| Catalyst-free; eliminates replacement and concern about SCR catalyst poisoning                |
| Hydrolyzer at equilibrium; easy to control and monitor  |
| Easy shutdown, fast startup; maximizes availability   |
| Standard construction materials; low cost long term maintenance and easy to upgrade if needed |
| Standard hydrolyzer; well characterized performance   |

*Emission Control & Chemical Technologies (EC&C) developed the U<sub>2</sub>A technology (U.S. Patent 6,077,491). Hamon Research-Cottrell and Wahlco, Inc. are co-exclusive licensees of EC&C and have structured an alliance to provide U<sub>2</sub>A technology to utilities and other clients throughout the world.*



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