Beyond ISO 22241

Ensuring AdBlue® Quality from Production to Vehicle Tank.

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It's in our Nature

The Global Challenge. NOx emissions remain a major environmental challenge

*Air Pollution is the biggest environmental health risk of our time.

*Nine out of ten people breathe unsafe air.

*Exposure can lead to stroke heart, lung diseases, cancer and more.

*Air Pollution causes approximately 6,7 million premature deaths annually (WHO)

*Transport regulations continue to tighten globally.

*SCR has become the dominant technology for NOx reduction.

*SCR performance depends on one critical consumable: AdBlue®.

SCR can remove more than 95% of NOx, but only if AdBlue® quality is maintained.

What AdBlue® (32,5% $CO(NH_2)_2$ + 67,5% H_2O) Really Does

Thermolysis : Urea decomposes thermally according to:
where HNCO is isocyanic acid.

$$CO(NH_2)_2 \rightarrow NH_3 + HNCO \qquad (1)$$

Hydrolysis : The isocyanic acid subsequently reacts with water vapor:

$$HNCO + H_2O \rightarrow NH_3 + CO_2 \qquad (2)$$

Overall Reaction : Combining Equations (1) and (2):

$$CO(NH_2)_2 + H_2O \rightarrow 2NH_3 + CO_2 \qquad (3)$$

Standard SCR Reaction

$$4NH_3 + 4NO + O_2 \rightarrow 4N_2 + 6H_2O \qquad (4)$$

Urea → Ammonia → NOx Reduction → N_2 + H_2O

Ammonia generated inside the exhaust performs the NOx reduction.

Correct chemistry requires correct fluid quality.

Why Quality Matters
Every contamination eventually reaches the SCR catalyst.

Supply chain diagram:

Production → Storage → Logistics → Distribution → Customer Tank → Vehicle

Although ISO 22241 defines product quality, most contamination occurs after production.

The Most Dangerous Contaminant: Metals

- Sodium
- Potassium
- Calcium
- Iron
- Copper
- Zinc

Picture Source: Yara

Pictures Source:
www.fluidlife.com

Key : **Unlike deposits, metal poisoning is generally irreversible.**

Effects of Severe AdBlue Crystallization in the SCR System

Pictures Source: Everblue.com

Pictures Source: Yara

Engine start inhibition countdown activated (e.g. Engine start disabled in 200 km).

Total loss of AdBlue dosing functionality, with the SCR system locked in a fault state.

Severe crystallization may result in visible white or gray deposits within the exhaust stream, particularly near the AdBlue injection point.

Excessive AdBlue crystallisation can partially block the exhaust system, causing the engine to run rough at low speed.

Quality Deviations and Their Consequences

Deviation	Consequence
Low urea concentration	Reduced NOx conversion
High concentration	Crystallization
Biuret	Deposit formation
Aldehydes	Catalyst deactivation
Insolubles	Injector blockage
Metals	Catalyst poisoning

Key **Different contaminations produce different failures, but all reduce SCR performance.**

Manufacturing Control Points

Quality Control Process :

▼ Urea Qualification

▼ Water Purification

▼ Equipment Compatibility

▼Concentration control

▼Filtration

Laboratory Release: ✓ Product Approved

Quality must be built into the process, not simply tested at the end.

Water: The Hidden Quality Risk. 67,5% of AdBlue® is water.

Control Parameters:

- ▼Conductivity
- ▼ Trace metals
- ▼ Silica
- ▼ Chlorides
- ▼ Microbiology

The quality of AdBlue® can never exceed the quality of the water used to produce it.

Lessons Learned from AdBlue Implementation in France

What We Learned During Early Euro IV Adoption:

- AdBlue® transferred into previously used lubricant drums.
- Cross-contamination occurred.
- SCR failures increased.
- Industry awareness evolved.

Most quality incidents were created by handling practices, not manufacturing defects.

Logistics: Where Risk Increases

What We Learned During Early Euro IV Adoption:

- ✓ Dedicated equipment
- ✓ Approved materials
- ✓ Tamper protection
- ✓ Telemetry

A compliant batch can become non-compliant at any transfer point.

Approved vs. Prohibited Materials

- ✓ Stainless Steel
- ✓ HDPE (High-Density Polyethylene)
- ✓ PP (Polypropylene)
- ✓ PVDF(Polyvinylidene Fluoride)

✗ Copper ✗ Brass ✗ Carbon Steel ✗ Zinc

Material compatibility is a quality control requirement, not an engineering preference.

Customer Site: The Final Quality Gate

Storage tank at fleet depot

- Dedicated tanks
- Closed transfer systems
- Filtered vents
- Temperature monitoring
- Employee training

The customer site is not the end of the supply chain. It is the final quality control point.

BS-VII and the Future: Why AdBlue® Quality Will Become Even More Critical ?

Future truck + digital diagnostics:

- **Lower NOx limits**
- **Low temperature operation**
- **Longer catalyst life**
- **Advanced OBD (On Board Diagnostics) systems**
- **Higher SCR efficiency targets**

Future vehicles will be less tolerant to fluid quality deviations.

Innovation for Low Temperature Operation.

Vehicles will be less tolerant to fluid quality deviations.

OptiSpray® concept :

- **Better atomization**
- **Improved evaporation**
- **Lower deposit formation**
- **Better NOx conversion at low temperatures**

Air1 OptiSpray has a low concentration (<0.05%) surfactant additive, active in preventing deposit buildup.
This means no adverse effects on the SCR catalyst.

OptiSpray™ prevents urea deposit formation in SCR systems

Key Messages

1. AdBlue® quality should be protected across the entire supply chain.
2. Contamination prevention is more effective than contamination detection.
3. Future BS-VII compliance will require even stricter quality control.

Quality In.
Compliance Out !

When the right AdBlue® reaches the vehicle, SCR technology delivers its full environmental potential.