

IME Guideline for the Responsible Transportation of Solid Ammonium Nitrate by Motor Vehicle

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INTRODUCTION

This document, *IME Guideline for the Responsible Transportation of Solid Ammonium Nitrate by Motor Vehicle*, is part of IME's ongoing efforts to ensure the safe handling and transportation of solid ammonium nitrate (AN) to protect the public, motor vehicle operators, the emergency response community, and commercial explosives businesses.

The U.S. commercial explosives industry manufactures, handles, transports, stores and uses AN in two physical forms. One of these forms, a solid, is referred to as technical grade AN, or "TGAN." It is the transportation of this solid form that is the subject of this guideline. The other form of AN is a liquid, known as AN solution, or ANS.¹ Together, TGAN and ANS account for over 90% of the raw material feed used to manufacture modern commercial explosive materials.

¹ For information on the handling and transportation of ANS, and for more detailed information on the overall management of TGAN, please see IME's Safety Library Publication 30 (SLP-30), *Safe Handling of Ammonium Nitrate*.

AN is also used extensively by the fertilizer industry. The form of AN used in fertilizer production is commonly referred to as fertilizer grade AN, or “FGAN.” Solid TGAN and FGAN prill are chemically identical and will behave identically when exposed to intense heat. The only difference between the two products is their density.²

Because this document is authored by IME, the term TGAN is used throughout. Nevertheless, the recommendations in this guideline are equally relevant to the handling and transportation of FGAN. Because TGAN and FGAN are chemically identical, both products present the same potential hazards if improperly managed or subjected to similar stressors such as fire, shock, and contamination.

The information provided in this guideline is not intended to cover all hazards, safe practices or technical challenges associated with the handling and transportation of AN. For additional information, please consult other sources including the appropriate references, standards, and regulations cited at the end of this document.

TRANSPORTATION OF TECHNICAL GRADE AMMONIUM NITRATE BY MOTOR VEHICLE

U.S. Department of Transportation (“DOT”) classifies TGAN as a Class 5 Oxidizer, Division 5.1, UN1942, PG III material. TGAN is not an explosive material as determined by U.S. DOT testing methods used to establish its classification for transportation in commerce in the United States.

Transportation of TGAN on U.S. roadways is regulated by DOT’s Hazardous Materials Regulations (“HMR”) in 49 C.F.R. Parts 171-178.

Security requirements of TGAN in transportation is regulated under DOT regulations in 49 C.F.R. § 172.800. Carriers must have a DOT security plan, including transportation security training for employees. Carriers may also want to consider performing Route Risk Assessments (RRA) for all routes used to carry TGAN. Factors considered in an RRA may include, but may not be limited to, the following:

- Climate
- Communications
- Driving surface condition
- Population density
- Road design (corners, intersections, bridges, hill crests, steep hills, signage)
- Terrain (flat, hilly, mountainous)
- Traffic density
- Visibility

49 C.F.R. §172.101 is the hazardous materials table where specific requirements for transporting TGAN can be found. The description relevant to TGAN is *“Ammonium nitrate, with not more than 0.2% total combustible material, including any organic substance, calculated as carbon to the exclusion of any other substance.”*

² TGAN has a lower density than fertilizer grade ammonium nitrate (“FGAN”). The bulk density of manufactured TGAN varies within the range of 0.74 g/cc to 0.88 g/cc (46 to 55 lbs./cu.ft.), depending on the manufacturing plant or the specific formulation produced. The bulk density of FGAN may range from 0.90 to 1.00 g/cc (56 to 62 lbs./cu.ft.). The shape and size of TGAN prill granules will, in part, influence the bulk density of the material.

The commercial explosives industry uses the following description on shipping papers:

UN1942, Ammonium nitrate, 5.1³

Below are two examples of TGAN placarding that are used for transportation in commerce. The placards communicate important first response information such as hazard Class, Division and UN Identification Number:



OR

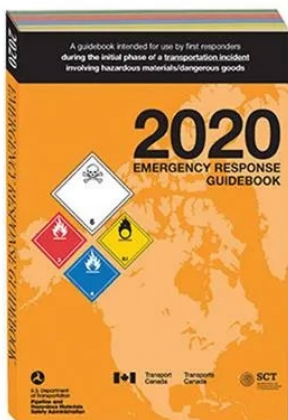


AND



The Emergency Response Guide ("ERG"), used by first responders, contains important safety information for actions to be initially taken at the scene of a hazardous materials incident. The date of the printing of the ERG appears on the cover.

³ The information for UN1942 that will appear on shipping papers is: "UN1942, Ammonium Nitrate with not more than 0.2% total combustible material, including any organic substance, calculated as carbon to the exclusion of any other substance, 5.1, Packing Group III."



Every 4 years, the ERG is reviewed and updated as may be required. The yellow ERG pages list materials in sequential order based on their UN number. The description of TGAN appears in the yellow-colored ER pages under Guide Number 140.

Pure TGAN is a white, water-soluble, crystalline substance with a melting point of 170°C. Decomposition starts at 210°C. Technical grades may start to decompose at temperatures lower than 210°C because of impurities. Additives and coating agents can have a marginal effect on the decomposition temperature; other chemicals can have significant effects.

TGAN, which is classified as an oxidizing agent, Division 5.1 substance, does not burn. However, as an oxidizer it can support the burning of fuels relatively easily. Even though TGAN does not burn, if exposed to heat and its temperature reaches above 210°C, it will decompose, and can do so violently.

FIRE – Execute Emergency Response Plan

A motor vehicle carrying technical grade ammonium nitrate should be provided with at least two fire extinguishers, each with a rating of 2A-10B:C or higher. Only persons trained in fighting fires involving hazardous materials shipments should be involved in the emergency response. Foam and/or dry chemicals are not effective for fires directly involving TGAN and should not be used.

- The most likely source of fires will be on the vehicle, e.g., electrical, fuel. These fires should be fought with on-vehicle fire extinguishers and any local fire extinguishers or hoses.
- Tire fires are the most dangerous due to the high heat released over an extended time period. Fire extinguishers are only likely to work on incipient tire fires. Only copious amounts of water will succeed with advanced tire fires.

If the fire directly or indirectly involves the TGAN, it should trigger the evacuation plan.

There is a risk that TGAN involved in a fire may detonate. Evacuate the area in all directions for 1 mile or greater if any amount of TGAN is involved in a fire.

Use of Preventative Measures and Tools

- Preventative Measures, Maintenance, and Technology:

- Preventative Measures

All equipment involved should be dry and free of contaminants. If the transport equipment is not dedicated to AN, it should be washed out and dried prior to loading. Bulk TGAN should not be in contact with wood. TGAN contamination by some materials must be avoided due to increased risk of reactivity which could, in a very worst-case scenario, lead to detonation. Potential contaminants include, but are not limited to, the following:

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|-------------------------|--|
| • Animal fats | • Hay |
| • Baled cotton | • Linseed oil or other oxidizable or drying oils |
| • Baled rags | • Lubricating oil |
| • Baled scrap paper | • Naphthalene |
| • Bleaching powder | • Oakum |
| • Burlap or cotton bags | • Oiled clothing |
| • Camphor | • Oiled paper |
| • Caustic soda | • Oiled textiles |
| • Charcoal | • Organic materials |
| • Charcoals | • Other organic substances that can act as fuels |
| • Chlorides | • Paint |
| • Coal | • Phosphorus |
| • Coke | • Sawdust |
| • Cork | • Straw |
| • Diesel fuels and oils | • Vegetable oil |
| • Excelsior | • Wood chips |
| • Fibers of any kind | • Wood shavings |
| • Finely divided metals | |
| • Fish meal | |
| • Fish oils | |
| • Foam rubber | |

- Preventative Maintenance

Visual inspections for tire pressure, tread depth, wheel, hub seal, lug nut, trailer axle lubrication level and drum brakes should be performed daily as part of a driver's pre- and post-trip inspections. Tractor lubrication levels should also be inspected at or regularly scheduled maintenance intervals and again during the unit's annual DOT inspection.

- Technology

Tire pressure monitoring systems should be considered. Examples include the following:

- Tire pressure equalizing and monitoring valve. This system provides a visual tire pressure indication for both dual tires in which air flows freely from one tire to the other, maintaining equal tire pressure and load distribution. In the event of a tire blowout, the internal safety valve will close immediately and will automatically isolate the “good” tire with only a slight loss of air pressure to the “good” tire. In the event of a slow air leak situation, the internal safety valve will isolate both tires after a pressure drop of 10 PSI.
- Electronic tire pressure monitoring system. This system utilizes wireless sensors that send a signal to an in-cab monitor/display. In a tire low air pressure alarm condition the wheel position will flash on the display with the current air pressure and a red colored alarm will illuminate with an audible beep.
- Tire Pressure and Temperature Monitoring Systems. These systems monitor real-time PSI and temperatures for up to 22 wheels. Data points for all tires are maintained. An audible alarm system will alert the driver to detected leaks.
- Laser or infrared tools to measure surface heat (e.g., infrared thermometers).⁴

⁴ Entities using non-continuous systems should establish standard operating procedures (SOPs) covering monitoring frequency (e.g., temperature and pressure checks at each stop, or after X number of hours of operation or miles driven). The SOP should also consider any accommodations or enhancements needed for, among other things, inclement weather, extreme ambient temperatures, and poor road conditions.

ADDITIONAL RESOURCES

- IME SLP-30, *Safe Handling of Solid Ammonium Nitrate* (2017)
- IME SLP-12, *Glossary of Commercial Explosives Industry Terms* (2018).
- IME SLP-14, *Handbook for the Transportation and Distribution of Explosive Materials* (2019).
- *Chemical Advisory: Safe Storage, Handling, and Management of Solid Ammonium Nitrate Prills*, EPA 550-F-15-001 (2015). https://www.epa.gov/sites/production/files/2015-06/documents/an_advisory_6-5-15.pdf
- *Principal Emergency Response and Preparedness Requirements and Guidance*, OSHA (2004), <https://www.osha.gov/Publications/osh3122.pdf>
- NFPA 400, *Hazardous Materials Code* (2016).
- NFPA 704, *Standard System for the Identification of the Hazards of Materials for Emergency Response* (2017).
- USCG 33 C.F.R. 126
- *Commercial Routing Assistance* (CRA) tool; Cybersecurity and Infrastructure Security Agency (CISA) and Idaho National Laboratory (INL) (2020). <https://cra.inl.gov/> .