



Safety Advisory for Storage, Handling and Management of Ammonium Nitrate

As all of us are aware about devastating explosion occurred at Beirut (country - Lebanon) on 04/08/2020 where large consignment of Ammonium Nitrate was stored for many years. In the wake of powerful explosion, all the licence holders are advised to undertake safety precautions to avoid such incident in the country.

Properties of Ammonium Nitrate:

Nature	-	White, odorless salt
Formula	-	NH_4NO_3
Molecular Weight	-	80.05 gms / mol
Melting point	-	155 - 169.4°C

The major problem arises with the prolonged storage of Ammonium Nitrate are hygroscopicity and phase changes leading to break down of the prill and caking of the product. Ammonium Nitrate has three main hazards:-

Fire

Being strong oxidizing agent, it can facilitate the initiation of fire and assist the combustion of materials contaminated with oil, rags, wooden articles, clothing's etc. Hot Ammonium Nitrate melt can initiate fire on contact with such materials.

Decomposition

If engulfed in fire and combined with contamination, confinement or both, it will give off brown vapors of nitrogen dioxide (NO_2) and explosive sensitivity of Ammonium Nitrate increases leading to detonation.

Explosion

Ammonium Nitrate is a potentially an explosive substance comprising the oxidizing nitrate ion in intimate contact with the fuel element. Small amount of contaminants are sufficient to act as a catalyst explaining the unpredictability of Ammonium Nitrate under fire conditions.

As a result of the decomposition reaction of Ammonium Nitrate, the risk of explosion increases by heating Ammonium Nitrate in combination with contaminants, confinement or both. In a fire situation, molten Ammonium Nitrate may be formed. The molten mass becomes confined such as in drain pipes, plants and machinery or combines with contaminants, leading to explosion.

The risk of explosion is decreased by reducing the potential sources for the Ammonium Nitrate such as heat, fire, contamination, confinement. If all such potential sources are eliminated, the chance of accidental explosion is remote.

Guidelines for Safe Storage of Ammonium Nitrate

1. Keep away from heat, hot surfaces, sparks, open flames and other ignition sources.
2. Prevent hot spots and thermal decomposition, the average temperature of Ammonium Nitrate shall not exceed 54.44 °C.
3. Keep the surrounding (15 meters) of the storehouse clean, free from dry grass, bush vegetation which can communicate fire inside. Due to heat, Ammonium Nitrate melts and begins to undergo decomposition when molten. Such thermal decomposition initiated by fire or heating leads to detonation. The molten mass becomes confined and prone to detonation.
4. Smoking and naked lights inside Ammonium Nitrate storehouse are not permitted.
5. Old stock of Ammonium Nitrate shall be consumed first.
6. Ammonium Nitrate shall not be stored with any other material irrespective of its compatibility or incompatibility.
7. Ammonium Nitrate shall not come in contact with Acetic Acid, Acetic Anhydride, Alkali Metals, Aluminium + Calcium Nitrate, Aluminium, Ammonium Chloride, Ammonium Dichromate, Ammonium Phosphate + Potassium, Antimony, Barium Chloride, Bismuth, Brass, Cadmium, Charcoal + Metal Oxides, Chloride Salts, Chromium, Cobalt, Copper Iron II Sulfide, Copper, Cyanoguanidine, Hydrocarbon Oils, Iron, Lead, Magnesium, Manganese, Nickel, Organic Fuels, Potassium Chromate, Potassium Dichromate, Potassium Nitrate, Potassium Nitrite, Potassium Permanganate, Sawdust, Sodium Chloride, Sodium Perchlorate, Sugar, Sulfide Ores, Sulphur, Tin, Titanium, Trinitroanisole, and Zinc
8. Take all precautions to avoid mixing with combustible and incompatible materials. Storage with high explosives and detonators shall be strictly avoided.
9. Avoid contamination due to corrosive and reactive properties of Ammonium Nitrate – bins of galvanized iron, copper, cadmium, chromium, lead and zinc shall not be used for storage.
10. The storehouse shall have adequate ventilation or be capable of adequate ventilation in case of fire.
11. Ammonium Nitrate readily absorbs moisture allowing individual prills stick together forming cake. To avoid formation of cake, stacking of Ammonium Nitrate bags shall be kept at minimum. Inter stack distances shall be adequate to avoid communication of fire and prevent sympathetic detonation.
12. Avoid compression/confinement of Ammonium Nitrate which is more likely to explode.
13. In-charge of Ammonium Nitrate storehouse shall take routine visit to the storehouse to ascertain the condition of baggage/deterioration, if any noticed, action shall be initiated for removal of the same immediately.
14. The movement of vehicles, carrying Ammonium Nitrate (bags) inside the storehouse shall be restricted. Leakage from fuel tank of the vehicle may contaminate with Ammonium

Nitrate forming dangerous ANFO mixture prone to explosion. All vehicles shall be free from leak/oil. Vehicle shall be fitted with spark arrestor.

15. Battery operated vehicles shall not be used inside the storehouse.
16. The in-charge of Ammonium Nitrate storehouse shall ensure minimum number of persons shall enter for loading and unloading of Ammonium Nitrate.
17. Ammonium Nitrate storehouse shall not be used for any other purposes other than Ammonium Nitrate storage.
18. Round the clock security shall be provided to the storehouse to restrict the entry of unauthorized person/s.
19. During rain and thunderstorm, activities inside the storehouse shall be suspended. Lightning conductors shall always be maintained in good condition and test shall be conducted routinely.
20. Any water seepage of roof shall be repaired immediately and restrict water logging inside the storehouse.
21. The shed shall be maintained in good condition by regular cleaning to avoid contamination.
22. The empty bags shall be disposed off with local regulation. It should be cleaned thoroughly by using water before disposal.
23. Spillage contaminated Ammonium Nitrate shall be collected and disposed off safely at designated place. Organic material (saw dust) should not be used to clean floors.
24. All regulatory licenses shall be in possession for manufacture, import, storage, sale, use, supply and transportation of Ammonium Nitrate.
25. All standards of MSDS shall be referred for compliance and regular training programs shall be conducted for all persons who are dealing with Ammonium Nitrate to spread awareness and hazard associated with storage and handling of Ammonium Nitrate.
26. All the provisions of Ammonium Nitrate Rules, 2012 and conditions of licence shall be strictly complied.

Guidelines for Safe Loading, unloading, maintenance and operation of vehicle engaged in transport of Ammonium Nitrate :-

1. The vehicles engaged in transport of the Ammonium Nitrate, shall be attended by only such drivers or cleaners, whose antecedents are verified by the local police and a list of such drivers or cleaners along with all personal particulars should be made available to the local police in advance to carry out the verification and the re-verification of such drivers or cleaners should be carried out at regular intervals, once in five years.
2. The vehicles carrying or containing Ammonium Nitrate shall be accompanied by at least two able bodied guards.
3. The vehicle carrying or containing Ammonium Nitrate shall not stop for a longer period than is reasonably required, and shall avoid stops at places where public safety is likely to be in danger:
Provided that where a vehicle transporting or containing Ammonium Nitrate is parked overnight due to any reasons beyond the control of the driver, the premises in which the vehicle is parked, -

- (a) shall not be used for any purpose that might give rise to the presence therein of an open flame, matches or any substance or article likely to cause explosion or fire;
 - (b) shall be away from any habitation or any godown containing articles of a flammable nature or other hazardous goods and the nearest police station shall be informed about the location of such temporary parking.
4. A vehicle while transporting Ammonium Nitrate shall be adequately secured at the expense of the licence holder and if the consignment of Ammonium Nitrate is likely to pass through sensitive areas notified by the Ministry of Home Affairs, it should be escorted by armed police escort or guard, provided by the District Police Administration.
 5. The Ammonium Nitrate melt shall be transported in the melt tanker with discharge faucets and manhole(s) duly sealed by the melt supplying firm and the melt supplying firm shall issue quality control certificate indicating clearly the concentration factor of the Ammonium Nitrate melt.
 6. The consignee shall verify that the concentration factor of Ammonium Nitrate is as specified in the invoice and that the seals on melt tank are intact.
 7. The transport of Ammonium Nitrate in sensitive areas notified by Ministry of Home Affairs shall not be allowed during the period from sunset to sunrise. The movement of Ammonium Nitrate and the particulars of the origin and destination of the consignment shall be informed to the concerned police authorities in writing.
 8. Fire extinguishers to be provided –
 - (a) Every vehicle transporting Ammonium Nitrate shall be provided with two fire extinguishers of minimum five kilograms capacity and one of the extinguishers shall be capable of dealing with fire involving electric circuits and the other, with other inflammable components.
 - (b) The fire extinguishers shall always be kept in good working condition.
 - (c) The fire extinguishers shall be located where they shall be convenient and ready for immediate use.
 - (d) The fire extinguishers shall be examined and recharged according to the manufacturers recommendations.
 9. The vehicles engaged in transport of Ammonium Nitrate shall be fitted with Global Positioning System and monitored by the transport licence holder in Form P-4.

Fire fighting measures

1. Fire involving Ammonium Nitrate cannot be extinguished by oxygen deprivation because of provision of oxygen from Ammonium Nitrate. Water is the most effective means of fire fighting.
2. Evolution of orange/ red nitrogen dioxide is a sign that the fire is out of control.
3. Evacuate the area within 1 km. Emergency response plan shall be initiated.
4. Fire fighting facilities shall be used for small fire and fire tender shall be called from nearest fire station to control the fire.

5. PPE (Personal Protective Equipments) shall be used to avoid inhalation of toxic fumes and medical attention to be sought immediately if required.
6. Affected area shall be completely washed with water and ensured there are no traces of Ammonium Nitrate.
7. Safety audit shall be conducted to understand the deviations in Standard Operating Procedures (SOP) which will help to improve safety at workplace.

It is advised that all the transactions of purchase, sale and use of Ammonium Nitrate shall be carried out through Online Ammonium Nitrate Returns System (ANRS) module only.
