

Ammonium Nitrate

Introduction

Ammonium nitrate (AN) is a “straight forward” compound with complex hazardous properties.

The three main hazards associated with ammonium nitrate are

- Fire,
- Toxic Fumes
- Explosions

Ammonium Nitrate

- Under normal conditions straight ammonium nitrate is stable and in itself presents no hazard
- Normally ammonium nitrate is not combustible, but if involved in a fire it will enhance the severity of the fire as it is an oxidising agent
- In a fire, ammonium nitrate gives off fumes that will contain the toxic oxides of nitrogen

Ammonium Nitrate

In the case of a fire combined with
i. a high degree of confinement

and / or

ii. contamination by certain other substances

then

**there is a high risk of an explosion
occurring**

Ammonium Nitrate

Pure ammonium Nitrate is difficult to detonate. Neither flame nor friction can cause detonation, and it generally requires initiation by some other detonation method / source. The sensitivity to detonation is increased by high temperature, high porosity and the presence of certain materials, hydrocarbons and other contaminants as well as the degree of confinement

Ammonium Nitrate

Ammonium nitrate is unpredictable in that it can burn or deflagrate or explode. This will depend on various conditions. Pure ammonium nitrate will burn with difficulty and usually as a cigarette type burn. If the Ammonium Nitrate is contaminated then the burning rate will increase and deflagration can occur. If the ammonium nitrate is contaminated and confined then the possibility of an explosion increases rapidly.

Ammonium Nitrate

The explosion hazard of ammonium nitrate arises from its ability to undergo rapid decomposition which gives off gaseous products. Thus thermally decomposing ammonium nitrate in strong confinement can undergo explosive decomposition. The presence of catalytic impurities can increase the sensitivity

15- Significant Accidents pre-1950 and post-1950

Pre-1950

Year	Location	Description	No.of Fatalities
1921	Kriewald, Germany	Caked AN in rail cars detonated when blasting explosives used to break up	19
1921	Oppau, Germany	Caked AN-AS fertiliser detonated when blasting explosives used to break up.	> 500
1924	Tessengerloo, Belgium	Use of blasting explosive led to a detonation in AN pile	> 100
1947	Texas City, Texas, USA	Wax-coated AN cargo in two ships exploded following major fire	> 600
1947	Brest, France	Wax-coated AN cargo in ship exploded following fire	21

Post 1950 - 2

Date/Place	Activity/Description/Consequence	Product	Accident Type
1954 Red Sea	Sea Transport Fire in ships hold, AN fertiliser + paper + organic/copper product. Explosions, ship abandoned and destroyed. No injury.	AN Fertiliser	Fire Explosion
1960 Traskwood USA	Rail Transport Wagons derailed, fire, Hydrocarbons conc. nitric acid and AN involved. Explosion. No injury.	AN Fertiliser	Fire Explosion
1963 Traskwood USA	Rail Transport Derailment, oil spillage + fire. AN involved. No explosion. No injury.	AN Fertiliser	Fire
1963 Holland	Storage 4000tes of NPK in bulk store, SSD, release of toxic fumes. No injury.	NPK Fertiliser	Decomposition (SSD)

Post 1950 - 3

1965 Atlantic Ocean	Sea Transport SSD in NPK load, water applied. Load shifted causing boat to capsize. 3 drowned.	NPK Fertiliser	Decomposition (SSD)
1967 USA	Rail Transport 50te AN in paper bags in wagons with wooden interior, fire, left to burn out. No injury.	AN Fertiliser	Fire
1966 USA	Storage AN fertiliser, also pesticides and combustible materials. Fire, Smoke affected fire fighters, Explosion. No injury.	AN Fertiliser	Fire Explosion

Post 1950 - 4

1972 France	Road Transport AN solution tanker. Decomposition	AN	Explosion
	in lagging. Contaminated with organic & AN, explosion, hot AN solution released, 2 fatally burnt.	Solution	
1972 Australia	Road Transport Semi-trailer with low density AN on fire, also oil load, too remote for fire fighting. Explosion. Three killed.	Low Density AN Industrial Grade	Fire Explosion
1973 USA	Storage Severe fire in AN store of wooden structure, fuel tank in payload. Difficulty with fire fighting. A few tonnes of AN exploded. Main heap -14000tes, unaffected. No injury.	AN Fertiliser	Fire Explosion

Post 1950 - 5

1975 Germany	Storage SSD in bulk NPK initiated by welding 1000 residents evacuated. No injury.	NPK	Decomposition (SSD)
1978 USA	Storage 500 te AN in a warehouse fire. Store burnt out completely. No explosion.	AN Fertilizer	Fire
1982 UK	Storage Major Tire, wooden furniture stored near AN fertiliser, toxic fumes released. 750-1000 evacuated, Deflagration in AN. No Injury.	AN Fertiliser	Fire

Post 1950 - 6

1987 France	Storage SSD in bulk 1450te NPK. Major release of toxic fumes. 20,000 local residents evacuated. Bulk AN not affected. No injury.	NPK	Decomposition (SSD)
1988 Yugoslavia	Storage SSD in bulk NPK. 17000te in storage. 12000 residents evacuated. No injury.	NPK	Decomposition (SSD)
1997 Brazil	Road Transport Truck loaded with AN caught fire and stopped on side of a narrow road. A petrol tanker tried to pass, caught fire and exploded. Subsequent AN detonation probably triggered by an exploding propane bottle on the trailer. A coach full of passengers was parked close to the scene of incident. Several passengers fatally injured.	AN Fertiliser	Fire Explosion

Post 1950 - 7

1998 Kentucky USA	Storage A warehouse with 4000 te AN in basement on fire, allowed to burn out. 2 explosions believed to be in propane cylinders, 2500 evacuated. No injury.	AN Fertiliser	Fire
2000 Florida USA	Road Transport. Collision between AN truck and gasoline tanker. AN truck driver killed due to collision. Fire allowed to bum out,	AN Fertiliser	Fire

A)-NEISHABUR ACCIDENT

- 1- DATE AND LOCATION : WEDNESDAY,17/1/2003, RAILWAY
STATION,NEISHABUR,IRAN
- 2-TYPE OF OCCURRENCE : FIRE AND EXPLOSION
- 3-PROCESS OR OPERATION : HANDLING OF AMMONIUM NITRATE BY
TRAIN
- 4-MATERILS INVOLVED : PETROL,COTTON,SULFUR,NAPHTA AND
AMMONIUM NITRATE
- 5- DESCRIPTION OF ACCIDENT

AT WEDNESDAY DATED 17/1/2003, A CARGO TRAIN CONTAINING
SEVERAL WAGONS OF AMMONIUM NITRATE,NAPHTA,PETROL,COTTON
AND SULFUR MOVING FROM MASHHAD TO TEHRAN HAD A SHORT
STOP IN NEISHABUR CITY OF IRAN.

A)-NEISHABUR ACCIDENT - 2

AFTER A WHILE,AT 4:10 AM BECAUSE OF AN UNKNOWN REASON THE TRAIN STARTED MOVING AND AFTER PASSING AROUND 40km IT WAS DERAILED AT NEXT STATION.

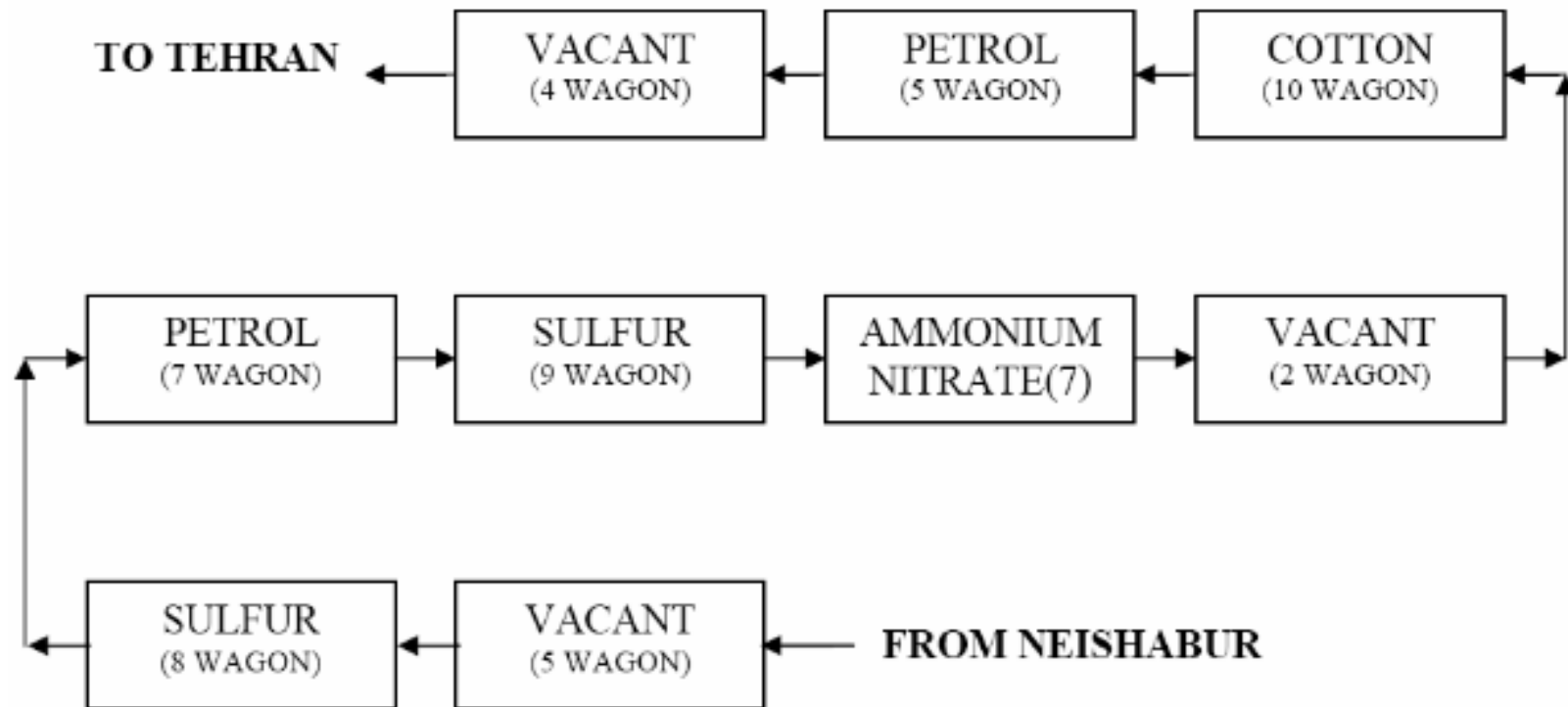
AT THIS POINT THE FIRST 4 VACANT WAGONS OF THE TRAIN WERE DETACHED AND THE OTHER WAGONS WERE OVERTURNED AND HIT ANOTHER CARGO TRAIN STOPPING AT STATION IN OPPOSITE DIRECTION. BECAUSE OF THIS COLLISION AND SPILLAGE OF PETROL FROM OVERTURNED WAGONS, A LARGE FIRE OCCURRED.

FIRE BRIGADE AND RESCUE FORCES TRIED TO CONTROL AND EXTINGUISH THE FIRE. FINALLY AT 9 AM THE FIRE WAS CONTROLLED AND APPARENTLY EXTINGUISHED.

AT 9:42 AM (42 MINUTES LATER) WHEN PEOPLE HAD GATHERED AT THE SCENE, SUDDENLY A SEVERE EXPLOSION OCCURRED AND MANY PEOPLE KILLED, DISAPPEARED OR WOUNDED AND MANY BUILDINGS UP TO 10km AROUND WERE DAMAGED. THIS EXPLOSION CREATED A LARGE CRATER (MEASURED 70m WIDE AND 20m DEPTH).

A)-NEISHABUR ACCIDENT - 5

HEREUNDER THE LAYOUT OF TRAIN AND WAGONS IS ILLUSTRATED:











A)-NEISHABUR ACCIDENT - 3

6-DAMAGES AND CASUALTIES

A LARGE NUMBER OF PEOPLE WERE DISAPPEARED,KILLED OR WOUNDED(MORE THAN 400) AND MANY BUILDINGS AND VEHICLES WERE DAMAGED.

7-CAUSE OF ACCIDENT

REVIEWING PHOTOS TAKEN BEFORE AND AFTER THE EXPLOSION IT WAS CONCLUDED THAT FIRST OF ALL FIRE WAS STARTED AND SPREAD INTO MOST OF WAGONS AND THEN SPREAD INTO AMMONIUM NITRATE WAGONS(7 WAGONS EACH CONTAINED 60ton OF AMMONIUM NITRATE).APPARENTLY FIRE WAS EXTINGUISHED BY FIRE FIGHTERS BUT THE CORE OF AMMONIUM NITRATE PILES WAS STILL HOT AND CAUSED AMMONIUM NITRATE DECOMPOSED AND EXPLODED.IN THIS ACCIDENT AROUND 200ton AMMONIUM NITRATE EXPLODED(FROM THE TOTAL OF 420ton)

A)-NEISHABUR ACCIDENT - 4

8-LEARNING POINTS

- COMPATIBILITY OF MATERIALS DURING HANDLING WAS NOT OBSERVED.
- WATER SHOULD NOT BE USED TO EXTINGUISH FIRE WHEN FIRES OF AMMONIUM NITRATE IS SPREAD.THE AREA SHOULD BE VACATED FROM PEOPLE.
- SUITABLE BRAKES AND STOPPERS SHOULD BE USED TO STOP THE TRAIN.
- THE TRAIN CONTAINING HAZARDOUS MATERIALS SHOULD NOT LEFT UNATTENDED.