

PRESENTATION ON  
EXPLOSION OF EMULSION PLANT  
AT  
PREMIER EXPLOCHEM LTD  
NASIK - INDIA

- By AMAR NATH GUPTA

## 1.0 HISTORY:

- Premier Explosives Limited (PEL) was founded by the author during 1980.
- PEL established as a small scale unit to produce ANFO and Water gel (slurry explosives) using double helical ribbon mixture with Flake aluminium as sensitizer.
- PEL developed emulsion technology and started manufacturing emulsion large diameter (over 75 mm diameter) and later small diameter emulsions.
- Designed a semi continuous process.
- PEL operated the plant up to 2004.
- Disinvested and transferred the technology and plant to Premier Explochem Limited (PECL).

- The plant operated by Premier Explochem Limited (with minority investment of Premier Explosives Limited and control by the new management) up to 2006 at the same location.
- PECL shifted the plant to a site near Nasik in 2006.
- PEL provided support for shifting / re-commissioning the plant at the new location.
- Plant was inaugurated and commissioned during January 2007 and handed over to PECL.
- Same plant operated for 26 years at its earlier locations under the supervision of Premier Explosives Limited.
- Massive accident took place on 5th May 2007 at about 01.30 am.

## **2.0 SEQUENCE ON EVENTS AS UNDERSTOOD FROM WITNESSES & RECORDS:**

- There was power outage from 18.00 hrs to 19.30 hrs.
- Boiler pressure reduced and steam availability at plant was low.
- Temperature of FB reduced and viscosity increased. Flow reduced.
- Flow of OB was Ok.
- Matrix line from Roto Pump to overhead hoppers got chocked
- Production stopped.
- Low steam pressure was noticed by the Production Officer.
- He sent the Supervisor to check the Boiler and increase the steam pressure.
- Production officer proceeded to lab.

- Operator started the plant after steam pressure increased.
- After some time accident took place.
- Except the supervisor and production officer, who were on their way to the Boiler and lab all perished.
- Building was turned to rubble.
- All machines were destroyed.
- Only major reinforcement beams, mixer shaft, gear box parts were found scattered over the site.
- Unconfirmed statement from the security guard stated that an unidentified person sped past just after the accident.

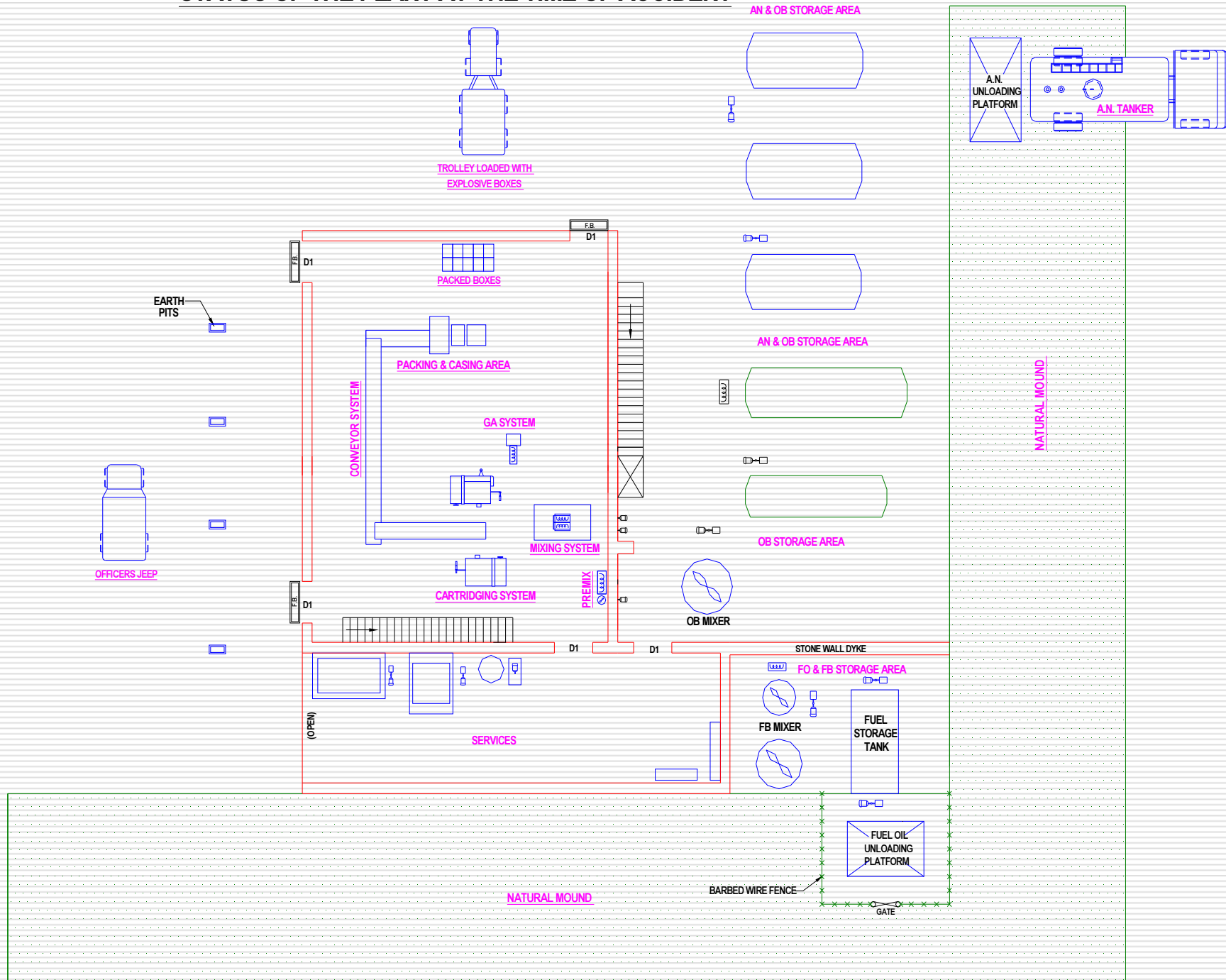
### **3.0 PRODUCT WHICH WAS BEING MANUFACTURED:**

- Small diameter cap sensitive explosive.
- Using AN + Sodium Nitrate Melt.
- Combination of PIBSA based emulsifier and SMO
- Sodium Nitrite gassing in aqueous solution.
- Doping with Porous AN prills
- Non aluminized
- Oils containing waxes and paraffin oils.
- Water - 13%

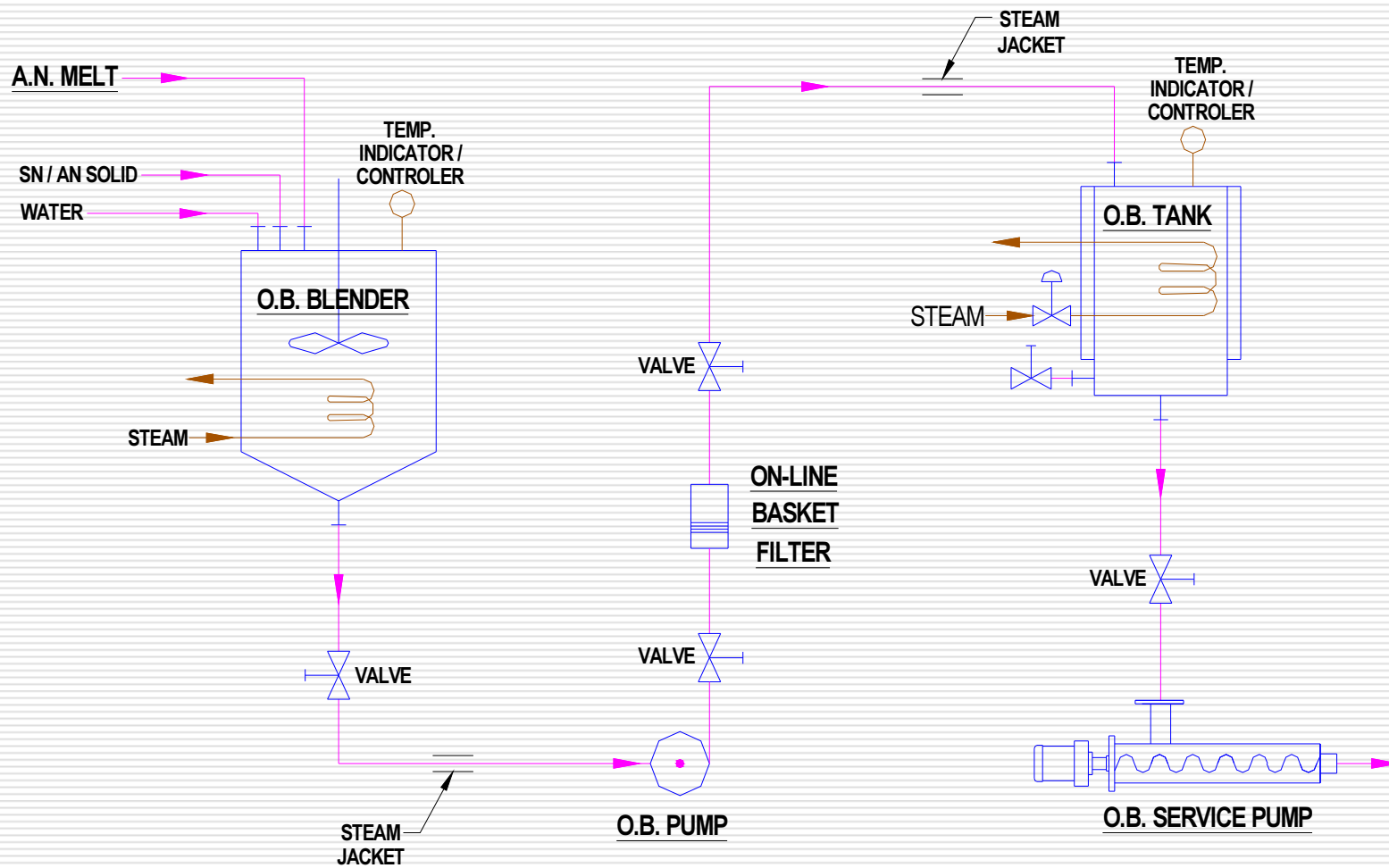
#### **4.0 SAFETY DEVICES USED:**

- High Pressure switches at outlets of all Roto Pumps.
- Calibrated bursting discs at outlets of all Roto Pumps.
- Solenoid valves on OB & FB storage tanks for temperature control.
- Interlock between gassing solution and Cartridge Pak machine.
- Interlock between Cartridge Pak and Product Hopper Pump.
- Flushing arrangement in the Product line to manually flush after stoppage of cartridging machines.

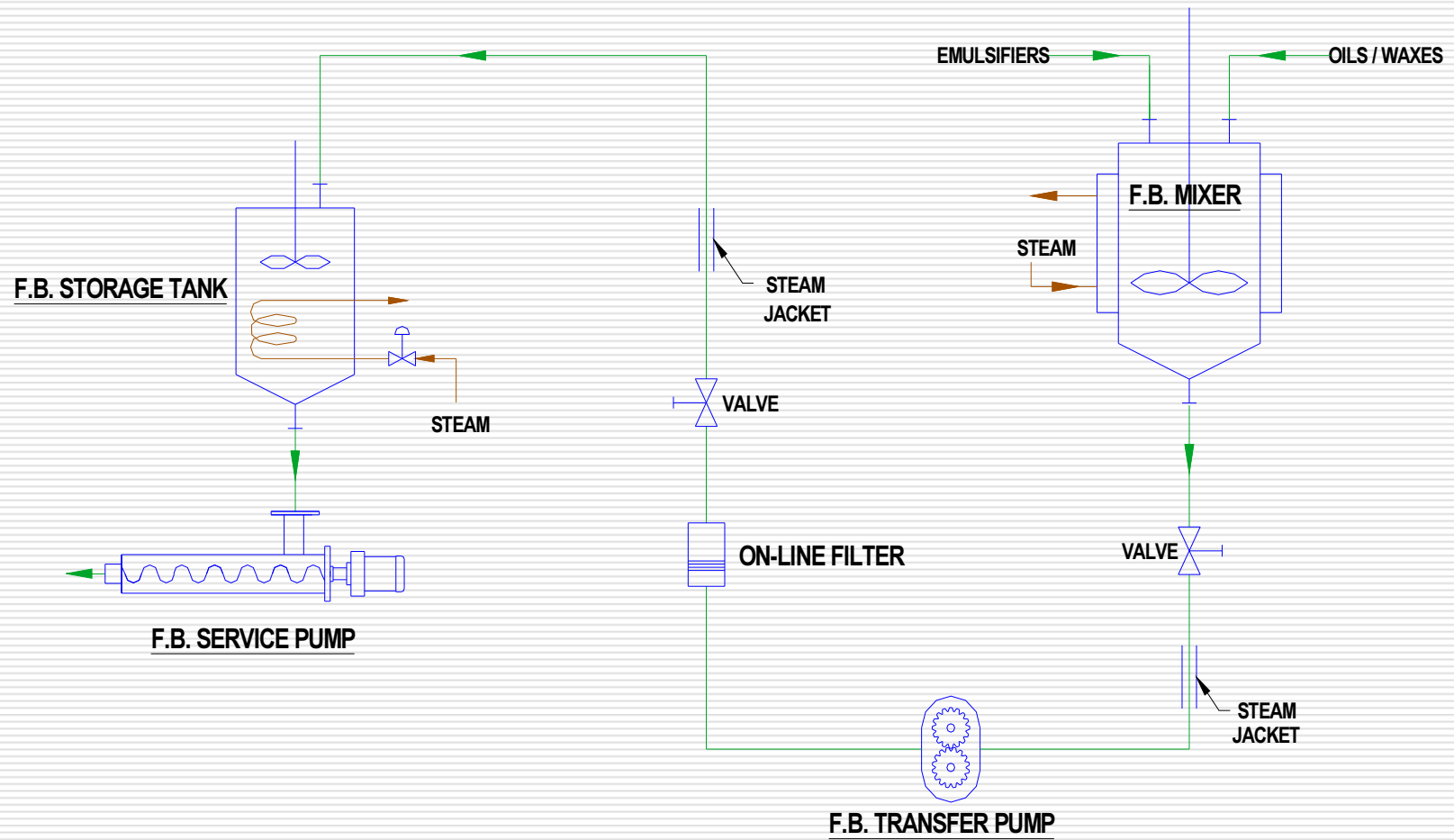
# STATUS OF THE PLANT AT THE TIME OF ACCIDENT



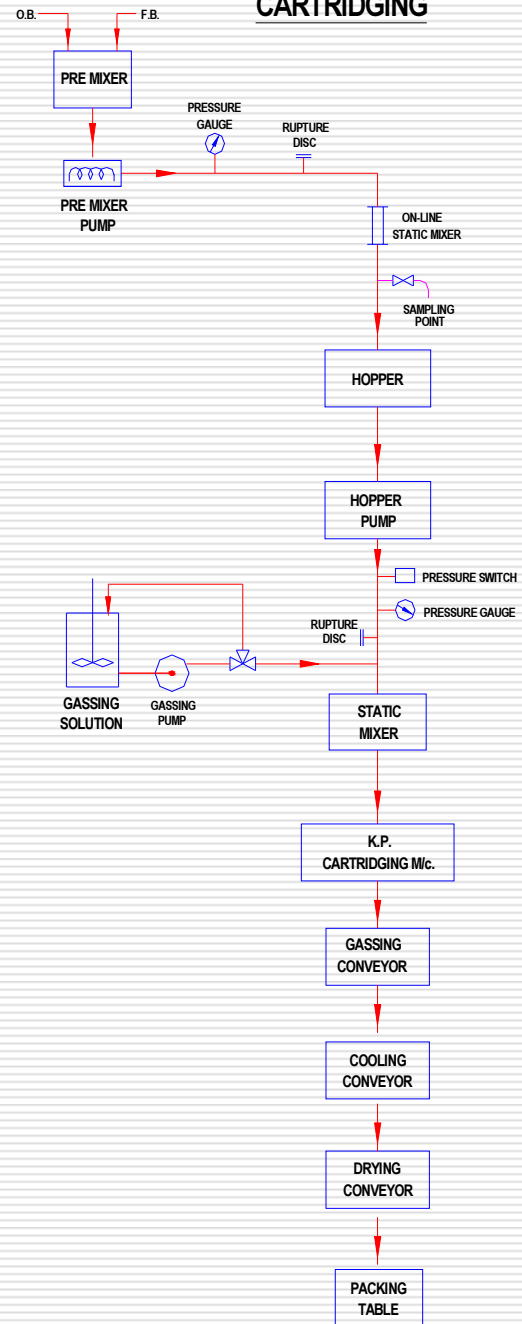
# A.N. MELT PLANT



# F.B. PLANT



## CARTRIDGING





**Chub Packing Machines**



**A.N. & O.B. Storage Area**



**F.O. & F.B. Storage Area**

## **9.0 CAUSES FOR EXTENSIVE DAMAGE :**

- Large quantity of explosives in the plant probably as shifting to magazine was delayed.
- One trolley of explosive was loaded and parked beside the plant but not moved out.
- Power outage had stopped all works and driver would have taken the opportunity to doze off being midnight.
- Sympathetic detonation resulted in explosion both inside and outside the plant.
- Major destruction was caused.

## **10.0 DIFFICULTIES IN PIN POINTING CAUSE :**

- Usual problems in the major accidents, which are:
- No witnesses.
- Plant totally obliterated.
- Log records destroyed with the building.
- Due to human calamities, entry prohibited due to mob furry.
- Administration deployed heavy earth moving equipment to search for survivors.
- Investigation could not be carried out to look for point of detonation and other details.
- Detailed Magistrate enquiry was held.
- Police enquiry was held.
- Chief Controller of Explosives enquiry was held.
- Expert Committee was formed and enquiry was held

## **11.0 PROBABLE SCENARIOS :**

### **SCENARIO - 1:**

- Due to drop in temperature of steam FB was very viscous. Flow was intermittent.
- When FB flowed emulsification took place.
- When FB did not flow more OB came into Premixer and non emulsified OB was pumped.
- Non emulsified OB crystallized in Premixer line and choked the line.
- Premixer Roto Pump worked against the static head while starving for feed.
- Crystallised OB did not allow the pressure to be sensed by the pressure switch and burst disc.
- Starved pump heated - leading to detonation of some quantity of well emulsified material in the line / pump.

## SCENARIO - 2:

- No problem at Premixer.
- Non emulsified OB mixes with gassing solution before static mixer and reacts.
- Flow of matrix not uniform because of high viscosity of matrix.
- Gassing solution being pumped at the designed flow.
- Results in excess gassing solution which reacts at high rate with AN.
- Presence of well emulsified explosives also in the static mixer.
- Reaction out of control and accident.

### SCENARIO - 3:

- All equipment and machinery were properly earthed.
- These were inspected and regularly checked.
- Checked in my presence on the date of Chief Controller of Explosives inspection on 13th January '07.
- Power outages and restoration sometimes causes very high voltage spikes.
- Very high voltage spike could result in failure of insulation, short circuit, flash causing accident.

## SCENARIO - 4:

- Professional jealousy.
- Power outage, midnight, security person is not very attentive.
- Outsider enters.
- Places a detonator in the trolley loaded with explosives and parked besides the plant.
- Trolley explosion causes sympathetic detonation of explosives inside the plant.

## **SCENARIO – 5:**

- All operations up to Product Pump are normal except that FB viscosity is high and not uniformly mixed matrix is flowing in the system.
- Flow of matrix is below the normal, gassing solution is flowing at normal speed.
- Over gassed matrix, which does not behave as Newtonian liquid, having very low density, chokes the Static Mixer.
- More and more material is getting accumulated in the short space between Product Pump, gassing inlet and static mixer.
- The bursting disc and high pressure switch is located only near the output of Roto Pump.

- The bursting disc operated but the high pressure, cap sensitive material is every where - near the pump mouth, high pressure switch, bursting disc, static mixer.
- Detonation can take place due to:
  - Pump working on the sensitive material
  - Pump working against dead load.
  - Over gassing reaction and heat build-up.
  - Any electric spike causing failure of high pressure switch insulation and flash.

## **12.0 LESSONS TO BE LEARNT :**

- I will invite this august assembly of learned and experienced persons to discuss this incident in fullest details.
- I have tried in my presentation to provide all details of this very unfortunate incident, where besides the assets of the company, 21 lives were lost, which are irreparable and tragic.
- I will try to provide, whatever further information is available with me and Premier Explosives Limited.
- The Government and the Management of Premier Explochem Limited is trying to reduce the human misery but we at this Safex need to use our collective wisdom to learn how we can avoid such trauma in future in many plants manufacturing emulsion explosives around the globe.

### **13.0 SUGGESTED START UP PROCEDURE :**

- Whenever any line gets choked in the continuous plant with on line gassing.
- We should stop operations and clean up not only the choked portion but the entire system.
- The clean up should be thorough – full bore and not by purging by compressed air.
- Wet steam / solvent like HSD can be used to obtain full clearance of the system.
- Initially start up without gassing to a point when the flow is smooth and till all parameters are normal and then starting gassing to resume production.

## **14.0 ACKNOWLEDGEMENT :**

- I will like to record my sincere thanks to Mr. Stephan Connolly of Orica to have encouraged me to make a small presentation at the meeting on Emulsion Explosives Manufacturing Safety, Hilton Bonn, Germany.
- I could not personally attend the above meeting due to shock and trauma caused by the event.
- I also suffered from prolapsed disc - not directly but because of over traveling
- Mr.Boetz and Mr.Connolly also encouraged me to join Safex and to be present today.
- I will fail in my duty if I do not thank my team at PEL consisting of Mr.T.V.Chowdary, Dr.N.V.S.Rao and Mr.T.Raghuveer who were closely associated with the project in implementing and commission and later discussing the event thread bare.

Thank you for your  
attention