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Decommissioning & Inspection Repairing of Ammonia Storage Tanks

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Abstract **- This article describes the methodology followed for the de-commissioning, inspection, repairing and re-commissioning of both ammonia storage tanks, repairs and modifications carried out on the tank. Ammonia Storage Tanks (T-2301A & B) at M/S. National Fertilizers Ltd was commissioned in 1987 and is in service since then. In the year 1999, after about six years of service, ice formation and bulging of PUF insulation was noticed between the concrete floor and tank's bottom plate along the periphery of the tank(T-2301B). In order to inspect and to carry out the necessary repair it was decided to de-commission the tank. The entire activity ranging from de-commissioning to re-commissioning was carried out in house. Only support of external agencies was taken for repair and inspection supervision. The old tank of capacity 10,000 MT was decommissioned in 2015-16 for internal inspection and to replace bottom load bearing along with insulation and foam concrete blocks all around the periphery. Decommissioning of Ammonia storage tank was a challenging task which involved intense thought provoking especially for emptying out the vessel off ammonia and oil with zero pollution & wastage. De-commissioning and re-commissioning of the tank was done using innovative method for oil removal with zero pollution & wastage and without even a single near miss incident within stipulated time.**

Key words- Ammonia storage tank, oil sludge, decommissioning, repair, NDT

INTRODUCTION:

National Fertilizers Ltd, (NFL) operates a fertilizer complex at Vijaipur, Distt. Guna (Madhya Pradesh) consisting of two units Vijaipur-I and Vijaipur-II, plants were commissioned in December 1987 and March 1997 respectively. Ammonia Plants are based on M/s. HTAS's Steam Reforming of Natural Gas and Urea plants are based on M/S. Saipem's Ammonia Stripping technology. NFL, a Schedule 'A' & a Mini Ratna (Category-I) Company the Vijaipur unit, which is an ISO 9001:2000 & 14001 certified, comprises of two streams. The Vijaipur have two ammonia plant M/S. Haldor Topsoe Technology, Denmark capacity 1750 & 1864 TPD for Line-I & line-II respectively and four urea plant of M/S. Saipem ammonia stripping process, Italy. The Line-I plant installed in 1988 and that of line –II in 1997.The capacity of Urea-I urea –II is 3030 & 3231 TPD respectively. The raw material used includes natural gas, water and power. Three Numbers Captive power plant of capacity 17 X 3 MW are used in this complex. Both the plants have consistently achieved high levels of capacity utilization.

DESCRIPTION OF AMMONIA STORAGE TANK

The complex has two ammonia storage tanks common for both streams, T-2301A of 10000 MT and T-2301B of 5000 MT capacity for storage of liquid ammonia at near atmospheric pressure and at -33^0C. The tanks were commissioned in 1987 and 1995 respectively. Both Tanks have their independent refrigeration and re-liquefaction systems. T-2301A Tank (10000MT) is vertical cylindrical type with domed roof and designed as single wall tank with insulated suspended deck having glass wool. In our ammonia storage tank four numbers PSV and two numbers vacuum breaker mounted on the top of the tank and vacuum breaker end are connected two hot ammonia, in case of vacuum inside the tank the vacuum breaker open and hot ammonia inflow to the tank to equalize the pressure. The overflow line connected through water seal. All PSV are in line (isolation valve are provided) one valve can be removed for maintenance (One set of spare valves are available in stores). In the year 1997 after about 6 years of service bulging of the PUF insulation was noticed in the 5000 MT capacity tank. The bulging was up to a distance of 2 ft from bottom concrete floor. After some period, small pieces of siporex blocks were found to be coming out due to formation of ice inside the gaps. The gaps were sufficient for the entry of rain water. In order to prevent the ingress of rain water, aluminium skirt was extended by 200 mm beyond the deck slab further to prevent moisture ingress, instrument air (dry air) was provided under the bottom skirt of the tank. In spite of taking all these measures ice formation could not be prevented and the condition of bottom support was deteriorating gradually. In view of this it was planned to decommission the tank for inspection and repairing.

Although sensitive instruments are available to actuate equipment which will maintain normal pressures, no assurances can be had that these instruments will perform properly at all times. Since a slight deviation of the pressure within the storage tank, either above or below atmospheric pressure, will tend to cause a failure of the storage tank, generally the hazards involved have been considered too great to warrant installing this latter type of storage tank.

When the pressure of the gas within the tank is higher than that of normal pressure, the gas flows through a pipeline into a condensing section which causes the condensable material to liquefy and drain from the condenser to the saturating section. The remaining incondensable. Physical properties of ammonia demand high pressure storage vessels or refrigeration. Gas leaving the condenser flows through the saturator where it comes in contact with liquid from the storage tank which is sprayed into the saturator. The sprayed liquid and condensate thereafter flow back into the storage tank. Simultaneously, the excess gas thus cooled and scrubbed is vented to the atmosphere. There will be no means for producing a vacuum in the gas space of the storage tank. Under this condition, gas will evolve from the liquid due to the heat inflow to the tank and this gas will be condensed and returned to the tank. Should, for any reason, the refrigeration on the condenser fail, then that would mean that the ammonia evaporated would escape to atmosphere and, if this is too much of a nuisance, it could be passed through vent scrubbing tower and be made into aqua ammonia or treated with an acid to produce ammonium salt solutions. A flare for burning of ammonia vapour during a refrigeration system interruption and a knockout pot to protect the compressors from damaging liquid entry are also utilized. This completes the holding refrigeration system.

The cylindrical portion of tank is insulated with moulded PUF followed by Aluminium sheet cladding. Four numbers of pilot operated reliefs cum breather Safety valves (set at 700 mm WC and -50 mm WC) are provided at top dome of the tank to protect the storage tank from over pressurization and vacuum condition. The tank is also equipped with automatic Pressure control valve connected with common flare stack. The tank is installed on foundation raised above ground level. RCC dyke wall of 4 meters' height is also provided outside the Tank for Safety purpose. In double wall 5000 MT storage tank there is no dyke wall. In single walled tank this comprises of flat bottom tank with a dome roof designed to withstand the stated conditions. Tanks of this type will have designed to withstand the stated conditions. Tanks of this type will have external surfaces insulated to minimize heat gain from the surroundings. External surfaces insulated to minimize heat gain from the surroundings. In double wall tank, the outer tank is not designed to contain any escape of the outer tank is not designed to contain any escape of liquid from the inner tank, its function being only to support and protect liquid from the inner tank, its function being only to support and protect the insulation. The pressure in the tanks is maintained by removing ammonia vapours and compressing them up to the required pressure-by running compressor. Each of four compressors having a capacity of 625 kg/hr. of ammonia vapour.

Sr. No.	Parameters	Value
1	Tank type	Double walled
2	Cup or inner tank diameter	21790 mm
3	Cup or inner tank height	20250 mm
4	Maximum product height	19817 mm
5	Outer tank diameter	23390 mm
6	Outer tank height	21350 mm
7	Operating temperature	- 33 °C
8	Design temperature	- 34 °C
9	Design pressure	700 mm WC
10	Design Vacuum	-50 mm WC
11	Test pressure (pneumatic)	875 mm WC
12	Heat gain per hour(Avg over 24 hrs)	31910 kcal at an ambient of 40 °C
13	Tank insulation	Foam Glass 200 mm thickness
14	Bottom	
15	Shell	P.U.F 125 mm thickness
16	(Suspended Deck) Roof	Fiberglass 300 mm thickness

Table-1

Detail of Tank Bottom Insulation

Procedure adopted for repair

Considering that the bottom siporex blocks supporting has got damaged, an alternative for replacing this support material was explored. One possible way was replacing entire siporex blocks by treated wood. However, due to high material cost it was not found to be economically feasible. After detailed study a combination of steel beam support, teak wedge and in situ perlite concrete casting was found to be feasible. It was decided to proceed with this method. The activity involved were as follows

a. Repair of siporex
b. PUF reapplication
c. Inspection

Three different agencies were engaged for lending support to the above activities. However, de-commissioning and re-commissioning were totally carried out in house.

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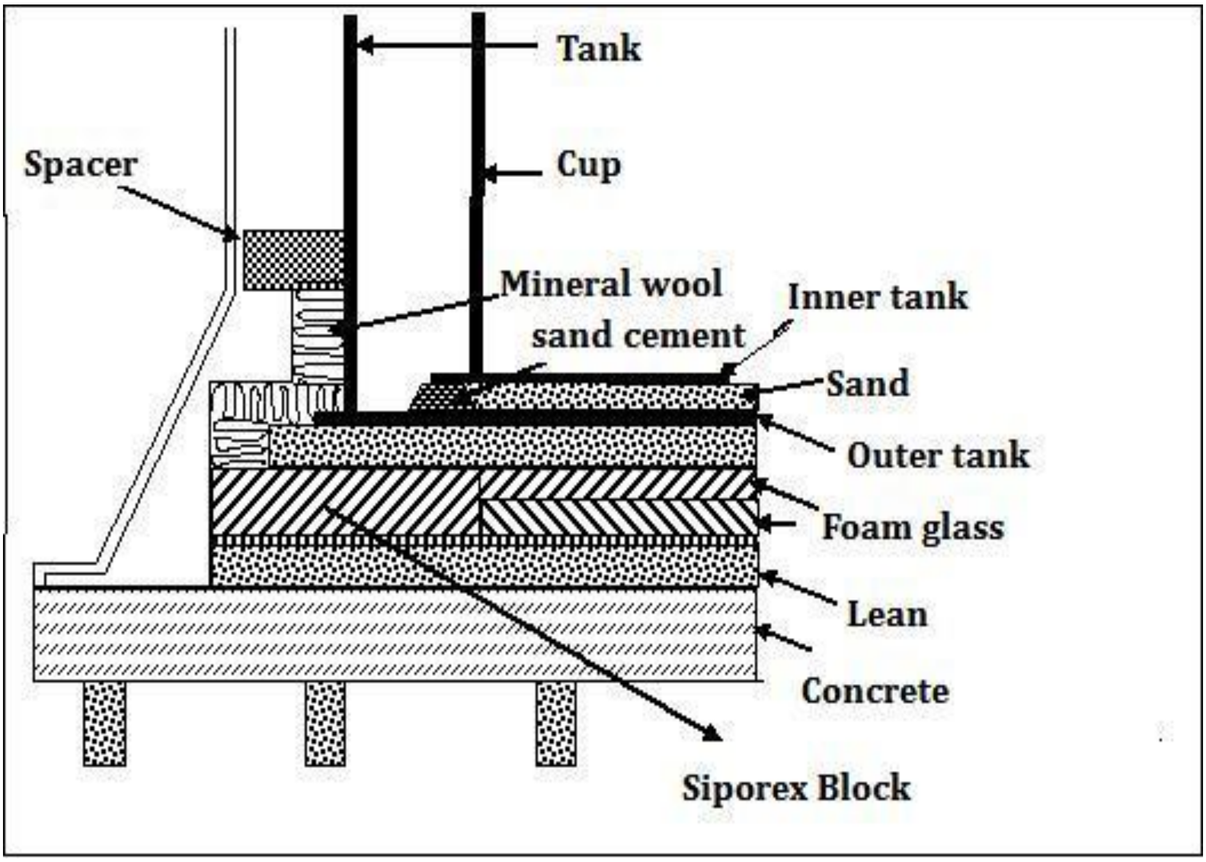

Fig-1

Arrangement for decommissioning of 5000 MT Tank

The following arrangements were made for decommissioning. As shown in the fig-2.

1. Though the 10,000MT tank has independent Refrigeration and re liquefaction system, the facilities may not be adequate, various modifications were carried out to send liquid Ammonia to 10,000MT tank from inter stage cooler of holding compressor at 5000 MT tank. For this purpose, a number of safety interlocks were modified in order to run the compressors associated with 5000 MT tank with vapours generated in 10000 MT tank.
2. For the 5000 MT tank the despatch pump suction nozzle is at 1100 mm level. This is equivalent ammonia 280 MT of ammonia. For the purpose of dispatching maximum quantity of liquid Ammonia out of this tank while emptying it out. A 2” inner tank drain nozzle was connected to suction line of smaller despatch pump of 15 TPH capacity.
3. A 2” DM water injection through rota meter for the dilution of residual Ammonia.
4. Arrangements for draining ammonical effluent into a tank and sending the same to Effluent Treatment Plant was made.
5. A 2” service Air header was provided.
6. A 2” Nitrogen header was provided.
7. A Blower was also provided for purging the tank required for man entry.

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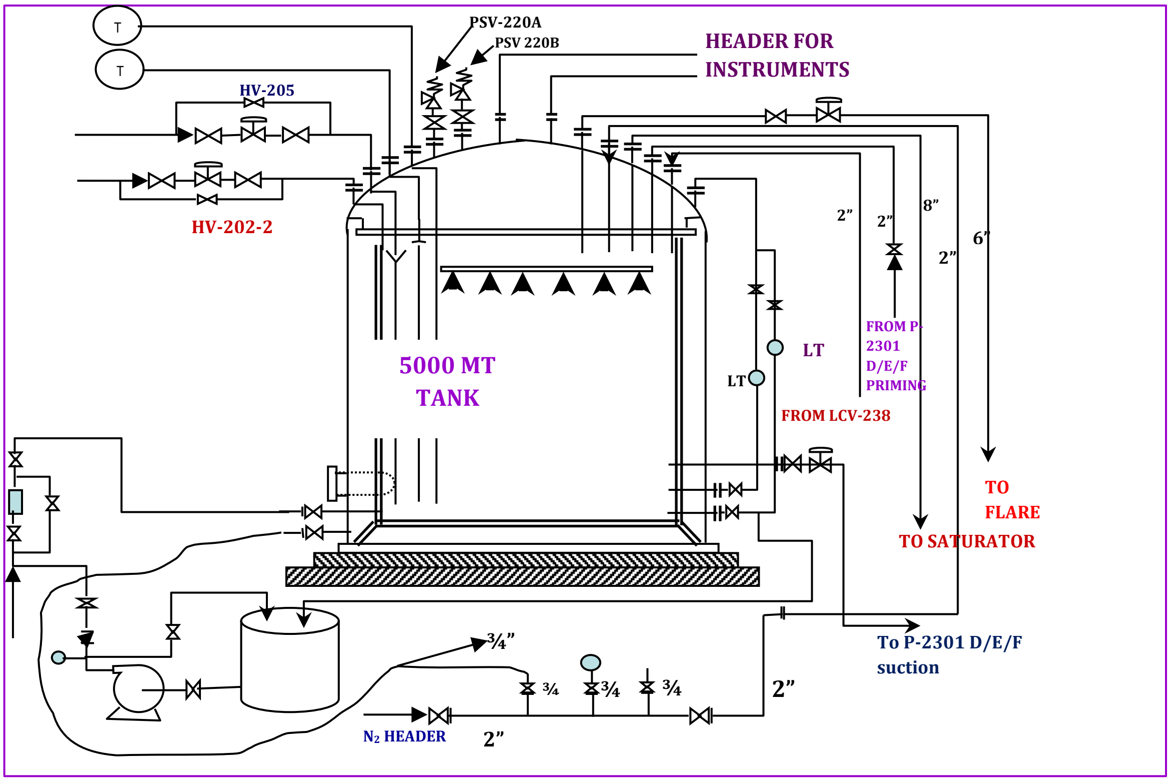

Fig. -2

Decommissioning Activities

1 In order to decommission the 5000 MT tank, transfer of Ammonia from this tank to 10,000 MT tank was started through the dispatch pump. After the liquid level came down to line suction nozzle (at 1100 mm level) of the dispatch pump, further transfer was carried out by the smaller pump (of 15TPH capacity) which was connected to the inner tank by its 2” drain. In this way liquid ammonia stock could be brought down to 80 MT. Since further ammonia transfer was not possible, remaining ammonia was allowed to evaporate gradually. The rate of evaporation was about 2 Te/day. Finally, about 30 Mt of ammonia could not be emptied out.

2. Meanwhile, 300 X 1300 I beams were inserted by scooping out crushed siporex blocks. The scooping out was carried out manually by crow bars, ice was melted out with steam and air tank bottom aluminum sheet, PUF insulation and cladding along the bottom periphery up to a height of approximately 1400 mm from tank foundation was removed so that all Siporex blocks & anchors were exposed to atmosphere.

3. While the above activities were going on, the tank level further came down to 15 MT due to evaporation. To remove rest of the ammonia, DM water was added @40-50 lit per hour through the inner tank’s bottom drain of the inner tank. Strict watching of the tank pressure was kept under observation. During this period N_2 was also kept open into the tank. Water addition and effluent disposal was done in 3 batches till ammonia concentration in the waste water came down to 0.5%. The ammonical water was sent to effluent treatment plant for ammonia neutralization/treatment.

4. Nitrogen purging was carried out by pressurization and depressurization till the Ammonia concentration came down to 0.5%. At this stage manhole covers of both the inner and outer tank were cut and opened. Top manhole cover was also opened. Number of blinds and slip plates were provided for all the inlet and outlet piping and nozzles.

5. To displace the N_2 and residual ammonia, a blower was run and its discharge was connected through the pump suction line and bottom manhole. Service air was connected through a 2” drain line and annular space. An exhaust fan was installed at the tank top man hole. It took almost 7 days to bring down the ammonia content of the tank down to a level of less than 35 ppm. Air purging was continued through the above points to facilitate safe man entry for inspection job inside the tank. After man entry, left over water and cleaning of oil was carried out manually. About 400 litters oil was collected from the tank.

INSPECTION

To assess integrity of the tank with respect to any service deterioration, NDT inspections of the tank were carried out by a team of NFL personnel under supervision of certifying authority i.e. M/s PDIL. The tests included were

1 Visual Inspection
2 Wet Fluorescent Magnetic Particle Test
3 Liquid Particle Test
4 Ultrasonic Thickness measurement of plates
5 Vacuum Box Test
6 Radiography Test.
7 Hydro Pneumatic Test
8 Settlement test of foundation
9 No significant defect was recorded

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REPAIRING OF TANK BOTTOM SUPPORT

Deck slab was prepared for in situ casting purpose by thoroughly cleaning & removing old PCC. The portion where temporary supports were not resting was laid with new PCC and slope was provided toward outer periphery for gravity draining. Waterproofing of this portion was carried out by brush applying of two layers of Koster's NB 1 compound. Permanent support at 72 locations, 2 on each side of anchors were provided over the waterproof layer. These supports were a combination of taper treated teak wedge & 200 mm X 1.2 m I beam painted with bitumen. After providing permanent supports, temporary beams were removed, PCC was laid and waterproofing compound was applied (NB 1 Compound). New in situ perlite was casted manually by providing perlite concrete of mix design of 1:2.5 (by volume). The concrete was placed with specially made arrangements so as to push the concrete right to the far end and against the foam glass lining. After curing of first layer of Perlite Concrete, the second layer of perlite concrete which is of similar design mix of 1 : 2.5 by volume and modified with bonding emulsion and chemicals is placed in the gap. This modified perlite concrete is shrink proof and does not require water curing. Both the layers of Perlite Concrete, after the curing period were dried thoroughly. The drying was completed with the aid of industrial fans / blowers. The dryness of the perlite concrete was confirmed by using a moisture meter. On completion of curing of concrete, the outer surface of concrete is smoothened and a 12 mm thick cement screed modified with Koster's SB Bonding emulsion was placed over the outer peripheral face of the Perlite Concrete. After the outer face of the Perlite Concrete was sufficiently smoothened and dried Koster's NB Elastic system was brush applied twice. This system was so applied that the application extended to the steel plate on the top and over the water proofing layer already installed on the surface of the RCC base slab.

EMERGENCY CONDITIONS

In order to maintain the tank pressure during emergency conditions Ammonia is vented to flare by pressure control valve which ignified by natural gas and service air.NG is sent through line to pilot burners for supporting burning of ammonia measured quantity of N_2 is maintained through molecule seal to arrest flash back to fire.

PROTECTION OF TANK AGAINST VACUUM

Through pressure control valve by injecting hot ammonia to tank. Tank is protecting against vacuum by the pilot operated safety valves which admits air in case tank pressure goes below 50 mm WC.

Fig. – 3

The simplest form comprises an inner tank which is the insulation. The simplest form comprises an inner tank which is surrounded by an outer tank, from the roof which is suspended a surrounded by an outer tank, from the roof which is suspended an insulated deck designed to fit loosely with in the shell of inner tank. insulated deck designed to fit loosely with in the shell of inner tank.

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Design Parameters

Sr. No.	Parameters	value
1	Equipment No	2301 A
2	Capacity-	10000 MT
3	Design / Operating Temperature-	(-) 35 ^{0}C / (-) 33 ^{0} C
4	Design Pressure -/ Vacuum-	700 mm WC / (-) 50 mm WC
5	Operating Pressure-	1.05 ata
6	Set Pressure	700 mm WC
7	No. PSV Installed	4
8	Design and Construction Code	API 620 App. R / 1978 and DIN 4994 for the Dome
9	Roof Material of	LTCS – SA 537 Class 1

Table No. -1

Decommissioning Arrangements (without DM water handling) for 10000MT Tank

Both Ammonia storage tanks 10000MT & 5000MT have independent refrigeration and re liquefaction system. In order to decommission10000MT tank, Liquid Ammonia was transferred from this tank to 5000MT tank through Ammonia dispatch pump. Level in the tank was minimized. 'Tank level low' trip switch (at 1000 mm level) was also bypassed to transfer maximum possible ammonia from the storage tank and achieve minimum possible level. After liquid level came down to suction nozzle of the dispatch pump, further ammonia transfer was not possible. Ammonia dispatch pump stopped at the level of 556 mm (316MT). Remaining ammonia was allowed to evaporate by injecting hot vapours to the tank gradually and condensing by running refrigeration compressors. Liquid Ammonia generated from condensed vapours was shifted to 5000MT tank. The rate of evaporation was about 2~5 T/day. After evaporating most of the ammonia, residual oil at bottom of tank was still there in cold and very high viscous condition and was not flowing through available drain valves. Removal of highly viscous oil from the tank was a challenge. Initially it was decided to spray water inside Ammonia Storage Tank to absorb Ammonia in residual oil sludge. But this idea posed a challenge of treatment of large quantity of contaminated water. The principle theme of approach was removal of residual oil sludge without affecting environment and to overcome large quantity of water wastage during De-commissioning of Ammonia Storage Tank. After hours of brain storming, an innovative idea originated as described below.

Procedure for 10000 MT Storage Tank

An old abandoned Lube Oil Tank with steam coil welded at bottom surface was used for oil heating. Centrifugal oil pumps (10 m^3/h capacity) was used for recycling oil back to Storage Tank or transfer it to oil drums as per the requirement. Arrangements were also made to create vacuum in Lube Oil Tank with an air ejector and a vent pipe from tank with sufficient height to vent ammonia vapours liberated from oil during heating. All items were arranged in house to implement the scheme. Schematic diagram of this innovative approach as shown in the fig No.4.

Decommissioning activities for Ammonia storage tank

1	Detailed job risk assessment
2	Decommissioning and inspection HAZOP study
3	Planning activities based on existing site condition
4	List of equipment and materials required
Detailed decommissioning and commissioning procedure that includes following stages:	
1	Ammonia transfer to another tank
2	Emptying the tank
3	Tank heating up process with hot Nitrogen vapours, Evaporate the remaining ammonia in a way that
4	Key process parameters
5	Tank valve isolation for heating purpose
6	Inerting of system and purging with Nitrogen
7	Oil sludge removing with vacuum arrangement
8	General inerting procedure
9	Key process parameters
10	Gas sampling
11	Tank blinding location and specifications
12	Over-rides

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13	Blind provided in inlet lines and proper isolation
14	Manway opening sequence
15	Danger of asphyxiant gas
16	Purging the tank with air
17	Sampling for Oxygen & Ammonia
18	Readiness for confined entry

Table No.-2

1. Initially 10 drums of used oil were heated in the oil tank and charged in the Ammonia Tank through available 1" tapping at pump suction nozzle which was nearest to the drain valve. This was done to drain oil in the Oil tank and then recycle it back to Ammonia Tank to increase its temperature and make it flow able. Thus the cycle of oil draining, heating and recycling it back to the Ammonia Tank was continued.

2. N_2 pressurization/depressurization was continued by keeping close watch on the tank pressure & temperature. before anything we have to secure the environment where we are going to enter so to avoid an explosive mixture know in the characteristics of the NH_3 (LEL 16% UEL 25%) the tank was purged. the purging was done using an inert gas as Nitrogen, so we connect the tank to N_2 line, open the vent and the drains of the tank and let the nitrogen flow at a sufficient pressure (greater enough than the atmospheric one obviously) the flow rate is calculated knowing the volume to purge.

3. Initially oil draining rate was very slow but after 3-4 days' oil circulation got stabilized as temperature increased. During oil draining, N_2 pressure was maintained (~400 mm WC) to give sufficient head for oil draining through drain valve. Within a week, oil temperature increased to about 10^0C and then pump discharge flow was diverted towards empty oil drums placed outside of dyke wall. Total 84 drums (of 200 lit capacities) of oil were recovered. Finally ensuring that no oil was coming out from Ammonia Tank, both side drain points and top manhole cover were opened partially keeping positive N_2 pressure in the Ammonia Tank.

4. Meanwhile, job for removal of insulation, concrete block & cladding along the bottom periphery up to the height of 1400 mm (approx.) from tank foundation and insertion of supporting beam was started.

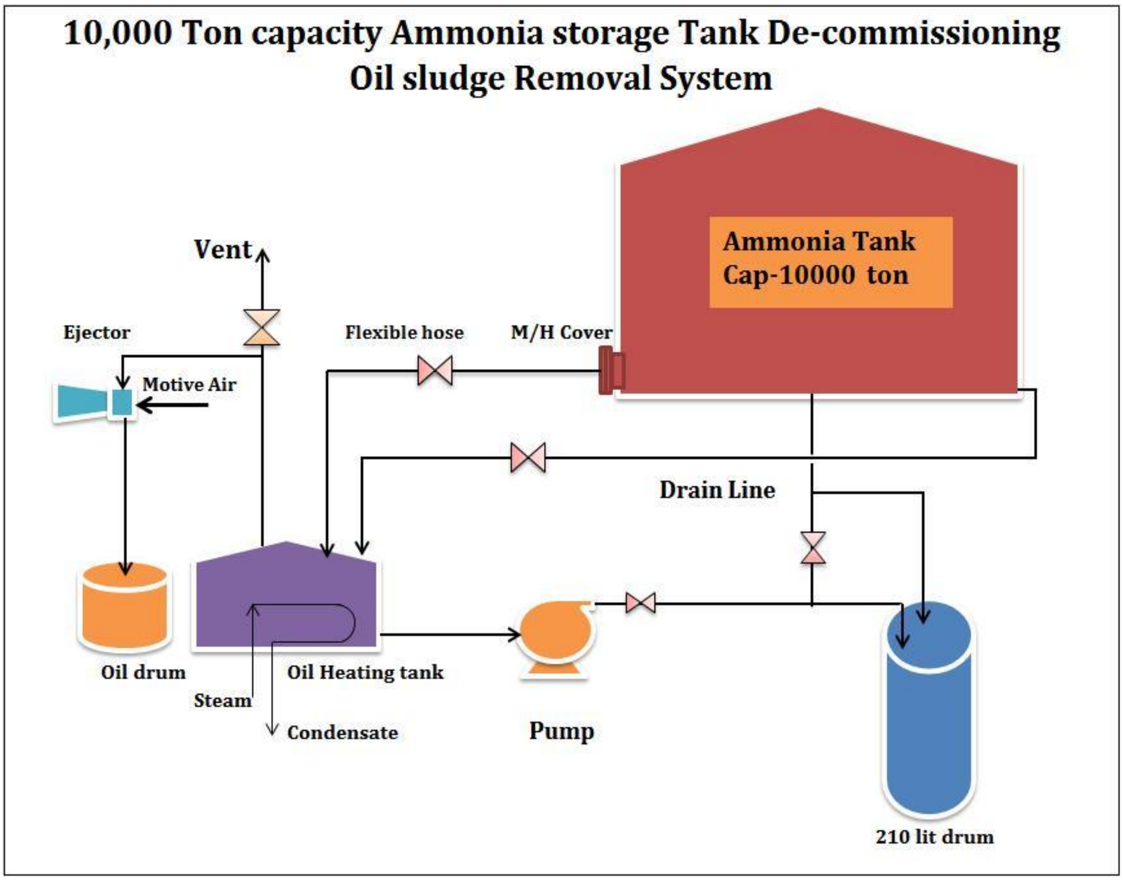

Fig -4

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Air Purging before Tank man entry

1. To displace Nitrogen & residual Ammonia, service air was opened inside the tank. Top manhole cover was opened and an exhaust blower was placed. Before tank inspection, ventilation by air must to be down. This could be performed by means of a high performance fan of 50,000 Nm^3/h blowing through a manhole. The nitrogen content has to be measured and when the O_2 concentration is in the range of 20 to 21%, ventilation can be stopped and maintenance and inspection personnel can then safely enter the tank. After depressurizing the tank, blinds were installed at all tank flanges. The blinds were fabricated of stainless steel material and thickness was chosen to withstand the design line pressure. Stainless steel material was preferred as it was considered suitable to withstand against cold ammonia which is likely to be present should any tank side valves pass. The 24" manhole removed and the manhole diaphragm plate was cut.

2. Man entry was done with appropriate safety PPE'S. Oil sludge was removed from the tank by using the technique of sucking and wiping. About 40 drums of oil sludge was collected from the tank. Once Oil sludge was removed and Ammonia was completely removed from the tank, atmosphere inside the tank was made conducive to move/work without any mask.
3. After cleaning of oil muck, saw dust was spread inside the tank to soak remaining oil from tank bottom partition plate segments. After about 30hrs oil soaked saw dust was removed manually.

4. Subsequent to thorough cleaning of the tank, electrical Power connections were provided as per safety rules for internal inspection and NDT. Scaffolding was erected and NDT etc. was done. No defect was observed at any weld of metal sheet.

Hydro pneumatic Test:

For Hydraulic test, Level in the tank was kept under hold for 24 hrs at every three meters' interval to check settling of foundation. Level was taken up to 12 meters of height. During this test, no leakage was found and also the readings of civil department showed no defect in the foundation. After successful Hydraulic test, Hydro pneumatic test was carried out by pressuring the Ammonia tank with N_2 at 655 mm WC pressure and no leakage was observed. Keeping tank under nitrogen positive pressure, filled water was discharged in nearby Cooling Water return header using a portable water pump as makeup water for Cooling Tower.

Re-commissioning Activities:

All the blinds & slip plates were removed under N2 positive pressure and all Pressure Safety Valves were taken in line. There after Ammonia vapors were introduced through tank top and venting of N_2 &Ammonia mixture was done through local vent for some time and then to the flare. N_2 displacement was stopped when Ammonia concentration in the tank vapours increased to a level of 85-90%.

Final Cooling Down:

Liquid ammonia was introduced through tank top Sparser at a very slow rate so as to maintain cooling down rate of 1-2^{0}C per hour. Tank pressure during this period was controlled by running the Refrigeration compressors. Liquid ammonia was introduced through the main inlet after achieving a temperature of -30^0 C.

Liquid ammonia may be stored as liquid in various types of containers.

Three methods are currently used

1-Store at ambient temperature and equivalent pressure in cylindrical vessels. (2.5 to 270 Te)

2-Storage under pressure in spherical vessels. (450 to 3000 Te)

3-storage at atmospheric pressure -in practice a slight positive pressure is maintained to simplify the operation of the refrigeration system. (3600 to 50,000 Te)

Types of ammonia storage tanks

The main types of atmospheric tanks operating at -33°C are:

1. Single wall tanks, which are tanks with one steel bottom and wall designed to contain the full liquid level of ammonia.
2. Double wall tanks, which are tanks with double steel bottom and wall, each designed to contain the full liquid level of ammonia. For reasons of better understanding the differences between single and double wall, and the meaning of full containment, one or more of the following barriers can be considered:
   1. Inner steel tank designed for full containment of liquid ammonia.
   2. Outer steel tank designed for full containment of liquid ammonia, the roof may be separate for each inner and outer tank or common.
   3. Concrete or steel wall designed as extra tank protection, not designed for containing liquid ammonia.
   4. Bund wall (or dike) with height and distance designed to contain liquid ammonia that may be released from the ammonia tank in an accidental situation.

Comparison of Ammonia Storage Tanks

Sr. No	Parameters	Refrigerated Storage tank	Spherical Tank	Pressure Storage tank
1	Temperature	-33^0 C to -38 ^{0}C	0^0 C to 5 ^{0}C	25^0 C to 50 ^{0}C
2	Pressure	103 to 115 K Pa	400 to 500 K Pa	1800 to 2600 K Pa
3	Capacity	3600 to 50,000 MT	450 to 3000 MT	45 to 270 MT

Table No.-3

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Operation

It is expected that the tank operation is in accordance with best available operating procedures based on HAZOP or similar process risk evaluation tools. The design of individual storage tanks and their associated ancillary equipment varies between installations. Typical items that require systematic focus during operation may include:

1. Relief valves.
2. Nozzles.
3. Drainage systems.
4. Insulation, both at the roof, wall and in the bottom.
5. Roll-over protection, proper circulation.
6. Heating system for foundations (where installed).

CONCLUSION

The decommissioning of ammonia storage tank is rare case and repeated after 15-20 years as per vessel safety and API 620 code internationally followed. A high level of competence and experience person was deputed in order to execute a thorough and effective assessment of the factors which may affect the integrity of tanks and the management of inspections. Reliable data was used for the evaluation. In decommissioning & commissioning of ammonia storage tanks, no water was used for Oil sludge removal. Thus no water contamination & its treatment cost. Oil removed and collected in drums is salable. No Air and Water pollution during decommissioning of tank. No wastage of water. Water used during hydro pneumatic test was transferred to cooling tower as make up water.

Legends- PUF-poly urethane Foam, ISO- International Organization for Standardization, TPD-Ton per day, MW-megawatt, WC-water column, mm-millimetre, RCC-reinforce concrete cement. HAZOP- Hazard and Operability, NDT-Non-Destructive Test, PPE-personal protective equipment’s.