Fertilizer Symposium 2016 – ISA Delhi Section

Environmental Issues in Fertilizer Plants- Meeting increasingly Environmental Controls Regulations

Presented By:

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Mini Ratna-1 Central Public Sector Enterprise, Department of Fertilizers

(ISO 9001:2008 Company)

Environmental Issues in Fertilizer Plants: Meeting increasingly Environmental Control Regulations

ISA District 14

- PDIL Profile
- Environmental Issues

  Specific Issues in Fertilizer Industries
- Environmental Concern

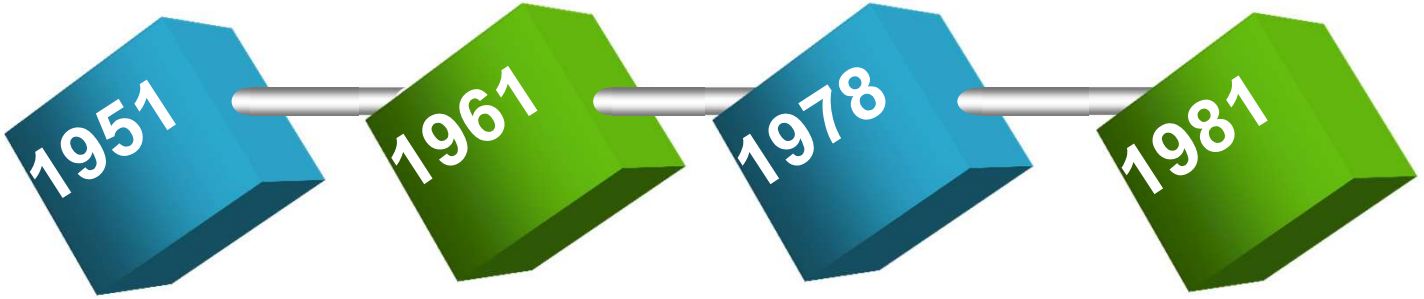
  Effluents and Emissions generated in Ammonia , Urea Plants , Offsite
- Environmental Protection Standards

  Environmental Regulations
- Pollution Prevention & Control
- Online Monitoring

  Effluents & Emissions

PDIL PROFILE

MILESTONES



1951	1961	1978	1981
Established as Technology wing of FCI with an objective to obtain Technological-Self reliance	Activities enlarged and it became Planning & Development (P&D) Division of FCI Limited	FCI restructured and P&D became an independent entity & incorporated on 7th March, 1978 as FPDIL	FPDIL renamed as PDIL to reflect diversified activities in areas beyond fertilizers & chemicals

Became Mini Ratna I in 2011

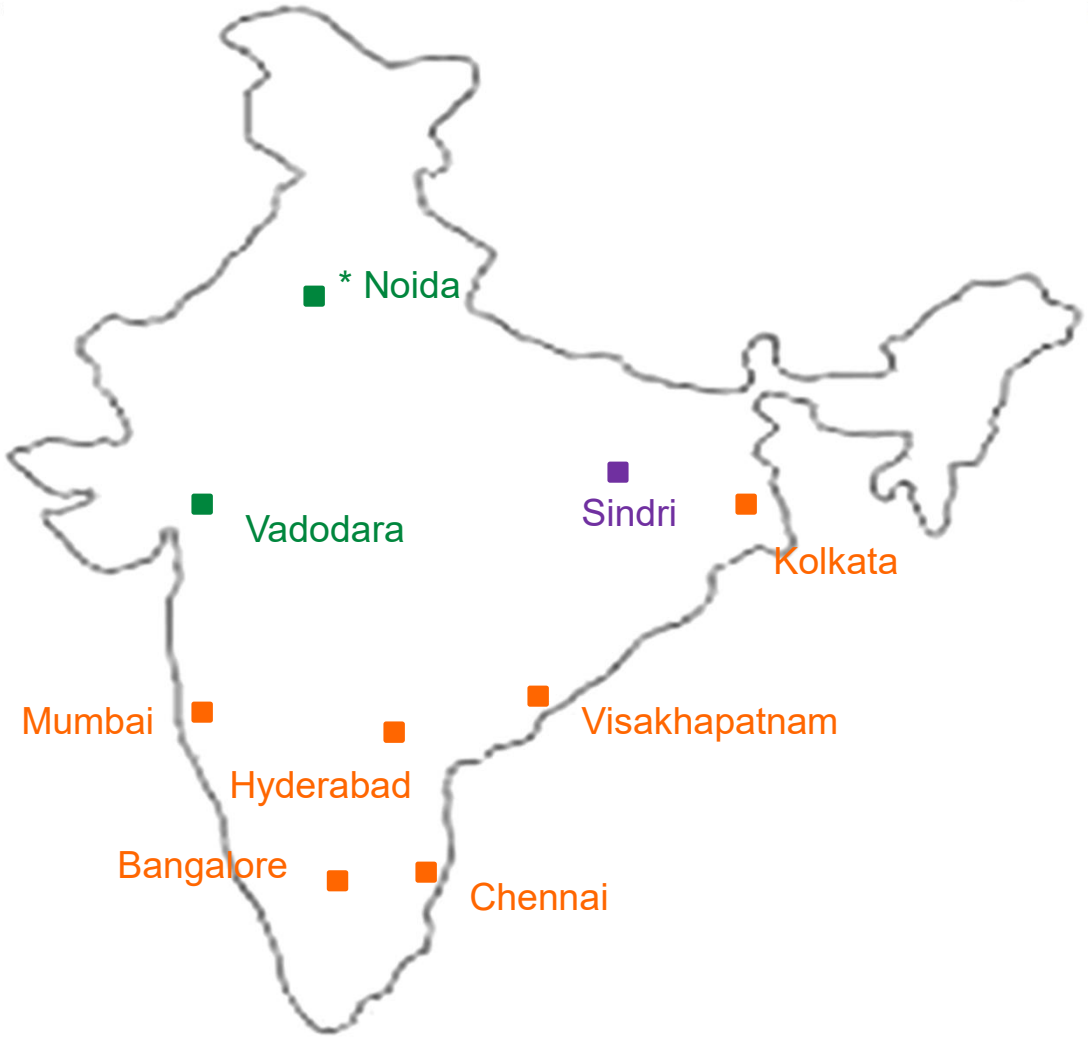
PAN INDIA PRESENCE

Regional cum Inspection Offices

Inspection Offices

Catalyst Production Centre

*Corporate Office



Major Sectors Served

Refinery

Fertilizers

Oil & Gas

Chemicals

Offsite/ Utilities

SERVICES OFFERED

PRE-PROJECT SERVICES

- Market Demand Study
- Techno Economic Feasibility Report (TEFR)
- Detailed Project Report (DPR)
- Site Related Services
- Environment Impact Assessment and Risk Analysis

ENGINEERING & PROJECT MGT.

- Project Engineering Services
  - Detailed Engineering
  - Procurement Services
  - Project Management
  - Scheduling & Monitoring
  - Construction Management
  - Commissioning
- Project Management Consultancy

THIRD PARTY INSPECTION and NDT SERVICES

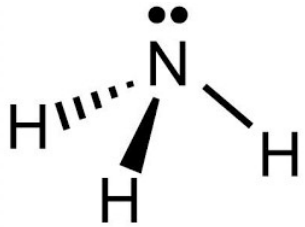
- Project & Third Party Inspection (Shop & Field Inspection)
- Work Assessment & Evaluation of Vendors
- Expediting of Supplies

OTHER SPECIALISED SERVICES

1. HAZOP Study
2. Due Diligence Study
3. Energy Audit/ Electrical Audit/ Safety Audit
4. Revamp/ Retrofit/ De-bottlenecking Studies
5. OISD Norms Study
6. Environmental Engineering
7. SSP (Single Super Phosphate) Audit

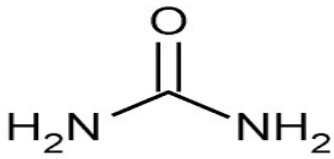
EPCM CREDENTIALS IN FERTILIZER SECTOR

61 AMMONIA



Greenfield/ Expansion	**26**
Overseas	**1**
BFPL, Australia- the then largest single stream gas based Plant in world	
In India	**25**
Coal Bed Methane based	1
Gas Based	15
Naphtha based	4
Fuel Oil based	3
Coal based	2
Feedstock Changeover	**1**
Capacity Enhancement	**16**
Energy Saving	**12**
Other Revamps	**6**

69 UREA



Greenfield/ Expansion	**38**
Capacity Enhancement	**16**
Energy Saving	**12**
Other Revamps	**6**

PMC CREDENTIALS IN FERTILIZER SECTOR

16 PRE-LSTK AWARD

Greenfield	5
Expansion	7
Feedstock Changeover	4

6 POST-LSTK AWARD

Greenfield/ Expansion	2
Feedstock Changeover	4

Projects executed in Non-Fertilizer Sector (Oil & Gas, Refinery, Pipeline)

1. Hydrogen Plants
2. Sulphur Recovery Unit
3. Refinery projects
4. LPG Import Terminals
5. POL Terminals/Depots
6. Cross Country Pipelines
7. Mounded Storage Facilities
8. City Gas Distribution
9. LPG Bottling Plants
10. Gas Gathering Stations
11. Enhanced Oil Recovery

Major Clients:

ONGC, IOCL, BPCL, HPCL, NRL, GAIL, IGL, CPCL, Kochi Refinery, Essar Oil

Environmental Issues

SPECIFIC ENVIRONMENTAL ISSUES IN FERTILIZER PLANTS

Specific Environmental Issues in Fertilizer Plants

- Demand for Fertilizers in India increased significantly during the Green Revolution resulting in mushrooming growth of fertilizer industries.
- Increase in number of industries : Caused serious problems due to release of toxic contaminants into air , water and soil.
- **Air Emissions** contain fluorides, NOx, SO2 along with heavy metals etc
- Inhalation of toxic fumes can cause autoimmune disorders, lung diseases and liver dysfunction etc.
- **Liquid waste** from these industries contain phosphates, fluorides and suspended solids.
- **Solid waste** contains scrape metal items, waste oil etc.

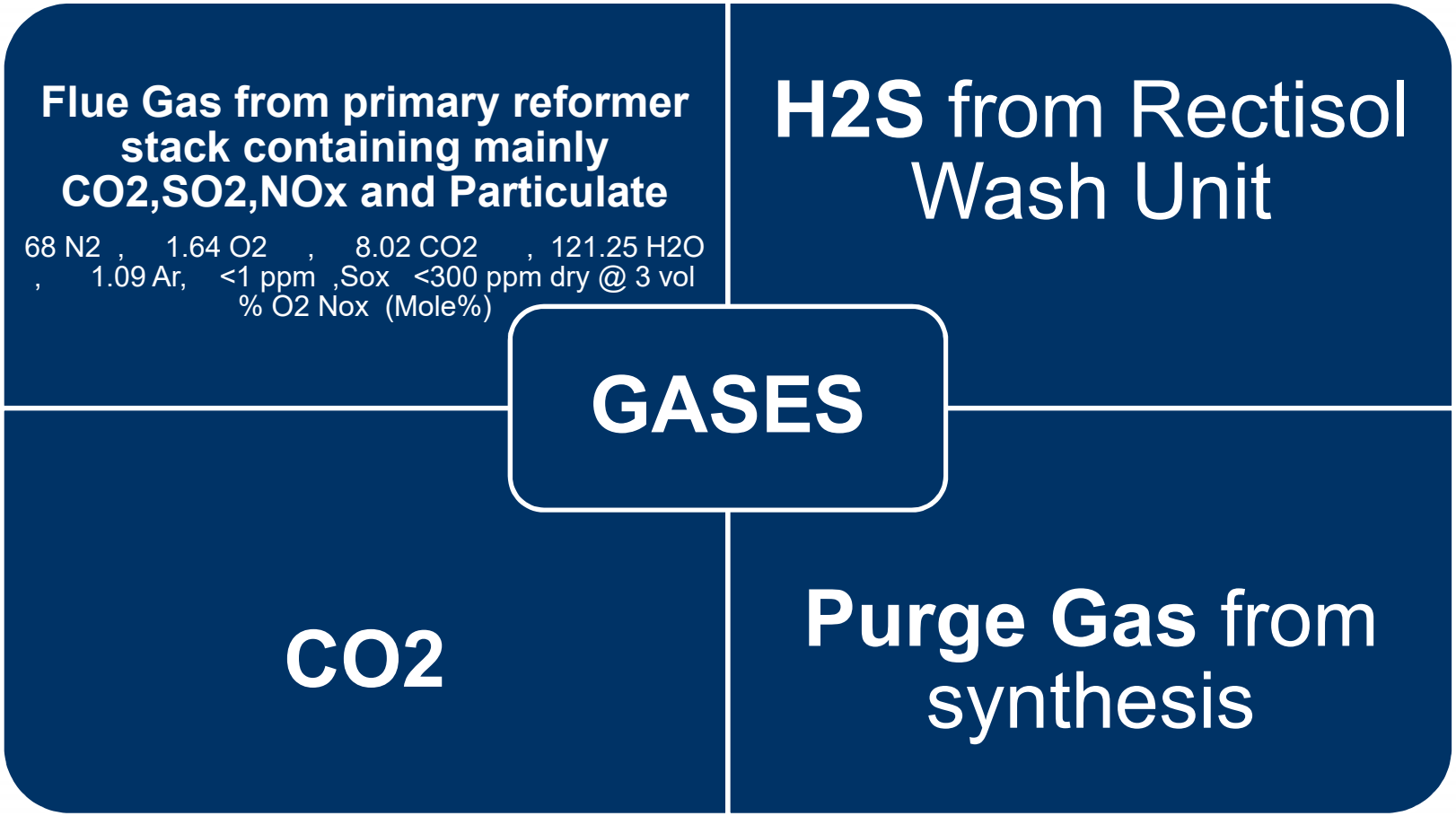
Environmental Aspects of Concern

EFFLUENTS & EMISSIONS GENERATED

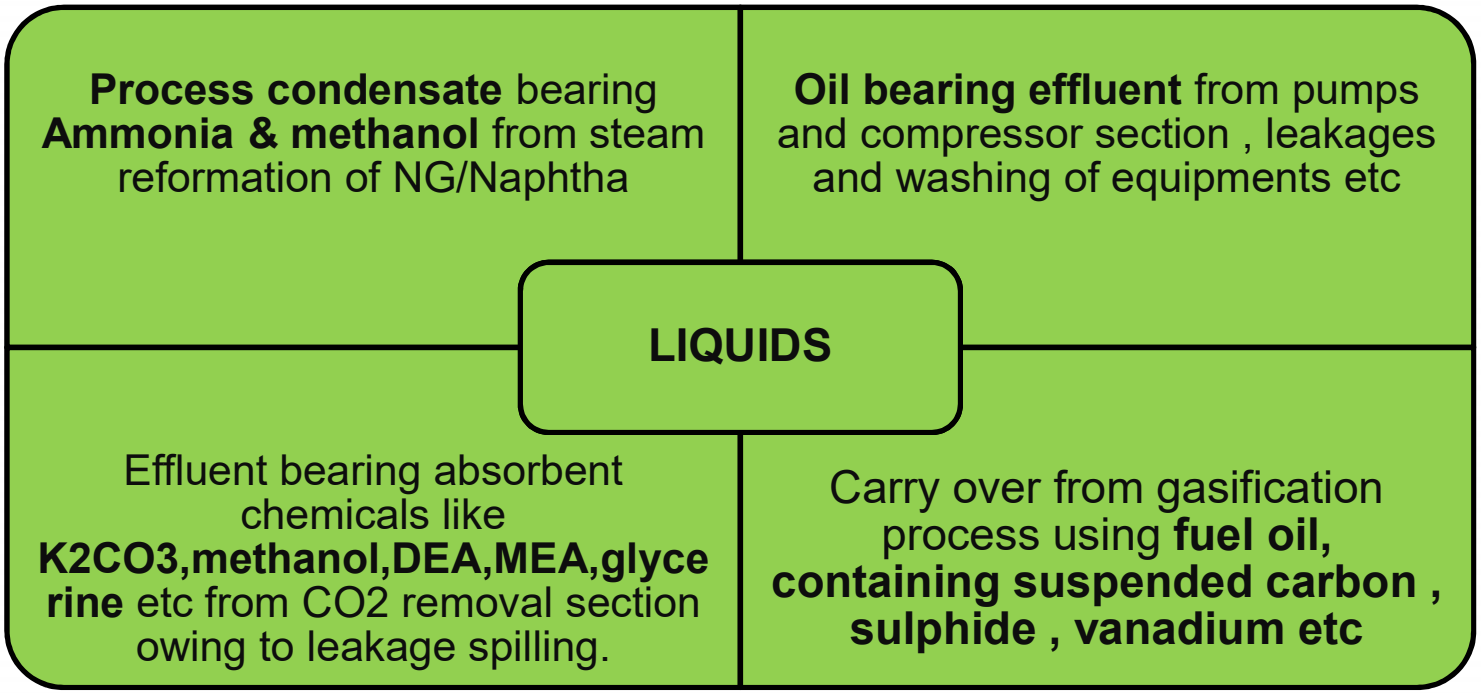
GASEOUS EFFLUENTS AND LIQUID EFFLUENTS

AMMONIA, UREA PLANTS, OFFSITES / UTILITIES

Typical Gaseous Effluents : Ammonia Plant



Typical Liquid Effluents : Ammonia Plant



Typical Gaseous Effluents : Urea Plant

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Effluents Vented to Atm.

CO2 Compressor inter stage vent
96.7 CO2 ,
1.7 N2 ,
2912 ppm H2 ,2443 ppm O2 (MOLE%)

CO2 Compressor discharge vent
97.7 CO2 ,1.7 N2 ,
2908 ppm H2O ,
1000 ppm O2
(MOLE%)

Scrubber vent
89.2 N2 . 5.3 O2,
4.9 H2O ,732 ppm CO2 0.9 ppm H2 0.2 ppm CH4,
5141 ppm NH3 (MOLE%)

Prillling Tower Vent
16 ppm Urea crystals ,
0.1 ppm CO2 ,
5.7 H2O ,
74.4 N2 ,53 ppm NH3,19.8 ppm O2

Gaseous Effluents : UREA PLANT

- **Expected gaseous emissions from the plant are**

a) Total NH3 from Prilling Tower < 50 mg / Nm3.

b) Total Urea dust/Suspended Particulate matter from Prilling Tower <= 45 mg / Nm3

- **Dust from prilling tower and product handling**
- **Ammonia fumes from the prilling tower and scrubbers**

Typical Liquid Effluents : Urea Plant

Turbine Off Spec Process Condensate	Desorber Off Spec Process Condensate
H2O+ Contaminants	>10 ppm Urea >10 ppm NH3
To Chemical pond	To Chemical pond

Liquid Effluents : UREA PLANT

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• **Process condensate** containing **urea, ammonia and CO2** from vacuum concentration section

• **Effluents** containing mainly **oil** from Carbon dioxide compression section, leakages from pumps and washing of equipments.

Typical Gaseous Effluents : Utilities Unit

Effluents Vented to Atm.

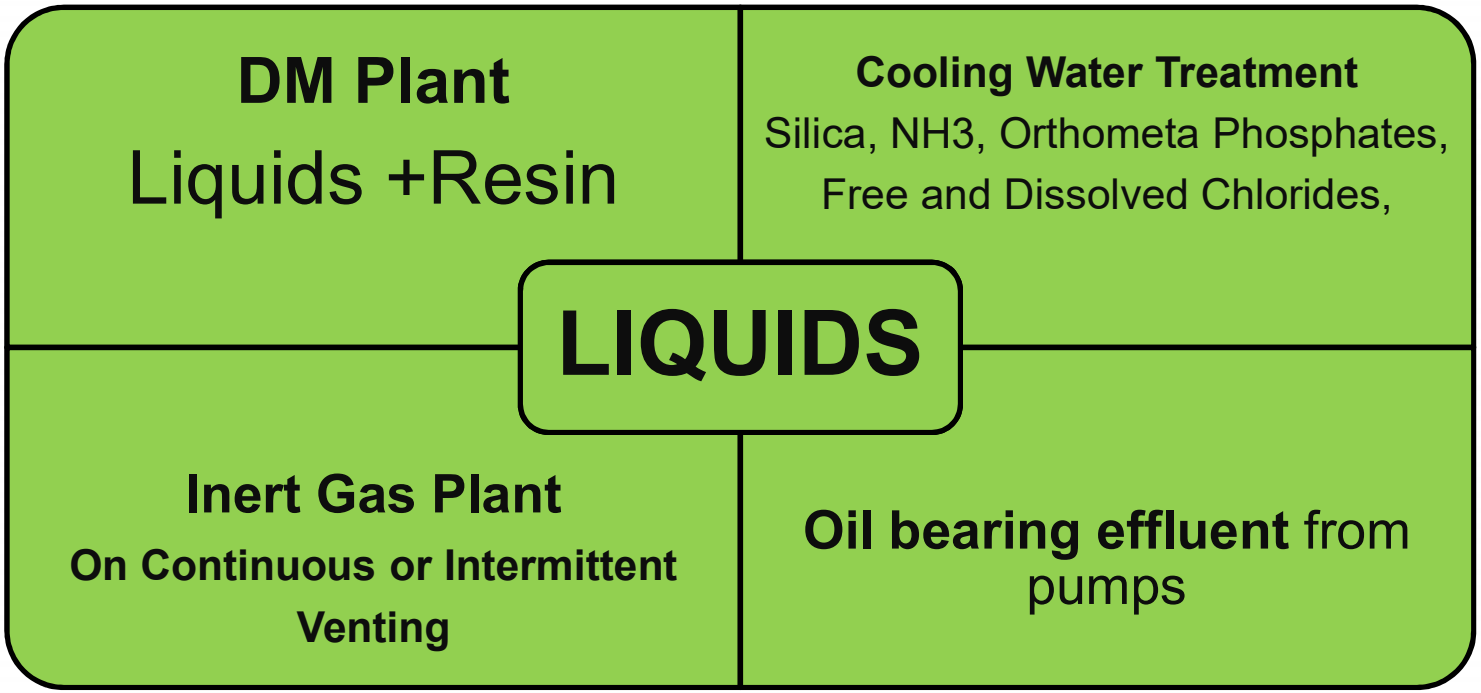
Power Generation , Boiler, Gas Turbines Stack

Solids and particles

Sulphur oxide as SO2

Nitrogen oxide NO2

Typical Liquid Effluents : Offsets/Utilities



ENVIRONMENTAL PROTECTION STANDARDS

ENVIRONMENTAL REGULATIONS

ENVIORNMENTAL ACTS :

Major Acts applicable to Fertilizer Industries:

1. a. The Water (Prevention and Control of Pollution) Act, 1974, Amendment Act 1988

b. The Water (Prevention and Control of Pollution) Cess Act 1977, Amendment Act 1991 & 1992

2. Air (Prevention and Control of Pollution) Act, 1981, Amendment Act 1989

3. **The Environment (Protection) Act, 1986**

a. Environment Protection Standards for Nitrogen Fertiliser Plants

b. Ambient Noise Standard for Different Areas

c. National Ambient Air Quality Standards

4. ISO 14001 (Environmental Management Standards)

ENVIRONMENTAL PROTECTION ACT 1986

EPA STANDARDS FOR NITROGENOUS FERTILIZERS

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Nitrogenous Fertilizers : Waste Water Discharge Standards

Parameter	Plants commissioned Jan 1,1982 onwards(mg/l)	Plants commissioned Prior to Jan 1,1982(mg/l)
• pH	• 6.5-8.0	• 6.5-8.0
• Ammonical N2	• 50	• 75
• Total Kjeldahl N2	• 100	• 150
• Free Ammonical N2	• 4	• 4
• Nirate Nitrogen	• 10	• 10
• Cyanide as CN	• 0.2	• 0.2

Nitrogenous Fertilizers : Waste Water Discharge Standards

Parameter	Plants commissioned Jan 1,1982 onwards(mg/l)	Plants commissioned prior to Jan 1,1982(mg/l)
• Vanadium as V	• 0.2	• 0.2
• Arsenic as As	• 0.2	• 0.2
• Suspended Solids	• 100	• 100
• Oil and Grease	• 10	• 10
• Hexavalent Chromium*	• 0.1	• 0.1
• Total Chromium **	• 2.0	• 2.0

*To be compiled with at the outlet of fluoride removal unit. If the recipient system so demand, fluoride as F shall be limited to 1.5 mg/l.

* * To be compiled with at the outlet of Chromate removal unit.

ENVIRONMENTAL PROTECTION ACT 1986

AMBIENT AIR QUALITY STANDARDS

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FERTILIZER INDUSTRY : Ambient Air Quality Standards

Pollutant	Time Weighted Average	Conc in Ambient Air
• Sulphur Dioxide (µg/m3)	• Annual* • 24 hours**	• 50 • 80
• Nitrogen Dioxide (µg/m3)	• Annual** • 24 hours**	• 40 • 80
• Particulate Matter (Size less than 10µm	• Annual* • 24 hours**	• 60 • 100
• Particulate Matter (Size less than 2.5µm	• Annual* • 24 hours**	• 40 • 60

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FERTILIZER INDUSTRY : Ambient Air Quality Standards

Pollutant	Time Weighted Average	Conc in Ambient Air
• Ozone (O3) (µg/m3)	• Annual* • 24 hours**	• 100 • 180
• Lead(Pb) (µg/m3)	• Annual** • 24 hours**	• 0.5 • 1
• Carbon Monoxide (mg/m3)	• Annual* • 24 hours**	• 02 • 04
• Ammonia (NH3) (µg/m3)	• Annual* • 24 hours**	• 100 • 400

*Annual arithmetic mean of min 104 measurements in a year at a particular site taken twice a week 24 hourly at uniform intervals.

**24 hourly or 08 hourly monitored values ,as applicable ,shall be complied with 98% of the time in a year ,2% of the time ,they may exceed the limits but not on two consecutive days of monitoring

ENVIRONMENTAL PROTECTION ACT 1986

EMISSION STANDARDS FOR AMMONIA PLANTS AND UREA PLANTS

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Emission Standards for Ammonia and Urea Plants:

AMMONIA	UREA	UREA
Oxides of Nitrogen (as NO2)	Plants Commissioned Pre 1982	Plants Commissioned Post 1982
400mg/Nm3(at 3% O2)	Particulate matter 150mg/Nm3or 2 kg/ tonne of urea	Particulate Matter 50 mg/Nm3 or 0.5 kg/ tonne of urea

ENVIRONMENTAL CONSIDERATION

POLLUTION PREVENTION AND CONTROL

Pollution Prevention What is it?

Practically speaking, Pollution Prevention is "changing the way things are made in order to reduce waste generation".

In other words, it is inherently avoiding or minimizing wastes rather than adding on treatment equipment or leaving their remediation to the future!

POLLUTION CONTROL

The fertilizer complex adopted following strategy for treating effluent and emissions generated :

- **Air Emission Control**
- **Ambient Air Quality Monitoring**
- **Liquid Effluent Management**
- **Water Management**
- **Solid Waste Management**
- **Green Belt Development**

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Application of 3 R's

AIR EMISSION CONTROL:

- **Nitrogen oxides** are reduced,

  When there is **low excess oxygen**, with steam injection;

  When **post combustion** measures are in place;

  And when **low-NOx burners** are in use
- Concentrations of **Sulfur Dioxide** in the flue gas from the reformer:

  Reduced by using natural gas.
- **Carbon Dioxide Recovery plant** installed to recover CO2 gas

AIR EMISSION CONTROL:

- **Scrubbers** for gaseous emission
- **Precipitators** for particulate matter
- **Cyclone Dust Collectors**
- **Natural Draft Prill tower** of substantial height to contain urea dust emission.

GASEOUS EMISSION REDUCTION :

- All the **safety valve discharges** are connected to flare stacks
- All **relief valves and safety valves** in urea plants:

  Connected to stacks extended up to the top of the prill towers
- **Dedusting System :**at the top of prill towers

  Brings down urea dust and ammonia emission levels below the statutory limits.

GASEOUS EMISSION REDUCTION :

- **Ammonia sensors** are fixed in the ammonia storage area, ammonia plant and processing areas :

  To detect and give indication in DCS in case of a local area leak.
- Flue gas Reformer Stacks **:Regular stack monitoring and analysis**.
- **Efficient prill bucket:** To reduce urea dust.
- **Adequate Stacks heights:** For better dispersion of Pollutants.

GASEOUS EMISSION REDUCTION :

- **Using natural gas** as the feedstock for the ammonia plant
- **Using hot process gas** from the secondary reformer **to heat the primary reformer tubes** (the exchanger-reformer concept), thus reducing the need for natural gas
- Consider **using purge gases** from the synthesis **process to fire the reformer**; strip condensates to reduce ammonia
- **Use carbon dioxide removal processes** that do not release toxics to the environment

AMBIENT AIR QUALITY MONITORING :

- **Stations for air quality monitoring** have been located in and around the industries.
- These stations **continuously monitor parameters** like suspended particulate matter , sulphur dioxide, carbon dioxide, carbon monoxide, nitrogen oxides, ammonia and total hydrocarbons.

LIQUID EFFLUENT MANAGEMENT:

- **Deep Hydrolyser and distillation columns** have been provided in Urea plants to treat process condensate.
- **Effluent Treatment Plants** based on steam stripping
- **Disc Oil separator** to separate oil from liquid effluents
- **Sewage Treatment** cum recycle plant **based on RO technology**
- **pH neutralization** facility: **Neutralization pits** are provided to receive the DM plant effluents and adjust the Ph by adding either acid or alkali
- Use of **Arsenic ,Cyanide and Chromate** is completely eliminated.

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WATER MANAGEMENT:

- Reuse of treated process and turbine condensate from ammonia plant
- Reuse of steam condensate from urea plant
- Reuse of treated waste water from urea plant
- Recycle of effluent after treatment in Reverse Osmosis effluent treatment plant
- Reuse of treated sewage water after treatment in sewage treatment plant
- Recycle of jacket cooling and RV sealing water of ammonia plant
- Reduction in quantity of cooling water makeup and in effluent generation by increasing the cycle of concentration from 3.5 to 8.0

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Monitoring of effluent water at final discharge:

- **Flow indicator/controller**
- **Ph indicator/recorder**
- **Temperature indicator/recorder**
- **On line Ammonia Analyzer**
- **High level alarms on guard pond, contaminated pond**

SOLID WASTE MANAGEMENT :

Measures taken for solid waste management:

- **Used Lead acid Batteries** are being returned to the supplier as buy back or disposing to authorized vendor
- **Scrape metal items** are being disposed to metal recoverers.
- **Waste oil generated** is being used for soaking of cotton threads in Bagging plant and as protective coating for steel pipes and rods in storage yard .
- **Selling of spent catalysts** to recyclers for recycling.
- Replacement of chromate based treatment of cooling water by **Non-Chromate based treatment .**

GREEN BELT DEVELOPMENT :

Measures taken for solid waste management:

- **Wide Green Belt** has been developed around the factory to keep environment quality in its most natural condition.
- For maintaining ecological balance, lot of **trees have been planted** in and around the industrial belt and township.

ENVIRONMENTAL CONSIDERATION

EFFORTS MADE BY FERTILIZER PLANTS

ONLINE MONITORING

EFFLUENTS AND EMISSIONS

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- As per **Central Pollution Control Board (CPCB)** directives, online **monitoring of Emissions & Effluents** in Fertilizer plants are of utmost importance & in implementation stage"
- **Monitoring of Particulate matter** emission from Prilling Tower
- **Monitoring of NOx, SOx** from Boilers
- **NOx** from Primary Reformer Stack
- **Monitoring Ph & Conductivity** of Liquid Effluents

ANALYZERS FOR EFFLUENTS MONITORING :

- Flue gas containing NOx,O2 & SO2 from **Primary Reformer Stack** is measured using:
  - **SO2 analyzer**
  - **NOx Analyzer**
- **Ph Analyzer and Conductivity Analyzer**

"You cannot get through a single day without having an impact on the world around you. What you do makes a difference , and you have to decide what kind of difference you want to make"

-Jane Goodall

Thank You