

KC Cottrell



Flue Gas Denoxification



A company that researches ways to safeguard the natural beauty of our planet.
A company whose mission is to keep our environment green to protect future dreams.
A company that co-exists with nature, recognizing that the environment is the most valuable asset.
KC Cottrell is preparing for the future with a firm commitment to the environment.

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Company profile

“The Clean Air Company, Global Leader in the Environmental Industry”

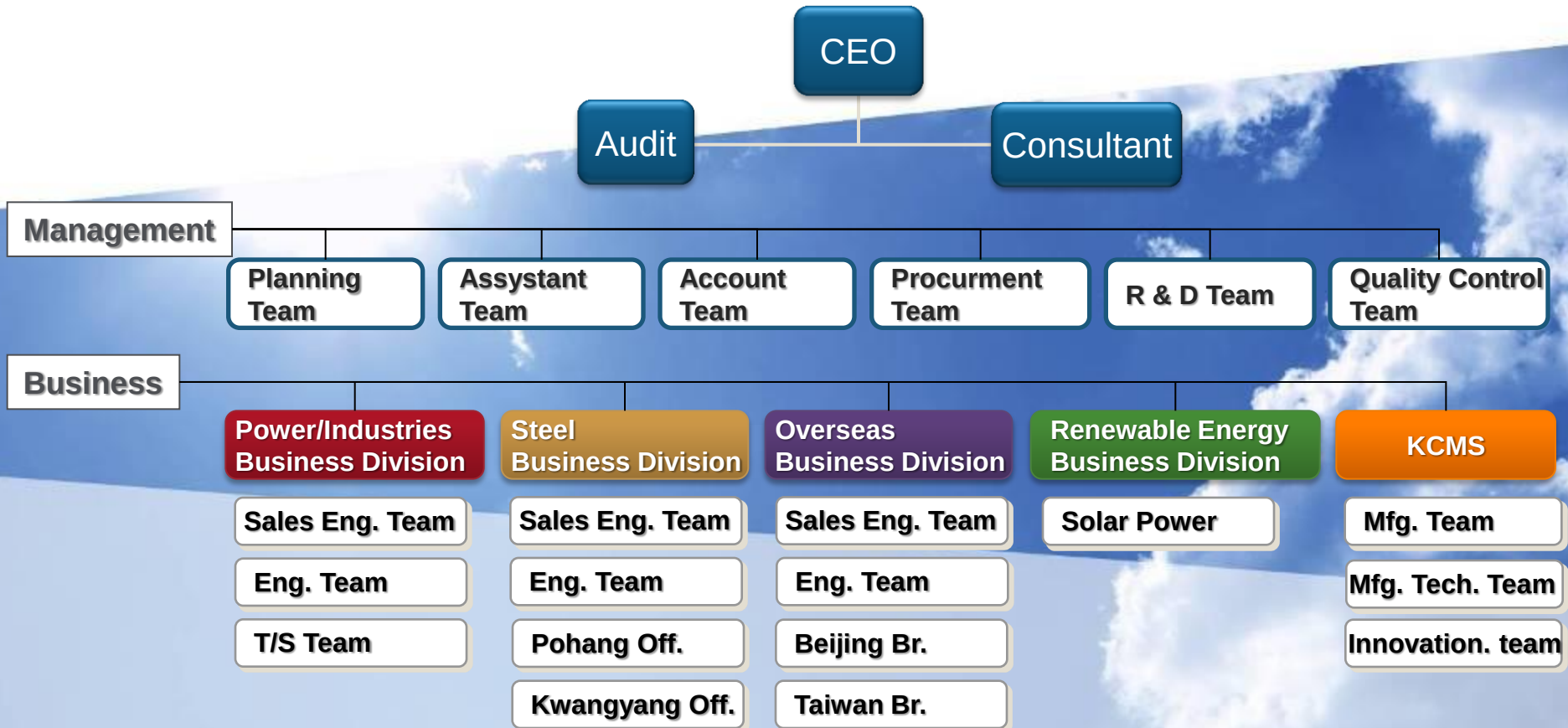
Establishment	27th Nov. 1973
Business Area	Dust Collection System, Flue Gas Treatment System, New renewable energy. Industrial Machinery.
Head office	160-1 Donggyo-dong, Mapo-gu, Seoul, Korea 121-817
Factory	253 Singi-ri Seoun-myeon, Anseong si, Gyeonggi-do, Korea 456-853

No. of Employees	224(Nov, 08)
Capital	KRW 8.5 Billion
Homepage	www.kc-cottrell.com
CEO&President	LEE TAE YOUNG





KC Cottrell Organization



Business Items

- Electrostatic Precipitator
- Fabric Filter
- Wet Scrubber
- Cyclones
- FGC (Flue Gas Conditioning) System
- Fly ash handling system
- Bottom ash handling system

**Dust
Collection
System**

**Flue Gas
Treatment
System**

- Flue Gas Desulfurization System
- Flue Gas Denitrification System
- Semi Dry Reactor System
- De-Dioxin System
- VOC Removal/Recovery System

- Solar Power Systems
 - Solar Power Generation System
 - Household system
 - BIPV Development

**New
renewable
Energy**

**Industrial
Machinery**

- Sludge Incineration System
- Solid Waste Incineration System
- GGH(Gas Gas Heater)
- Dampers, Expansion Joints
- Air Cooled Heat Exchanger

Service Organization



Sales &
Management

Engineering &
Technical Service

Product &
QA

Research &
Development

CUSTOMER

A 3D donut chart diagram with four colored segments: olive green (top-left), teal (top-right), magenta (bottom-left), and purple (bottom-right). In the center of the donut is a white circle with the word "CUSTOMER" in blue, bold, capital letters. Four thin black lines connect the text labels to their respective segments: "Sales & Management" to the olive green segment, "Engineering & Technical Service" to the teal segment, "Product & QA" to the magenta segment, and "Research & Development" to the purple segment. The entire diagram is set against a background of a blue sky with white clouds.

Affiliated Companies

KC Internal Network

KC Cottrell



KC Landfill Service Co., Ltd.

KC Solar Power Co., Ltd.

**KC Manufacturing
Services (KCMS)**

KC EnviroServices Co., Ltd.

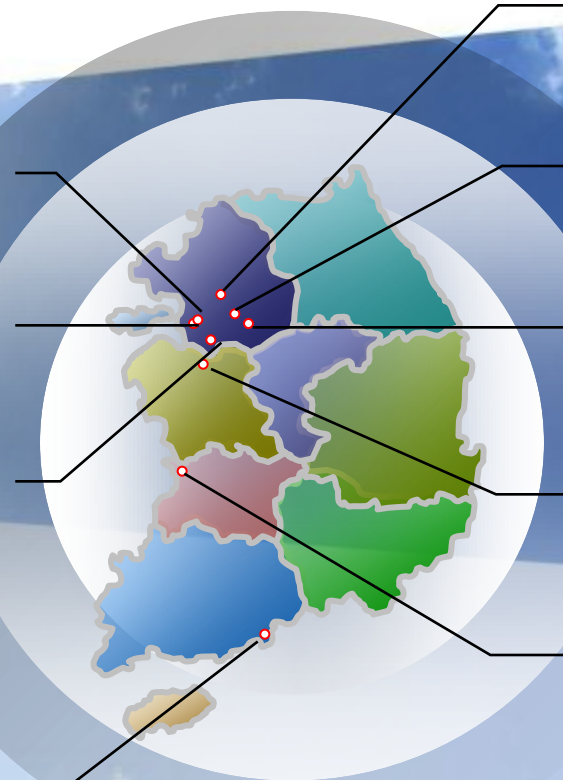
Clestra Hauserman Ltd.

Jord KC Co., Ltd.

**Veolia ES&KC
EcoCycle Co., Ltd.**

**Ansung
Glass Industrial Co., Ltd.**

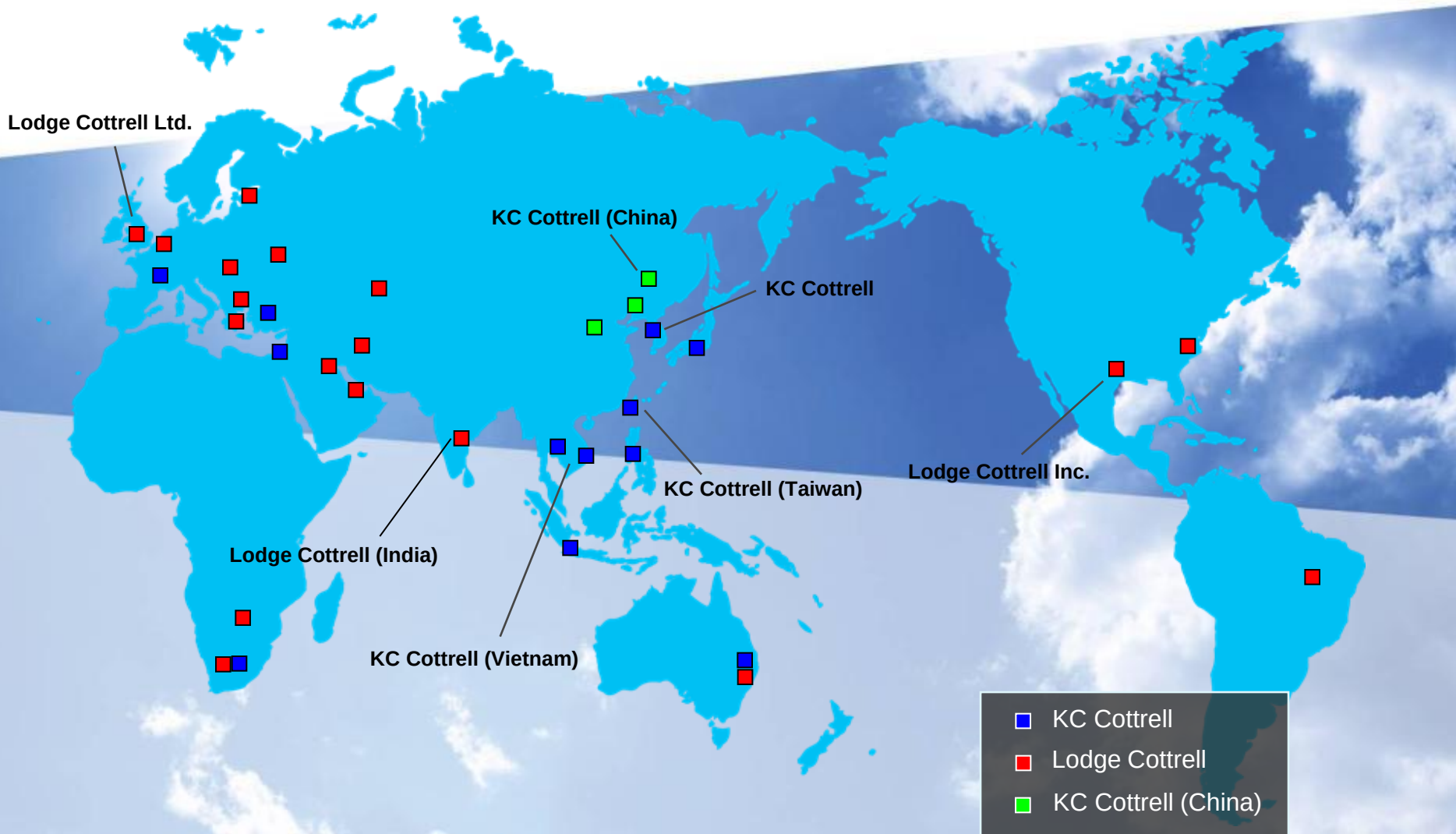
**KC Jeongrim
Environment Co., Ltd.**



KC Cottrell



Affiliated Companies Global Network



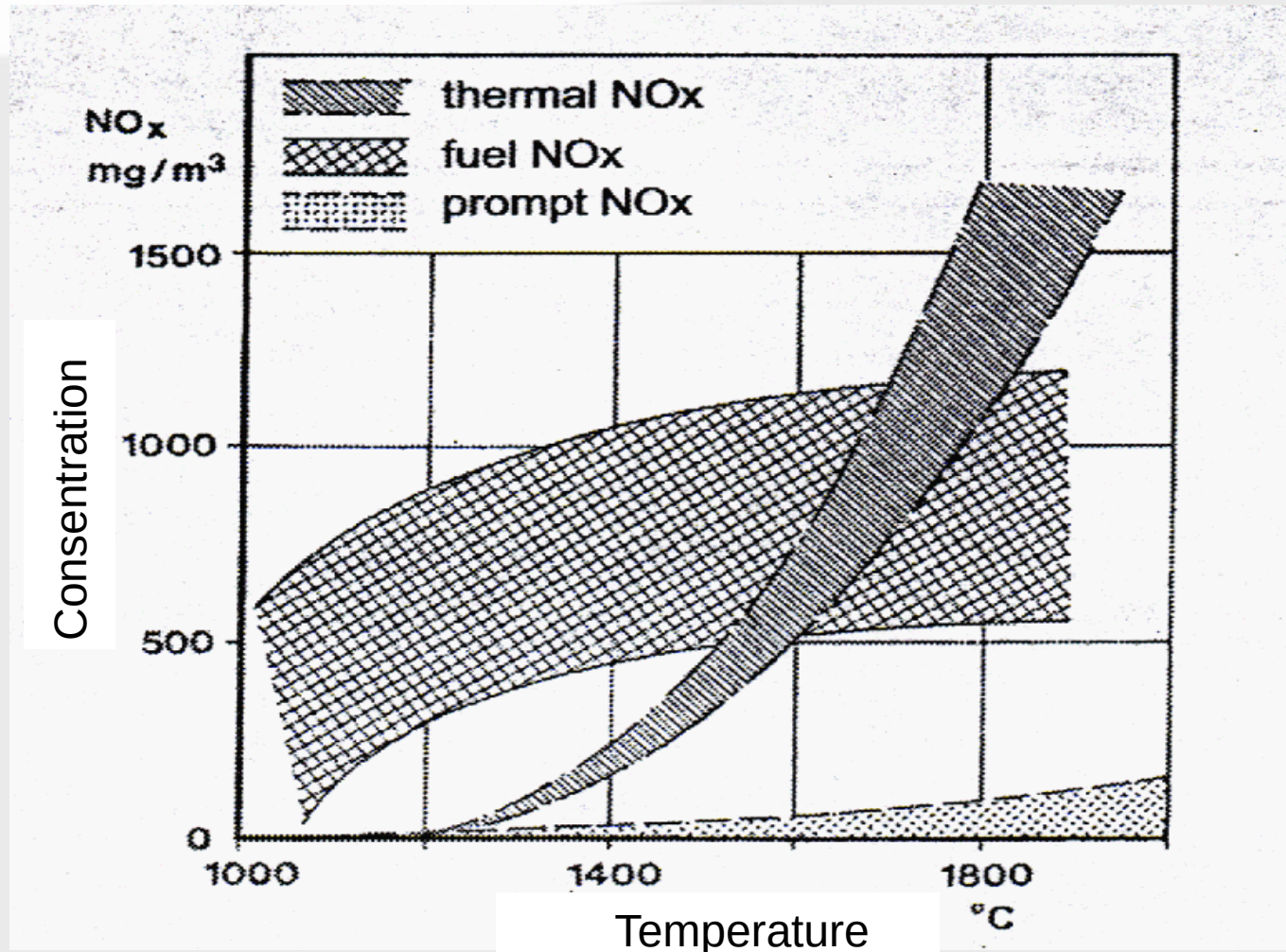


Company Introduce
De-Nox Technology
SCR Technology
SCR Model Test
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What's the Nox?

- ❑ Overall designation of NO, NO₂, N₂O₃, N₂O, N₂O₄, N₂O₅ etc. as environmental pollutant. Mechanism 
- ❑ ...Induce acid rain, photochemical smog , ozone warning and Plant corrosion.
- ❑ ...Induce Respiratory disease etc.
- ❑ Natural ecosystem destruction,

NO_x Formation



De-Noxification Technology ▶

Formation Control
(Combustion Modification)

- Temperature Control
- O2 Control
- Combustion Control

Removal
(Post-Combustion Modification)

- Reduction : SNCR SCR Hybrid
- Others : Adsorption(A/C)

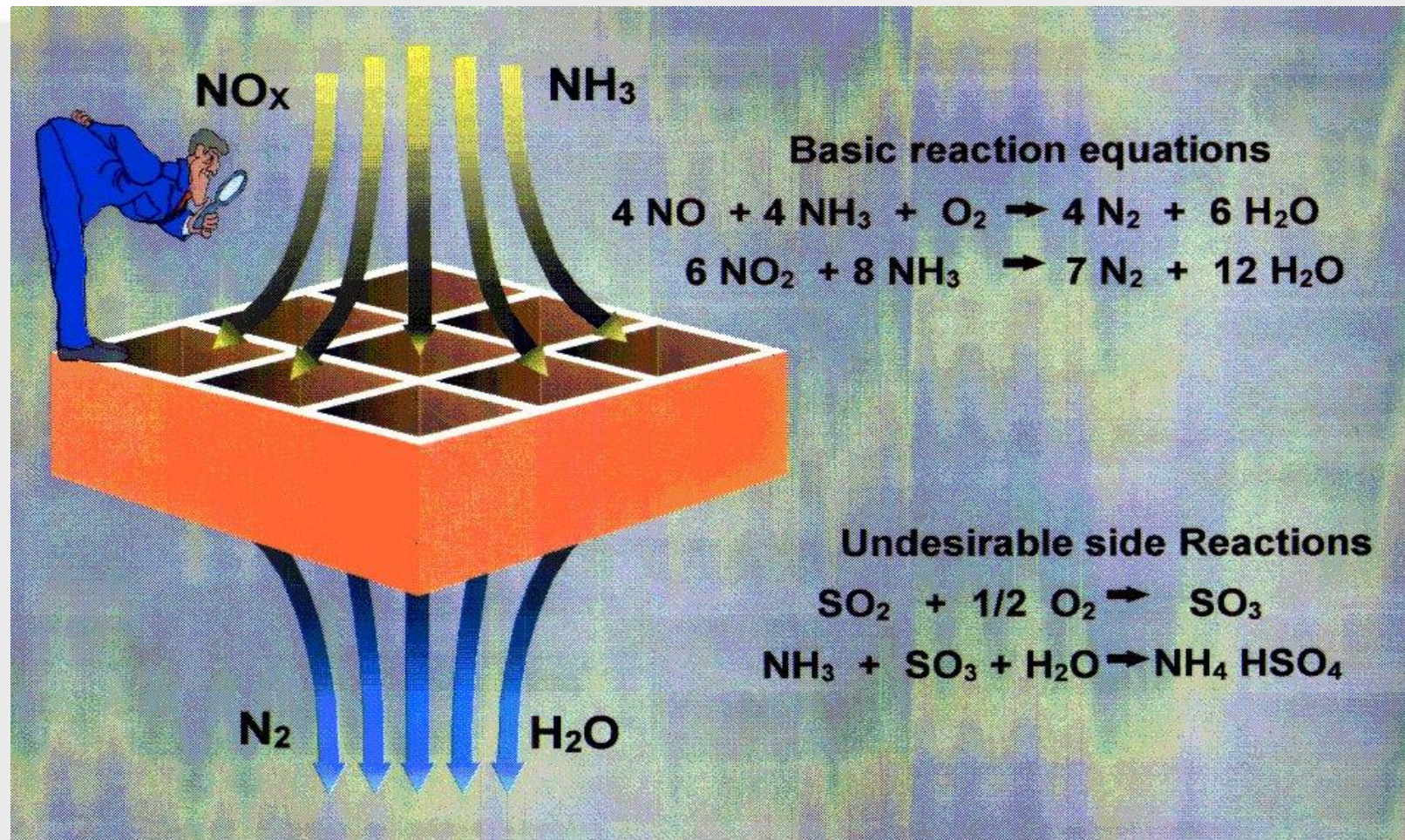


KC Business Item

Comparison of De-NOx Technology

Technology	Advantage	Disadvantage	Removal Eff.
Off-Stoichiometric	Low Op. Cost	High Investment Cost Unstable De-NOx eff.	30 – 60 %
Low Nox Burner	Low Op. Cost Medium De-NOx eff with FGR	High Investment Cost Limited flexibility per boiler type and fuels Unstable De-Nox Eff.	30 – 50 %
Flue Gas Recirculation	Rel. High De-NOx eff. Suitable for LNG	High Investment Cost High Operation Cost Unstable De-NOx Eff	40 – 80 %
Reduced Air Preheating	Rel High De-NOx Eff	Poor Heat Efficiency Unstable De-NOx Eff	25 – 65 %
SCR 	High Denoxification Efficiency Reliable NOx operation	High Investment Cost High Operation Cost	70 – 95 %
SNCR 	Low Investment Cost Low Operation Cost Non-toxic reduction agent	high temp. window  Narrow BLR Op. flexibility  High ammonia slip	25 – 50 %

De-NO_x Reaction





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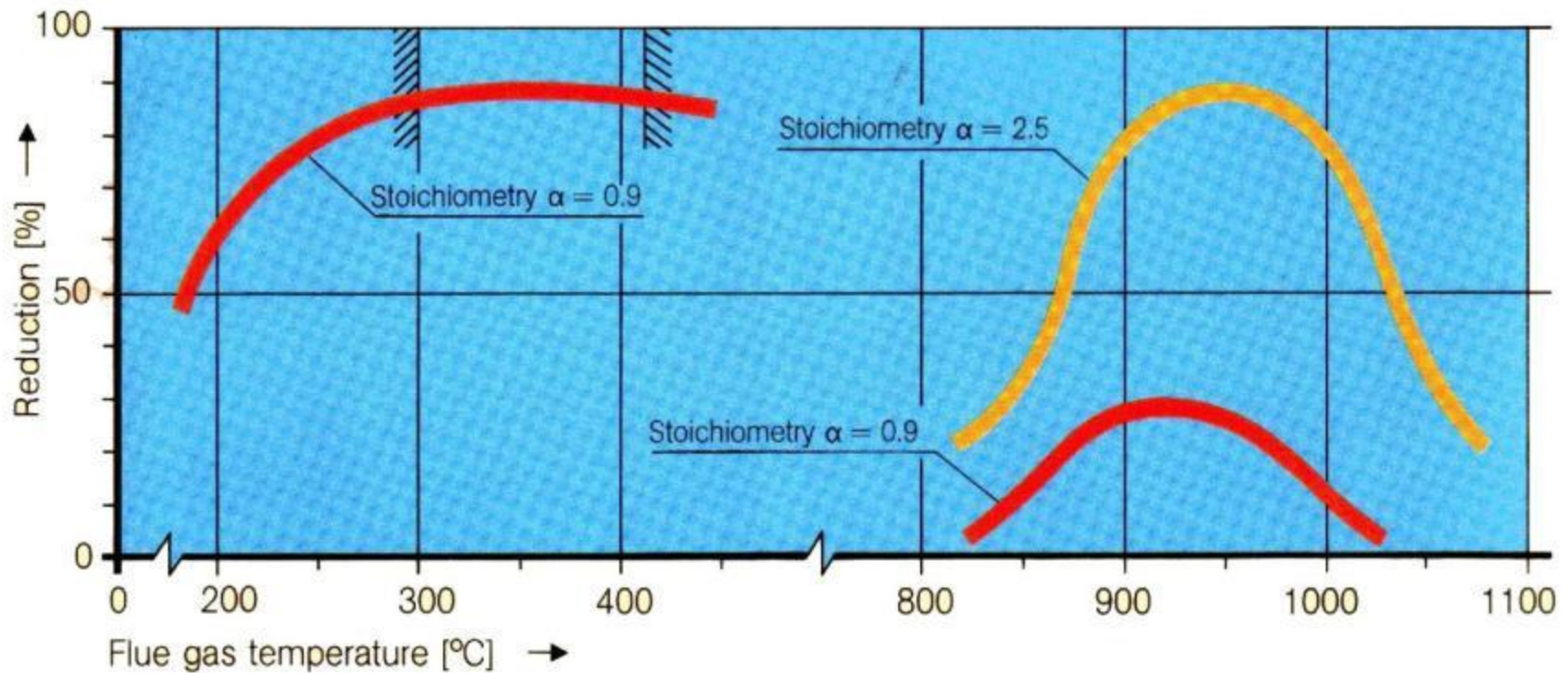
Comparison of Reducing Agent

Property	50% Urea Solution	Anhydrous Ammonia	29.4% Aqueous Ammonia
Physical Form	Liquid	Liquified gas	Liquid
Chemical Formula	NH_2CONH_2	NH_3	NH_4OH
Molecular Weight	60.06	17.03	35.05
Specific Gravity @60°F	1.14	0.597	0.90
Vapor pressure @80°F, psia	6.4	152.7	13.5
Crystallization point °F	64	108	-110
Boiling point °F	209	-28	95
Flammability limits vapor cone in air	Non flammable	16~25	16~25
Ignition temp(vapor)	Non flammable	1204 °F	1204 °F
Threshold limit value (vapor)	N/A	25	25
odor	Trace ammonia	Pungent, detectable @5ppm	Pungent, detectable @5ppm
Storage requirement	All steel construction vented tank	265 psig ASME stress relieved steel tank	265 psig ASME steel tank

SCR & SNCR Efficiency Comparison

SCR process

SNCR process



System Composition

SNCR

Chemical Storage System(Tank)

Chemical Injection System(Nozzle)

Control System

SCR

Chemical Storage System(Tank)

Chemical Injection System(Nozzle, Vaporizer)

SCR Reactor (Catalyst)

Control System

SCR(Selective Catalytic Reduction)

□ Use Reducing agent and Catalyst

UREA

Ammonia(Anhydrous, Aqueous)

Catalyst(V_2O_5 , TiO_2 , WO_3)

□ Reaction`



Location of SCR on the process

❑ High dust SCR ▶

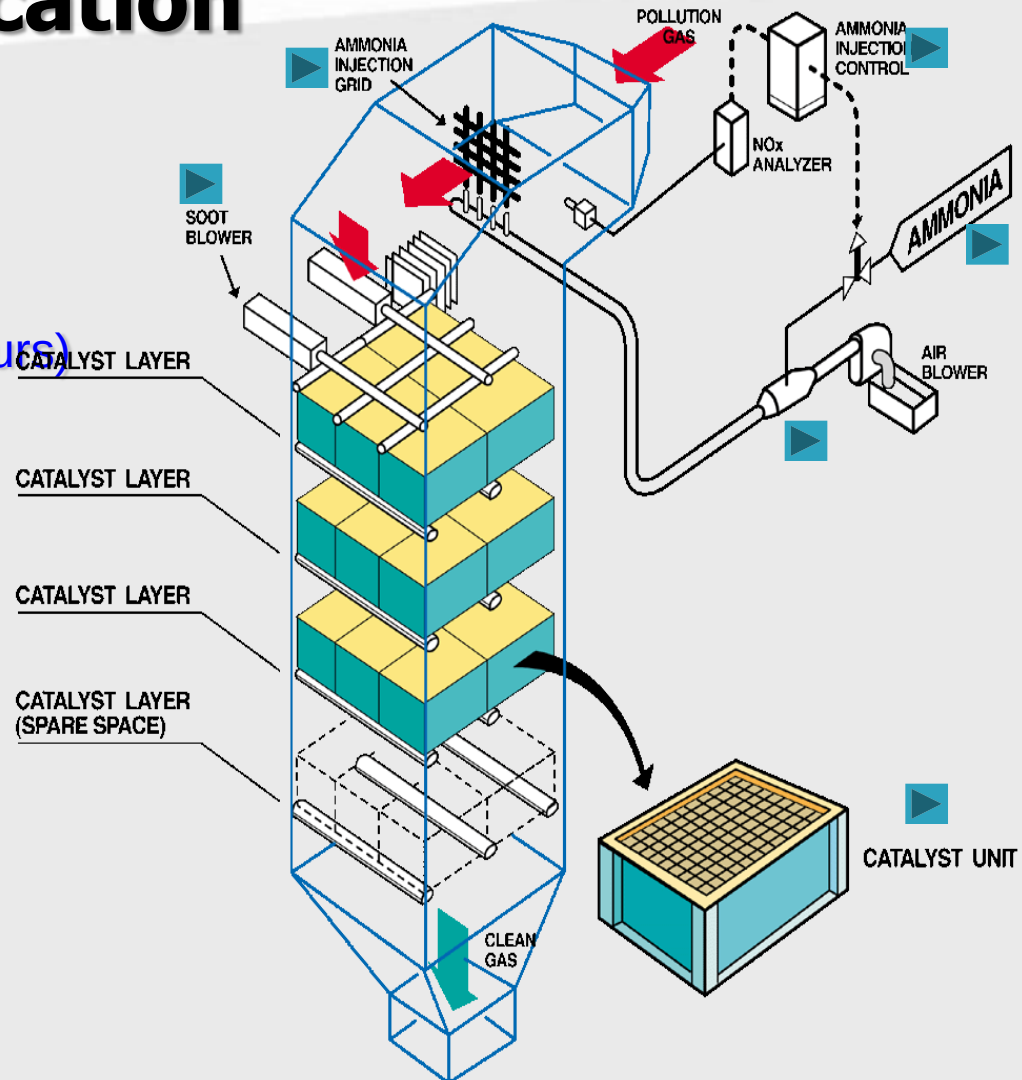


❑ Low dust SCR(Tail end SCR) ▶

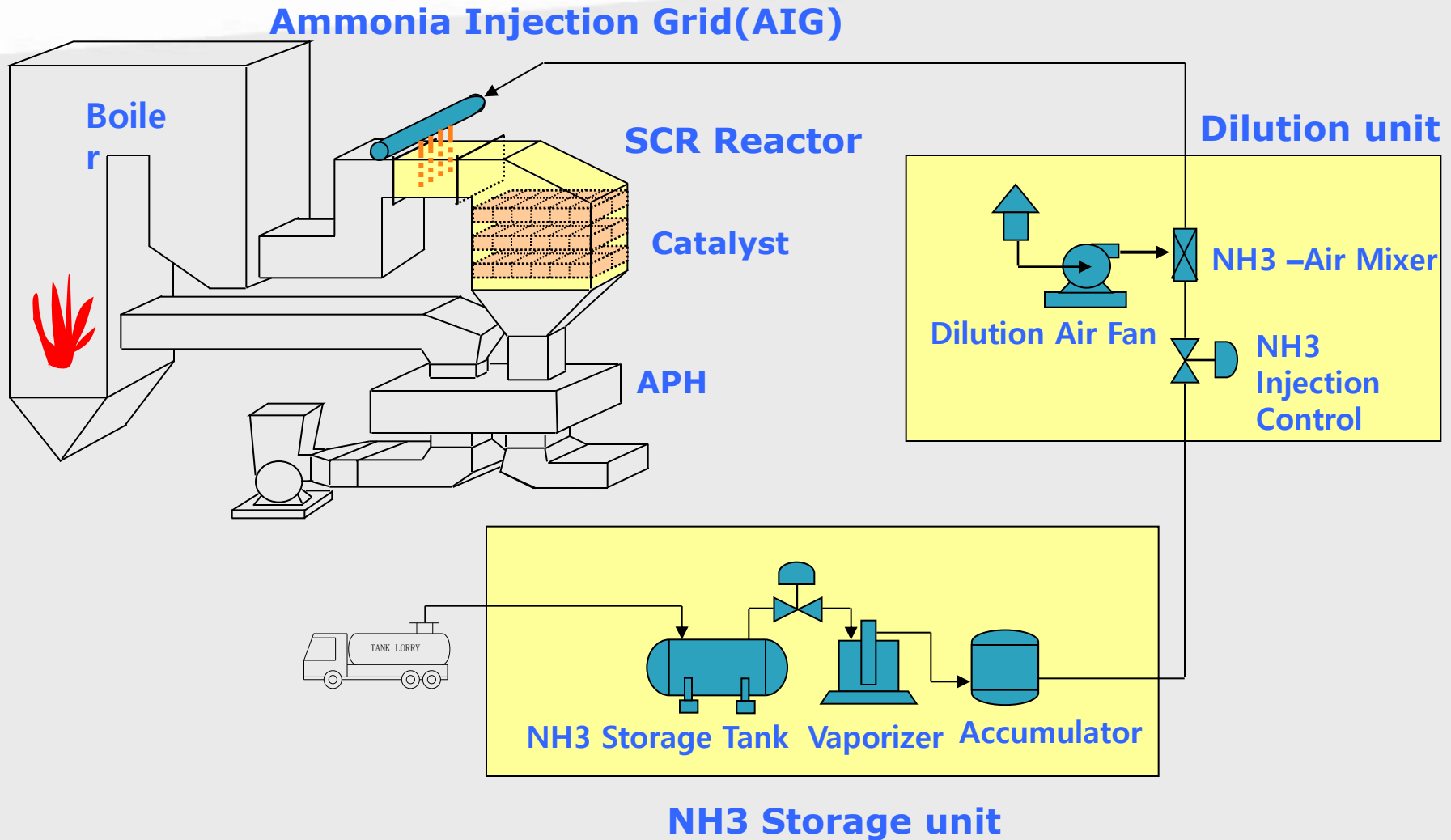


SCR System Application

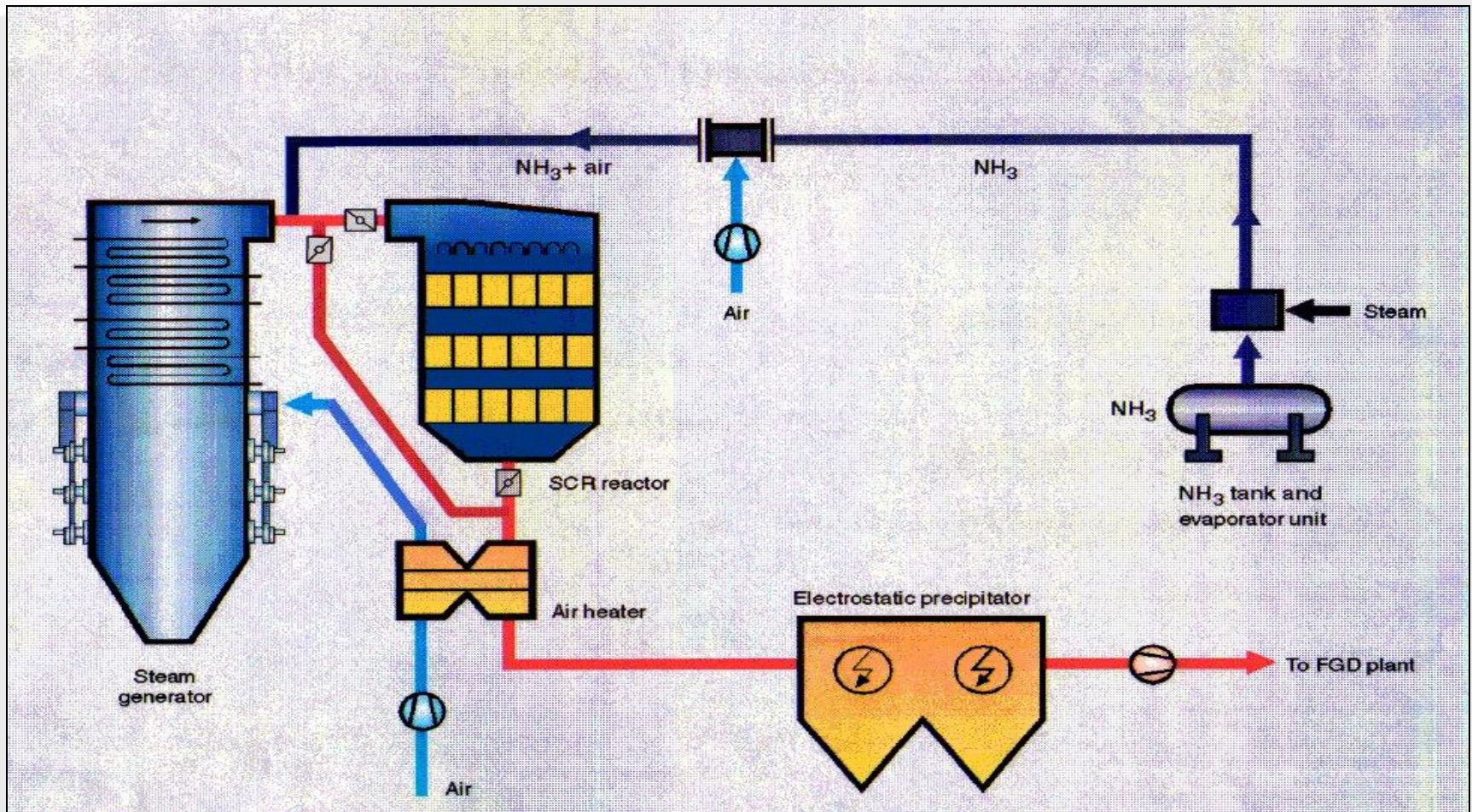
- ❑ Rxn Temp. : 200~450°C
(Depend on Fluegas condition)
- ❑ NOx Removal Eff. : Over 90%
- ❑ Catalyst Life Time(Operating Hours)
: 24,000 hrs~40,000 hrs
- ❑ Catalyst Type
: Honeycomb type
Corrugated type
Plate Type
- ❑ Facility
 - Chemicals Storage System
 - Chemical Supply System
 - SCR Reactor
 - Control System



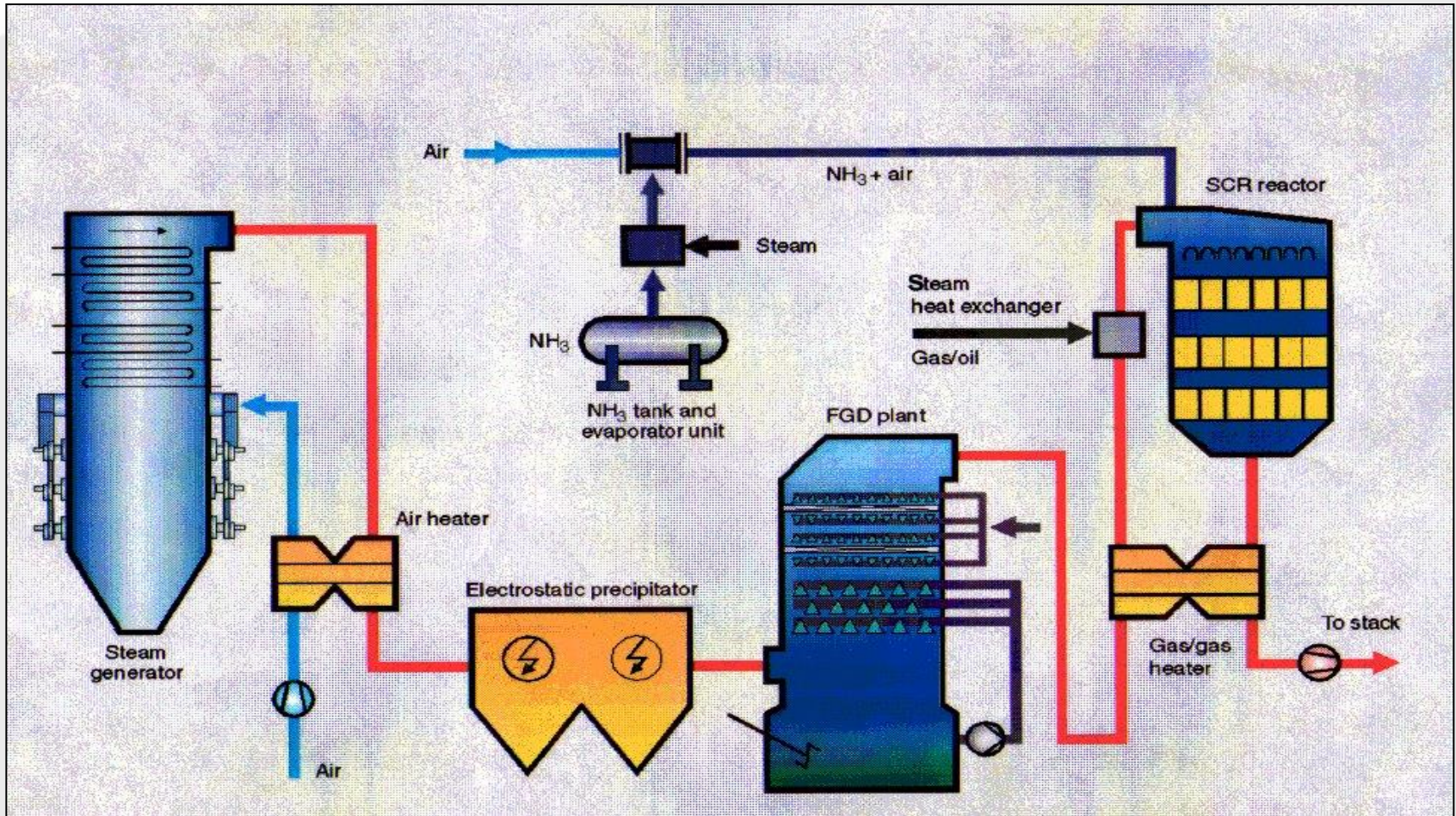
Typical Process of SCR System



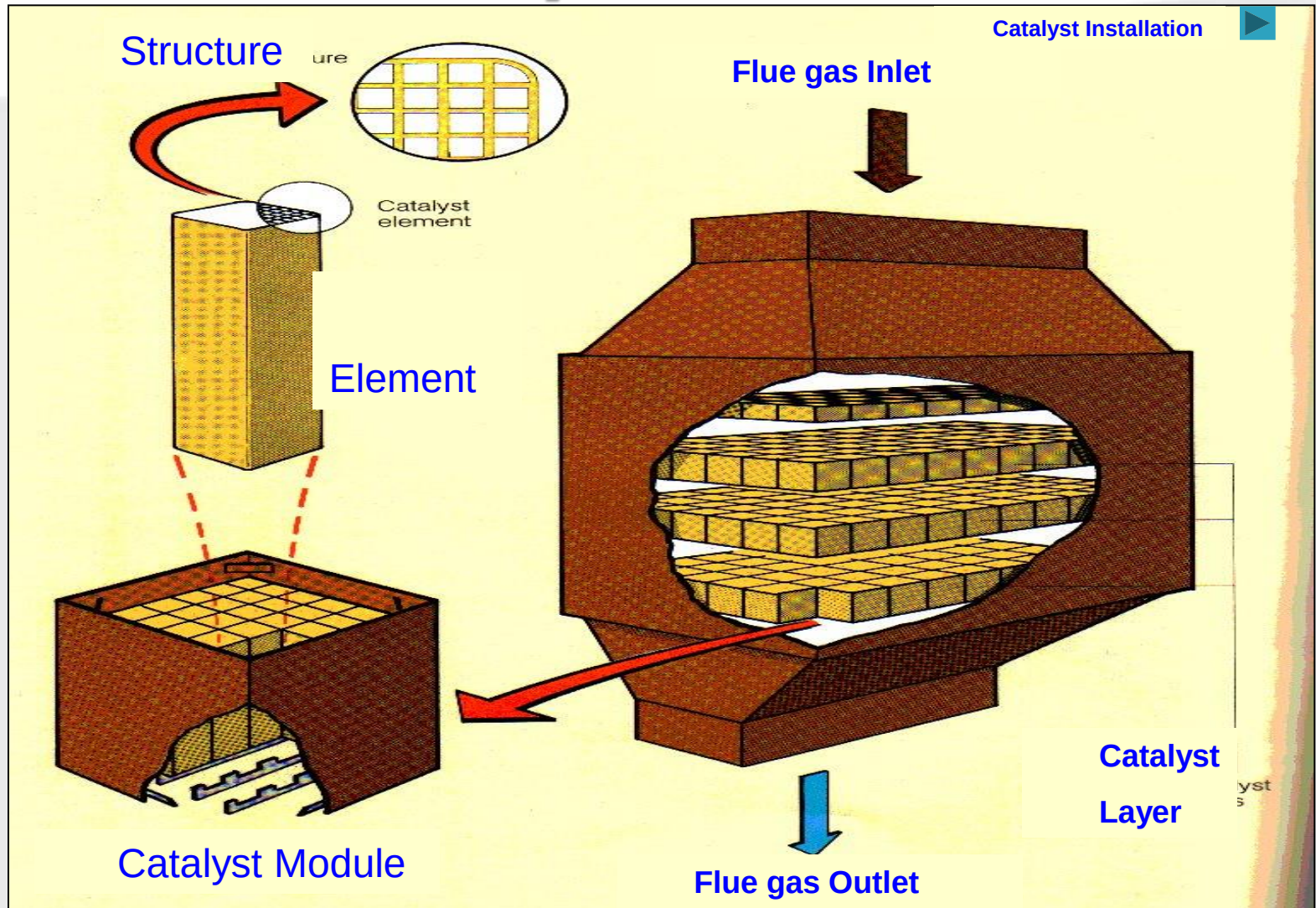
High Dust Arrangement



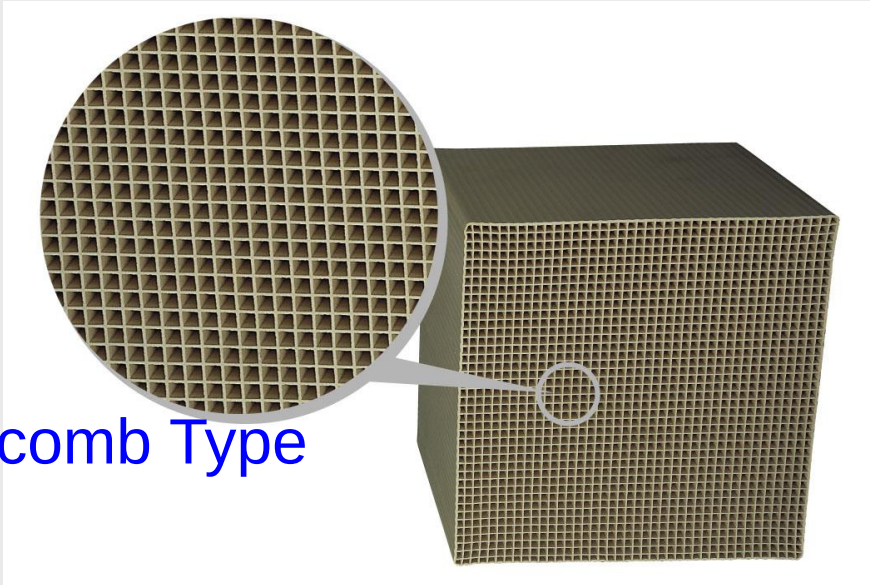
Low Dust (Tail end) Arrangement



Structure of Catalyst



Catalyst Type



Honeycomb Type

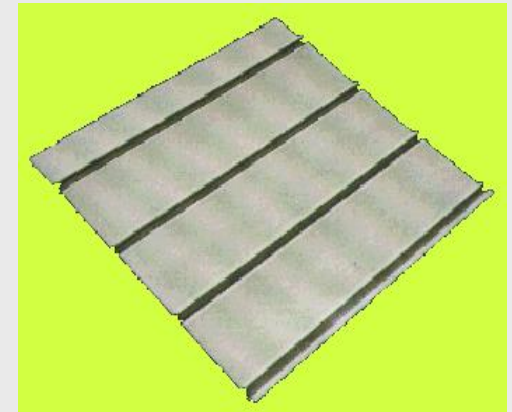
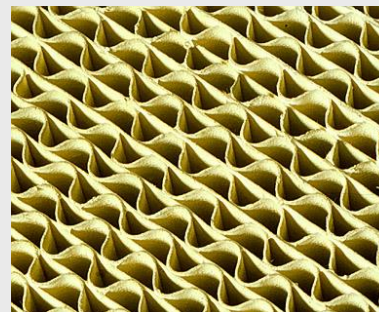
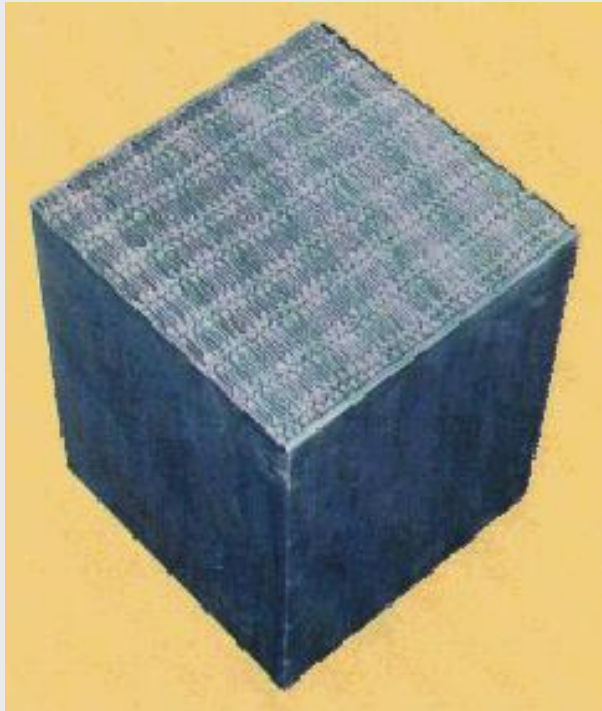


Plate Type

Corrugated Type



Catalyst for De-NO_x



➤ Composition

- Base : TiO_2
- Active Site : V_2O_5 ▶
- Others : WO_3

➤ Shape ▶

- Honeycomb Type
- Corrugated Type
- Plate Type

Points to be duly considered for SCR Design

Stable Efficiency



> 90%

Low Pressure Drop



20~100 mmH₂O

Catalyst Life Time



24,000~40,000 oph

Optimum SCR Reactor



Compact Design

Maintenance



Convenience

Corrosion or Plugging of the Latter Facilities



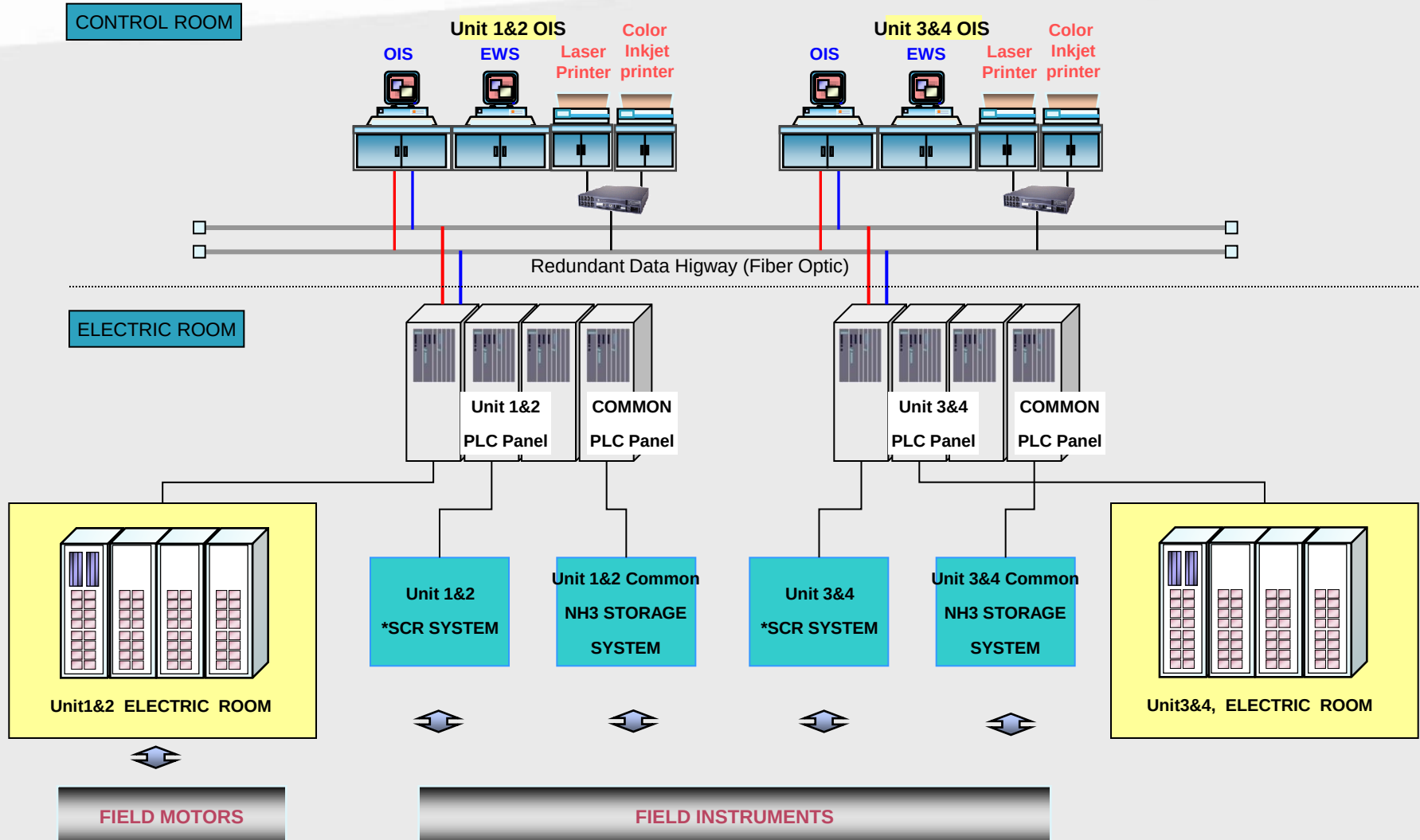
SO₃ Conv. NH₃ Slip

Optimum Location

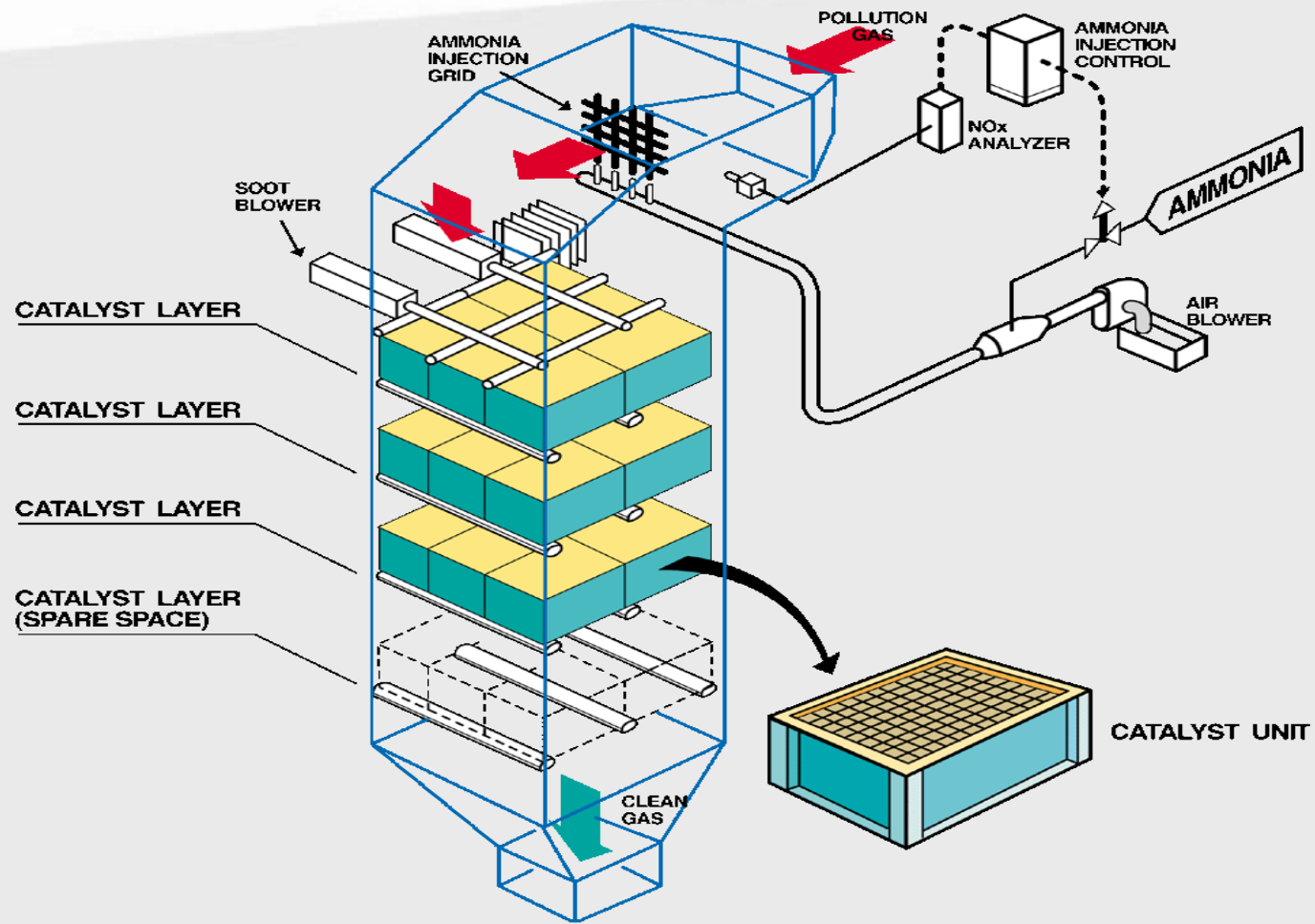


Optimum Gas Condition

Control System(Case : 1~4 Unit)



SCR System



Anhydrous Ammonia Storage Tank



- ▶ Roof is installed in order to protect tank from hard sunlight at the top of tank.

Anhydrous Ammonia Storage Tank House



Anhydrous Ammonia Unloading Compressor



Aqueous Ammonia(25%) Vaporizing System



- Vaporizer
- Nozzle
- Steam Air Heater
- Fan

SPRAY NOZZLE



< Tip Connection >



< Tip Part >

Soot Blower

Fixed Type

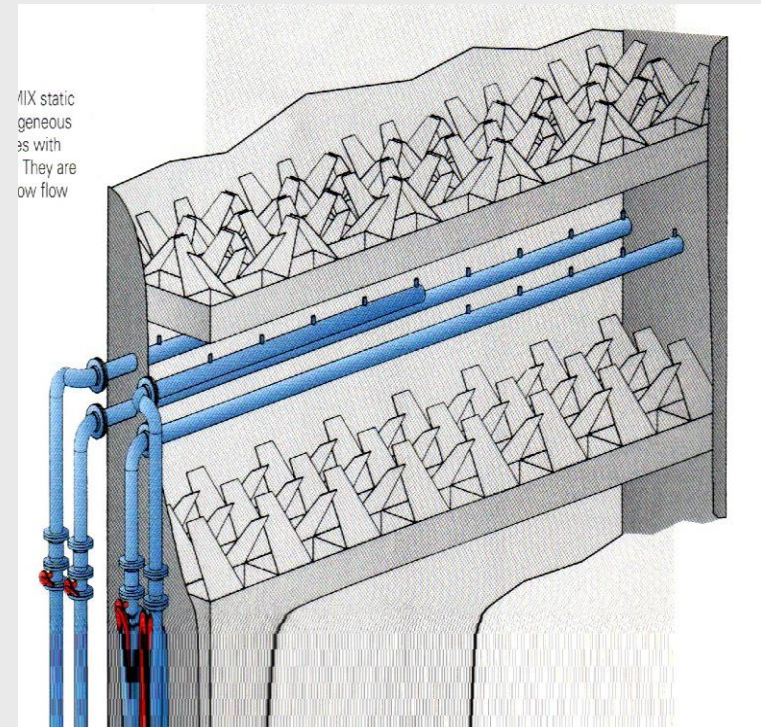


KC Cottrell 

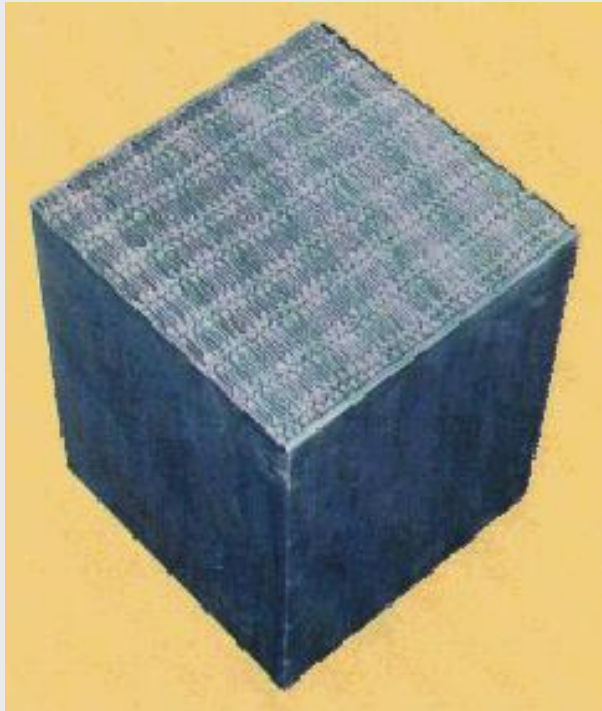
Retractable Type



Static mixer for Gas Flow Mixing



Catalyst for De-NO_x



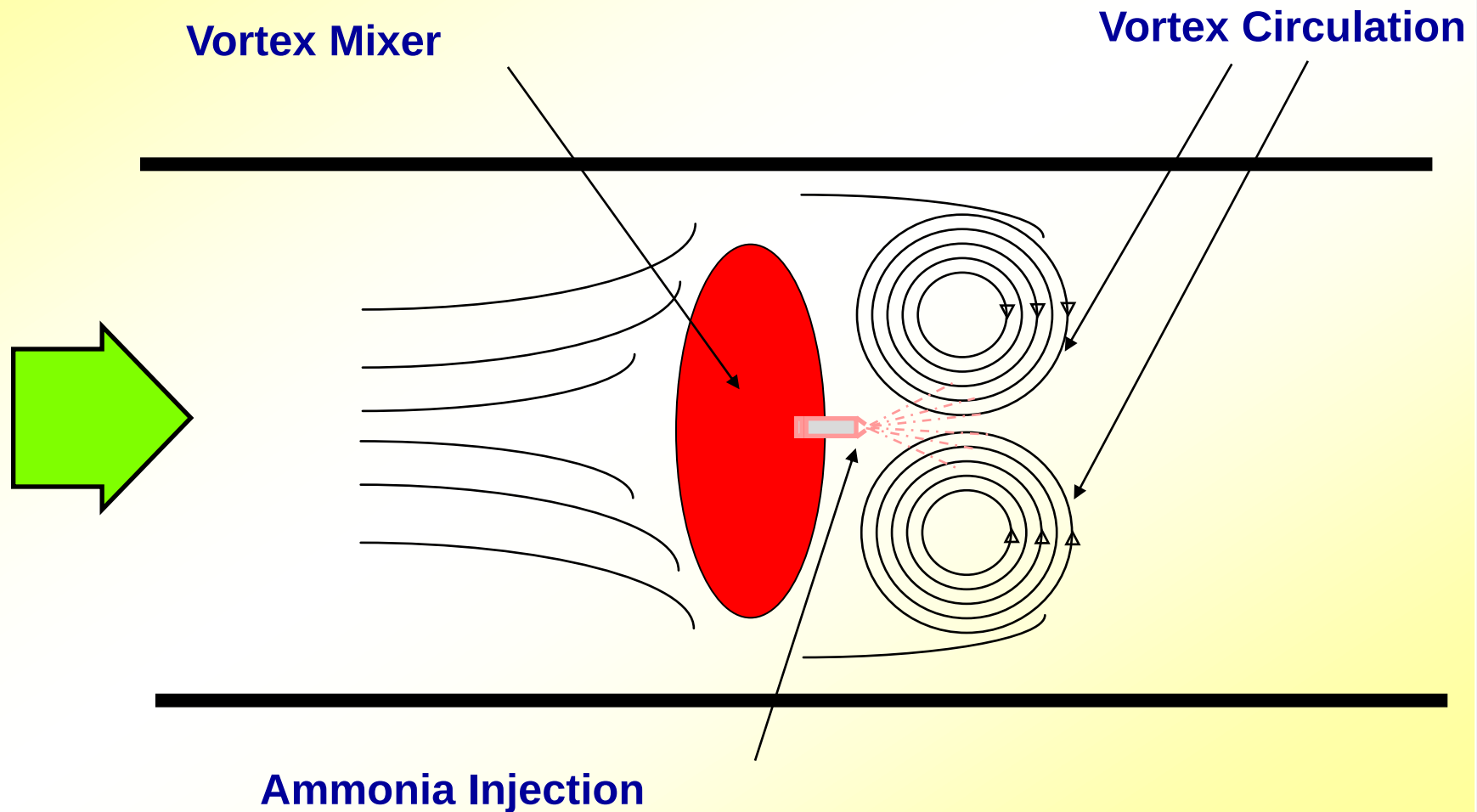
➤ Composition

- Base : TiO_2
- Active Site : V_2O_5 ▶
- Others : WO_3

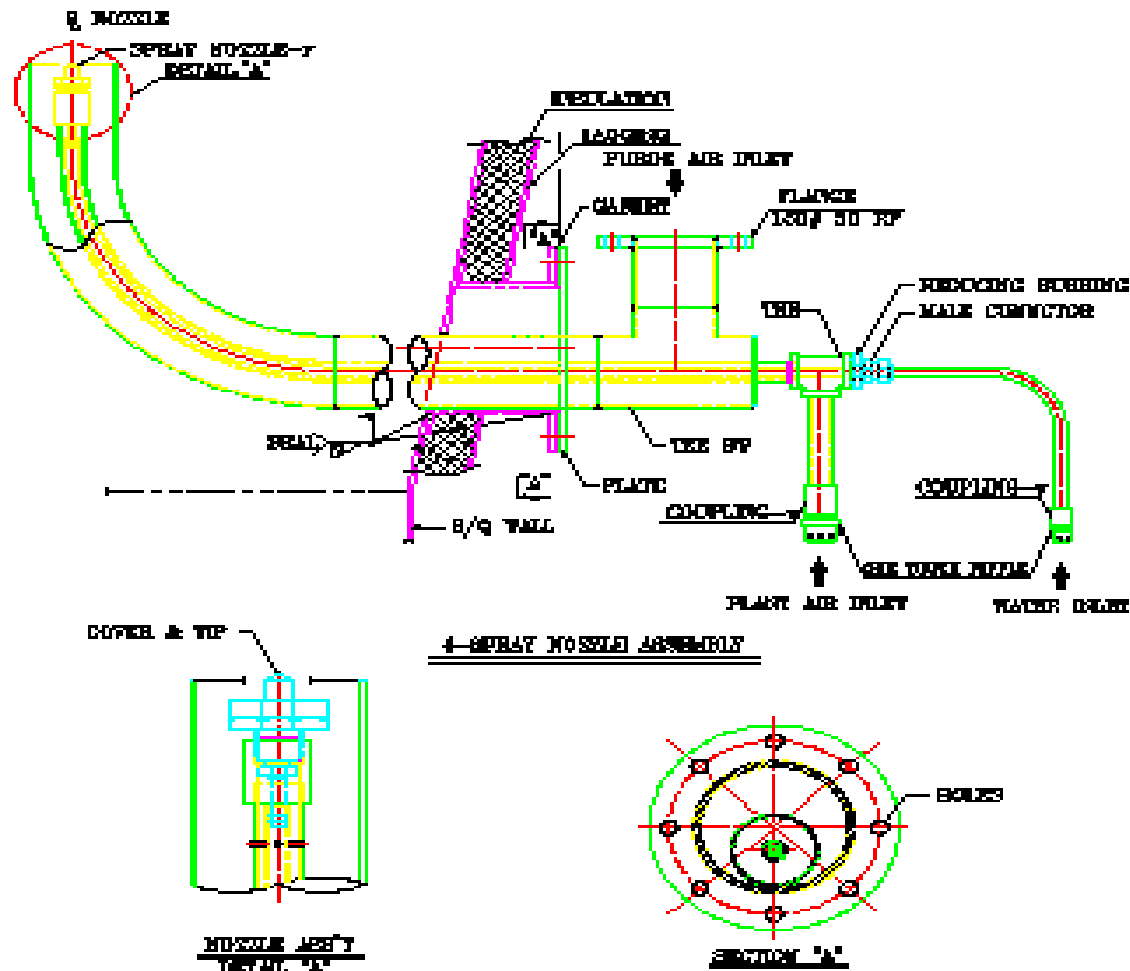
➤ Shape ▶

- Honeycomb Type
- Corrugated Type
- Plate Type

"Delta Wing" Mixer for Gas Flow Mixing



Atomizing Dual Fluid Nozzle



Chemical Storage Tank



Chemical Feeding Pump

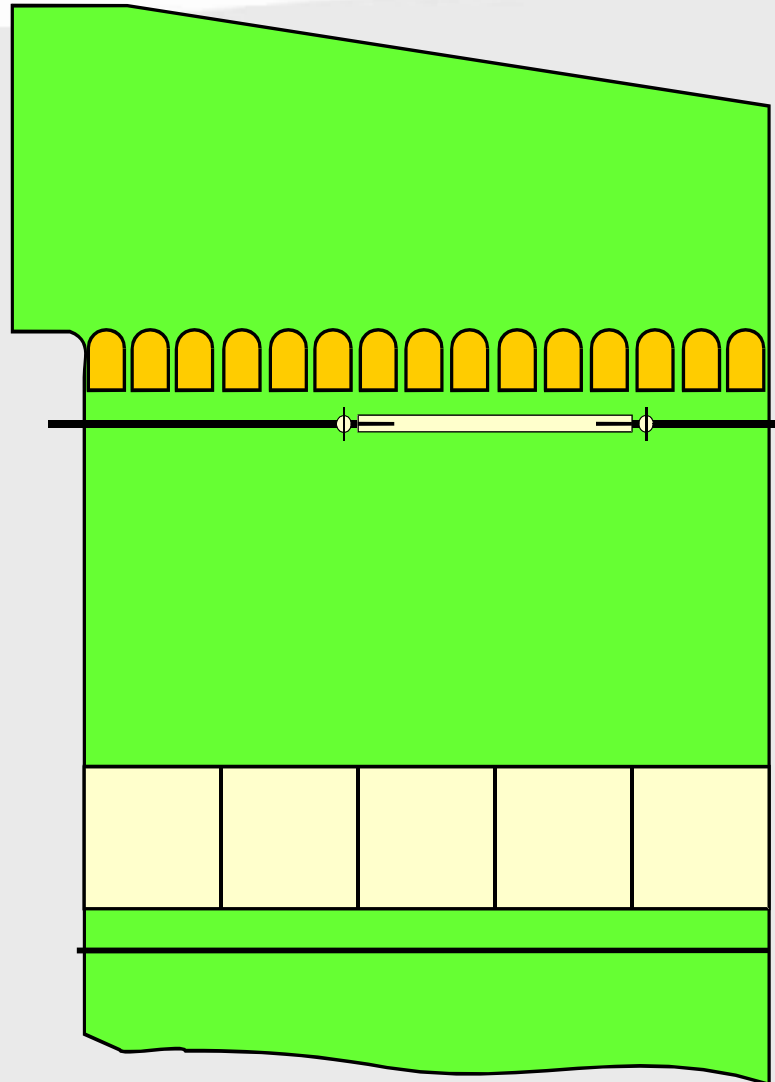
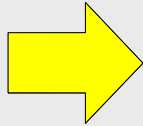


Duct Burner



Equalizer in SCR Reactor

Flue
Gas



Equalizer

First Catalyst Layer

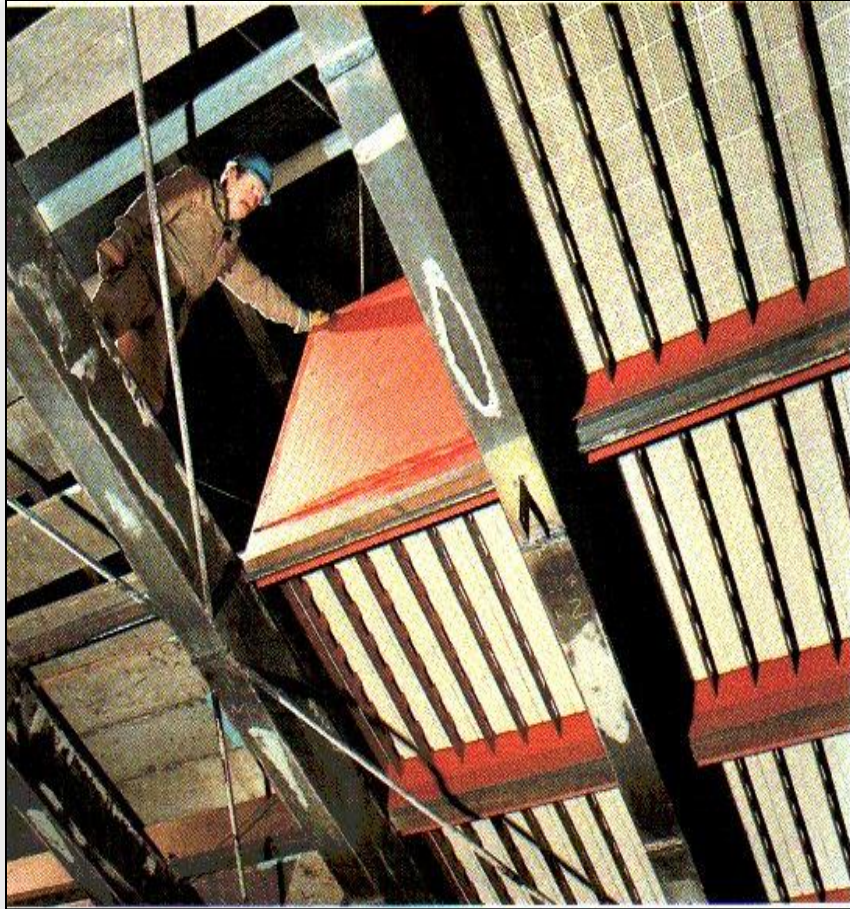
Ammonia Injection Grid



Ammonia Injection Grid



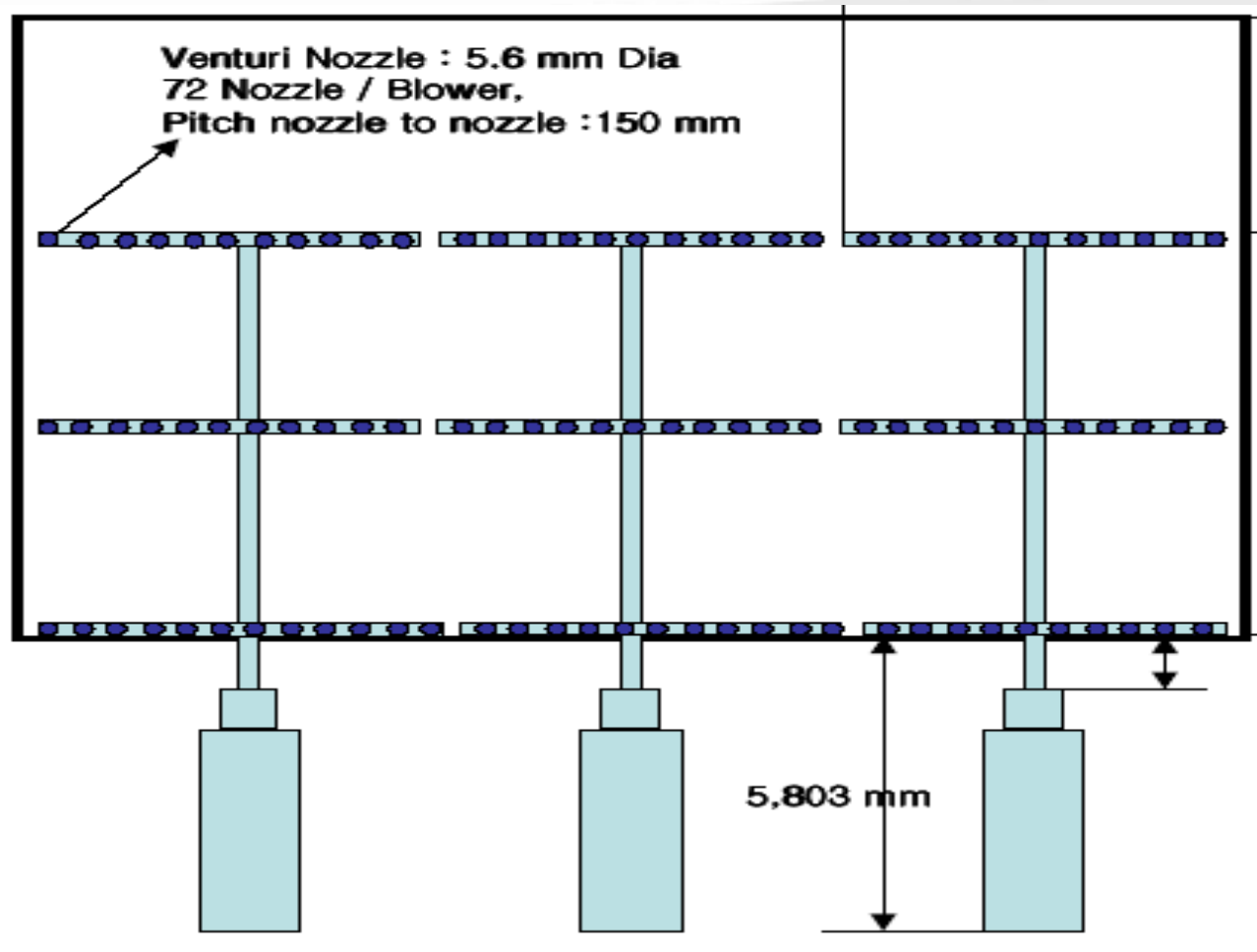
Catalyst Installation



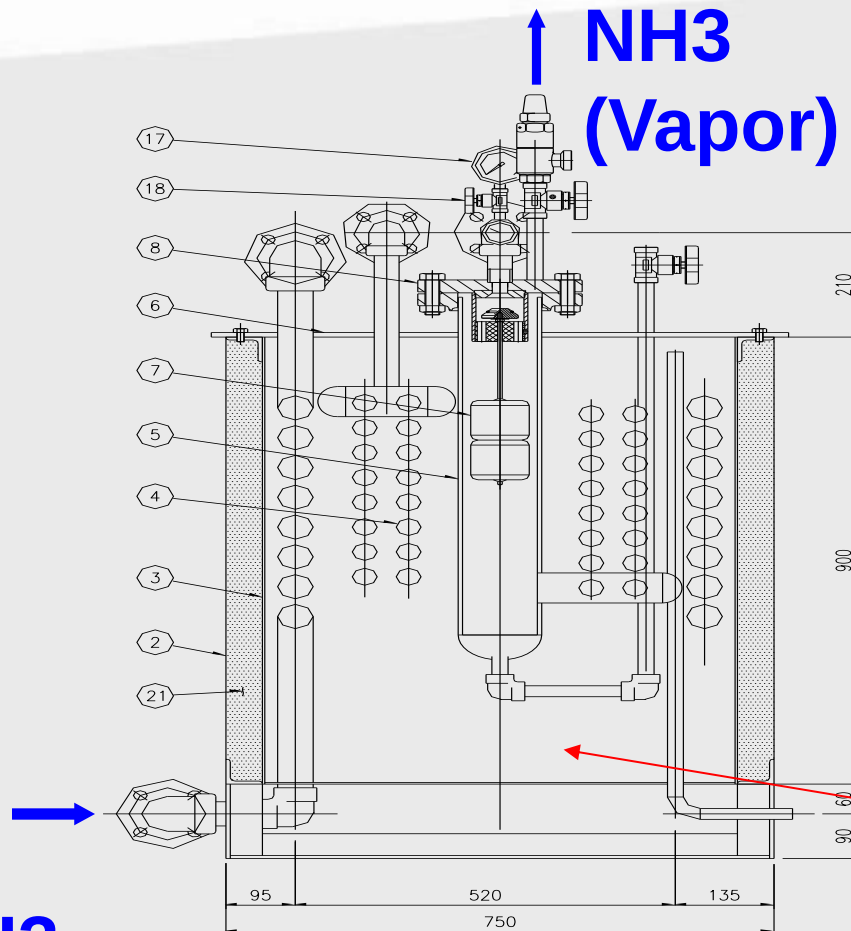
Internal Support for Catalyst Module



Soot Blower(Typical)



Vaporizer(Anhydrous Ammonia)



Type	Steam Evaporation Heating
Design Temp/Press	55 (C) 22.2 kg/cm ²

**NH₃
(Liquid)**

Water

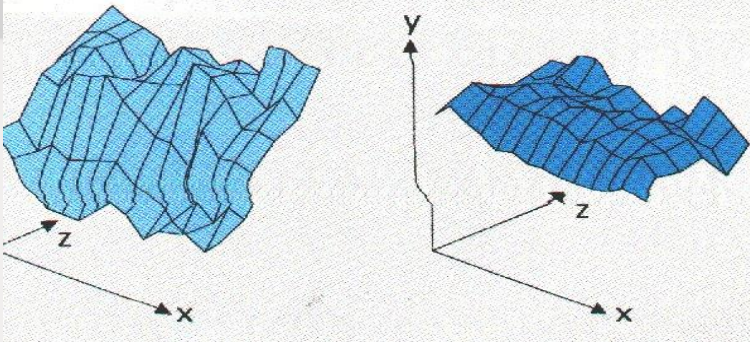


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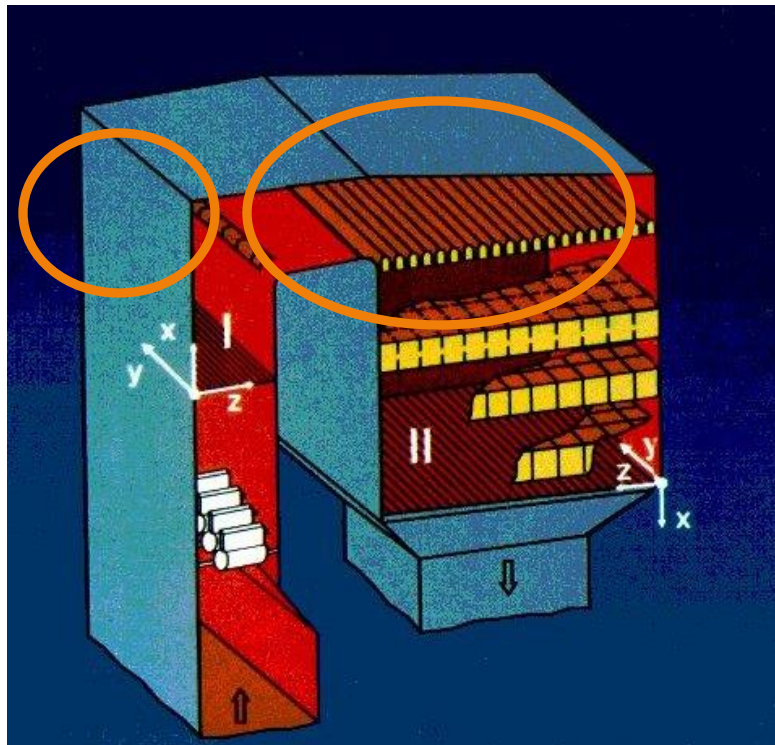
Model Test (SCR Reactor)



Before Correction After Correction



Flow w/o Guide Vanes or Baffling system

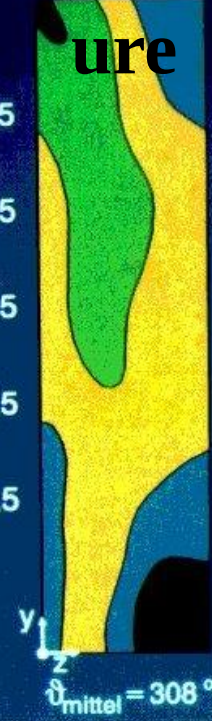
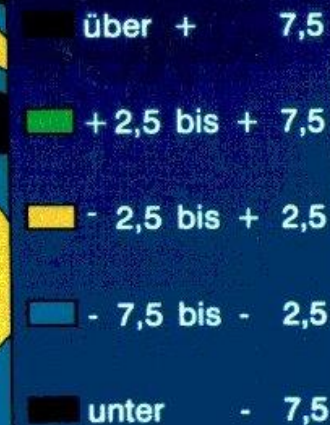
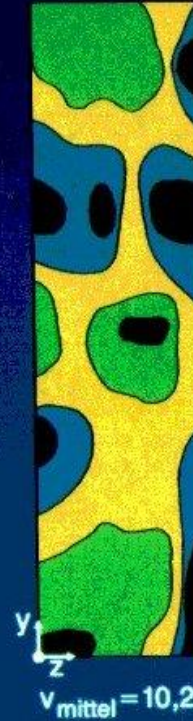


Measuring Point I : Upstream of SCR
Measuring Point II : Downstream of SCR

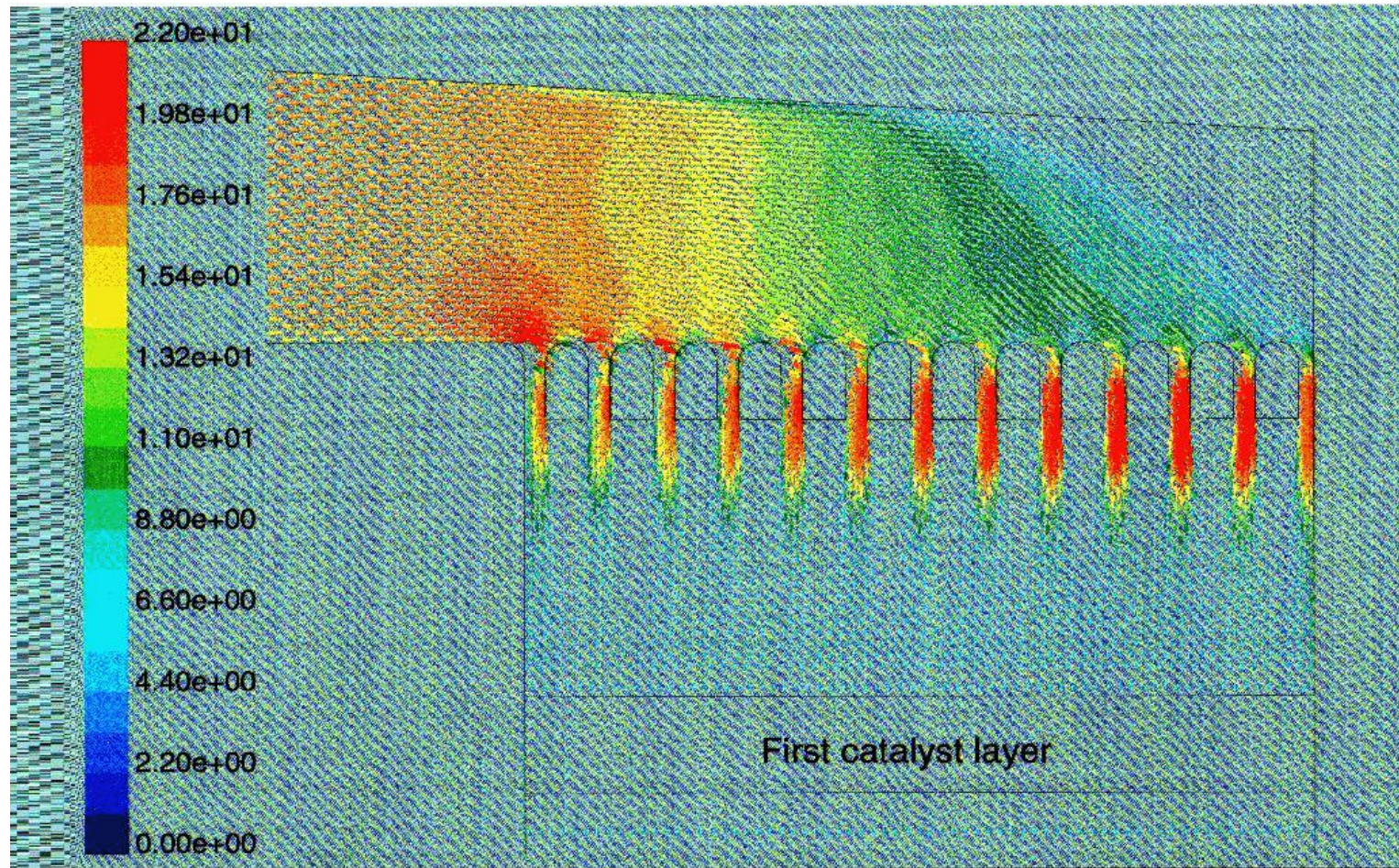
Measuring Point : Upstream

Velocity

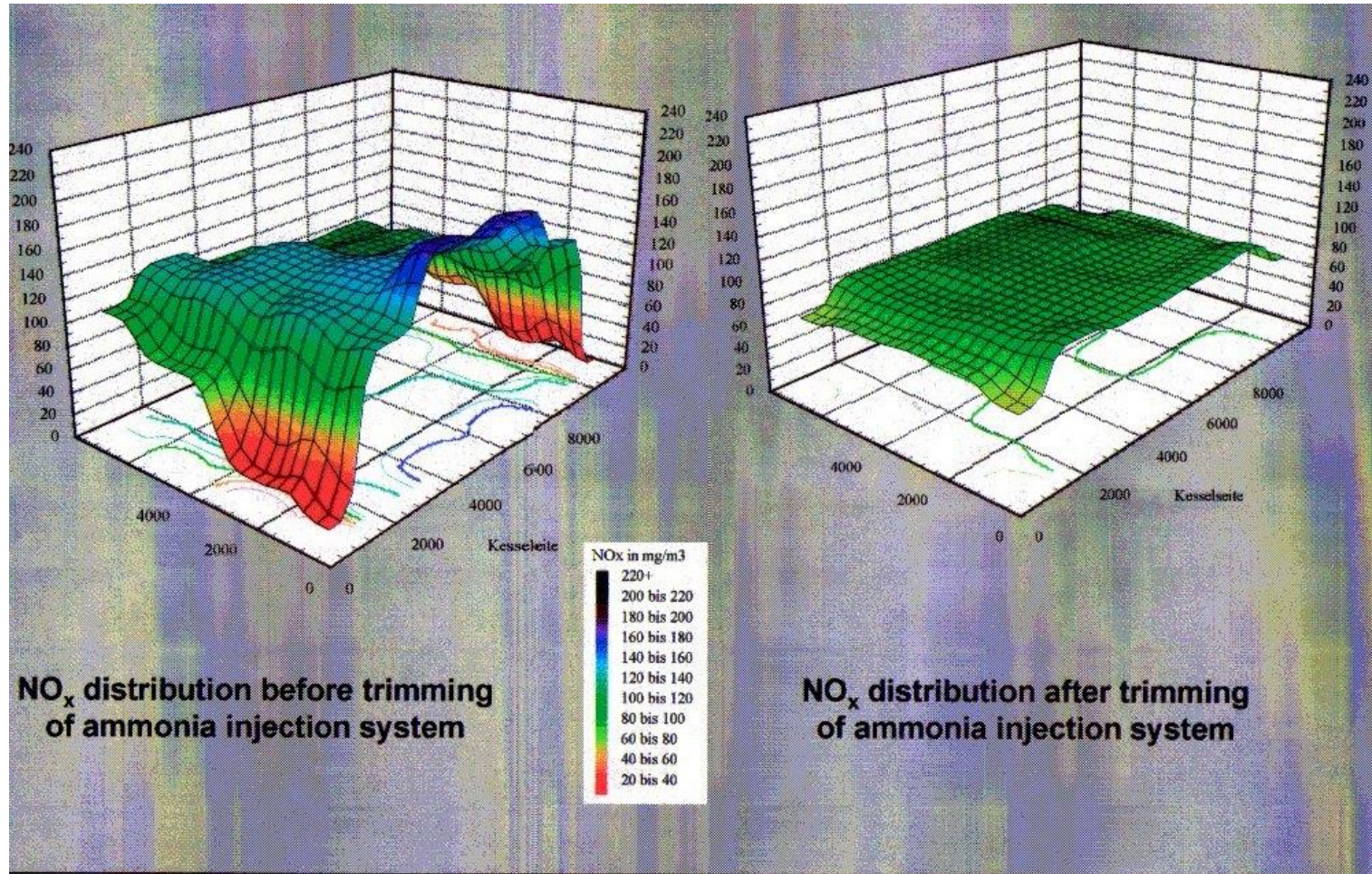
Temperature



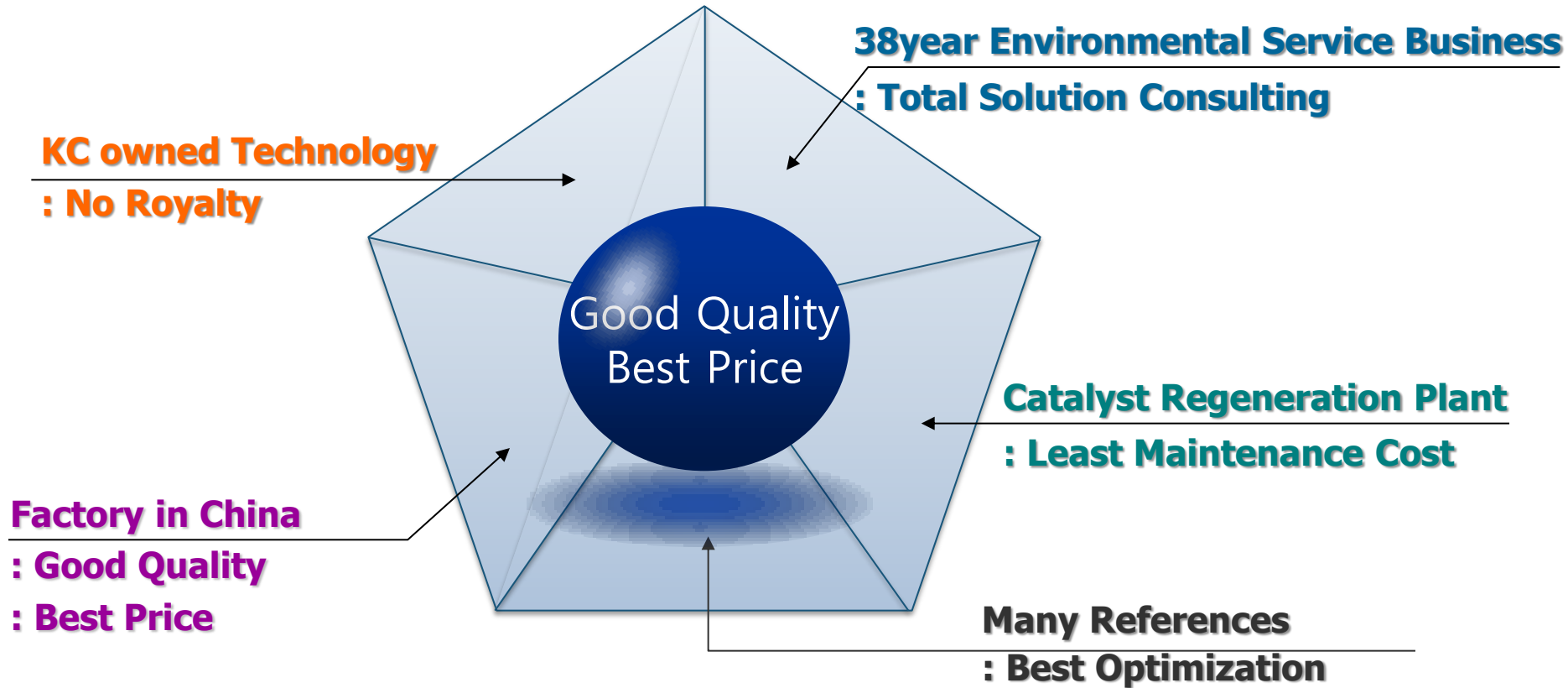
Equal Distribution of Flow with Baffling System



NO_x Distribution Downstream of Catalyst



Merit of KC Cottrell's System Economical & Excellent Quality



Merit of KC Cottrell's System

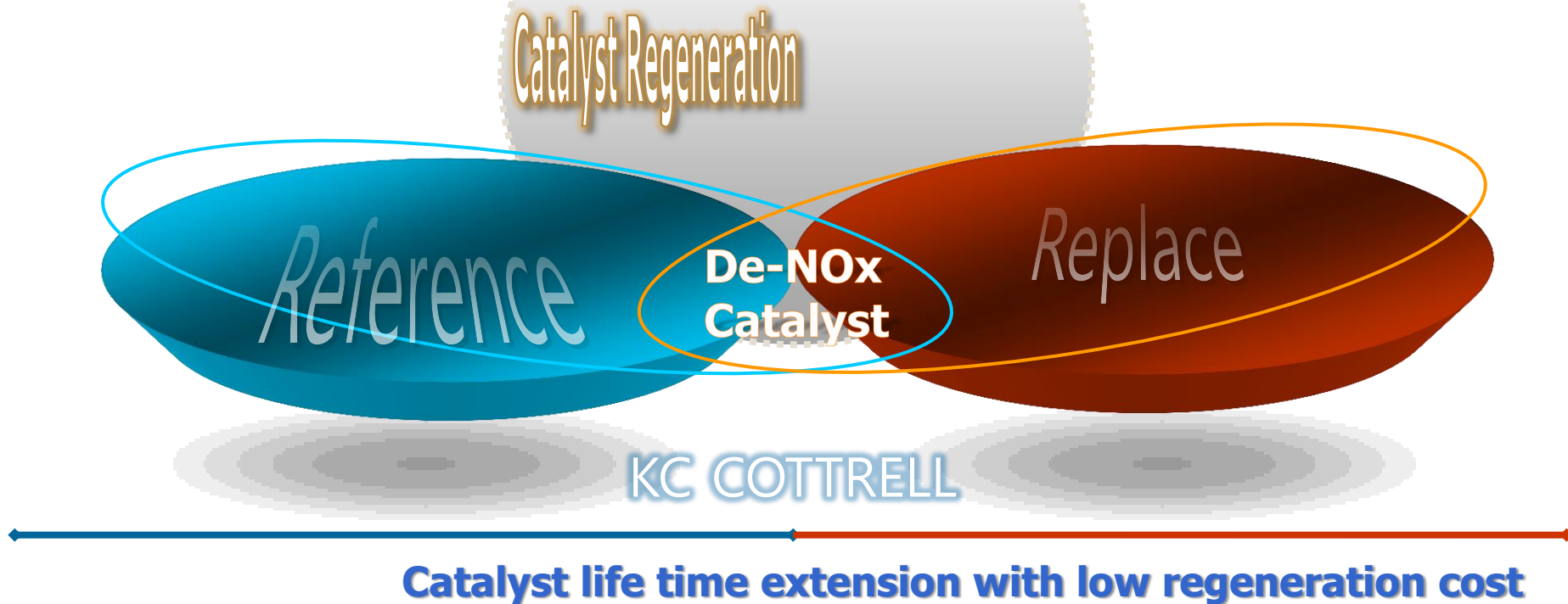
Best Removal Efficiency

- **SCR(Selective Catalytic Reduction) process is world widely confirmed the only proven technology being able to achieve more than 80% of NOx removal.**
- **Dioxin over 90% can be removed.**
- **Various process, various capacity of flue gas cleaning system reference.**
- **Continuous R & D**
→ **Catalyst efficiency analysis & life extension, regeneration, CO catalyst commercializing, etc**

Merit of KC Cottrell's System

Catalyst Regeneration Technology

Operating Regeneration Plant based on the License with European Company which has world best references in regeneration market.





Company Introduce
De-Nox Technology
SCR Technology
SCR Model Test
References

De-NOx References(I)

Customer & Location	Application	Start-up Date	Gas Vol.(Am ³ /min)
Hyundai Eng. & Con. Co., Ltd. Kunpo MSW Incineration Plant (SCR System w/Ammonia)	Incinerator(Stoker) 200TPD	2000	1,568
Pohang Iron & Steel Co., Ltd. Pohang Steel Works No.1 Stainless Steel Manufacturing Factory (SCR System w/Urea)	Stainless Steel APL Line	2000	150
Hyundai Heavy Industries Co., Ltd. CKS International Airport No. 4 Incineration Plant (SNCR System w/Urea)	Incinerator(Rotary Kiln) 70TPD	2001	3,413 x 2
Pohang Iron & Steel Co., Ltd. Pohang Steel Works No.3 Stainless Steel Manufacturing Factory (SCR System w/Urea)	Stainless Steel APL Line	2002	240
Korea Southern Power Corp. Youngnam Thermal Power Plant Unit No. 2 Orimulsion Fuel Conversion (SCR System w/Ammonia)	B-C Oil & Orimulsion Boiler 200 MW	2002	18,978

De-NOx References(II)

Customer & Location	Application	Start-up Date	Gas Vol.(Am ³ /min)
Sunglim Oil Chemical Co., Ltd. Ansan Plant Unit No.3. (SNCR System w/Urea)	Incinerator (Rotary Kiln + Stoker) 148TPD	2003	6,444
Sammam Petrochemical Co., Ltd. Yeocheon Plant (SNCR System w/Urea)	Incinerator(FBC) 60TPD	2003	480
KCEC Yeocheon Plant (SNCR System w/Urea)	Incinerator (Rotary Kiln + Stoker) 50TPD	2004	1,650
KCEC Yeocheon Plant (SNCR System w/Urea)	Incinerator (Rotary Kiln + Stoker) 70TPD	2004	2,370
Hanwha Corporation Taegu Dyeing Industry Complexcorp (SCR System w/Ammonia)	Coal Fired Boiler 50 MW	2004	5,329

De-NOx References(III)

Customer & Location	Application	Start-up Date	Gas Vol.(Am ³ /min)
Samsung Fine Chemical Co., Ltd. Ulsan Plant Unit No.3 (SCR System w/Ammonia)	B-C Oil & Orimulsion Boiler 50MW	2005	5,470
Sunchang Corporation Incheon MDF Plant (SCR System w/Ammonia)	Wooden Fired Boiler 25TPH	2005	1,950
Taishan Thermal Power Plant Unit No. 5 CHINA (SCR System w/Ammonia)	Coal Fired Boiler 600MW	2006	75,000
Korea East West Power Corp. Tangjin Thermal Power Plant Unit No. 1~4 (SCR System w/Ammonia)	Coal Fired Boiler 500MW	2006	40,160 x 4
POSCO KwangYang Steel Work Unit No. 1~4 (SCR System w/Ammonia)	Sinter Plant De-NOx, De-SOx, De-Dioxin	2007	34,040 x 4

De-NOx References(IV)

Customer & Location	Application	Start-up Date	Gas Vol.(Am ³ /min)
SNNC(Gwangyang) Kawasaki Plant System Fe-Ni Plant (SCR System w/Ammonia)	Rotary Kiln	2008	7,311 x2
Hyundai Oil Bank Co., Ltd. Daesan Refinery Plant Power Station Unit No. 1 & 2 (SCR System w/Ammonia)	Oil fired Boiler 120T/h	2008	3,380 x2
SH Corporation Western office Boiler Unit No. 8 (SCR System w/Ammonia)	150TPH LNG Boiler	2009	3,748
LG Chemical Corp. Onsan Refinery plant Unit No. 1 (SNCR System w/Urea)	Oil Fired Boiler 150T/h	2009	4,200

De-NOx References(V)

Customer & Location	Application	Start-up Date	Gas Vol.(Am ³ /min)
Korea Midland Power Corp. Cheju Thermal Power Plant Unit No.2~3 (SCR System w/Ammonia)	75 MW x 2Units B-C Oil Fired Boiler	2009	3,938 x 2
Doosan Heavy Industries & Construction Co., Ltd. Tailand Gheco Thermal Power Plant Unit No.1 (SCR Reactor & Ammonia Injection System)	700 MW x 1Unit Coal Fired Boiler	2010	61,605
Korea Middle East Power Corp. Bukjeju Thermal Power Plant Unit No. 2~3 (SCR System w/Ammonia)	75 MW x 2Units B-C Oil Fired Boiler	2010	7,881 x 2
POSCO / Gwangyang Steel Mill Sinter Plant #5 (Flue Gas Cleaning System) (SCR System w/Ammonia)	Sinter plant De-NOx, De-SOx, De-Dioxin	2010	44,322

De-NOx References(VI)

Customer & Location	Application	Start-up Date	Gas Vol.(Am ³ /min)
Mitsubishi Heavy Industries Ltd. Guacolda Power Station in Chile Unit No. 4 (Ammonia Supply System)	150 MW Coal & Petcoke Fired Boiler	2010	15,534
Hyundai Green Power Co., Ltd. Hyundai Steel Mill Thermal Power Plant Unit No. 1~4 (SCR System w/Ammonia)	100 MW x 4Units BFG,COG,LDGI Fired Boiler	2010	21,143 x 4
Korea South East Power Corp. Samchunpo Thermal Power Plant Unit No. 1~2 (SCR System w/Ammonia)	500 MW x 2Units Coal Fired Boiler	2011	94,710 x 2
Ansung Glass Industrial Co., Ltd. Furnace Unit No. 1 (SCR System w/Ammonia)	Glass Furnace	2011	611



POSCO, Kwangyang works sinter M/C 1-4 units





POSCO, Kwangyang works sinter M/C 1-4 units



- **Fuel : Sintering**
- **Capacity : 3Mil.ton/Y x 4Units**
- **Start-Up date : 2007**
- **Efficiency : 85%**
- **Flow rate : 2,042,400 Am³/hr**
- **Temp. : 250 °C**



Taegu Dyeing Industry Complex Corp



- **Fuel : Coal**
- **Capacity : 50 MW**
- **Start-Up date : 2004**
- **Efficiency : 78%**
- **Flow rate : 320,000 Am³/hr**
- **Temp. : 380 °C**

Youngnam Thermal Power Plant



- **Fuel : B-C Oil & Orimulsion**
- **Capacity : 200MW**
- **Start-Up date : 2002**
- **Efficiency : 50%**
- **Flow rate : 1,138,680 Am³/hr**
- **Temp. : 380 °C**



Samsung Fine Chemical Co., Ltd.



- **Fuel : B-C Oil(4%,S) & Orimulsion**
- **Capacity : 50MW**
- **Start-Up date : 2005**
- **Efficiency : 57%**
- **Flow rate : 328,440 Am³/hr**
- **Temp. : 380 °C**

KUNPO MSW Incineration Plant



- **Fuel : MSW**
- **Capacity : 200TPD**
- **Start-Up date : 2000**
- **Efficiency : 75%**
- **Flow rate : 94,080 Am³/hr**
- **Temp. : 260 °C**

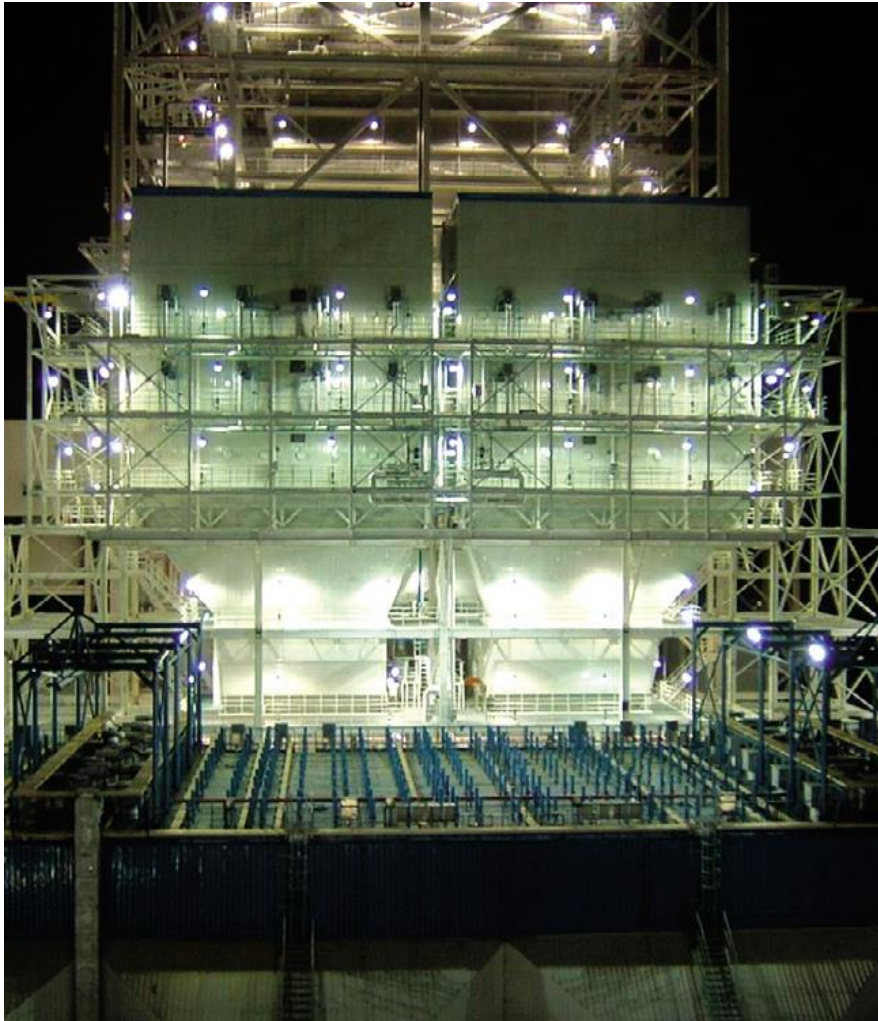
SUNCHANG MDF Plant



- **Fuel : Wooden Fired Boiler**
- **Capacity : 40TPH**
- **Start-Up date : 2005**
- **Efficiency : 85%**
- **Flow rate : 107,330 Am³/hr**
- **Temp. : 250 °C**



Taishan Thermal Power Station #5(China)



- **Fuel : Coal Fired Boiler**
- **Capacity : 600MW**
- **Start-Up date : 2006**
- **Efficiency : 80% ~94%**
- **Flow rate : 4,500,000 Am³/hr**
- **Temp. : 365 °C**



Tangjin Thermal Power Station #1~4



- **Fuel : Coal Fired Boiler**
- **Capacity : 500MW x 4**
- **Start-Up date : 2006**
- **Efficiency : 82%**
- **Flow rate : 2,409,600 Am³/hr**
- **Temp. : 350 °C**



Hyundai Green Power Steel Mill Power Station#1~4 Boilers(BFG,COG,LDG Firing)



- **Fuel : BFG,COG,LDG**
- **Capacity : 100MW x 4**
- **Start-Up date : 2010**
- **Efficiency : 83.3%**
- **Flow rate : 1,268,580 Am³/hr**
- **Temp. : 345 °C**

THANK YOU
For your attention.

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