

AN ISO 9001 COMPANY

FLUE GAS DESULPHURISATION
ADVANCED SCRUBBER TECHNOLOGIES



PARAMOUNT
The Environment People!

ABOUT PARAMOUNT

Paramount Pollution Control Limited is a multi-disciplinary engineering & consultancy organisation engaged in turnkey projects in the field of Environmental Engineering & supply of pollution control Equipments & systems.

Paramount's team comprise of specialists & highly experienced engineers comprising of chemical, environmental, civil, mechanical, electrical, instrumentation & scientists at our R&D centre.

The name Paramount today stands for a '*Total Environment Management Company*'.

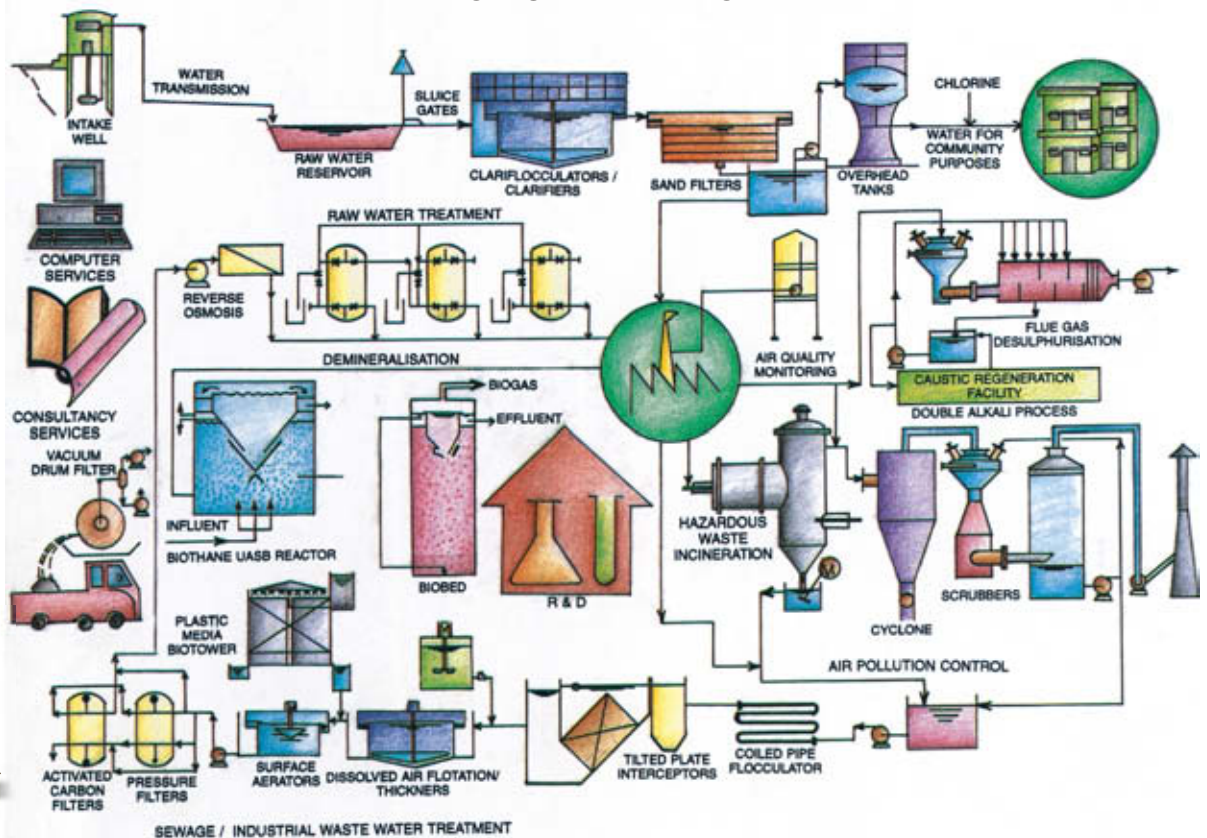
Paramount has two proven sources of accomplishments. One, the people, qualified resource that represent varied engineering faculties. Two, the R&D, the most advanced by any standard. This has enabled Paramount to handle turnkey assignments of any magnitude both in private as well as public sector. Through a continued emphasis on Research and Development, the company has made significant pioneering contributions in developing indigenous process know-how and in some cases

these are first of the kind in the country. The areas of specialization include design and execution of plants & manufacturing of equipment/systems for treatment of water and wastewater, solid waste and control of air pollution.

For **Air Pollution Control Systems, Flue Gas Desulphurisation (FGD) & Hazardous Waste Incineration Systems** the company has the backup of a technical collaboration with **ANDERSEN 2000 INC. USA** who are internationally reputed leaders in Advance Emission Control Technology. A wide range of equipment choice is available to enable custom design of systems to meet individual needs in this area.

Paramount's contribution to Environmental Engineering has been significant for over 20 years now. Our R&D Centre has launched extensive research programmes for developing new processes on Water/Wastewater Treatment and Air Pollution Control. Paramount's R&D Centre (by far one of the largest in private sector) is equipped with most modern and versatile instruments and automatic analysers backed by a committed team of scientists.

SPECIALITY AREAS



EQUIPMENTS, SYSTEMS - APPLICATIONS

AIR POLLUTION CONTROL

| | | |
|---|--|---|
| Sulphur Dioxide Control And Double Alkali Process <i>Wet & Dry Processes, Absorption and Regeneration Systems</i> | Power Plants Utility Boilers Diesel Generators Oil Fired Industrial Boilers Oil fired Incinerators Acid Gas Incinerators Chemical Plants | Sulphuric Acid Plants Cogeneration Plants Zinc /Lead/Copper Smelters Molybdenum Ore Roasters Barium Sulphate Reduction Kilns Strontium Sulphate Reduction Kilns CO ₂ Recovery Plants |
| Fine Particulate Matter <i>Fixed & variable throat Venturi Scrubbers</i> | Lime Kilns Bark and Hog Fuelled Boilers Coal Fired Boilers Oil Fired Boilers Cupolas Calciners and Kilns Paper Plant Recovery Boiler Electric Furnace Emissions Coal Dryers | Scrap Incinerators Liquid Waste Incinerators Sewage Sludge Incinerators Coke Ovens Fertilizer Plants Municipal Incinerators Sintering Plants Cement Kilns Pathogenic Incinerators |
| Gaseous Emissions <i>Packed Bed Scrubbers</i> | HCl Emissions HF Emissions SO ₂ Emissions H ₂ S Emissions Laboratory Hoods | Pickling Operations HCN Emissions Chlorine Gas Emissions Bromine Emissions CO ₂ Scrubbing |
| Sticky and Oily Particulates, Aerosols, Mists <i>HEAF™ Dry Filtration Equipment</i> | Asphalt Roofing Manufacture Asphalt Pipe Coating Plasticizer Emissions Meat and Fish Smokehouses Fiber Glass Curing Ovens Core Bake Ovens, Polymeric Coating and Curing Ovens Vegetable Oil Expellers and Extractors Floor Tile Manufacturing Scrap Metal Preheaters and Dryers Tube and Wire Drawing Emissions Plywood Veneer Dryers Restaurant Broilers Latex Dryers Wire Coating and Curing Electrode Manufacturing Emissions Rubber Vulcanizing and Compounding Pouring Foundries | Phenolic Resin Emissions Sulphur Emissions Organic Chemical Reactor Discharges Nylon Extrusion Emissions Heat Treating Smoke Commercial Food Frying Operations Adhesive Curing Ovens for Tape Aluminium Foil Rolling Coffee/Cocoa Bean Roasting Emissions Peanut Roasting Emissions Hardboard Tempering Ovens Electroplating Aerosols Mobile Asphalt Kettles and Tankers Automobile Shredders Drop Forge and Forge Press Emissions Coal Gasification & Conversion Mineral Wool Curing Ovens |
| Submicron Particulate Matter <i>CHEAF™ Wet Filtration Equipment</i> | Sulphuric Acid Mists Phosphoric Acid Mists Hydrochloric Acid Mists Nitric Acid Mists Detergent Manufacturing Food and Flavouring Spray Dryers Ammonium Nitrate Prilling & Pelletizing Compressed Air Filtration Urea Prilling and Pelletizing | Soda Ash Calciners Soda and Borosilicate Glass Furnaces Vacuum Pump Discharges Galvanizing Emissions Potassium Chloride Dryers Molten Salt Baths Electroplating Bath Emissions Phosphorus Furnace Emissions Process Gas Filtration |
| Dust and Large Particulate Matter <i>Low Energy Scrubbers</i> | Rock Crushers Conveyor Transfer Points Bucket Elevators Granulators | Grinding and Polishing Emissions Sand Shakeouts Asphalt Batch Plants Grain Milling |
| Odour Control <i>Absorption, Adsorption, and Chemical Treatment Systems</i> | Rendering Plants Organic Chemical Production Phenolic Emissions Sewage Treatment Plants Sludge Dryers Hydrocarbon Emissions Reduced Sulphur Compounds Poultry and Egg Production | Foundry Odours Breweries Wet Grain Milling and Drying Polymerizers Animal Feed Plants Paint and Varnish Manufacturing Leather Tanning |

SULPHUR DIOXIDE REMOVAL

Paramount offers world famous and proven patented Sulphur dioxide scrubbing system with 95-99%+ sulphur dioxide removal. Unique feature worth mentioning is, the system works equally well on low and high inlet sulphur dioxide concentrations. Even with large variations in the inlet sulphur dioxide concentrations to the scrubbing system, the system produces an almost constant outlet sulphur dioxide concentrations. This characteristic of our scrubbing system is due to its operation in the **“Concentrated absorption chemical mode”**. This system differs substantially from the other sulphur-dioxide removal processes.

The acting chemical in the scrubbing system is sodium sulfite. The concentration of dissolved solids in this system is maintained at a much higher level than other conventional system enabling the system to have low recirculated liquid flow rate to the scrubbing system and more sulphur dioxide capturing capacity per unit volume of scrubbing liquid. This characterizes in the reduction of recirculation system.

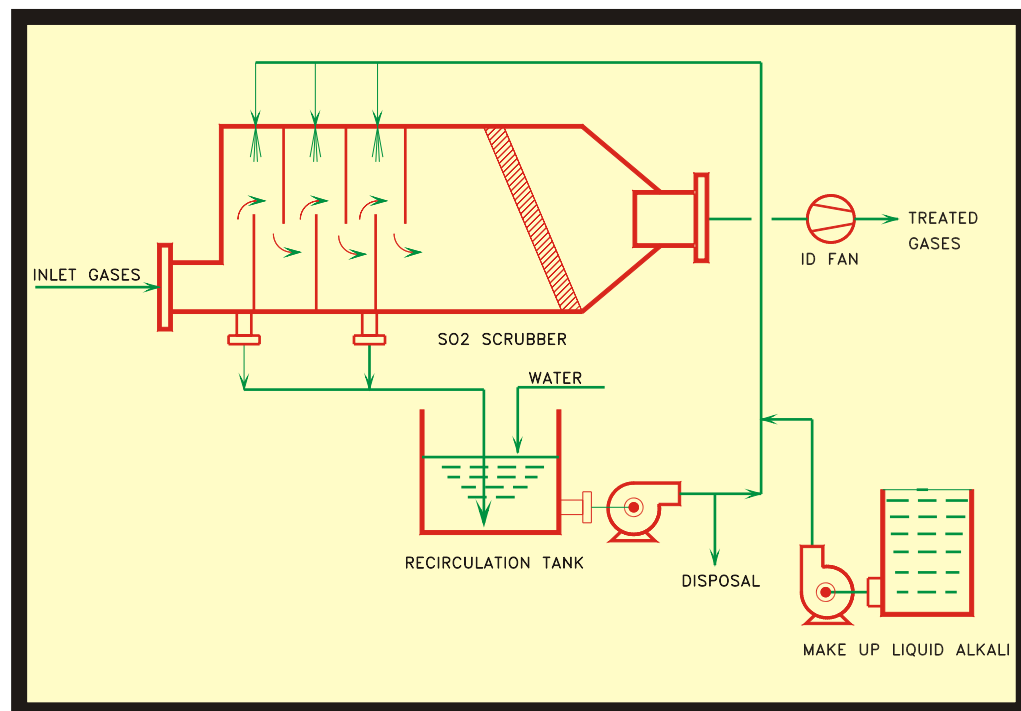
The scrubbing system uses **“patented, non-plugging, low differential pressure Horizontal spray-baffle type scrubber.”**



Packaged SO₂ Scrubber for heavy oil fired boiler

“Though both horizontal and vertical versions are available, we recommend the horizontal unit which provides the greatest ease of operation and maintenance. This system can be combined with Venturi Scrubber if the gas stream has significant particulate matter.

HORIZONTAL SPRAY BAFFLE SO₂ SCRUBBER



SULPHUR DIOXIDE REMOVAL

Another **unique feature** of our scrubbing system is, it always operates in an **acidic mode**. When NaOH is added to the system as a make up reagent, it converts to sodium bisulphite back to sodium sulphite, rather than existing in the scrubbing solution as free sodium hydroxide. The same is true in case soda ash is used in place of NaOH.

Another common problem in conventional scrubbers is calcium scaling in the scrubber. The scaling magnitude is predominant in alkaline mode of operation as calcium precipitate as calcium carbonate and calcium sulfate causing severe scale formation in the scrubber. This scrubbing system operates on acidic mode of operation and even dramatic variations in sulphur dioxide concentration cannot take back the system to alkaline mode of operation thus calcium precipitation is practically avoided in this design of scrubbing system.

ADVANTAGES OF HORIZONTAL SPRAY BAFFLE SCRUBBER :

1. *Proven & patented design of Andersen 2000 Inc. U.S.A*
2. *Comprise of maximum number of SO₂ scrubbers world wide based on this technology with over 500 installations*
3. *Horizontal configuration ensures ease of operation & maintenance due to reduced heights*
4. *Gas comes in contact with fresh scrubbing liquid at every stage (unlike other counter-current scrubber) which increase*
7. *Ability to handle high surges of SO₂ concentration with less effect on outlet SO₂ levels due to operation in concentrated mode*
8. *Can be designed to achieve even 1 ppm SO₂ at outlet for*

SO₂ Scrubbers for Steam generators burning high sulphur fuel



View of Quench for SO₂ Scrubbers

APPLICATIONS

- Utility Boiler
- Diesel Generators
- Oil Fired Boiler/Furnaces
- Coal Fired Boilers
- Power Plants
- Copper/Zinc/Lead Smelters
- Cogeneration Plants
- Acid Gas Incinerators
- Oil Fired Incinerators
- Sulfuric Acid Plants
- Sulphide Ore Smelter
- Molybdenum Ore Roaster
- Barium Sulphate Reduction
- CO₂ Recovery Plants

DOUBLE ALKALI PROCESS

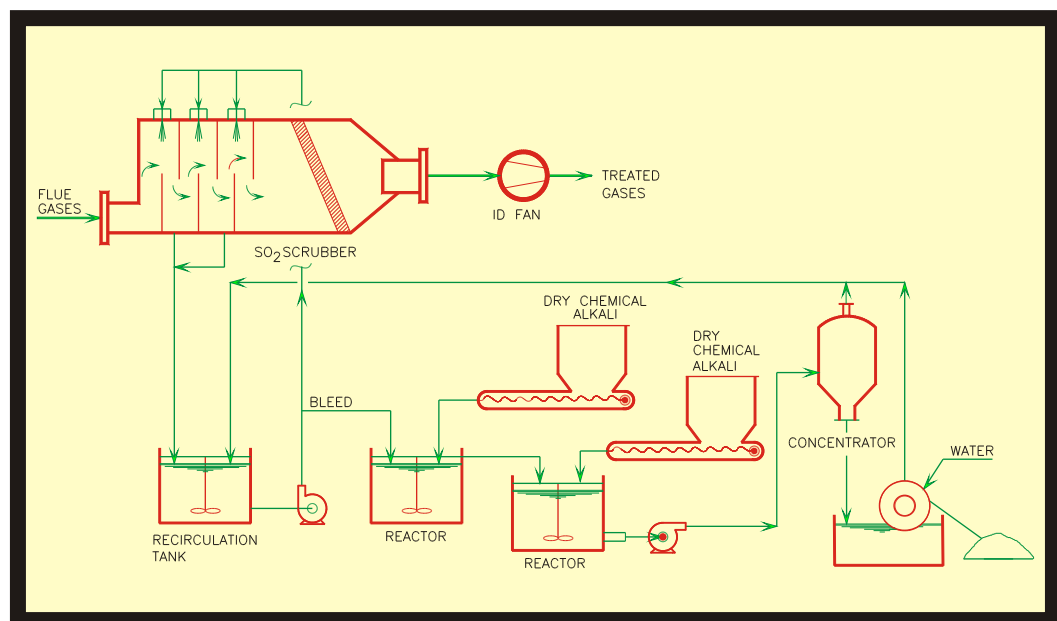
During scrubbing reaction, SO_2 reacts with sodium sulphite to form bisulphite, which then do not take further part in chemical reaction. Hence it needs regeneration or disposal.

In the Patented Double Alkali Process, Bleed stream (characteristics & quantity depend on flue gas characteristics, total SO_2 load, outlet SO_2 emissions, etc.) from scrubber recirculation tank containing sodium sulfite, sodium bisulfite and sodium sulphate is reacted with lime under very specific operating conditions like pH, conductivity, mixing, reaction time etc. most

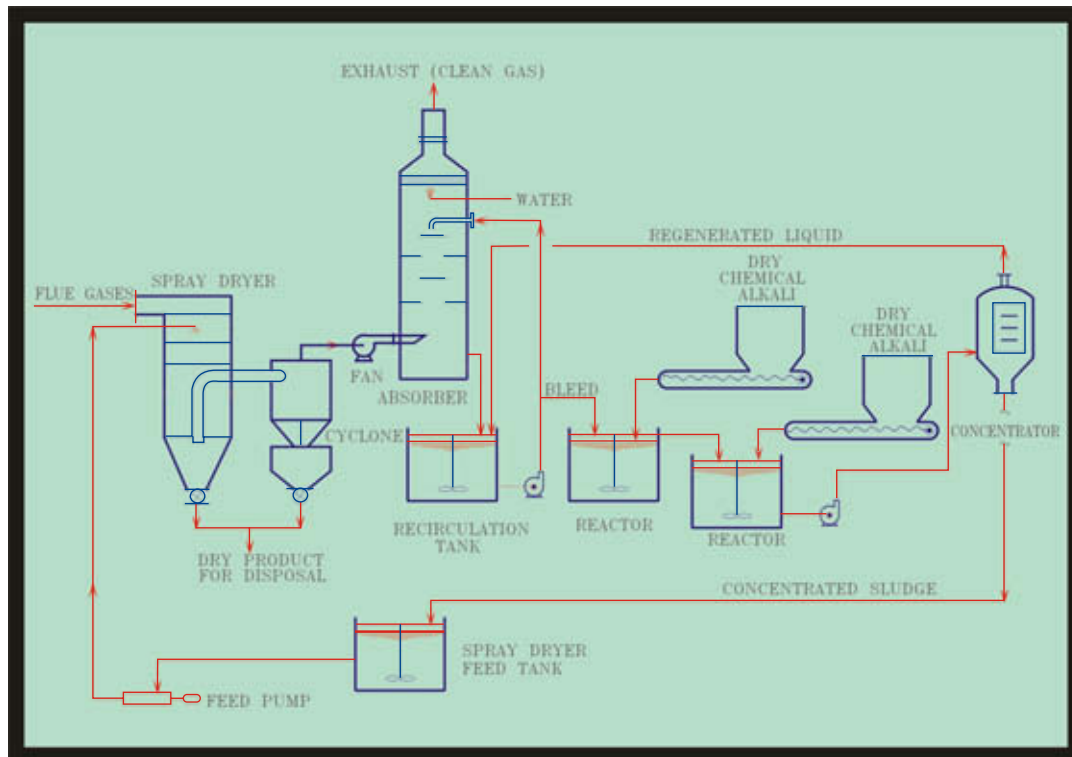
conductive for regeneration of caustic. The sodium bisulfite is thus regenerated chemically.

The calcium sulfite, calcium sulphate produced in the reaction are precipitated and withdrawn from the system. The bisulfite is converted back to sulfite. The regenerated liquid is then taken back to the scrubbing system. The regenerated sodium salts mostly offsets the need for new sodium salts. Gypsum can be produced as an option. The payback period for this system is generally less than a year.

DOUBLE ALKALI PROCESS FOR SULPHUR DIOXIDE REMOVAL



DOUBLE ALKALI PROCESS



SPRAY DRY - DOUBLE ALKALI PROCESS FOR SULPHUR DIOXIDE REMOVAL

UNIQUE FEATURES

Most proven & widely used process for sulfur dioxide systems.

Extremely low caustic consumption, almost 10% of stoichiometry or less.

No choking problems in scrubber as clean liquid is used for scrubbing.

No liquid waste (bleed) is generated

Eliminates complex liquid treatment facilities

Solids produced are safe for land fill. Gypsum can be produced as a by-product

Saves considerably on operating cost as it is viable for SO₂ loads beyond 1 T/Day.

Very low payback period

Reduces water consumption drastically.



FGD with Double Alkali Process at a Copper Smelter



| UTILITIES & CHEMICALS | | | |
|-------------------------------|---|--|---|
| Parameter | Lime/Limestone Scrubbing | Caustic Scrubbing | Double Alkali Process |
| Chemical used | Lime / Limestone | NaOH | NaOH/Na ₂ CO ₃ & Lime (CaO) |
| Expected Chemical consumption | 1.3 kg/kg of SO ₂ removed for lime /1.8 kg/kg of SO ₂ removed for limestone | NaOH : 1.2 kg/kg of SO ₂ removed | NaOH : 0.09-0.12 kg/kg SO ₂ removed. CaO : 0.9-1.1 kg/kg of SO ₂ removed |
| Water consumption | High due to excesslime carry over in sludge which is lost in cake | High as water is lost in bleed | Low as no carry over of lime in sludge and treated bleed is recycled |
| Optimum use of chemicals | Higher than stoichiometric as bleed contains unreacted lime. | Higher than stoichiometric as bleed contains unreacted caustic | Most Optimum as system operates in acidic or at neutral pH |
| Power consumption | High due to high recirculation rates and high pressure drop | Low due to low recirculation rates & low pressure drop | Low due to low recirculation rates & low pressure drop |

| OPERATING PARAMETERS | | | |
|--|--|--|--|
| Parameter | Lime/Limestone Scrubbing | Caustic Scrubbing | Double Alkali Process |
| Achievable Efficiency of SO ₂ removal | 85-90 % | 95-99% + | 95-99% + |
| System availability | 80-87% | 95-98% | 95-98% |
| Operating pH | 8.5-10.5 | 8.5-10.5 | 6.9-7.0 |
| Quantity of recirculating liquid (L/G Ratio) | 10 to 14 m ³ /1000 m ³ of gas for 85-90 % removal efficiency | 2.6-3.0 & 4.5-6.0 m ³ /1000 m ³ of gas for 95 & 99+ % removal efficiency | 2.6-3.0 & 4.5-6.0 m ³ /1000 m ³ of gas for 95 & 99+ % removal efficiency |
| Pressure drop | High | Low | Low |

OPERATION & MAINTENANCE

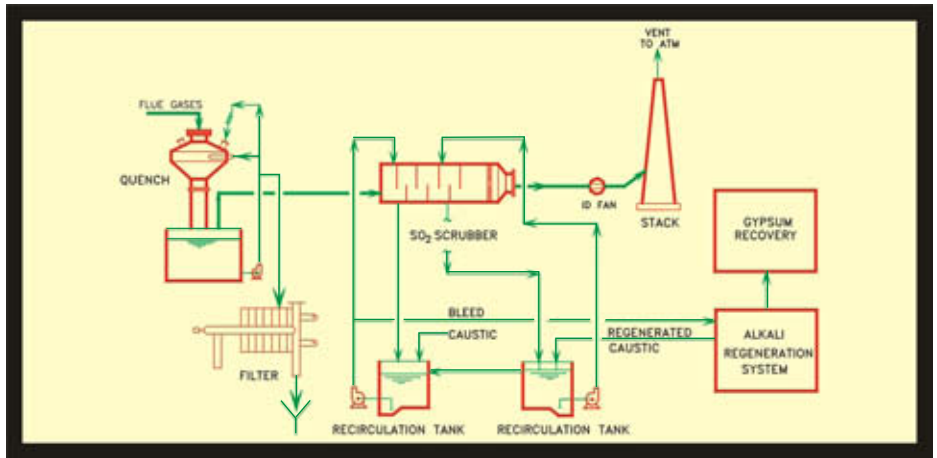
| Parameter | Lime/Limestone Scrubbing | Caustic Scrubbing | Double Alkali Process |
|---|---|-------------------|---|
| Consistency in maintaining outlet emission levels | Low | Very high | Very high |
| Capacity to handle surges of high SO ₂ load at inlet without major effect on outlet SO ₂ emission | Low due to low reactivity of lime/ limestone. | High | High. (due to operation of scrubbing system in concentrated mode resulting in high buffer capacity of scrubbing liquid) |
| Scaling in scrubber | Extremely high | Low | Practically Nil as it operates in acidic mode |
| Requirement of Spares for maintenance | High due to erosion & plugging | Low | Low |
| Size of scrubber | High | Low | Low due to higher mass transfer coefficient |

END PRODUCTS

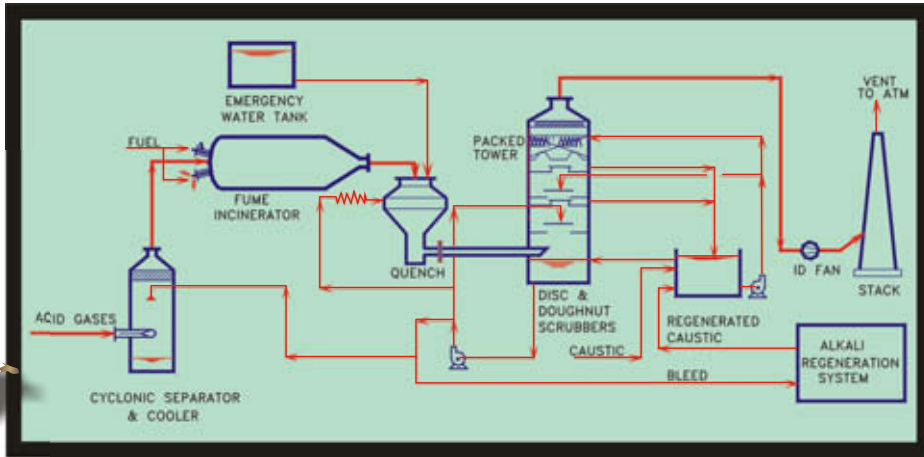
| Parameter | Lime/Limestone Scrubbing | Caustic Scrubbing | Double Alkali Process |
|--------------------|--|---|---|
| Quantity of solids | Very high due to excess lime carry over in sludge | Not applicable as bleed needs elaborate special treatment before it is disposed | Low as no excess carry over of lime |
| Quality of solids | Poor due to presence of excess lime carry over in bleed liquor | Not applicable | Good as no carry over of lime in bleed liquor |

TYPICAL FGD APPLICATIONS

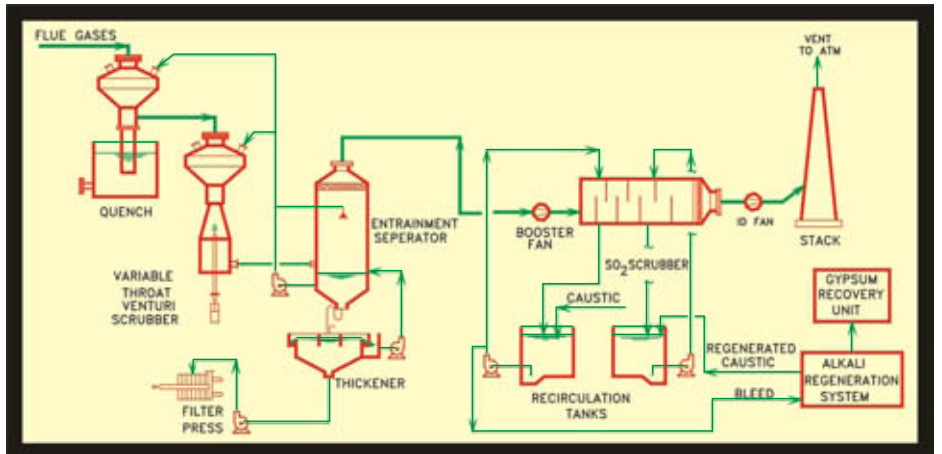
POWER PLANT BASED ON HEAVY FUEL / RESIDUE



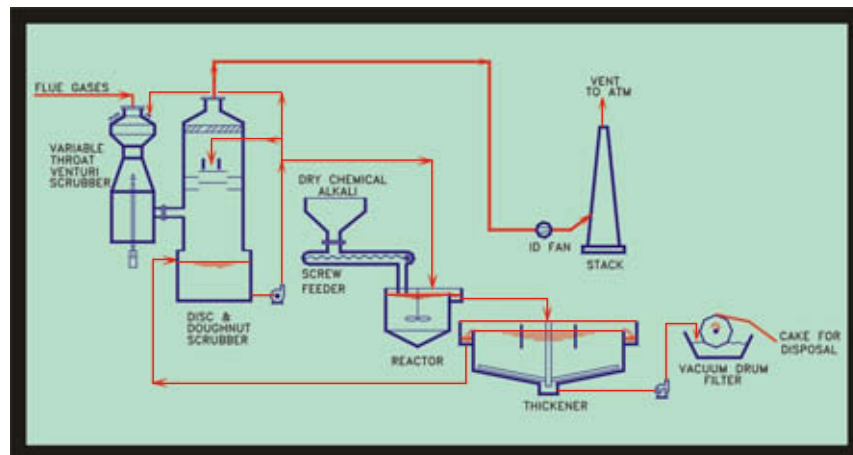
ACID GAS INCINERATOR



COPPER SMELTER



HEAVY OIL FIRED FURNACE



TYPICAL FGD-APPLICATIONS



FGD with Double Alkali Process at a Copper Smelter



FGD with Double Alkali Process at a 100 MW Power Plant



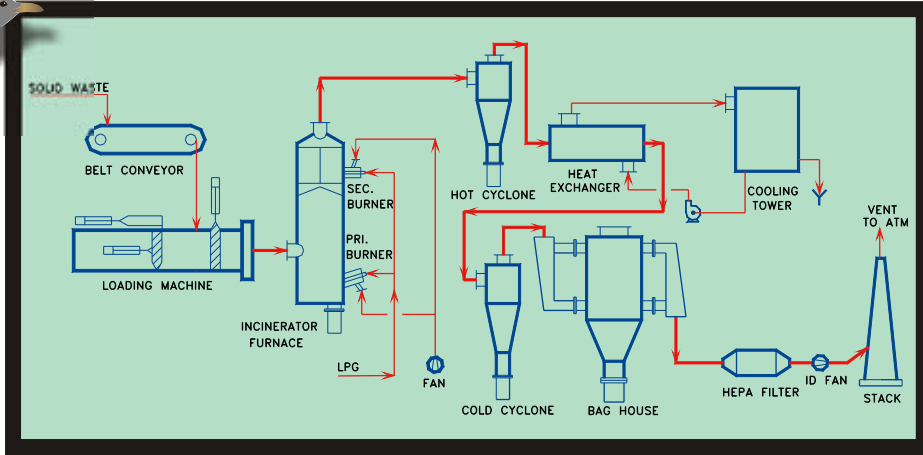
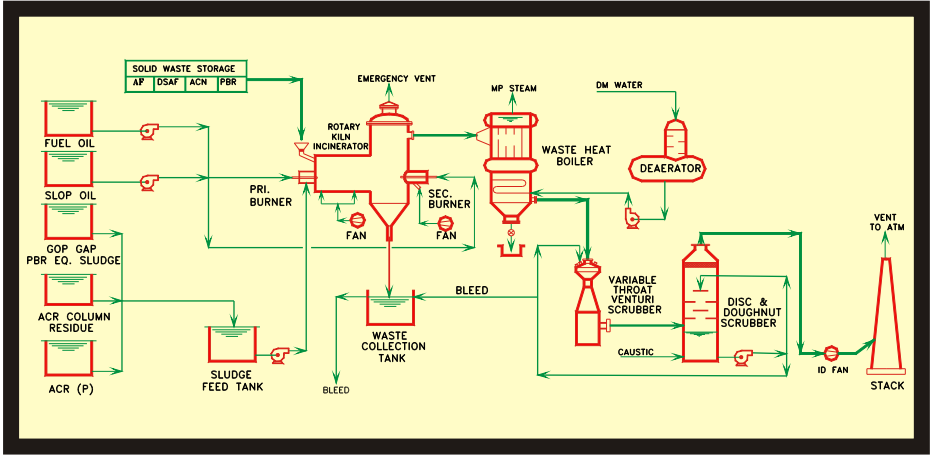
View of a large FGD unit with FRP Scrubber

SO₂ Scrubbers for utility boilers burning high sulphur fuel



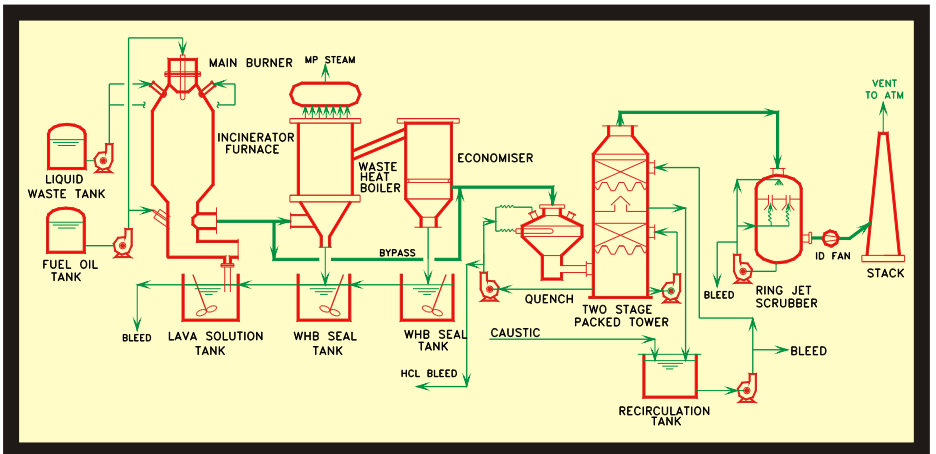
AIR POLLUTION CONTROL APPLICATIONS

SOLID/SEMI-SOLID/SLUDGES/
LIQUID WASTE INCINERATOR
FOR AN INTEGRATED
PETROCHEMICAL COMPLEX

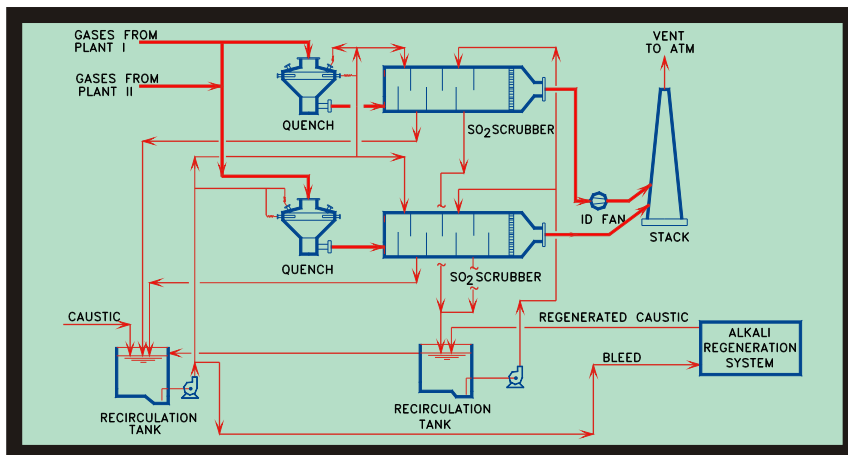


ACTIVE SOLID WASTE
INCINERATOR FOR NUCLEAR
POWER PLANT

COMPLEX LIQUID WASTE
INCINERATOR FOR TINOPAL
PLANT



FGD WITH DOUBLE ALKALI
PROCESS FOR SULPHURIC
ACID PLANT



AIR POLLUTION CONTROL APPLICATIONS



Rotary Kiln Incinerator plant with Particulate/ SO_2 /HCl Scrubbers



Incinerator Scrubber with Venturi and Packed Tower



SO_2 Scrubbers for Sulphuric Acid Plants



Acid Gas Incinerator with Double Alkali Process



FGD for a heavy Oil Fired Steam Generator

HIGH EFFICIENCY AIR FILTER, HEAF™

*For Sticky and Oily Particulates,
Aerosols and Mists*

High Efficiency Air Filtration devices, manufactured under trademark of HEAF™, include four different types.

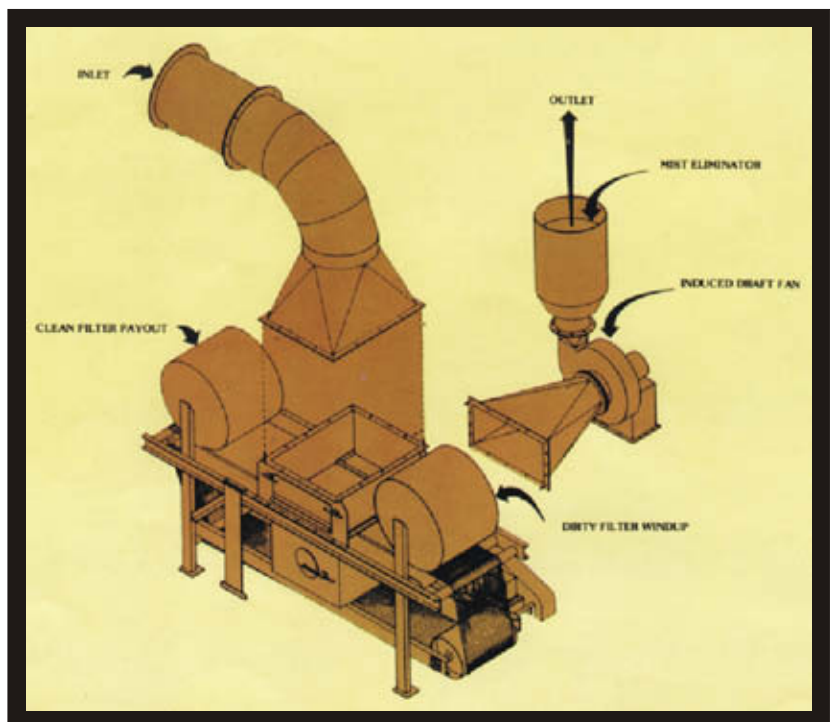
These units are the Mini- HEAF™, the stationary Drum HEAF™, the Flat-Bed HEAF™, and the Rotary Drum HEAF™. The Mini-HEAF™, is used for small air pollution sources, and uses a manually changed cartridge filter for the capture of air pollutants. The stationary drum HEAF™ is used only for pressurized gas stream where fully automatic operation is required.

The Flat-Bed HEAF™ uses roll type filters for moderate gas flows, and is fully automatic in operation. The Rotary Drum HEAF™ unit is a fully automatic filter used for individual emission control applications upto 2,00,000m³/hr in a single unit.

HEAF™ units are used to control emissions from sources where fabric filters cannot be used, because they plug up with sticky or viscous particulate materials, where wet scrubbers require excessive energy consumption because of extremely



Rotary Drum HEAF™ Unit for Plasticizer operation



Flat bed HEAF™

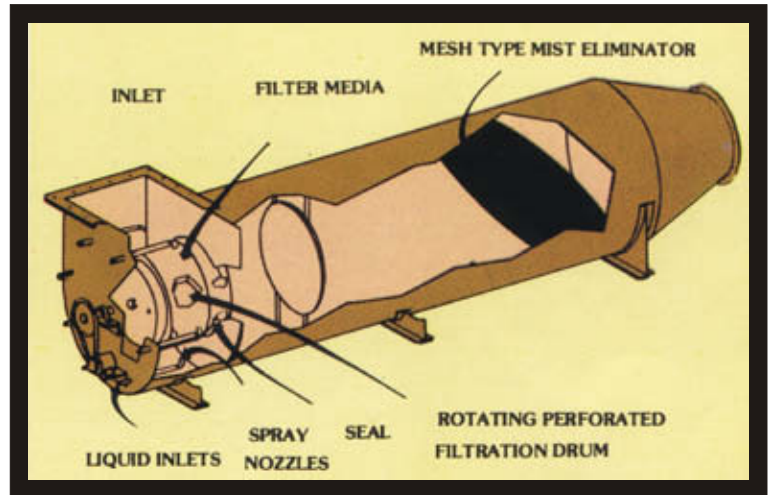
CLEANABLE HIGH EFFICIENCY

AIR FILTER. CHEAF™

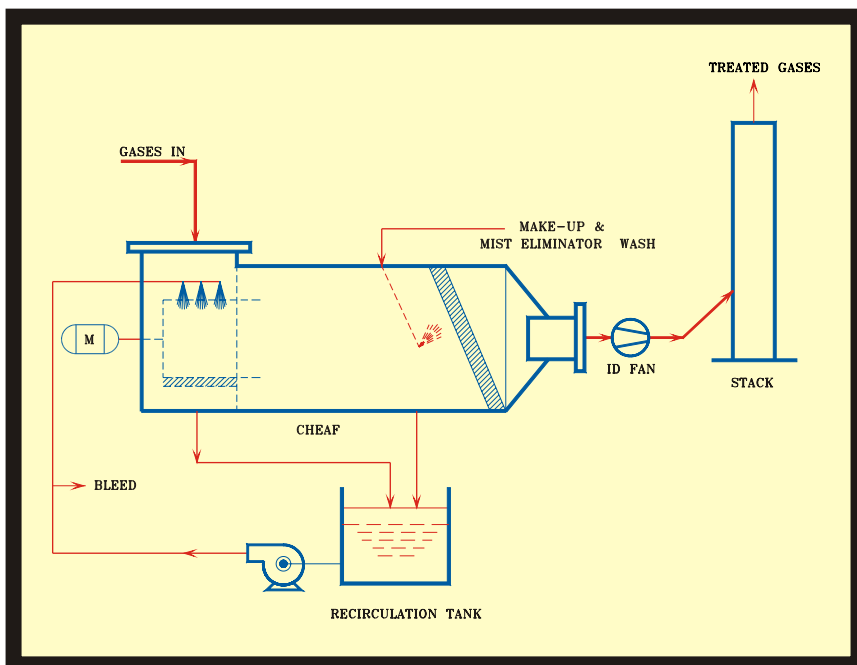
For Submicron Particulate Matter

The cleanable High Efficiency Air Filtration device, manufactured under the trade mark of CHEAF™ is a wet collector system which uses either a polymeric, metallic or glass fibre filtration mat to remove submicron particulate matter from exhaust gas streams. For many applications, the CHEAF™ unit offers substantially reduced energy consumption over that required for a venturi scrubber on the same application. The CHEAF™ can be used on most particulate matter which is not sticky or viscous and which does not deposit scale on the filter mat.

The two different types of CHEAF™ are the fully cleanable type and the renewable media type. Fully cleanable CHEAF™ units can be used on dust emissions in the mineral and mining industries, on inorganic chemicals, dryers and calciners, and on prill tower emissions, and in manufacture of ammonium nitrate and urea. They can also be used for spray dryer emissions in the food products and flavoring industries and the perfume manufacturing industries.



CHEAF™ Unit for Urea Prill Tower emission



Typical configuration of a cleanable CHEAF™ and a flow sheet for use of CHEAF™ for emission control system for Urea Plant Prill Tower are shown.

CHEAF™ units can be built of virtually any engineering material which include stainless steel, plastic, FRP, rubber lined steel and mild steel.

Single units can be built to handle gas flows upto 6,80,000 m³/hr.



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