Gas Monitoring in the Power Generation Industry

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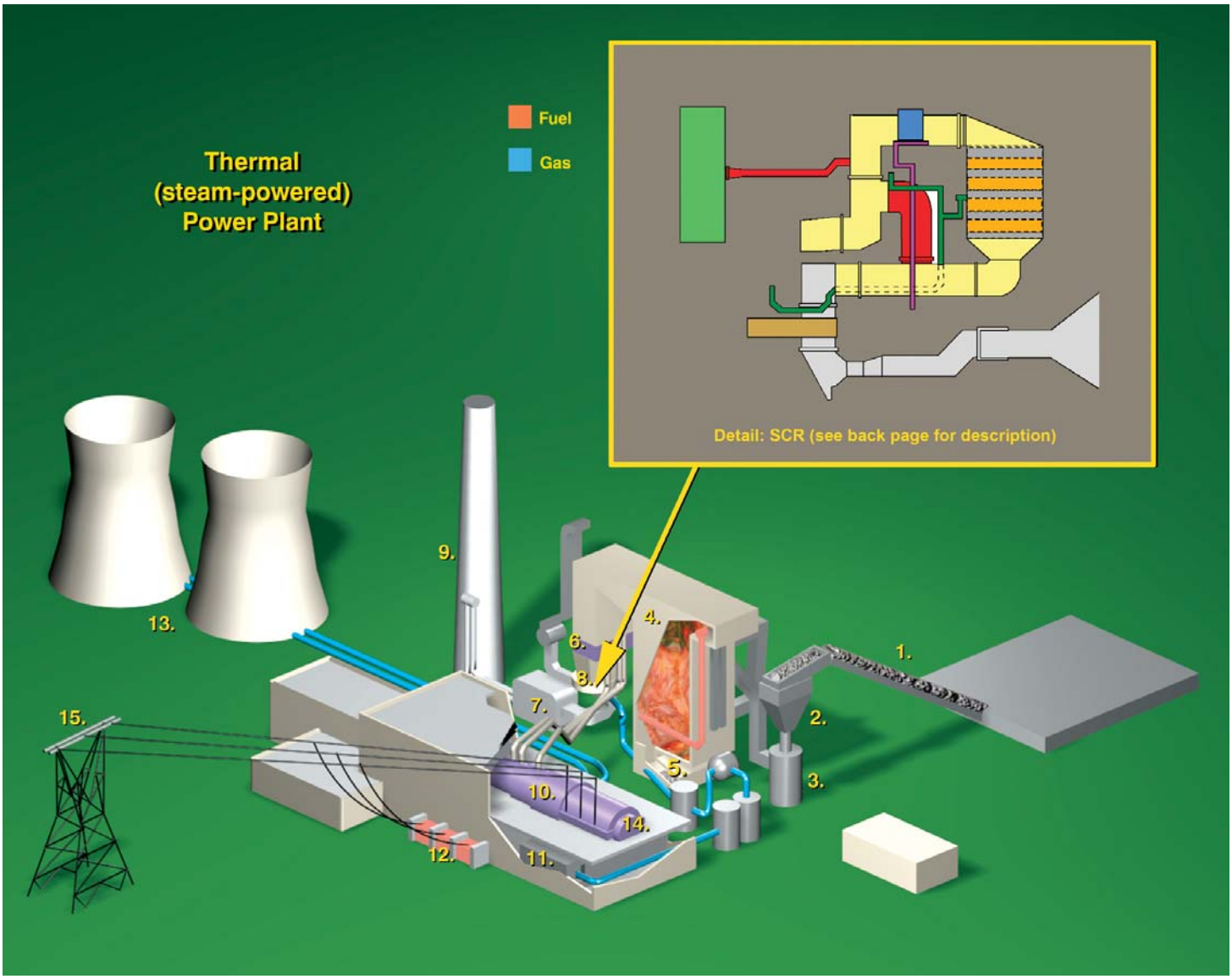
There are several areas in power generation plants where gas detection instrumentation should be used. These range from fuel (coal or natural gas) delivery and purification to stack emissions, from toxic gas and oxygen sensors to combustible gas monitors. Reasons for monitoring include EPA regulation compliance, worker safety and property protection from explosive hazards.

Monitoring needs at coal-fired plants, natural gas-fueled plants and gas turbine power plants, including newer cogeneration, or combined heat and power (CHP) facilities, are basically similar.



1 Coal storage and transportation areas (underground bunkers, tunnels, silos, conveyor belts)
2 Stoker
3 Coal Pulverizers
4 Boiler
5 Coal Ash
6 Air Preheater
7 Electrostatic Precipitator
8 Selective Catalytic Reduction (SCR) System
9 Smokestack
10 Turbine
11 Condensers/Water Treatment (penstocks, pipe lines, tanks, cooling towers, evaporators)
12 Transformers
13 Cooling Towers
14 Generator
15 High-Voltage Power Lines

Coal-Fired Power Plant

No.	Location	Description	Type of Monitoring	Hazard	Instrument(s)
1	Coal storage and transportation areas (underground bunkers, tunnels, silos, conveyor belts)		Low-level carbon monoxide (CO) monitoring	Coal dust is highly flammable. Low ppm CO is the first indicator of combustion.	Ultima® X Gas Monitor
2	Stoker	Elevated grate on which coal is burned			
3	Coal pulverizers	Crush coal into fine dust	Oxygen (O_2) monitoring in inerted pulverizers	Low-level oxygen indicates insufficient inerting	Ultima X Gas Monitor
			Combustible gas, oxygen, carbon monoxide and hydrogen sulfide (H_2S) monitoring	Flammable chemicals are used for maintenance work	Ultima X Gas Monitor; Toxgard® II Monitor
4	Boiler	Closed vessel in which water is heated and converted into steam	Combustible gas, oxygen, carbon monoxide and hydrogen sulfide (H_2S) monitoring in walkways and chambers	Flammable chemicals are used for maintenance work	Ultima X Gas Monitor; Toxgard II Monitor
5	Coal ash	Collects in hoppers below furnace			
6	Air preheater				
7	Electrostatic precipitator	Filters waste gases			
8	Selective catalytic reduction (SCR) System	(see overleaf)	Low ppm ammonia (NH_3) monitoring for worker safety and emission control	Ammonia gas is hazardous to workers	Ultima X Gas Monitor Chemgard® Gas Monitor
9	Smokestack	Releases filtered waste gases			
10	Turbine	Receives pressurized steam and uses it to create mechanical energy	Hydrogen (H_2) leak detection monitoring in turbine compartment (a confined space)	Explosive hazard	Ultima X combustible; if low-ppm H_2 monitoring use Ultima X electrochemical
11	Condensers/water treatment (penstocks, pipe lines, tanks, cooling towers, evaporators)	Cools turbine steam and condenses it into water; discharged to cooling towers	Chlorine (Cl_2) and ammonia (NH_3) low-level leak detection monitoring	Chlorine and ammonia gases are hazardous to workers	Ultima X Gas Monitor Toxgard II Monitor Chemgard Gas Monitor
12	Transformers	Steps up voltage			
13	Cooling towers	Emit water vapor clouds to condensers to cool hot air			
14	Generator	Converts mechanical energy into electrical energy			
15	High-voltage power lines	Transports electricity to transmission stations			
Additional Monitoring at Natural Gas-Fueled, Gas Turbine, Cogeneration and Other Power Plants					
	Along natural gas storage and transport path , (pipelines, metering room, battery room)		Natural gas leak detection monitoring	Explosive hazard	Ultima XIR; Ultima X combustible
	Battery storage areas		Hydrogen monitoring	Explosive hazard	ppm Ultima X Monitor
	Hydrolysis plants		Hydrogen leak detection monitoring	Explosive hazard	ppm Ultima X Monitor

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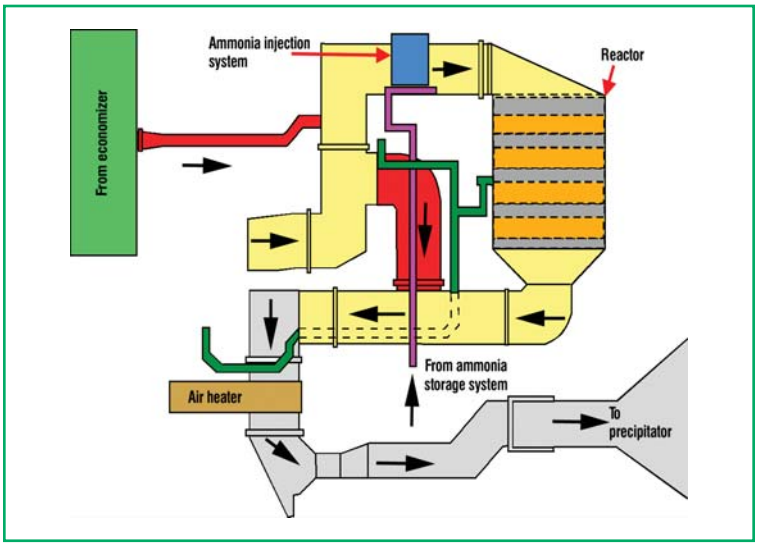

Sample SCR System

The Selective Catalytic Reduction (SCR) Process

Selective Catalytic Reduction is a process used to reduce nitrogen oxides in combustion gases, to comply with air pollution control standards for emissions reduction in coal-fired, oil-burning, and municipal waste incineration-fueled power generation plants, as well as in gas turbine power plants.

Large quantities of nitrogen oxides (NOx)—notably nitrogen monoxide (NO) and nitrogen dioxide (NO_2)—are byproducts of combustion. Nitrogen oxides contribute to acid rain and cause the formation of photochemical oxides, such as ozone. The SCR process reduces nitrogen oxides in flue gases to pure nitrogen and water, using a catalyst and a reducing agent, most commonly ammonia (NH_3).

SCR technology is used worldwide, and its use in the United States is expected to expand as EPA limits become more stringent.

NH_3 Monitoring

NH_3 monitoring of the SCR process is necessary for "process control" — to control and minimize ammonia emissions, or "slips", which can make fly ash unusable and contaminate the gas absorption equipment. It is also essential for worker protection from excessive ammonia exposure, in the event of a leak along the NH3 storage and delivery route. Ammonia is highly toxic, even in small amounts.

SCR Installation Options

SCR units can be installed in various places in the flue gas stream. The two types most commonly used are High Dust Systems (for most applications, including combined heat and power and cogeneration plants) and Tail-End Systems (used when there is not enough space for a High Dust System, or when flue gas contents may interfere with the catalyst). Low Dust Systems are most common in gas turbine combined cycle plants (which use exhaust heat for a secondary process, such as water heating or steam production) and waste incineration plants; choice of arrangement depends on the composition and properties of the flue gas, as well as the amount of space available.

The following OSHA Standards may be applicable for your plant's SCR system: 1910.111, Storage and Handling of Anhydrous Ammonia and 1910.119, Process Safety Management of Highly Hazardous Chemicals. Consult your safety officer for more information.

Instruments

Ultima® X Gas Monitor, Chillgard® RT Infrared Refrigerant Monitor

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