Process Instrumentation

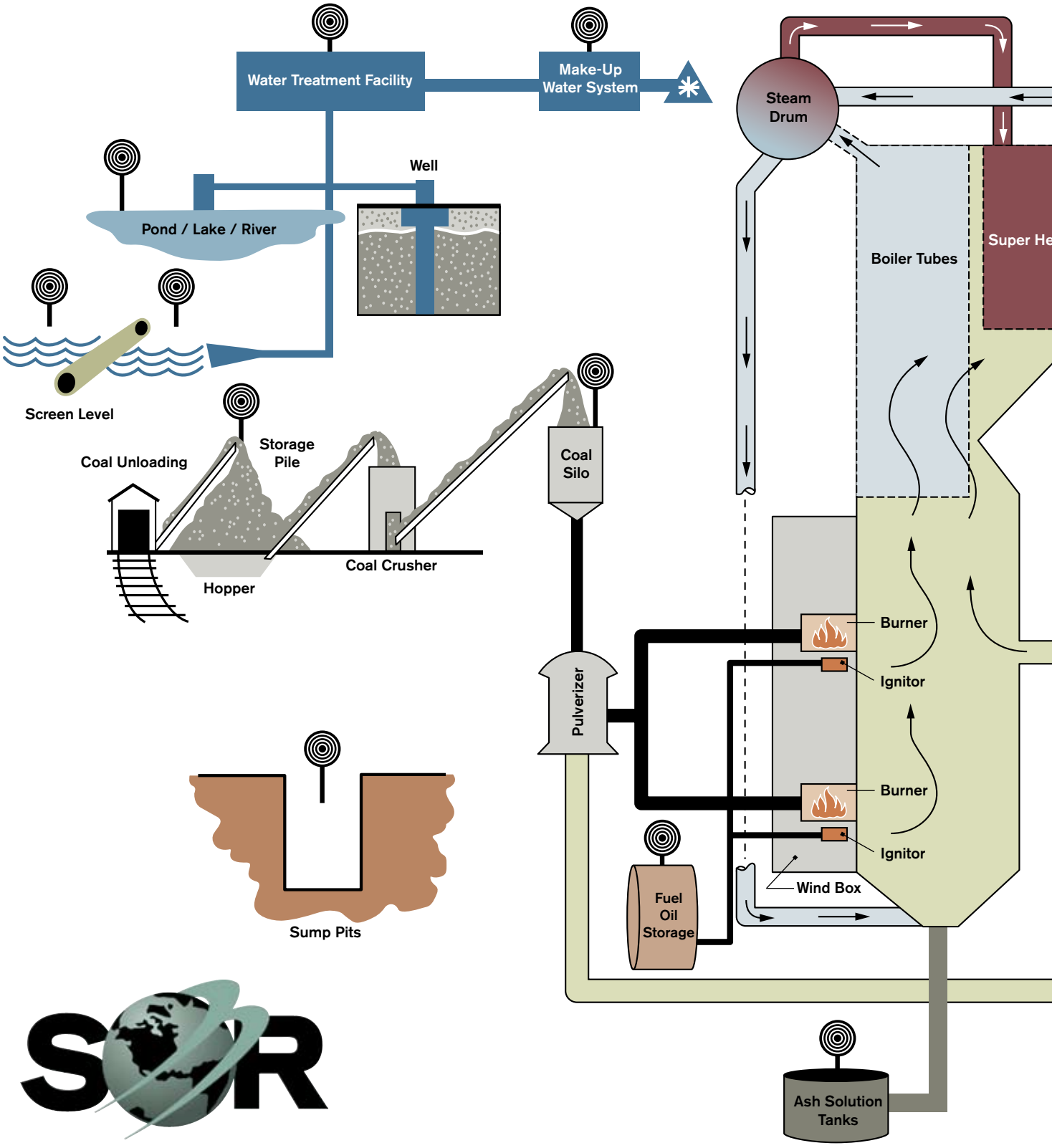
Power Generation

echOsonix®

Applications

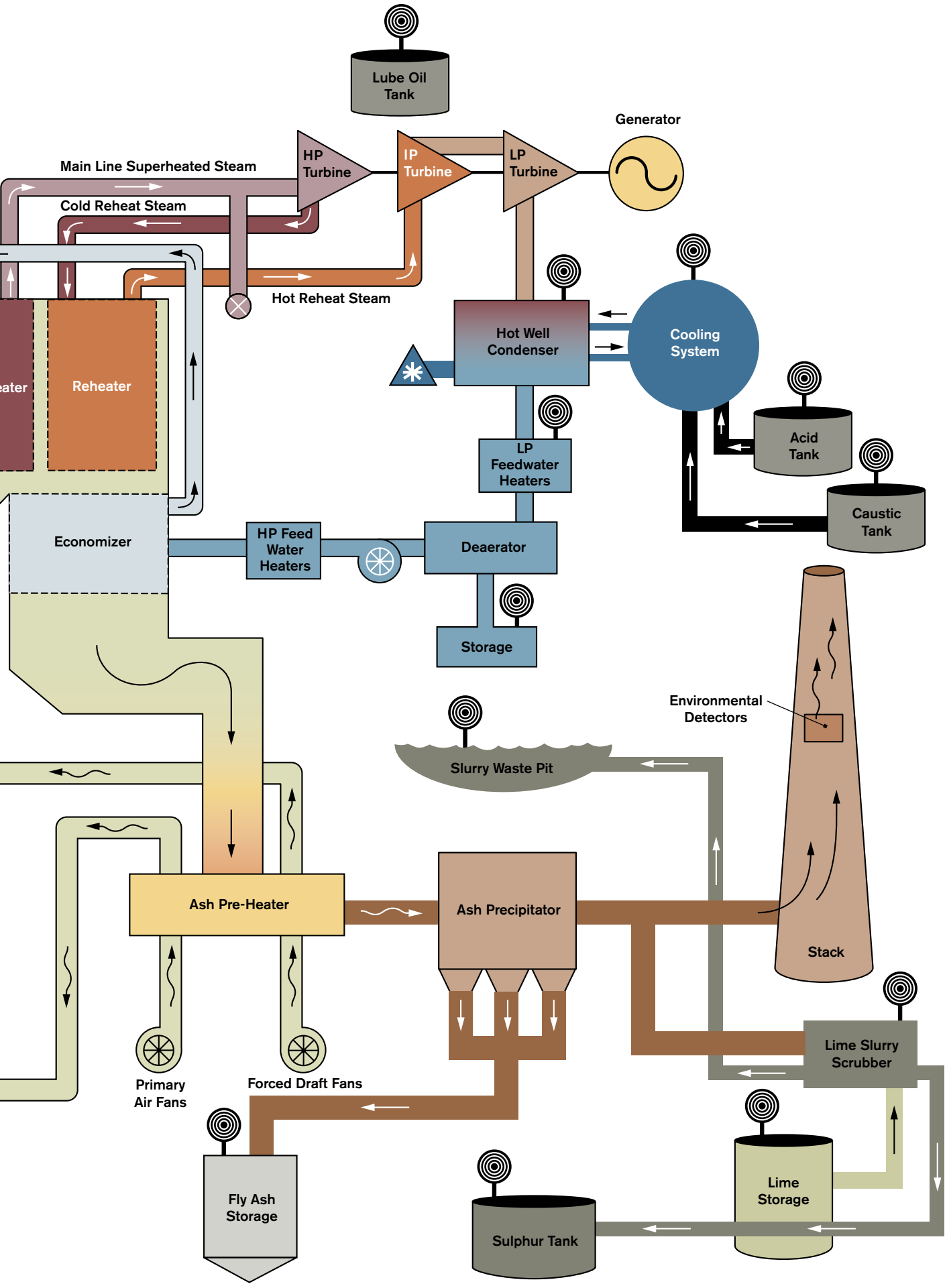
Typical

Coal-Fired Steam Power Plant



SOR

Process Instrumentation


Lube Oil Tank
Generator
Main Line Superheated Steam
HP Turbine
IP Turbine
LP Turbine
Cold Reheat Steam
Hot Reheat Steam
Reheater
Hot Well Condenser
Cooling System
Acid Tank
Caustic Tank
LP Feedwater Heaters
Economizer
HP Feed Water Heaters
Deaerator
Storage
Environmental Detectors
Slurry Waste Pit
Ash Pre-Heater
Ash Precipitator
Stack
Lime Slurry Scrubber
Primary Air Fans
Forced Draft Fans
Fly Ash Storage
Sulphur Tank
Lime Storage

echOsonix® non-contact level sensors and transmitters prove their value in the field.

1,300 Mw Coal Plant - Wisconsin

Situation: The plant fuel is supplied by a coal bunker with seven separate discharge hoppers. It is fed by a "tripper car" to prevent each hopper from running out of coal. A loss of coal would create an imbalance in the fuel feed system and possibly lead to a costly shutdown. The tripper car must know the level status of each hopper to efficiently operate and prevent an interruption of service.

Challenge: The coal does not flow smoothly and evenly when it enters the hoppers. It sticks and then cascades subsequently creating sharp angled surfaces and uneven profiles within the bunkers. Contact-type sensors are easily destroyed in this environment, so a non-contact sensor is required to measure the level.

Results: The high power of the echOsonix allows it to receive a strong return echo from the surface regardless of its profile. Seven echOsonix units have been accurately monitoring this application without creating service interruptions since February 2005.

623 Mw Converted Coal Plant - Ohio

Situation: This plant was originally designated to be a nuclear facility, then later converted to a coal plant prior to its completion. Due to its close proximity to the Ohio River, it is critical that the cooling tower level is maintained within acceptable limits to prevent overflow. An overflow discharge into the river would result in serious environmental impact and fines.

Challenge: Measuring the level of the cooling system was made difficult due to thick clouds of steam and condensate. In addition, unstable chemical conditions in the cooling water created varying amounts of foam. Both of these factors contributed to a history of failures with many other products and technologies.

Results: The penetration from low-frequency sound and flexibility provided by the adaptive gain feature of echOsonix overcame these issues. Twenty-six various echOsonix units installed since September 2001 continue to effectively and reliably measuring level in cooling towers, sumps and filtrate sumps.

2,360 Mw Coal Plant - Pennsylvania

Situation: Five oxidation columns are used to extract gypsum from the plant's emissions for use in drywall manufacturing. Lime slurry scrubbers convert the sulfites to sulfates and the resulting slurry is settled out in a thickener. The solids are then pumped to a fog plant and the resulting product goes to the hot, corrosive, turbulent environment of the oxidation columns.

Challenge: The oxidation columns have a very acidic, turbulent steam environment that generates large amounts of foam on the material surface. These conditions quickly rendered stainless steel radar units ineffective, shortening the product's life.

Results: One 10 kHz echOsonix unit was installed on each column in March 2005. The Teflon-faced polypropylene sensor has survived the corrosive and turbulent environment. The high-power and low-frequency design of echOsonix has provided excellent performance as well.

U73

U71

Water Treatment

Boiler water must be pure to eliminate build-up in boiler tubes and on turbine blades causing loss of efficiency and potential damage to equipment and personnel. Power plant water treatment facilities feed pure water into a closed-loop system where it is recycled indefinitely.

Various instruments are needed for the entire water treatment facility. Please refer to the SOR Water Treatment Product Application Notes brochure for specifics of typical instrumentation.

Purified water flows from the treatment plant to the make-up water system, which feeds into the hotwell condenser, if required. This system is intended to replace expected losses, but proper water supply must be maintained.

Coal System

Raw coal is brought into the plant and unloaded into large storage piles. A coal crusher reduces pieces in size, then feeds into a silo that stores 8 to 12 hours of supply. Pulverizers then reduce the pieces to dust, mix it with primary air and send it to the boiler burners. Catastrophic accidents at power plants typically involve highly volatile coal dust, so explosion-proof instrumentation is required in this area.

Air/Ignition

Boiler water is heated by burning pulverized coal and primary air. Oil-fired igniters light coal burners which continuously supply heat to generate steam. Forced air is injected directly into the boiler. Combustion by-products and heat move through the boiler and into the environmental system, in continuous one-way flow.

Large fans force primary and draft air through the ductwork, providing a positive pressure flow. For proper operation and safety, this flow must be maintained. Heater controls on the air pre-heater must be monitored to ensure the correct temperatures.

Steam Generation

Low-pressure feedwater heaters use steam from the turbine to heat and pressurize water drawn from the hotwell condenser. A deaerator removes excess oxygen from the water before it flows through the high-pressure feedwater heaters and the boiler economizer. From there, water goes into the steam drum where steam is separated and drawn off to the superheater. The remaining water passes through the downcomer and into the bottom of the boiler tubes. Water returning from the tubes passes back into the steam drum where more steam is drawn off and the remaining water sent back through the boiler. The boiler is essentially a large convection oven with tube bundles for steam generation. It draws water in the bottom and sends it through tubes directly above the burners before going to the steam drum.

Feedwater heaters must be carefully monitored for pressure, temperature and level. Each successive heater has higher temperatures and pressures, so instrumentation must be selected for each specific heater's needs. The economizer is a group of boiler tubes set at the end of the heat path. It absorbs some of the unspent heat from boiler gases to pre-heat water moving to the steam drum. The line feeding from it to the steam drum must be monitored for pressure, temperature and flow.

The steam drum is a long cylinder with baffles to separate water and steam. After separation steam is drawn into the superheater. Water levels, pressure and temperature in the drum and its inlet/outlet lines must be monitored. Pressure instruments on the drum require either a pigtail siphon or diaphragm seal to protect from heat.

Steam System

From the steam drum, steam passes through the superheater and into the turbine, which converts the heat into mechanical energy. The conversion is done in three stages to use as much heat energy as possible. After steam leaves the turbine, it is condensed back to water and recirculated to the boiler.

Steam is drawn from the steam drum and sent to the superheater where pressure, temperature and flow must be monitored. Steam comes out dry and superheated, ready for the turbine. A dripleg is used on superheated steam lines to collect particles of moisture still present in the dry steam which can cause severe damage to the turbine. A level switch senses the liquid level and opens a dump valve.

The reheater takes spent steam from the high-pressure (HP) turbine and superheats it again before it goes to the intermediate pressure (IP) turbine. Steam passes directly from the IP turbine to the low-pressure (LP) turbine. The turbine, the most expensive and critical component of a power plant, converts heat in the steam to mechanical energy. The turbine shaft turns a generator at high speed to generate electricity.

Spent steam exits the LP end of the turbine and enters the hotwell condenser, where it is cooled and condensed into water. Make-up water is added at the hotwell when required. Cooling systems are typically circulating water, refrigerant or some combination of the two, and require temperature, level and sometimes pressure instrumentation.

Environmental System

By-products of combustion are ash, gases and heat wastes. The heat is dissipated through the cooling system, while the solids and gases are removed through the environmental system. Ash and solids that fall to the bottom of the boiler (bottom ash) are collected in a hopper and removed periodically. Fly ash is entrained in the exhaust flow and collected in the ash precipitator. Pressure and temperature transmitters used at the inlet and outlet of the precipitator protect against clogging and overheating.

Scrubbers are typically used to remove combustion gases by bubbling exhaust through lime slurry. Detectors inside the stack monitor performance of the environmental system for emissions reports to government agencies.

SOR® offers a full line of commercial-grade process instruments.

echOsonix®
Level Transmitters

Level
Switches

Level

Temperature

Pressure

Flow

Flow
Switches

Temperature
Switches

Pressure
Switches

Process Instrumentation

We Deliver Quality On Time

SOR Inc.
14685 West 105th Street
Lenexa, Kansas 66215

Phone 913-888-2630
Toll Free 800-676-6794
Fax 913-888-0767

www.sorinc.com
www.echOsonix.com

SOR Europe, Ltd.
Star Road
Partridge Green, Sussex
RH13 8RA, United Kingdom

Phone +44-140-371-1331
Fax +44-140-371-0177
sales@soreur.co.uk

SOR - China
Room 903, No. 10 Building
Wan Da Plaza
No. 93 Jian Guo Road
Chao Yang District
Beijing, China 100022

Phone +86 (10) 5820 8767
Fax +86 (10) 5820 8770

Registered Quality System to ISO 9001

Form 1357 (09.06) © 2006 SOR Inc.