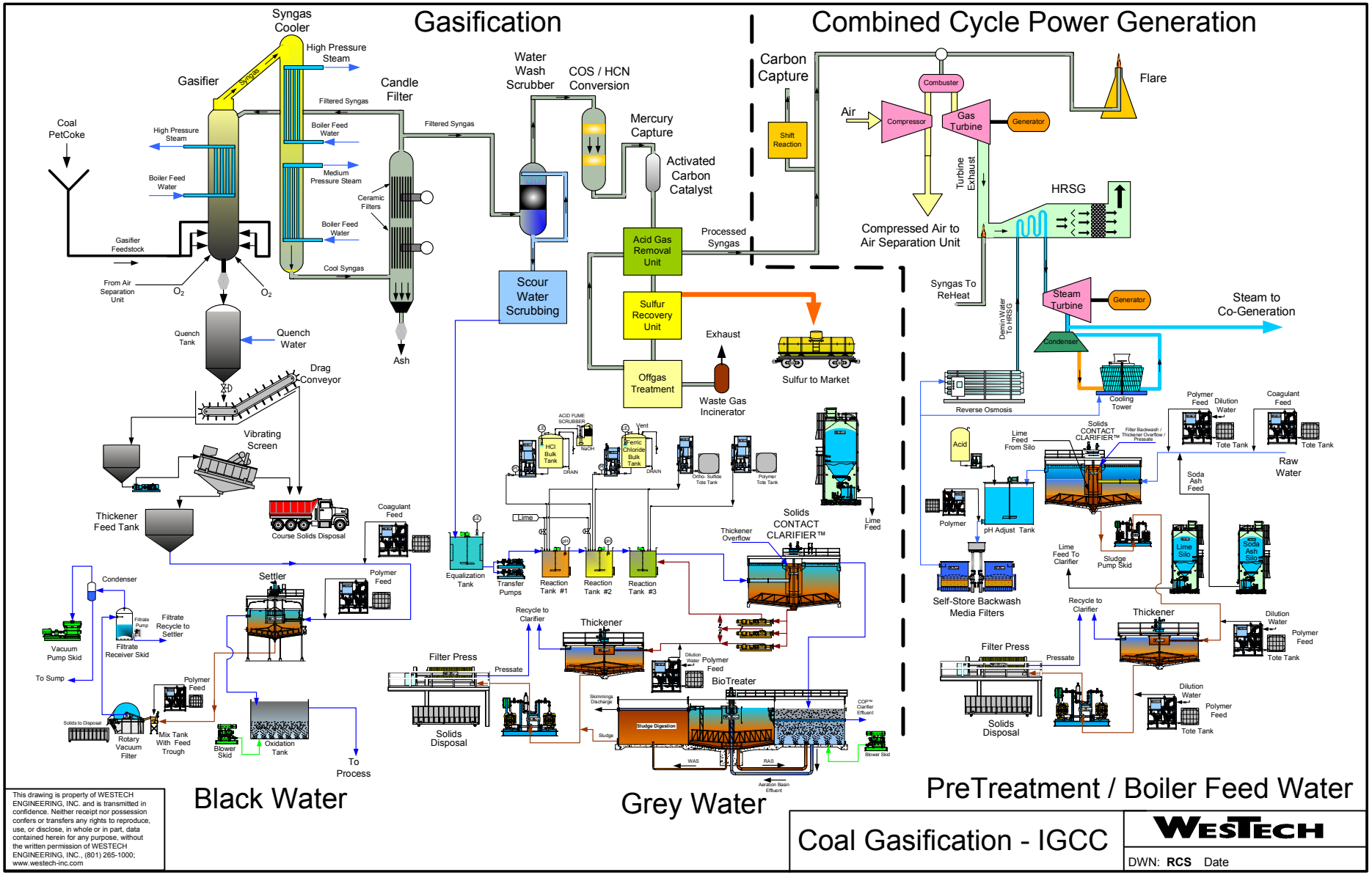

Paste Thickeners are used within existing coal plant operations to thicken product and to handle coal refuse. Reclaimed water at the paste thickener reduces makeup water costs as compared to high-rate thickening. High operating and chemical costs of filters can be eliminated with the use of paste technology. Coal refuse paste provides safe impoundment of tailings without the requirement, expense, and safety hazards of a water-retaining dam. Operations to extract coal from existing refuse ponds have also successfully used paste technology.

Integrated Coal Gasification with Combined Cycle Power Generation (IGCC)

Coal gasification, the conversion of coal to liquid fuel, has a long history. One innovation to the process is the addition of a combined cycle power generation system. As in the traditional combined cycle power plant, a gas turbine is used as the first means of power generation. In this case, the gas turbine is fired by the syngas of the gasification plant. The syngas is also used to heat the exhaust of the gas turbine, and this heated stream is sent to a heat recovery steam generator (HRSG). The HRSG produces steam which drives a steam turbine, generating further electricity. The waste steam from this process can be used in other parts of the coal gasification process.

Syngas Scrubbing

The syngas produced by the gasifier is scrubbed to remove sulfur and other contaminants. The gas stream then moves on for mercury removal with activated carbon. The waste stream produced by this syngas scrubber is analogous to the wastewater produced in flue gas desulfurization (FGD) at a coal-fired power plant. This is to be expected since the gasifier is "burning" coal or some other fuel source and releasing the same types of contaminants produced in a coal-fired boiler. The scrubber's downstream flow must therefore be treated to remove heavy metals such as selenium, cadmium, and mercury, as well as other process contaminants. However, unlike FGD, there are no gypsum solids produced.

Metals Precipitation

The first step in the treatment process is to precipitate heavy metals. This is most commonly done through the addition of lime slurry, but depending on the size of the waste stream it can also be accomplished with the addition of caustic. In either case, the pH is raised to a level above 11 where metals precipitate as hydroxides. Further reduction of heavy metals may be achieved with organosulfide addition. This precipitates metal sulfides which have much lower solubility limits than hydroxides. This process allows mercury removal down to parts per trillion levels. The resulting pH is normalized with hydrochloric acid. Using hydrochloric acid to adjust the pH prevents the sulfide reintroduction that would accompany the use of sulfuric acid.

Solids CONTACT CLARIFIER™

The metal precipitates must now be removed from the waste stream. A Solids CONTACT CLARIFIER™ removes the precipitates from the now very dilute stream. The Solids CONTACT CLARIFIER™ employs an impeller which draws sludge from the tank bottom through a draft tube and into the reaction well. This impeller imparts high flow with low shear. The recycle stream is sized for 10 times the inlet flow and has a suspended solids level of 10,000 ppm. Incoming solids contact previously-flocculated and settled solids resulting in high solid removal rates. A portion of the blowdown sludge from the Solids CONTACT CLARIFIER™ is recycled to a mix tank. This promotes additional floc formation and solids removal.

Sludge Thickening and Dewatering

Sludge from the solids contact unit flows to a traditional thickener and then to a conventional dewatering process. Dewatered sludge containing mercury, metal hydroxides, and sulfides is sent to hazardous waste landfills.

Combined Cycle

The combined cycle power generation portion of the plant has the same water requirements as any combined cycle power plant. The water may require pretreatment prior to ion exchange or reverse osmosis. This pretreatment can take the form of clarification and filtration or may even require lime softening.