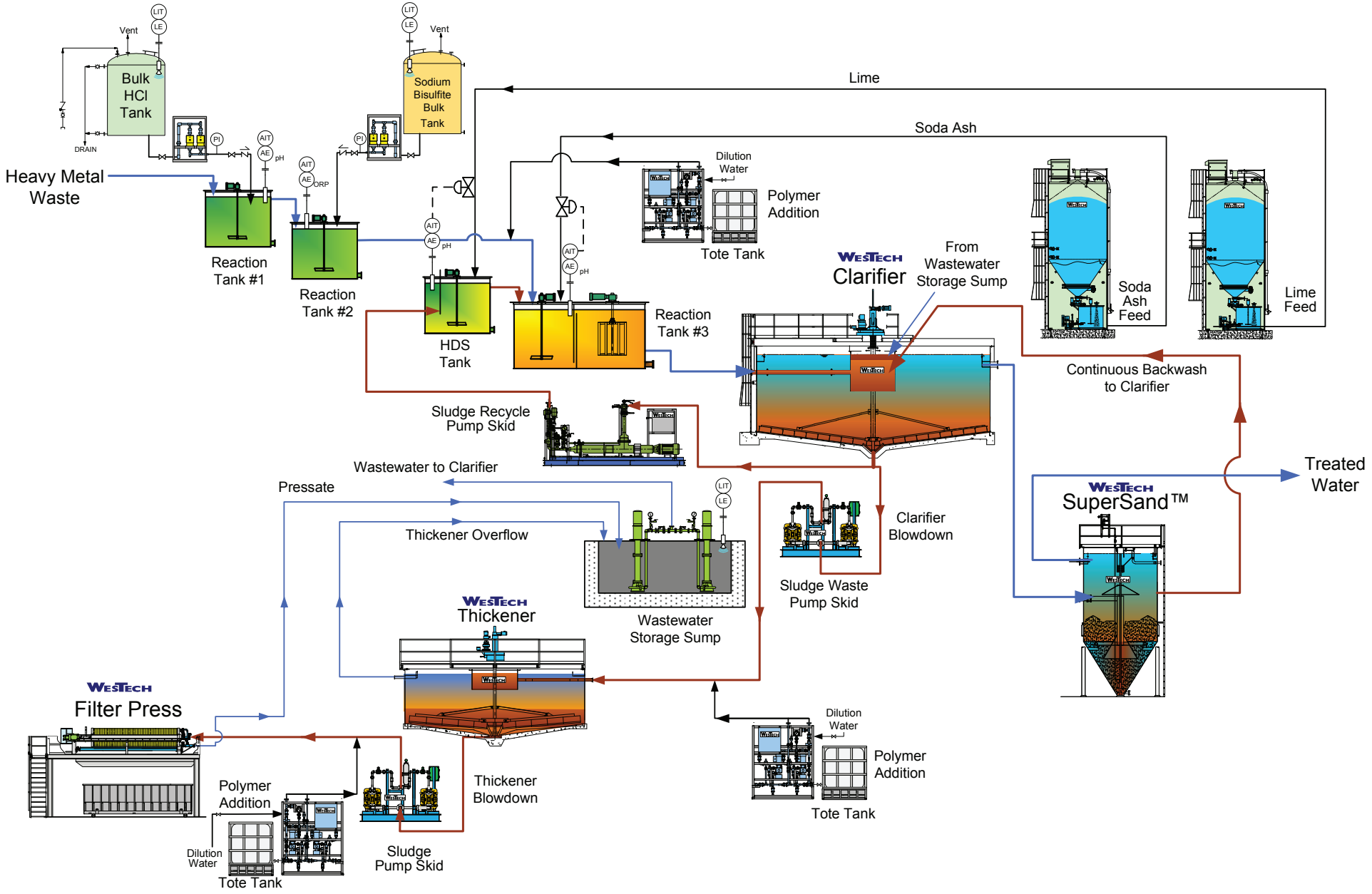

Heavy Metals Removal

WESTECH

DWN: **RCS** DATE:

Since its beginning in 1973, ***WesTech*** designs, engineers, supplies, and installs water, wastewater, and process equipment for municipal and industrial customers around the world. From headworks to tertiary treatment, from petrochemical processes to water reclamation and drinking water, from small communities to large cities and factories, WesTech offers a wide array of custom process solutions for any application.

Heavy Metals Wastewater Treatment System (Chrome Removal)

Chromium is present in the wastewaters of a number of industries, including: stainless steel manufacturing, protective coatings on metal, magnetic tapes, chrome plating, tanneries, textile dyes production, pigments and paint production, production of cement, paper, rubber, etc. Chromium is typically precipitated in two steps: reduction and precipitation.

First Step

In the first step (Reaction Tank #1) acid is added to lower the pH to < 3 so that the reaction may take place. The reaction is conducted in Reaction Tank #2 where hexavalent chromium (Cr+6) is reduced to trivalent chromium (Cr+3). In this step, compounds such as ferrous sulfate ($FeSO_4$), sodium bisulfite ($Na_2S_2O_5$), or sulfur dioxide (SO_2) are used as reducing agents. The trivalent chromium is precipitated as $Cr(OH)_3$.

Second Step

In the second step (Reaction Tank #3), lime is typically used for the precipitation reaction. In this flow diagram, a process known as high density sludge (HDS) is employed to help promote precipitation. The heart of the HDS process is the pH in the HDS or densification tank which needs to be at a pH of 11.5 or higher. A change of state takes place at the higher pH and the process works better. The actual precipitation of chrome hydroxide takes place under mildly caustic conditions. Thus, there will always be some $Cr(OH)_3$ in the clarifier feed, but these hydroxides will eventually be recirculated through the densification tank and undergo a change of state.

In this process, previously settled sludge is recycled to the reaction tank (HDS tank) where it is mixed with fresh lime slurry. This lime slurry coats the sludge, making it more reactive and able to form stable flocs with the incoming solids in Reaction Tank # 3.

The effluent concentration is 0.2 ppm Cr at pH 7.5. If additional metals are present, the pH is raised to approximately 10 to promote further precipitation.

Carbonate Precipitation

To further facilitate removal of additional metals, carbonate co-precipitation is sometimes used. Carbonate precipitation takes place only if free carbonate ions (CO3-2) are present and this occurs only if the pH is high. Some wastewaters, especially those with lead, cadmium, nickel, etc. which can form insoluble carbonates that can be used in carbonate precipitation, may already contain enough carbonates to allow precipitation to occur. Alternatively, inorganic carbonates such as soda ash (Na_2CO_3) can be added. High pH's also promote the precipitation of the metals as hydroxides. Hence, carbonate precipitation is often a co-precipitation. As mentioned above, carbonate precipitates settle and can be dewatered more easily than the corresponding hydroxide precipitates.

Note that pH values above 10 promote the formation of metal hydroxy complexes that can increase the metal solubility and reduce the precipitation effectiveness.

The treated water is then filtered by either pressure or gravity media filters depending on the logistics of the final disposal.

The sludge from this process typically goes to a conventional thickener and filter press for dewatering prior to disposal. Dewatering produces an average 20:1 reduction in sludge volumes. The water from the dewatering system is returned for processing. Variations of this process can be used to precipitate most heavy metals.