



The Pump Detective

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The case of the out of compliance Scrubber.....

A customer has a 5' diameter, 20' high scrubber to remove HCl from an air stream. It is a packed tower with spray nozzles.

The sketch is showing the layout. A circulation pump pumps dilute NaOH from the reservoir to spray nozzles in the column which distributes scrubbing liquid across the top of a bed of random packing.

The air with HCl fumes enters the column from the bottom and exits from the top through a stack.

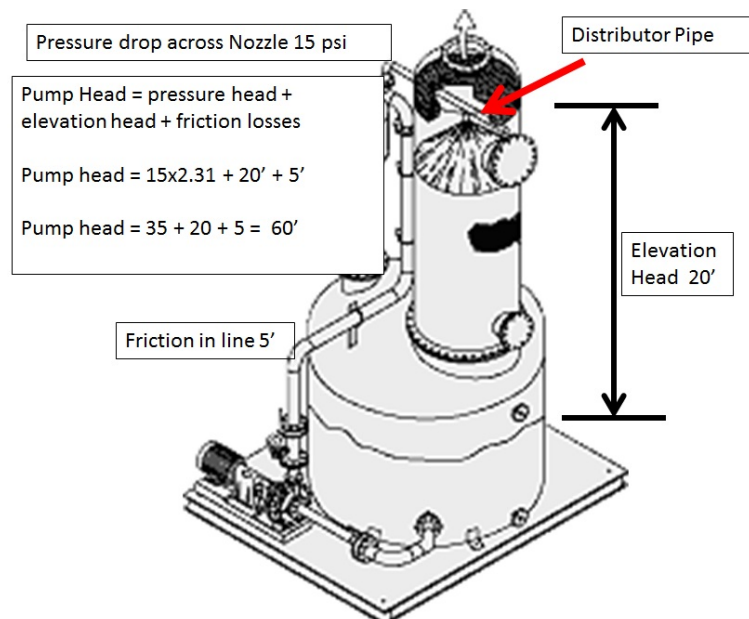
The Scrubber had been installed and running without incident for 4 years.

One day, the environmental manager told the operations manager the scrubber was out of compliance. In checking they found the pump discharge pressure too low. Also the motor amps were reading high.

They concluded the pump had worn or corroded to such an extent that it could not put out enough pressure and the clearances had opened up to make it very inefficient.

The maintenance department repaired the pump, but the performance was still subpar. So they bought and installed a new pump. The performance was still low on head and high on horsepower.

That's when they called us to look at it.



Since neither a repair nor new pump improved the system performance, it was obvious the pump was not the culprit and it was time to look beyond the pump flanges.

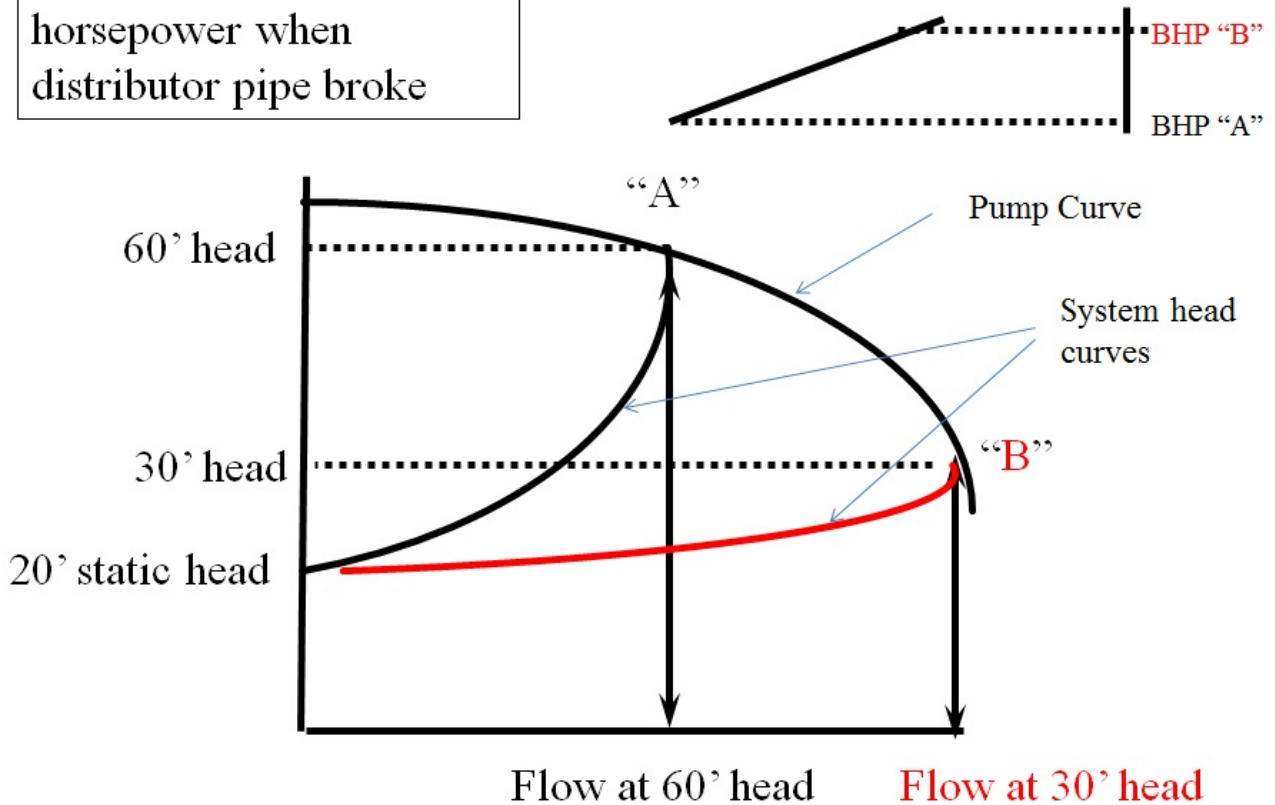
The sketch shows the system layout and the process calculations for the pump head.

Since it was obvious the pump is running out on the curve we looked for the cause. Sure enough when the column was inspected we found the distributor pipe to the spray nozzles was broken.

All the flow was coming out of a broken pipe and not through the spray nozzles. This would cause a lower head since the resistance (pressure drop) of the nozzles was no longer there.

The pump curve and system curves are shown. The design system head curve is "A" and made up of 35' nozzle loss, 20' elevation and 5' friction. When the pipe broke, the head was only 20' elevation plus the new, slightly higher friction (due to additional flow) This would cause the pump to walk out on its curve to where the new system head curve "B" meets the pump curve. At the lower head the flow would go up and of course the horse power would go up.

Change in head, flow and horsepower when distributor pipe broke



Without flow to the spray nozzles, the scrubbing liquid would "channel" through the packed column and it would lose its scrubbing efficiency.

Moral to the story is to check the system before blaming the pump.