HCI Systems, Inc.
Software Solutions

ASME B31.8 H2S Radius of Exposure (ROE) Tool

ASME B31.X Tools. HCI Systems, Inc.

I am starting this series with an example of how the Radius of Exposure (ROE) tool works. B31.8 Chapter IX discusses Sour Gas Service. Sour gas, if you do not know, is Hydrogen Sulfide or H2S.

H2S is nasty stuff. Anyone who has worked at a refinery knows they are required to wear a H2S monitor for safety. These devices are usually set for a low PPM like around 10-20 PPM for obvious reasons. H2S has the side effect of destroying your sense of smell at level around 50 PPM. So without a monitor you could walk into a H2S cloud with little advance warning. By the way, H2S smells like rotten eggs. At elevated levels H2S, it starts messing with your respiratory system. So that is your next level of awareness. At levels 500 PPM you enter the IDLH zone. IDLH stands for Immediate Danger to Life and Health.

Transporting sour natural gas brings with it a host of material selection issues, NACE requirements, PWHT of welds, etc. And, the need to risk assess leaks, certainly when in proximity to populated areas. This is addressed in B31.8 Chapter IX, Section 850.

So, the code has provided guidance, reference tables and equations for generating the ROE. Seems easy enough.....but let's give this some thought. First thing is that the reference tables provided start with a H2S mole fraction of 5% which generates a 100 PPM radius of 1165 FT and a 500 PPM radius of 533 FT with a 1MM SCFD release.

SCFD stands for standard cubic feet per day. OK, so how do you compute the release volume? Well, there are equations for that too. For line pressures above Pcritical, the flow is known as choked flow and the equation can be simplified to:

Flow (SCFD) = d * d * P_{line} * 24000

If you run the numbers using a line pressure of 275 PSIA and diameter of 30 IN, this equates to a hole about the size of about 3/8". The code also comments that if there are volume limiting measures (like automatic block-off valves), the volume of the pipe can be used. OK, so what length of a 30 IN pipe does that equate to? Well, that is approximately 39 miles. What is the typical distance between compressor stations? (That's a question for the readers).

But wait a minute. 100 PPM ROE is well above the level where the sense of smell is affected. And, 500 PPM is approaching the IDLH levels. So what do we call these zones? The stinky zone and the danger zone? Also, what about the leaking natural gas? At some point aren't we approaching the LEL? Hmmm..... Sounds like a LEL map to me.

Moving on to the next observation. What about effects of wind speed and wind direction? What good is a ROE circle when the wind is blowing at 20 MPH? And how do we display this information that is easy to visualize?

So the photo for this posting is how HCI Systems displays this information. Google maps of course. Dah. Now to address the wind, a user configurable distortion profile is setup that relates the wind direction and speed to alter the circle to an eclipse and offsets the emission point as the wind speed increases. The emission point is established by GPS coordinates either by HCI's MI Tablet tool or can be entered manually via Google tools. There you have it. So now when your boss sees you on Google, you can say you are really working.....thanks to HCI. :)

By the way, any guesses on the location of the example dispersion model? It's in Texas.

So what about multiple leaks? OK. I'll save that one for another post. Easy enough. It's a database query.

Want to know more? Contact me at: richgehse@hcisoftware.biz

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