

SULFUR-RITE® SYSTEM

SOLID H₂S REMOVAL SYSTEM FOR RAILCAR
VAPOR UNLOADING OPERATIONS



Molten sulfur is a basic component of many chemicals used in a variety of industries. It is typically brought into the chemical plant via tanker truck or rail car. Most molten sulfur comes from an industrial H₂S removal process called the Claus Process, and contains dissolved H₂S.

Flexsys is the leading manufacturer and supplier of chemicals for rubber processing and related industries; they are located in SW Pennsylvania. Flexsys uses molten sulfur as the raw material for their process, and to protect their employees, they were investigating various methods for removing H₂S from the vapor emitted from the rail cars. They had looked at using carbon for the H₂S removal, but found that SULFUR-RITE® was a better option for two main reasons:

1. The carbon cannot effectively handle the extreme swings in H₂S load without exceeding the outlet concentration requirement.
2. Carbon is combustible, and the combination of high base temperatures (280 °F) and the high potential H₂S inlet levels would cause the bed to potentially ignite, as the adsorption of H₂S on the carbon evolves heat.

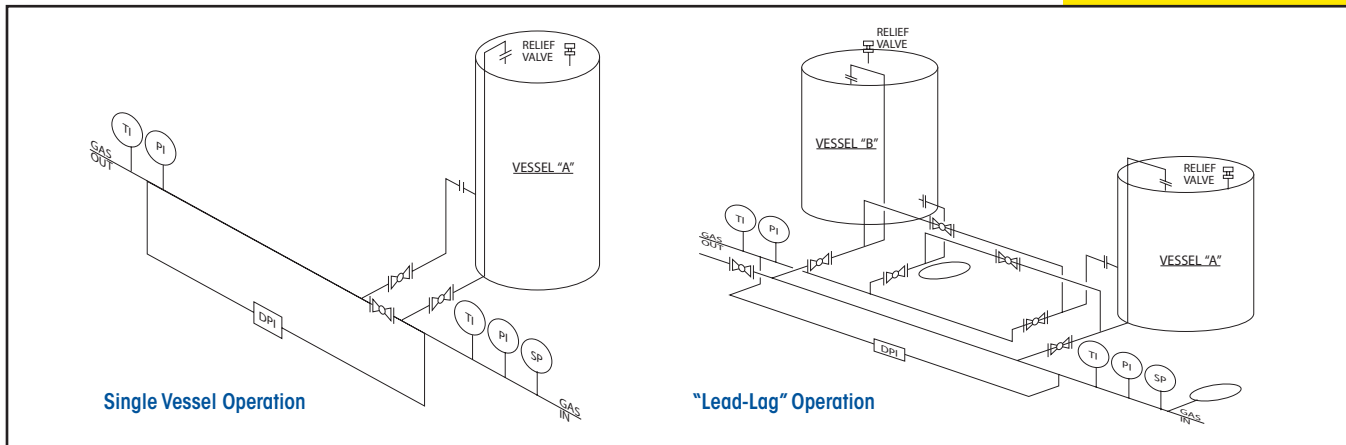
SULFUR-RITE® is non-flammable and non-hazardous in both its fresh and spent form.

The sulfur rail cars can contain a relatively high amount of H₂S in the vapor space. In the unloading procedure, the railcar is first vented to the SULFUR-RITE vessel while it is heated. This is to protect personnel from the toxic H₂S. Once molten, the railcar is pressured



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using flue gas from a combustion process and the sulfur is transferred to storage tanks. When sulfur transfer is complete the railcar is vented to the SULFUR-RITE vessel a second time to depressurize the H₂S laden vapor through the SULFUR-RITE media.

The SULFUR-RITE® unit was custom designed to remove the H₂S to less than 1ppm in the vapor. During the early stage of the process run, the H₂S level is usually non-detectable, and gradually over time the H₂S level gradually increases as the bed becomes spent.

The unit was started up in early 2002, and operated as predicted. Flexsys recently ordered their 2nd batch of SULFUR-RITE media. The unit is run in batch-mode, and requires minimal operator attention. The vessel is carbon steel as there are no corrosive compounds that require a more robust material of construction.

The SULFUR-RITE product is an iron-oxide media impregnated onto a ceramic base, with supplemental chemicals added to promote the reaction. It is a dry free-flowing granular material with the following properties:

- Non-hazardous both in fresh and spent form
- Low Pressure Drop

- Minimal operator attention required
- Predictable Performance

The reaction is specific to H₂S and partially effective for methyl and ethyl mercaptans. If either CO₂ or O₂ is present in the gas stream, the efficiency of the process may be enhanced. The inlet gas must be water-saturated to maintain the moisture content of the media, except in aerobic cases in which case the air can be dry.

The general reaction for H₂S in the absence of O₂ is:



The primary reaction product is iron pyrite (fools gold) which is stable and completely non-hazardous. Disposal is handled at a local non-hazardous landfill.

SULFUR-RITE provides for a very flexible operation with turn-up and turndown from 0-100%. If H₂S loading is reduced due to lower concentrations or gas rate, the run length becomes longer. As H₂S loading increases, the media will require more frequent change-outs. Systems are designed for either batch processes (Single Vessel Operation) or continuous operations (Lead-Lag Configuration).

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