UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

MAY 2 1996

OFFICE OF
WATER

MEMORANDUM

SUBJECT: Wells Used to Inject Spent SULFA-CHECK Slurry - UIC Well Classification Advisory #9

FROM: Thomas E. Belk, Chief
Underground Injection Control Branch

TO: Water Supply Branch Chiefs
Water Supply Section Chiefs
UIC Section Chiefs
Regions I - X

It has been determined by the Office of Solid Waste and Emergency Response that the spent SULFA-CHECK slurry is not a hazardous waste. NL Treating Chemicals/NL Industries, Inc. has requested that the injection wells used to dispose of the slurry be classified as Class II wells. §146.5(b) states "Class II wells inject fluids: (1) which are brought to the surface in connection with conventional oil or natural gas production and may be comingled with waste waters from gas plants which are an integral part of production operations..."

It seems clear the slurry was not brought to the surface in connection with production, but is a result of a process carried out after the gas has been produced.

Therefore, the disposal well is disposing of non-hazardous industrial waste below the lowermost Underground Source of Drinking Water and is a Class I well.

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WATER

OCT 07 1995

MEMORANDUM

SUBJECT: Sulfa-Check Process-Review Request

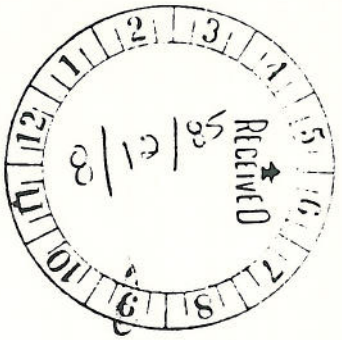
FROM: A. Roger Anzzolin

TO: David Friedman
Characterization and Assessment Division (WH562B)

In our phone conversation today I explained that : (1) NL Chemicals is requesting that the spent slurry waste from their process be classified a non-hazardous waste, and (2) the slurry waste be allowed to be disposed of in Class II wells according to the Underground Injection Control (UIC) regulations.

I have attached a complete set of company information, and copies of all pertinent letters. I would like you to review the information and make a determination and assessment of its characteristics as a hazardous waste.

If you have any questions, please do not hesitate to call me at 382-5559. Your assistance is greatly appreciated.



August 2, 1985

Mr. Roger Anzollin
Drinking Water Programs, (WH-550)
401 M Street
Washington, D.C. 20460

Dear Mr. Anzollin:

As per our conversation August 2, 1985, I am enclosing the following information regarding the SULFA-CHECK process and resulting spent slurry: 1) Description of the SULFA-CHECK process, 2) typical Chemical Analysis of the spent slurry 3) analysis of the spent slurry for characteristics of hazardous waste, 4) letter from EPA, Solid Waste Section regarding spent slurry waste classification, and 5) letter from EPA Region V regarding waste classification of the spent slurry, and NL Treating Chemical's response to that letter.

Your review and approval is requested, regarding disposal of the liquid portion of a SULFA-CHECK sweetener spent slurry in Class II wells when commingled with fluids brought to the surface in connection with oil and gas production operations. Please confirm that the SULFA-CHECK spent slurry is considered a gas plant wastewater as defined in 40 CFR 144.6 (b)(1).

The SULFA-CHECK spent slurry is generated from a unique sour gas sweetening process called SULFA-CHECK*. The SULFA-CHECK sweetener is a liquid product formulated to react with hydrogen sulfide (H_2S) to directly produce sulfur, thus removing H_2S from the processed gas stream. The system may be used for removal of hydrogen sulfide from natural gas streams at the wellhead, gas gathering facilities, and full scale gas processing plants.

Assessment of a typical SULFA-CHECK spent slurry indicates that the proposed waste stream is not hazardous, and is low in toxicity. A typical SULFA-CHECK spent slurry is expected to be practically non-toxic by ingestion with a calculated oral LD50 exceeding 5000 mg/kg. The SULFA-CHECK spent slurry was found to be only moderately toxic to fish with a 96-hour LC50 exceeding 500 mg/l. The Chemical Analysis and Analysis of the spent slurry for characteristics of hazardous waste (40 CFR 216.20-261.24) show that the waste contains no listed hazardous wastes; is not ignitable, reactive, or corrosive; and contains no metals or pesticides in concentrations exceeding the EP toxicity

*Patented

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limit. Due to the nature of the treatment process, no heavy metals, pesticides, sulfides, or cyanides are expected to be present in the spent slurry. Additionally, the SULFA-CHECK process is not used to treat a hazardous waste.

Based on the SULFA-CHECK process and spent slurry information submitted, we request your analysis of the proposal to dispose of the SULFA-CHECK spent slurry in Class II injection wells, and verification that such disposal meets the requirements under 40 CFR 144.6 for disposal of non-hazardous gas plant wastewaters.

Should you require any further information in your review of the SULFA-CHECK process and spent slurry, please call me at (713) 457-1125.

Yours truly,

Kathryn T. Allford

Kathryn T. Allford
Environmental Analyst
NL Treating Chemicals

KTA:bl

Attachments

cc: A. E. Beasley
K. Bhatia
T. Brown
J. Dobbs

ATTACHMENT I

SULFA-CHECK™
for
SOUR GAS SWEETENING

Treating Chemicals

SULFA-CHECK™ for SOUR GAS SWEETENING

NL Treating Chemicals' unique SULFA-CHECK sweetening process* removes hydrogen sulfide from sour gas by converting it directly to sulfur. The one-step process employs a new product, SULFA-CHECK, an alkaline aqueous solution which is easy to handle and non-flammable.

Removal of hydrogen sulfide with SULFA-CHECK is specific and rapid. Passage of sour gas through a scrubbing tower containing SULFA-CHECK solution results in immediate removal of H_2S and conversion to sulfur with no further processing necessary. The process is simple enough to run unattended and requires no heat or power. Disposal of spent liquor is safe and easy.

The degree of hydrogen sulfide removal is controllable all the way to total removal. Proper control of process parameters limits interference by carbon dioxide.

Because of its simplicity, low operating cost and relatively low capital investment, the SULFA-CHECK sweetening process is ideal for isolated sweetening applications such as oil wells which produce sour associated gas, or on offshore platforms where space is critical and safety is a major concern. It can also be used to sweeten carbon dioxide recovered during enhanced oil recovery operations.

Features of SULFA-CHECK Sweetener and the SULFA-CHECK Sweetening Process

- Since passage through only one scrubbing tower can give virtually complete H_2S removal, the SULFA-CHECK sweetening process is attractive where gas contamination is low and capital investment must be minimized.
  - Existing Equipment - SULFA-CHECK may be substituted for conventional scrubbing solutions in typical oilfield wet contact reactors. This substitution is possible over a wide range of conditions and gas compositions.
  - New Equipment - The one-step, one-vessel process means low capital investment. Freedom from manpower, fuel or utility requirements keeps construction and operating costs low.
- The process is economical. Overall costs compare very favorably to conventional sweetening processes.
- The high reaction efficiency of SULFA-CHECK makes it useful for H_2S polishing or for emergency scavenging.
- SULFA-CHECK can aid in prevention of corrosion by sweetening natural gas to be used as reinjection gas or in gas lift operations.
- SULFA-CHECK can be used to scrub H_2S from either field processing or central plant processing units, thus providing sulfide-free gas to minimize corrosion of transmission pipelines.
- For enhanced oil recovery operations employing CO_2 injection, SULFA-CHECK can remove H_2S from recovered CO_2 prior to reinjection.
- Where flaring is required, removal of H_2S with SULFA-CHECK permits easy and simple compliance with SO_2 limitations.
- Suspended solids from the spent slurry contain no heavy metals and may have commercial value. In some areas of the world, by-product sulfur has value for conversion to sulfuric acid for manufacture of ammonium sulfate fertilizers.
- Analyses show that the typical spent slurry is not ignitable, corrosive or reactive and does not contain heavy metals or chlorinated pesticides.

Field Tailoring Is a Unique Aspect of the SULFA-CHECK Sweetening Process

Ideally the SULFA-CHECK sweetening process should be field tailored to the specific gas stream to achieve the desired level of H_2S removal at minimum cost. The parameters which affect success are:

- Gas Flow Rate
- H_2S Content
- Scrubber Column Height
- pH of Scrubber Solution
- Gas Temperature
- Gas Pressure

Reaction of SULFA-CHECK sweetener with sulfide is very rapid so that low as well as relatively high flow rates can be handled with a comparatively low scrubber column height. This is important for two reasons:

1. High conversion is affected
2. CO_2 absorption is kept to a minimum.

Scrubber solution pH is critical to the efficiency of H_2S removal. A pH between 7.5 and 11 is sufficient to maintain the stability of SULFA-CHECK without being so alka-

line that CO_2 is scavenged rapidly by caustic. Continuous control of pH thus is a critical factor for process economics and utility. The pH in the SULFA-CHECK process is maintained by a buffering system.

Contact time is also an important variable controlling the efficiency of H_2S removal and the degree of interference from CO_2 scavenging. This can be controlled by adjusting column height to maximize H_2S removal and minimize CO_2 removal; proper adjustment will give the lowest SULFA-CHECK/sulfide ratio.

Advantages of the SULFA-CHECK Sweetening Process Over Conventional Processes

Current commercial techniques for removal of hydrogen sulfide from sour natural gas streams have some major disadvantages.

ALKALINE SCRUBBERS:
Alkaline scrubbers are not selective. Side reaction with CO_2 consumes caustic. The caustic process is not suitable for gases with high concentrations of CO_2 because of this side reaction. The SULFA-CHECK process is almost insensitive to CO_2 between pH 7.5 and 11.

PRECIPITATION OF INORGANIC SULFIDES:
Zinc oxide and zinc carbonate are used to remove H_2S by precipitation of insoluble zinc sulfide. The spent liquors contain precipitated metal sulfides and are classified as Class 1 (hazardous) disposal wastes. If acidized, the solids will evolve poisonous hydrogen sulfide. The SULFA-CHECK process yields an inert slurry containing mostly sulfur and sodium bicarbonate. Acidification will not cause hydrogen sulfide evolution.

ALKANOLAMINE SCAVENGING:
Alkanolamines including mono- and diethanolamines are not selective for H_2S removal in the presence of CO_2. Economical operations require thermal regeneration of alkanolamines and a sulfur plant to process recovered H_2S. These requirements need space and higher capital investments than the one-step, one-vessel SULFA-CHECK process. These requirements also limit the use of alkanolamine processes at offshore locations.

FORMALDEHYDE:
Formaldehyde solution is potentially dangerous to operators because formaldehyde is highly toxic and a suspected carcinogen. Safe operations of formaldehyde plants require close supervision. SULFA-CHECK solution is safe to handle.

Limitations of the SULFA-CHECK Process

The SULFA-CHECK process is not applicable to all sweetening requirements but most limitations are economic rather than performance related.

For extremely large volume gas processing requirements, specifically gases with several percent H_2S, the choice between the SULFA-CHECK process and a regenerative process or other process should be based on a cost performance evaluation of the total system. A combination of some other process and the SULFA-CHECK process, as a highly efficient polisher, may be more attractive in processing of some very large gas volumes.

The process might not be useful with a single vessel if a continuous gas flow must be maintained. Even though the SULFA-CHECK process if continuous, flow must be interrupted for periodic disposal of spent slurry. Long running times are possible to minimize these interruptions. Multiple vessels can be used in parallel to achieve continuous operation.

Economic limitations would probably not be as significant in a situation where large scale oil production must be curtailed because of associated sour gas production.

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Rocky Mountain Region
Casper, WY
Telephone: 307/472-4309

West Texas Region
Midland, TX
Telephone: 915/684-7869

Mid-Continent Region
Oklahoma City, OK
Telephone: 405/840-7194

Texas Gulf Coast Region
Houston, TX
Telephone: 713/987-5439

Eastern Region
Lafayette, LA
Telephone: 318/237-4810

INTERNATIONAL LOCATIONS

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