

**JOHNNY RAY CLEMENTS  
ELECTRIC AND INSTRUMENT  
SERVICE CORP.**

185 Cedar Oaks Drive, Mabank, TX 75147, 1-~~817~~<sup>903</sup>-451-4112

OFFICE OF PUBLIC ASSISTANCE

OCT 14 1998

OO#7733

To: Annie Tyrone  
From: Johnny Ray Clements  
Subject: Dynegy Permit Public Meeting in Payne Springs, TX October 8, 1998

CHIEF CLEMENTS OFFICE

FRI OCT 13 PM 4:10

REGISTRATION DIVISION  
OCT 14 1998

Hello, my name is Johnny Ray Clements owner of Johnny Ray Clements Electric and Instrument Service Corp.

First I would like to tell you about who I am and my history in the oil patch. I worked over ten years for Fish Engineering and Construction Inc. as an electrical supervisor and superintendent. Projects under my direction were almost all gas processing plants. About five years of that experience was building the Dynegy Eustace Plant and remodeling the Jay, Florida gas field and the Exxon St. Regis Plant and surrounding plants. The Eustace and Jay facilities are sour gas plants. In January 1985 I started my company contracting to Smackover Shell Limited Partnership Eustace Field and Plant.

Since January, 1985 my company has contracted in the Eustace Plant for nearly 14 years. We have been contracted by every owner the plant has had. I have also contracted work in the three other sour gas plants in Texas, one in Alabama, and one in Wyoming. I also have sour gas experience in the paper mill industries. I have contracted in sweet gas plants in Texas and Louisiana.

Our current work load is to do electrical and instrument preventive maintenance, troubleshooting, repairs and some construction at the Dynegy Eustace plant, and Dynegy's 12" sour gas and 3" fuel pipelines from the Myrtle Springs Plant to the Eustace Plant. We also perform similar jobs for the Shell Oil Co. wellfield that feeds the Eustace plant with sour gas. I am a working contractor and perform many of these jobs myself. I also have electrical and instrument technicians that work in the Eustace plant and pipeline. These technicians are well trained and experienced in the handling and detection of sour gas, hydrocarbon gases, chemicals and acids.

Now let me tell you about the Dynegy Eustace Plant, and sour gas pipeline. The plant is by far the best operated, cleanest, and safest sour gas plant that I have ever worked in. There are several reasons for this outstanding performance. The plant has the most experienced staff to manage operate and maintain the plant that I have worked with. Many of these Dynegy employees were at the Eustace Plant in 1980 when it began

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SERVICE CORP.**

185 Cedar Oaks Drive, Mabank, TX 75147, 1-214-451-4112

operations. The employees that transferred to the Eustace plant had many years experience in the other gas plants and oil production. The Eustace Plant employees are hard working, alert, and conscientious about their jobs and responsibilities. No jobs are performed in the plant without good communication between operations personnel and the person performing the job. Most jobs are done with a safe work permit. This means operations must check that all safety requirements are in place and the work area has been checked for any hazards. Before any equipment is worked on, it is isolated, depressured, drained and locked and tagged out and tried. The Dynegy Safe Work Permit System assures that all of these checks have been made. Contractors use the same system as the plant employees. All Eustace plant employees and contractors are trained Dynegy for all government required training and additional training required by Dynegy. The Dynegy Eustace plant employees and contractors are first class people who do a great job.

Contractors at the Eustace plant work side by side with the plant employees almost like partners. To assure that everyone is working toward a common safe goal of operating and maintaining the Eustace plant, there is no adversarial relationship between plant personnel and contractors.

The Eustace plant has more emission controls and ambient air monitoring devices than any sour gas plant that I have ever been associated with. These controls and monitoring systems are continually being upgraded as new technology becomes available. This is also true for the 12" sour gas pipeline. The pipeline is equipped with a state of the art SCADA System that allows the pipeline to be monitored from the control room at the Eustace Plant. The Eustace plant is always reviewing operating procedures and ways to improve the safety and performance of the plant.

The Dynegy Eustace Plant is a well operated and well maintained plant that runs better now than ever. I am sure that as the plant gets older, Dynegy will continue to improve this plant to assure its clean and safe operation.

As a contractor, I would not want this letter to be interpreted as self-serving. There have been many facilities where I have turned down work because of unsafe conditions for my employees and myself. My daughter has worked for me as an electricians helper and soon my son may have that opportunity. If the Dynegy Eustace Plant is as unsafe as some people believe, I would not put my family, employees and myself at risk. All statements above are truthful and without prejudice.

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Commissioning

July 23, 1998

TEXAS NATURAL RESOURCE  
CONSERVATION COMMISSION

1998 JUL 27 PM 3:41

OPA *10*

Chief Clerks Office MC-105  
Texas Natural Resource Conservation Commission  
P. O. Box 13087  
Austin, TX 78711-3087

CHIEF CLERKS OFFICE

JUL 28 1998

CCO# 7733

Gentlemen:

Re: Dynegy Midstream, Inc. (formerly Warren NGL, Inc.)  
Air Quality Permit Nos. 6051 & 6052  
Henderson County, Texas

We are located on Bushwhacker Peninsula in Payne Springs approximately three miles south and only slightly west of the Dynegy plant referenced above. We are very much concerned about the emissions from this plant.

Our area has become a retirement area with more permanent, full-time residents rather than just "weekend" residents or commuters. With this change in demographics, there are more people here full-time to be exposed to the emissions produced by the Dynegy plant. We also have residents involved in exercise programs which include walking, jogging, running, cycling, gardening, etc. These activities, performed outdoors, further expose our residents to the dangers of contaminants in the air.

When winds are from the south as they are a good part of the time, emissions are blown away from us and toward some other less fortunate people. But, on the days when there is little wind, emissions drift over us. When performing activities outdoors we are often bothered with raw-feeling nasal passages and scratchy throats.

When we have low cloud cover with low ceiling and fog as is often the case in winter and/or stormy seasons, there is a further burning of the eyes along with a noxious odor that makes it impossible to stay outside for any length of time. Weather conditions act as a cap or umbrella which holds the emissions in place over us. Fire rising from the stack must surely constitute a fire hazard as well. At night the sky is filled with fiery light and a large plume of thick smoke collects overhead contaminating our air. When winds are from the north, we receive a direct shot of fumes and emissions.

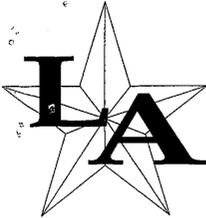
We don't feel this company is acting responsibly by releasing emissions into the air. We don't feel they are acting responsibly by not advising local residents of risks associated with contaminants from their plant. And, we further feel they are not acting responsibly by not advising residents of action required to ensure the safety of the community in the event of failure of their plant and/or some other hazardous emergency associated with their operation.

Sincerely yours,

*C.C. + Barbara Creach*

C. C. & Barbara Creach  
250 Bushwhacker Drive  
Mabank, TX 75147  
903/451-9706

✓



# Support Group, Inc.

P.O. Box 470, Athens, Texas 75751

OFFICE OF PUBLIC ASSISTANCE

OCT 14 1998

(903) 489-0679

RECEIVED

Fax (903) 489-0652

COA#7733

October 8, 1998

CHIEF CLERKS OFFICE

OCT 13 PM 4:11

RECEIVED OCT 13 1998  
CLERKS OFFICE

**TO: TEXAS NATURAL RESOURCES CONSERVATION COMMISSION**

**Re: Air Quality Permit Nos. 6051 & 6052 -- Renewal Applications  
Relating to an existing Natural Gas Processing and Sulfur Processing Plant  
Located on Route 2, approximately 4 Miles SW of Eustace, Henderson County, TX**

Dear Distinguished Members of the TNRCC:

My name is Don Donaldson. I am a life long resident of Texas and have been a resident of Henderson County since 1990. My professional background involves 22 years of Risk Management & Risk Mitigation with a significant amount of experience in toxic tort, Super Fund Claims and exposures, and interactions with the TNRCC and its predecessor organizations. I have worked for years in environmental litigation involving Haz-Mat claims and clean up, occupational exposures and diseases.

I have seen and worked with occupational and environmental injuries and litigation from such tangential theories as Meat Packer's Asthma to the horrific nightmare of the loss of all hands on a semi-submersible platform in the Gulf from the uncontrolled release of Hydrogen Sulfide. I have had to knock on far too many families' doors to be the first to advise them of the loss of loved one due to a BOP failure, gas explosion, or fatal release of some toxic substance. I was front and center for 10 years in the Brio/Southbend matter and may be one of the most knowledgeable people in this or any other state on virtually every aspect of that fiasco. I have also been involved with Conroe Creosote, Lone Star Steel, numerous chlordane migration and invasion incidents all across Texas. I can assure the distinguished representatives of TNRCC that I did not seek to acquire this wealth of toxic tort/regulatory oversight experience. Despite my best efforts, it seemed to find me.



So, when I was contacted by a family friend about the activities of Cedar Creek Lake Area Concerned Citizens and their concerns about the Dynegy's renewal applications for the Sour Gas Plant near Eustace, I was less than anxious to become involved. Despite all the years of experience and insight I have accumulated in oilfield related catastrophes, I have always maintained the general belief that corporations, especially very large Fortune 500 corporations, do not intentionally, through action or inaction, harm the general public in the blind pursuit of profit. This is not to say that I have not seen horrible things done by companies or at a minimum, grossly negligent conduct. Those observations were tempered by an even greater number of situations where individuals or even entire groups would become gripped in anxiety due to the unsubstantiated rumors or threats of exposures relating to hazardous materials or emissions.

Many times the reality, based on my inside knowledge and independent investigation, found most or all of the fears were due to a lack of information and/or education or, misinformation by an interested party and, sometimes it was just plain old greed. It was with this background that I reluctantly contacted one of the organizing members of the Cedar Creek Lake Area Concerned Citizens after numerous phone calls and emails from my concerned friend.

After speaking with a few members of this group, I very reluctantly agreed to actually meet with them and review some of their materials and documentation. Prior to the meeting, I did some basic research on TNRCC permitting, emission standards and testing, and reviewed some of the more recent scientific reports and learned treatises on Hydrogen Sulfide and Sulfur Dioxide exposure risks. I began to become slightly concerned after my initial attempt to obtain a clear understanding of the TNRCC's emissions standards, effective screening levels (ESL), ambient air testing and reporting requirements, and public notification requirements specifically relating to Hydrogen Sulfide and Sulfur Dioxide as contained in Title 30 of the Texas Administrative Code. Having over 20 years of experience in locating, understanding and applying all sorts of state and federal statutes, I found the combined statutory and regulatory provisions of the TNRCC to be the most needlessly complex, confusing, bureaucratic hodge-podge I had ever seen. It very quickly became my opinion that the regulators in charge of the permitting, and oversight and monitoring of toxic waste emitters in this state were, by the very nature of their published rules and regulations, telling the public to go away and do not interfere with that which we do not want you to know or understand.

So, I agreed to stop by for a quick visit a few weeks ago and pick up some material and get back to them. I was met by some very ordinary people, calm and rational in demeanor and appearance, and began to review the documentary materials they presented to me. I was not badgered or pressured. There was no attempt to influence my opinion or predispose the outcome of my review. The minutes turned into hours as I poured through stacks of official records, reports, and documentation of the Dynege plant operations. Having done countless such document reviews in daily professional life, one develops a sense about the credibility of the documents being reviewed, the credibility of the argument the documents purport to expose, and fundamental integrity of the proponents. As I reviewed, even by my standards, an enormous volume of TNRCC documents, industry materials, scientific data, and even video tape they had taken of upsets and unauthorized emissions from the Dynege facility, I was slowly overcome by a sense of disbelief.

The official materials, scientific evidence and documented accounts from residents I reviewed during this six hour "brief visit" revealed a shocking pattern of uncontrolled upsets and fugitive emissions which received little if any response by the plant owners/operators. The TNRCC's actions in investigating, evaluating, and compliance monitoring throughout this period, despite numerous and repeated complaints and offers of evidence by local residents, can only be described as abject indifference. Still in a state of disbelief I initiated my own investigation of the plant operations, cooperation with local residents, and the TNRCC's stewardship of their regulatory duties to protect the natural resources and citizens of this state.

One of the first obstacles I encountered as I began my investigation was the unexplained loss by TNRCC's Tyler office of almost 7 months of upset and fugitive emission reports for 1997 relating to the Dynege's Sour Gas Operation in Eustace. One of my main concerns was the seeking some explanation for what appeared to be regulatory indifference by TNRCC to the deluge of consumer complaints made against Dynege's operation. I wanted to compare the extensive and detailed telephone logs of calls and complaints maintained by the residents I met to the records of the TNRCC. It is my understanding the entire period in question, almost seven months of reports, records, and documentation of critical information and statutory documentation cannot be accounted for or located by the TNRCC.

Just today I learned that the Western Sour Gas Plant in Edgewood apparently has been acquired by Dynege and it is rumored to be their intention to shut down the Edgewood plant so that all processing formerly done at Edgewood will be done at Eustace. Was the TNRCC aware of this situation? Would not such action on Dynege's part require reconsideration or reapplication of their permit due to the additional emissions generated by taking over the Edgewood Sour Gas processing?

Also just yesterday, I discovered that Dynege Midstream, Inc., a Delaware corporation, is not in good standing with the Texas Secretary of States Office and/or the Comptroller of Currency<sup>1</sup>. How can a corporation which has not seen fit or been able to resolve its affairs with the Secretary of State and the Comptroller of Currency office even submit an application for approval to a subsidiary state agency in Texas? If the TNRCC was not aware or take the time to become aware of this situation it raises serious concerns. To my knowledge, no insurance company, car dealership, retail sales company could obtain similar privileges. What should the citizens do about a regulatory authority with such a broad mandate to protect the health and safety of citizens who will allow a foreign corporation to come into this state and begin toxic chemical emissions without having the desire and/or ability to maintain good standing and satisfying all state tax requirements?

There is much about the renewal process and approval which raises concern. The copies of Dynege's renewal application released to the public indicated that an important part of the renewal process involves an inter-departmental check of complaints. Given the obvious importance of such a cross check of each and every permit application for violations and complaints I was shocked that the renewal Dynege's renewal applications could receive such prompt inter-departmental approval when the records for over one half of the previous year are missing. It is my understanding that the TNRCC's own rules as well as the enabling statutory language requires due consideration of citizens complaints in any application submission. I would like to know how any meaningful and responsible review was made of the Dynege renewal applications without this vital information. Further, I would like to know if the TNRCC does not feel that all entities under its supervision are exempt from maintain good standing with constitutional offices run by elected officials like the Secretary of State and the Comptroller of Currency?

Do the people you see here this evening have any reason to worry about some intention to conceal important information to which we are entitled? Do we need to be concerned about the possibility anyone involved in this process would or could deceive this community who have already announced grave concerns about the plant safety and emissions?

My own limited investigation of the circumstances surrounding the renewal process leads me to the conclusion as a citizen and experienced professional in investigating and evaluating toxic tort events that the safety of the residential population, including the large and growing school age population, has received little if any attention or concern in the past, continues to be a minor concern today and, unless dramatic steps are taken, could easily become a footnote in some TNRCC accident report describing a catastrophic release of deadly emissions from Dynege's Eustace Plant sometime in the not too distant future.

To really understand the health hazard presented by the Dynegy plant operations and emissions, one must be aware of the spectrum of toxic and life threatening gases, liquids, and/or solids which are created, processed or stored there. For the purposes of this discussion, I will limit my comments to only the sulfur compounds involved at Dynegy. According to the Permit Renewal Applications submitted by Dynegy, there are at least 9 other compounds or entire families of compounds that are subject to release or exposure at this facility. Those compounds are highly toxic individually, however, it is important to note that enhanced toxic effect one or more of those other compounds has when combined with smallest quantity of Hydrogen sulfide or Sulfur Dioxide.

There is one thing which anyone who has come in contact with Hydrogen Sulfide and survived the experience would universally agree upon: the unmistakable odor of rotten eggs. It is a most unpleasant and foul smell which is so noxious to senses that concentrations as low as .25 ppm are detectable by smell and concentrations of 20-30 ppm are barely tolerable<sup>2</sup>. It is a fairly unique odor in nature and absolutely unique to the Dynegy plant emissions as there is no other natural or artificial emission source in proximity to the plant.

According to National Institute for Occupational Safety and Health & Centers for Disease Control, "Hydrogen Sulfide is a nearly ubiquitous, acute acting toxic substance. It is a leading cause of sudden death in the workplace. Brief exposures to hydrogen sulfide...have caused unconsciousness, respiratory paralysis, and DEATH. ...there is some evidence that hydrogen sulfide alone at low concentrations or in combination with other chemical substances (e.g., hydrocarbons or carbon disulfide) has caused nervous system, cardiovascular, and gastrointestinal disorders, and effects on the eyes."<sup>3</sup>

This same criteria document, which was reviewed by 6 consultants, two professional societies, and various Government agencies having interest and responsibility for occupational safety and health, recommends that exposure to hydrogen sulfide be limited to a ceiling concentration of 10 parts per million for no longer than 10 minutes. According to NIOSH Standards, any occupational situation where there is even the POTENTIAL for exposure to hydrogen sulfide at a concentration of 50 ppm REQUIRES CONTINUOUS MONITORING due to the rapid, often lethal effects of exposure.<sup>1</sup>

According to the internationally recognized, *ENCYCLOPAEDIA OF OCCUPATIONAL HEALTH AND SAFETY*, workers which will be exposed to levels of hydrogen sulfide concentrations as low as 10 ppm should receive pre-employment medical examinations to rule out pre-existing conditions of the eyes and nervous system. It emphasizes that any person with eye and/or nervous disorders should not be assigned to any work environment involving exposure to hydrogen sulfide whatsoever. All employees exposed to hydrogen sulfide levels of 10 ppm within the work place should receive medical examinations at least every 6 months throughout the period of their workplace exposure.<sup>4</sup>

The Science Information Resource Center indicates that the *threshold for olfactory fatigue occurs at 150 ppm*<sup>5</sup>, which means that despite the profound smell of rotten eggs associated with this deadly gas, one breath of hydrogen sulfide at this concentration will cause the loss of the sense of smell, thus the characteristic noxious odor is unreliable as a warning signal to exposed persons. There is can be no argument that the persons in close proximity to the Dynege plant are very exposed persons. The TNRCC apparently considers communities as remote as the City of Corsicana, TX within the range of affected locations from the toxic emissions of the Eustace plant. The TNRCC voluntarily provided the mayor, the city manager and the county judge complete copies of both Dynege renewals applications. I am sure Navarro County residents are pleased about the TNRCC's aggressive concern for their environmental quality due to Dynege's emissions from the Eustace plant. I would ask you, therefore, why are the people of Navarro County favored over the *critically exposed and affected* residents of Henderson County who learned of the renewal applications almost by chance as a result of an add placed in the *Athens Review*. If Athens and Corsicana comprise the outer boundaries of toxic exposure, there seems no logical or rational reason our community, the men and woman who live in direct proximity to the chemical emissions, would receive such second class treatment from the agency which is charged with protecting the health of all Texas citizens. Has the local community surrounding the Dynege Plant done something to justify or warrant the wrath or abandonment of the TNRCC? If so, please, on behalf of all concerned and affected citizens of Henderson County, I ask for you to accept our deepest and most sincere apology for whatever we may have done to deserve such disfavor to any employee or representative of the TNRCC.

TNRCC  
10/08/98  
Page 7

This is literally a matter of life and death for the local community. The uncooperative and nonresponsive feedback received by anyone who has asked for assistance or information fuels the concern about the plant's safety and reliability. If the TNRCC will not respond to the viable and reasonable inquires and concerns of the local community, we will be forced to take our concerns to other regulatory agencies, the governor's office and even potential judicial relief. Take a moment to consider the position of this community. Take a moment to think about the children of this area which is expected to double during the life of the renewal permit you are evaluating. Whatever you do, please be prompt and please be forthright, because time is of the essence to all concerned. Awaiting your considered response, I will remain

Very truly yours,



Don H. Donaldson, CIC, CRM, RPA  
President  
:dp  
Enclosure

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<sup>1</sup> Certificate of Account Status dated, 10/07/98, attached.

<sup>2</sup> *Handbook of Chemistry & Physics*, Section IV, Part B, Chp. 18, p. 261

<sup>3</sup> NIOSH, A Recommended Standard For Occupational Exposure to Hydrogen Sulfide. Publication No. 77-158 (May 1977)

<sup>4</sup> INTERNATIONAL LABOUR OFFICE - GENEVA, *Encyclopaedia of Occupational Health and Safety*, 3<sup>rd</sup> (Revised) Edition, p. 1090,1

<sup>5</sup> SIRC, *Chemical Hazards of the Workplace*, 2<sup>nd</sup> Edition, ISBN 0-397-53025-0. J.B. Lippincott Company, 1988.

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John Sharp, Texas Comptroller of Public Accounts

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click Letter of Corporate Standing and use your browser print function.  
(Certificates for 6.06 dissolution are NOT available through this Web site at this time.)

[Letter of Corporate Standing](#)[Officers and Directors Information](#)

Company Information	<b>DYNEGY MIDSTREAM INC</b> 1000 LOUISIANA ST STE 5800 ATTN BOB SCHW HOUSTON, TX 77002-5000
Status	<b>CORPORATION IS NOT IN GOOD STANDING</b>
Registered Agent	C T CORPORATION SYSTEM 350 N ST PAUL ST DALLAS, TX 75201
State of Incorporation	DE
Charter/COA Number	000884973-6
Charter/COA Date	08-02-1991
Charter/COA Type	FOREIGN PROFIT
Corporate Status	ACTIVE
Corporate Date	08-02-91
Next Report Due	1998 ON 05-15-98
Last Report Filed	1997
Last Public Information Report Filed	1997

For help, see [Detailed Instructions](#)

INTERNATIONAL LABOUR OFFICE GENEVA

THE ENCLOSED INFORMATION WAS  
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**ENCYCLOPAEDIA  
OF  
OCCUPATIONAL  
HEALTH** THIRD (REVISED) EDITION  
**AND SAFETY**

\* Technical editor:  
Dr. Luigi Parmeggiani

VOLUME 1

**A-K**

carov berekisi vodoroda pri indalacionnom konom putian  
(ozdeistvija). Kontrašov, V. A. *Giiena truda i profesion-*  
*stivnye zapolevanija* (Moscow), Oct. 1977, 10: 22-25, 16 ref.  
(In Russian)

## Hydrogen sulphide

### Hydrogen sulphide (H<sub>2</sub>S)

#### UNCLASSIFIED HYDROGEN

m.w.	34
d.	1.54
m.p.	-85.5 °C
b.p.	-60.7 °C
v.d.	1.19
v.p.	20 atm (2026.10 <sup>3</sup> Pa) at 20 °C
e.l.	13-46%
t.	260 °C

soluble in water, ethyl alcohol, gasoline, kerosene and crude oil  
a colourless gas with a characteristic rotten-egg odour.

TWA OSHA	20 ppm ceiling
	50 ppm/10 min peak
MOSH	10 ppm/10 min peak
TLV ACGIH	10 ppm 15 mg/m <sup>3</sup>
STEL ACGIH	15 ppm 27 mg/m <sup>3</sup>
DLH	300 ppm
MAC USSR	10 mg/m <sup>3</sup>

**Production.** It is produced by reacting iron sulphide with dilute sulphuric or hydrochloric acid or by reacting hydrogen with vaporised sulphur. It is also released during the decay of sulphur-containing organic materials and, as such, may be encountered in mines (where it is often called "stink damp"), gas wells, sewers, etc. It occurs as the by-product of many chemical processes, particularly those involving viscose rayon, synthetic rubbers, petroleum products, dyes and leather, and in the processing of sugar.

**Uses.** Hydrogen sulphide is used for the production of various inorganic sulphides, sulphuric acid and organic sulphur compounds such as thiophene and mercaptans. It is widely used as an analytical reagent. In agriculture it is used as a disinfectant.

### HAZARDS

**Fire and explosion.** Hydrogen sulphide is a flammable gas which burns with a blue flame giving rise to sulphur dioxide, a highly irritating gas with a characteristic odour. Mixtures of hydrogen sulphide and air in the explosive range may explode violently; since the vapours are heavier than air, they may accumulate in depressions or spread over the ground to a source of ignition and flash back.

When exposed to heat, it decomposes to hydrogen and sulphur and, when in contact with oxidising agents such as nitric acid, chlorine trifluoride, etc., it may react violently and ignite spontaneously.

Extinguishing agents recommended for the fighting of hydrogen sulphide fires include carbon dioxide, chemical dry powder and water sprays.

**Health hazards.** Even at low concentrations, hydrogen sulphide has an irritant action on the eyes and respiratory tract. Intoxication may be hyperacute, acute, subacute or chronic.

Low concentrations are readily detected by the characteristic rotten-egg odour; however, prolonged exposure dulls the sense of smell and makes the odour a very unreliable means of warning. High concentrations

can rapidly deaden the sense of smell. Hydrogen sulphide enters the body through the respiratory system and is rapidly oxidised to form compounds of low toxicity; there are no accumulation phenomena, and elimination occurs through the intestine, urine and the expired air.

In cases of slight poisoning, following exposure to from 10 to 500 ppm, a headache may last several hours, pains in the legs may be felt and rarely there may be loss of consciousness. In moderate poisoning (from 500 to 700 ppm) there will be loss of consciousness lasting a few minutes, but no respiratory difficulty. In cases of severe poisoning the subject drops into a profound coma with dyspnoea, polypnoea and a slate-blue cyanosis until breathing restarts, tachycardia and tonic-clonic spasms.

Inhalation of massive quantities of hydrogen sulphide will rapidly produce anoxia resulting in death by asphyxia; epileptiform convulsions may occur and the individual falls apparently unconscious, and may die without moving again. This is a syndrome characteristic of hydrogen sulphide poisoning in sewermen; however, in such cases, exposure is often due to a mixture of gases including methane, nitrogen, carbon dioxide and ammonia.

In subacute poisoning, the signs may be nausea, stomach distress, foetid eructations, characteristic "rotten-egg" breath, and diarrhoea. These digestive-system disorders may be accompanied by balance disorders, vertigo, dryness and irritation of the nose and throat with viscous and mucopurulent expectoration and diffuse rales and ronchi.

There have been reports of retrosternal pain similar to that found in *angina pectoris* and the electrocardiogram may show the characteristic trace of myocardial infarction, which, however, disappears quite rapidly. The eyes are affected by palpebral oedema, bulbar conjunctivitis, and mucopurulent secretion with, perhaps, a reduction in visual acuity—all of these lesions usually being bilateral. This syndrome is known to sugar and sewer workers as "gas eye". It has been found in the viscose rayon industry that the severity of this keratoconjunctivitis is directly related to the atmospheric concentration of hydrogen sulphide and not to that of carbon disulphide which lowers the danger threshold level of the former. Experimental studies have shown that the atmospheric concentration of hydrogen sulphide must be kept below 10 mg/m<sup>3</sup> if keratoconjunctivitis is to be prevented.

The existence of chronic hydrogen sulphide intoxication is denied by certain authorities, whereas others claim that this disease is characterised by headaches, asthenia, eye disorders, chronic bronchitis and a grey-green line on the gums; as in acute poisoning, the ocular lesions are said to predominate. Reports of nervous system disorders including paralysis, meningitis, polyneuritis and even psychic troubles have also been made.

In rats, exposure to hydrogen sulphide has given rise to teratogenic effects.

**Metabolism and pathology.** Hydrogen sulphide has a general toxic action. It inhibits Warburg's respiratory enzyme (cytochrome oxidase) by binding iron, and the oxvdo-reduction processes are also blocked. This inhibition of enzymes essential for cellular respiration may be fatal. The substance has a local irritant action on the mucous membranes since, on contact with moisture, it forms caustic sulphides; this may also occur in the lung parenchyma as a result of combination with tissue alkalis. Experimental research has shown that these sulphides may enter into the circulation, producing respiratory effects such as polypnoea, bradycardia and

hypertension, by their action on the vasosensitive, reflexogenic zones of the carotid nerves and Hering's nerve.

*Post mortem* examination in a number of cases of hyperacute poisoning has revealed pulmonary oedema and congestion of various organs. A characteristic autopsy feature is the odour of hydrogen sulphide that emanates from the dissected corpse. Other features of note are the haemorrhages of the gastric mucosae, the greenish colour of the upper regions of the intestine and even of the brain.

*Detection and analysis.* A prime indicator of hydrogen sulphide presence in the air is the characteristic odour, which can be detected at even minute concentrations.

A variety of methods exist for detecting hydrogen sulphide in the atmosphere, including the use of detector papers impregnated with lead sodium acetate and detector tubes, and various other reagents such as cadmium sulphide, lead sulphide and *p*-dimethylphenylenediamine. A very sensitive method (1 ppb) with sampling on silica gel and spectrophotometric analysis has recently been described.

## SAFETY AND HEALTH MEASURES

*Technical prevention.* Persons working on processes in which hydrogen sulphide is either employed or given off as a by-product should be informed of the dangers of this substance. Processes should be enclosed and exhaust ventilation applied to possible escape areas. The atmospheric concentration of hydrogen sulphide around these processes should be monitored.

Where it is necessary to enter a confined space that may contain hydrogen sulphide (such as a process plant or sewer), the space should be purged and the hydrogen sulphide concentration determined before entry and at frequent intervals during the course of the work; under no circumstances should reliance be placed on the sense of smell to detect the presence of the gas.

Where the presence of hydrogen sulphide has been detected, the worker entering the confined space should wear suitable respiratory protective equipment of a self-contained or airline type, a safety belt and lifeline, and should be observed from the outside by a responsible worker. Hydrogen sulphide may be dissolved or trapped in sludge in sewers or process vessels and will be released into the atmosphere during sludge agitation. Workers exposed to hydrogen sulphide should also wear chemical safety goggles.

It has been suggested that calcium chloride or a mixture of ferrous sulphate and lime should be added to process washing water as a neutralising agent each time the development of hydrogen sulphide occurs.

Hydrogen sulphide cylinders should be stored in a well ventilated, fire-resistant structure, protected from the weather. Smoking and naked flames should be prohibited in areas where hydrogen sulphide is stored or used and electrical equipment should be of the flameproof type. During transport the cylinders should be suitably restrained and should bear an appropriate warning label.

*Medical prevention.* Persons required to work in areas where hydrogen sulphide may be encountered should receive a pre-employment medical examination. Persons with eye and nervous disorders, in particular, should not be assigned to work entailing exposure to hydrogen sulphide; the pre-employment examination should be backed up by periodic examinations (preferably at intervals of 6 months). In Italy these examinations are compulsory for oil refinery workers, viscose spinners and sewermen.

Diseases caused by hydrogen sulphide are recognised as occupational diseases in Czechoslovakia, Finland, the Federal Republic of Germany, Italy, Japan, Mexico, Spain, Switzerland, etc.

*Treatment.* In the event of acute poisoning, the victim should be removed from exposure and transported to the nearest resuscitation centre for hyperbaric oxygen treatment. When no such facilities are available it is helpful to carry out artificial respiration with inhalation of oxygen. The respiratory centre may be stimulated by injections of lobelin and nikethamide (1 cm<sup>3</sup> and 5 cm<sup>3</sup> respectively). Vitamin C may be injected intravenously.

Eye exposure should be treated with boric acid solution or isotonic physiological solutions; instillation of a drop of olive oil has also been recommended as an immediate measure. For the more serious cases, recourse may be had to 1% adrenalin solution drops and the application of hot or cold compresses.

CACCURI, S.

### Occupational health:

CIS 77-1371 *Criteria for a recommended standard—Occupational exposure to hydrogen sulfide.* DHEW (NIOSH) publication No. 77-158 (National Institute for Occupational Safety and Health, 4676 Columbia Parkway, Cincinnati) (May 1977), 149 p. 171 ref.

"Hydrogen sulphide poisoning. Medical emergency at the enterprise" (Intoxications par hydrogene sulfuré. Urgence medicale dans l'entreprise). Demaret, D., Fialaire, J. *Archives des maladies professionnelles, de medecine du travail et de securite sociale* (Paris), Dec. 1978, 39/12 (761-767). (In French)

### Safety:

CIS 78-753 *Hydrogen sulfide.* Data Sheet 284, Revision A (National Safety Council, 425 North Michigan Avenue, Chicago 60611) (1977), 4 p. Illus. 7 ref.

### Detection and analysis:

CIS 77-1350 *An evaluation of portable, direct-reading H<sub>2</sub>S meters.* Thompkins, F. C., Becker, J. H. DHEW (NIOSH) publication No. 77-137 (National Institute for Occupational Safety and Health, 4676 Columbia Parkway, Cincinnati) (July 1976), 167 p. Illus.

CIS 79-1319 "Hazards in the work environment—Hydrogen sulfide". Waernbaum, G., Wallin, I. *Scandinavian Journal of Work, Environment and Health* (Helsinki), Mar. 1979, 5/1 (31-34), 3 ref.

CIS 80-1008 *H<sub>2</sub>S safety handbook* (Safety Oilfield Services, PO Box 52722, Lafayette, Louisiana 70505) (1978), 32 p. Illus.

## Hydroxylamine

### Hydroxylamine (NH<sub>2</sub>OH)

OXAMMONIUM

m.w. 33  
sp.gr. 1.20  
m.p. 33.0 °C  
b.p. 56.5 °C  
v.p. 10 mmHg (1.33·10<sup>3</sup> Pa) at 47.2 °C  
f.p. 129.4 °C (explodes)

soluble in water, ethyl alcohol and acids

very hygroscopic white crystals or colourless liquid with alkaline reaction; in alkaline medium, hydroxylamine is a powerful reducing agent; in an acid medium, it acts as an oxidising agent.

*Production.* Mainly by electrolytic reduction of ammonium chloride and alkaline decomposition of the resultant hydroxylamine hydrochloride, or by reducing

# Occupational Health Guideline for Hydrogen Sulfide

## INTRODUCTION

This guideline is intended as a source of information for employees, employers, physicians, industrial hygienists, and other occupational health professionals who may have a need for such information. It does not attempt to present all data; rather, it presents pertinent information and data in summary form.

## SUBSTANCE IDENTIFICATION

- Formula:  $H_2S$
- Synonyms: Sulfuretted hydrogen; hydrosulfuric acid; hepatic gas
- Appearance and odor: Colorless gas with a strong odor of rotten eggs. The odor of this gas should not be used as a warning, since its presence may deaden the sense of smell. Hydrogen sulfide can also exist as a liquid at low temperature and high pressure.

## PERMISSIBLE EXPOSURE LIMIT (PEL)

The current OSHA standard for hydrogen sulfide is a ceiling level of 20 parts of hydrogen sulfide per million parts of air (ppm) or a maximum allowable peak of 50 ppm for 10 minutes once, if no other measurable exposure occurs. NIOSH has recommended that the permissible exposure limit be reduced to 15 mg/m<sup>3</sup> (10 ppm) averaged over a 10-minute period, and that work areas in which the concentration of hydrogen sulfide exceeds 70 mg/m<sup>3</sup> be evacuated. The NIOSH Criteria Document for Hydrogen Sulfide should be consulted for more detailed information.

## HEALTH HAZARD INFORMATION

### • Routes of exposure

Hydrogen sulfide can affect the body if it is inhaled or if it comes in contact with the eyes, skin, nose or throat. It can also affect the body if it is swallowed.

### • Effects of overexposure

1. *Short-term Exposure:* Inhalation of high concentrations of hydrogen sulfide vapor may cause loss of consciousness and death. Inhalation of lower concentrations may cause headache, dizziness, and upset stomach. Exposure to hydrogen sulfide can cause temporary loss of the sense of smell, and irritation of the eyes, nose, or throat.

2. *Long-term Exposure:* Not known.

3. *Reporting Signs and Symptoms:* A physician should be contacted if anyone develops any signs or symptoms and suspects that they are caused by exposure to hydrogen sulfide.

### • Recommended medical surveillance

The following medical procedures should be made available to each employee who is exposed to hydrogen sulfide at potentially hazardous levels:

#### 1. *Initial Medical Examination:*

—A complete history and physical examination: The purpose is to detect pre-existing conditions that might place the exposed employee at increased risk, and to establish a baseline for future health monitoring. Examination of the eyes and lungs should be stressed.

—Eye disease: Hydrogen sulfide is a severe eye irritant and may cause tissue damage. Those with pre-existing eye problems may be at increased risk from exposure.

—14" x 17" chest roentgenogram: Hydrogen sulfide may cause human lung damage. Surveillance of the lungs is indicated.

—FVC and FEV (1 sec): Hydrogen sulfide is a respiratory irritant. Persons with impaired pulmonary function may be at increased risk from exposure. Periodic surveillance is indicated.

2. *Periodic Medical Examination:* The aforementioned medical examinations should be repeated on an annual basis, except that an x-ray is considered necessary only when indicated by the results of pulmonary function testing, or by signs and symptoms of respiratory disease.

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These recommendations reflect good industrial hygiene and medical surveillance practices and their implementation will assist in achieving an effective occupational health program. However, they may not be sufficient to achieve compliance with all requirements of OSHA regulations.

#### • Summary of toxicology

Hydrogen sulfide gas is a rapidly acting systemic poison which causes respiratory paralysis with consequent asphyxia at high concentrations. It irritates the eyes and respiratory tract at low concentrations. Inhalation of high concentrations of hydrogen sulfide, 1000 to 2000 ppm, may cause coma after a single breath and may be rapidly fatal; convulsions may also occur. Exposure to concentrations of hydrogen sulfide above 50 ppm for one hour may produce acute conjunctivitis with pain, lacrimation, and photophobia; in severe form this may progress to keratoconjunctivitis and vesiculation of the corneal epithelium. In low concentrations, hydrogen sulfide may cause headache, fatigue, irritability, insomnia, and gastrointestinal disturbances; in somewhat higher concentrations it affects the central nervous system, causing excitement and dizziness. Prolonged exposure to 250 ppm of hydrogen sulfide may cause pulmonary edema. Prolonged exposure to concentrations of hydrogen sulfide as low as 50 ppm may cause rhinitis, pharyngitis, bronchitis, and pneumonitis. Repeated exposure to hydrogen sulfide results in increased susceptibility, so that eye irritation, cough, and systemic effects may result from concentrations previously tolerated without any effect. Rapid olfactory fatigue can occur at high concentrations.

### CHEMICAL AND PHYSICAL PROPERTIES

#### • Physical data

1. Molecular weight: 34.08
2. Boiling point (760 mm Hg): -60 C (-76 F)
3. Specific gravity (water = 1): Liquid = 1.54
4. Vapor density (air = 1 at 15 C (59 F)): 1.189
5. Melting point: -82.4 C (-116 F)
6. Vapor pressure at 25 C (77 F): 20 atm
7. Solubility in water, g/100 g water at 20 C (68 F): 2.9 (slight)
8. Evaporation rate (butyl acetate = 1): Not applicable

#### • Reactivity

1. Conditions contributing to instability: Elevated temperatures may cause containers to burst.
2. Incompatibilities: Contact with strong oxidizers and oxidizing materials may cause fires and explosions. Hydrogen sulfide attacks many metals, which results in the formation of sulfides.
3. Hazardous decomposition products: Toxic gases and vapors (such as sulfur oxides) may be released in a fire involving hydrogen sulfide.
4. Special precautions: Liquid hydrogen sulfide will attack some forms of plastics, rubber, and coatings.

#### • Flammability

1. Hydrogen sulfide is a flammable gas.
2. Autoignition temperature: 260 C (500 F)
3. Flammable limits in air, % by volume: Lower: 4.3; Upper: 46
4. Extinguishant: Alcohol foam, carbon dioxide

#### • Warning properties

1. Odor Threshold: According to the AIHA *Hygienic Guide*, hydrogen sulfide can be recognized by the "sense of smell at low concentrations. Odor not reliable at high concentrations, and olfactory fatigue occurs quickly . . . . Threshold is 0.13 ppm. Faint but readily perceptible at 0.77 ppm. Easily noticeable at 4.6 ppm. Strong, unpleasant, but not intolerable at 27 ppm." The *Hygienic Guide* also states that "olfactory fatigue can occur with(in) 2 to 15 minutes at 100 ppm."

2. Eye Irritation Level: Grant states that "effects of hydrogen sulfide on the eyes are notable only at sublethal concentrations, most commonly at concentrations so low that they have no discernible systemic effect . . . . Typically, workmen exposed to low concentrations of hydrogen sulfide gas . . . have no sensation of irritation or discomfort for at least several hours, or sometimes for several days while working in the presence of low concentrations. Ocular symptoms generally start after several hours of exposure and may not appear until the patient has finished his work for the day. There is then gradual onset of a scratchy, irritated sensation in the eyes, with tearing and burning . . . . Experimentally it is demonstrable that at a concentration of 100 ppm in air an immediate irritation of the eyes and respiratory tract is produced, but conditions responsible for the vast majority of cases of hydrogen sulfide keratoconjunctivitis are those in which the concentration is too low to cause immediate irritation and has toxic effect only after several hours or days of exposure. However, in industries where the concentration is regularly kept below 10 ppm in air, it is rare to have any irritation of the eyes."

The *Hygienic Guide* states that "50 to 100 ppm causes slight conjunctivitis and respiratory tract irritation after 1 hour."

3. Evaluation of Warning Properties: Since olfactory fatigue occurs at high concentrations, and since the irritant effects are delayed, hydrogen sulfide is treated as a material with poor warning properties.

### MONITORING AND MEASUREMENT PROCEDURES

#### • Eight-Hour Exposure Evaluation

Measurements to determine employee exposure are best taken so that the average eight-hour exposure is based on a single eight-hour sample or on two four-hour samples. Several short-time interval samples (up to 30 minutes) may also be used to determine the average exposure level. Air samples should be taken in the employee's breathing zone (air that would most nearly represent that inhaled by the employee).

#### • Ceiling Evaluation

Measurements to determine employee ceiling exposure are best taken during periods of maximum expected airborne concentrations of hydrogen sulfide. Each measurement should consist of a fifteen (15) minute sample or series of consecutive samples totalling fifteen (15)

minutes in the employee's breathing zone (air that would most nearly represent that inhaled by the employee). A minimum of three (3) measurements should be taken on one work shift and the highest of all measurements taken is an estimate of the employee's exposure.

• **Peak Above Ceiling Evaluation**

Measurements to determine employee peak exposure should be taken during periods of maximum expected airborne concentration of hydrogen sulfide. Each measurement should consist of a 10-minute sample or a series of consecutive samples totalling 10 minutes in the employee's breathing zone (air that would most nearly represent that inhaled by the employee). A minimum of three measurements should be taken on one work shift and the highest of all measurements taken is an estimate of the employee's exposure.

• **Method**

Sampling and analyses may be performed by collection of hydrogen sulfide in an impinger containing an alkaline suspension of cadmium hydroxide, followed by chemical treatment, and spectrophotometric analysis. Also, detector tubes certified by NIOSH under 42 CFR Part 84 or other direct-reading devices calibrated to measure hydrogen sulfide may be used. An analytical method for hydrogen sulfide is in the *NIOSH Manual of Analytical Methods*, 2nd Ed., Vol. 6, 1980, available from the Government Printing Office, Washington, D.C. 20402 (GPO No. 017-033-00369-6).

## RESPIRATORS

• Good industrial hygiene practices recommend that engineering controls be used to reduce environmental concentrations to the permissible exposure level. However, there are some exceptions where respirators may be used to control exposure. Respirators may be used when engineering and work practice controls are not technically feasible, when such controls are in the process of being installed, or when they fail and need to be supplemented. Respirators may also be used for operations which require entry into tanks or closed vessels, and in emergency situations. If the use of respirators is necessary, the only respirators permitted are those that have been approved by the Mine Safety and Health Administration (formerly Mining Enforcement and Safety Administration) or by the National Institute for Occupational Safety and Health.

• In addition to respirator selection, a complete respiratory protection program should be instituted which includes regular training, maintenance, inspection, cleaning, and evaluation.

## PERSONAL PROTECTIVE EQUIPMENT

• Employees should be provided with and required to use impervious clothing, gloves, face shields (eight-inch minimum), and other appropriate protective clothing

necessary to prevent the skin from becoming frozen from contact with liquid hydrogen sulfide or from contact with vessels containing liquid hydrogen sulfide.

- Any clothing which becomes wet with liquid hydrogen sulfide should be removed immediately and not reworn until the hydrogen sulfide has evaporated.
- Employees should be provided with and required to use splash-proof safety goggles where liquid hydrogen sulfide may contact the eyes.

## COMMON OPERATIONS AND CONTROLS

The following list includes some common operations in which exposure to hydrogen sulfide may occur and control methods which may be effective in each case:

Operation	Controls
Liberation from pockets during underground mining operations near sulfide ores	Local exhaust ventilation; respiratory protective devices
Liberation during refining of high-sulfur petroleum	Concentration and recovery of H <sub>2</sub> SO <sub>4</sub>
Liberation from accumulations of decaying organic matter in sewers and waste waters of tanneries, glue factories, fat-rendering plants, and fertilizer plants	Provide continuous water discharge to sewer and cover and vent waste drains
Liberation as a by-product of dehairing and tanning process	Provide separate sewage lines and cover and vent waste drains; add neutralizing agents (CaCl <sub>2</sub> ) as appropriate; local exhaust ventilation
Liberation during manufacture of viscose rayon	Local exhaust ventilation
Liberation during production of sulfur dyes, carbon disulfide, sulfur, oleum, and thioprene	Local exhaust ventilation or process enclosure
Liberation during vulcanization of rubber; during manufacture of coke from coal having high gypsum content	Local exhaust ventilation or process enclosure
Liberation during excavation projects	Respiratory protective equipment

Liberation in closed containers containing organic matter

Respiratory protective equipment; life-support line

## EMERGENCY FIRST AID PROCEDURES

In the event of an emergency, institute first aid procedures and send for first aid or medical assistance.

### • Eye Exposure

If liquid hydrogen sulfide gets into the eyes, wash eyes immediately with large amounts of water, lifting the lower and upper lids occasionally. If irritation is present after washing, get medical attention. Contact lenses should not be worn when working with this chemical.

### • Skin Exposure

If liquid hydrogen sulfide gets on the skin, immediately flush the contaminated skin with water. If liquid hydrogen sulfide penetrates through the clothing, remove the clothing immediately and flush the skin with water. If irritation is present after washing, get medical attention.

### • Breathing

If a person breathes in large amounts of hydrogen sulfide, move the exposed person to fresh air at once. If breathing has stopped, perform artificial respiration. Keep the affected person warm and at rest. Get medical attention as soon as possible.

### • Rescue

Move the affected person from the hazardous exposure. If the exposed person has been overcome, notify someone else and put into effect the established emergency rescue procedures. Do not become a casualty. Understand the facility's emergency rescue procedures and know the locations of rescue equipment before the need arises.

## SPILL AND LEAK PROCEDURES

• Persons not wearing protective equipment and clothing should be restricted from areas of spills or leaks until cleanup has been completed.

• If hydrogen sulfide is spilled or leaked, the following steps should be taken:

1. Remove all ignition sources.
2. Ventilate area of spill or leak to disperse gas.
3. If in the gaseous form, stop flow of gas. If source of leak is a cylinder and the leak cannot be stopped in place, remove the leaking cylinder to a safe place in the open air, and repair the leak or allow the cylinder to empty.
4. If in the liquid form, allow to vaporize.

## REFERENCES

- American Conference of Governmental Industrial Hygienists: "Hydrogen Sulfide," *Documentation of the Threshold Limit Values for Substances in Workroom Air* (3rd ed., 2nd printing), Cincinnati, 1974.
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- Hunter, D.: *Diseases of Occupations* (4th ed.), Little, Brown, Boston, 1969.
- *Hygienic Information Guide No. 20 - Hydrogen Sulfide*, Commonwealth of Pennsylvania, Department of Environmental Resources, Bureau of Occupational Health, 1971.
- Manufacturing Chemists Association, Inc.: *Chemical Safety Data Sheet SD-36, Hydrogen Sulfide*, Washington, D.C., 1968.
- Manufacturing Chemists Association, Inc.: *Chemical Safety Data Sheet SD-71, Phosphorus Pentasulfide*, Washington, D.C., 1958.
- Milby, T. H.: "Hydrogen Sulfide Intoxication - Review of the Literature and Report of Unusual Accident Resulting in Two Cases of Nonfatal Poisoning," *Journal of Occupational Medicine*, 4:431-437, 1962.
- National Institute for Occupational Safety and Health, U.S. Department of Health, Education, and Welfare: *Criteria for a Recommended Standard . . . Occupational Exposure to Hydrogen Sulfide*, HEW Publication No. (NIOSH) 77-158, GPO No. 017-033-00217-7, U.S. Government Printing Office, Washington, D.C., 1977.
- Patty, F. A. (ed.): *Toxicology*, Vol. II of *Industrial Hygiene and Toxicology* (2nd ed. rev.), Interscience, New York, 1963.
- Sax, N. I.: *Dangerous Properties of Industrial Materials* (3rd ed.), Van Nostrand Reinhold, New York, 1968.

## RESPIRATORY PROTECTION FOR HYDROGEN SULFIDE

Condition	Minimum Respiratory Protection* Required Above 10 ppm
Gas Concentration	
300 ppm or less	Any supplied-air respirator with a full facepiece, helmet, or hood. Any self-contained breathing apparatus with a full facepiece.
Greater than 300 ppm or entry and escape from unknown concentrations	Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode.  A combination respirator which includes a Type C supplied-air respirator with a full facepiece operated in pressure-demand or other positive pressure or continuous-flow mode and an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive pressure mode.
Fire Fighting	Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode.
Escape	Any gas mask providing protection against acid gases or hydrogen sulfide. Any escape self-contained breathing apparatus.

\*Only NIOSH-approved or MSHA-approved equipment should be used.

**Medical Surveillance:** Consider the points of attack in preplacement and periodic physical examinations.

**First Aid:** If a person breathes in large amounts of this chemical, move the exposed person to fresh air at once and perform artificial respiration.

**Personal Protective Methods:** No particular methods are recommended by NIOSH.

**Respirator Selection:**

0.5 ppm: SA/SCBA  
2 ppm: SA/SCBA  
Escape: GMS/SCBA

**References**

- (1) See Reference (A-61).
- (2) See Reference (A-60).

## HYDROGEN SULFIDE

- Hazardous substance (EPA)
- Hazardous waste (EPA)

**Description:** H<sub>2</sub>S, hydrogen sulfide, is a flammable, colorless gas with a characteristic rotten-egg odor and is soluble in water.

**Code Numbers:** CAS 7783-06-4 RTECS MX1225000 UN 1053

**DOT Designation:** Flammable gas and poison.

**Synonyms:** Sulfuretted hydrogen, hydrosulfuric acid, stink damp.

**Potential Exposure:** Hydrogen sulfide is used in the synthesis of inorganic sulfides, sulfuric acid, and organic sulfur compounds, as an analytical reagent, as a disinfectant in agriculture, and in metallurgy. It is generated in many industrial processes as a by-product and also during the decomposition of sulfur-containing organic matter, so potential for exposure exists in a variety of situations. Hydrogen sulfide is found in natural gas, volcanic gas, and in certain natural spring waters.

It may also be encountered in the manufacture of barium carbonate, barium salt, cellophane, depilatories, dyes, and pigments, felt, fertilizer, adhesives, viscosc rayon, lithopone, synthetic petroleum products; in the processing of sugar beets; in mining, particularly where sulfide ores are present; in sewers and sewage treatment plants; during excavation of swampy or filled ground for tunnels, wells, and caissons; during drilling of oil and gas wells; in purification of hydrochloric acid and phosphates; during the low temperature carbonization of coal; in tanneries, breweries, slaughterhouses; in fat rendering; and in lithography and photoengraving.

NIOSH estimates that 125,000 workers in the United States are exposed or potentially exposed to hydrogen sulfide.

**Incompatibilities:** Strong oxidizers, metals.

**Permissible Exposure Limits in Air:** The Federal standard is a ceiling value of 20 ppm (30 mg/m<sup>3</sup>) with a maximum peak above this value for an 8 hr shift of 50 ppm (75 mg/m<sup>3</sup>) for a maximum duration of 10 min once only if no other measurable exposure occurs.

NIOSH recommends that exposure to hydrogen sulfide be limited to a ceiling concentration of 15 mg/m<sup>3</sup> (10 ppm) for 10 min. A requirement for continuous monitoring when there is a potential for exposure to hydrogen sulfide at a concentration of 70 mg/m<sup>3</sup> (50 ppm) or higher is also recommended. Occupational exposure to hydrogen sulfide has been defined as exposure at or above the ceiling concentration of 15 mg/m<sup>3</sup>.

ACGIH as of 1983/84 has set a TWA value of 10 ppm (14 mg/m<sup>3</sup>) and an STEL of 15 ppm (21 mg/m<sup>3</sup>). The IDLH level is 300 ppm.

**Determination in Air:** Collection with an impinger using cadmium hydroxide; spectrophotometric analysis. See NIOSH Methods, Sec A. See also reference (A-10). NIOSH has also recommended sampling and analytical methods using a methylene blue technique adapted from the NIOSH/OSHA Standards Completion Program. The methylene blue method for sampling and analysis was selected because of its sensitivity and because it has already demonstrated a wide applicability in industry. The use of NIOSH validated detector tubes is also recommended for this purpose. For continuous monitoring, no specific instrument is recommended. However, minimum capabilities such as response time, sensitivity, and range are specified.

**Permissible Concentration in Water:** According to EPA (A-3), available data indicate that water containing concentrations of 2.0 µg/l undissociated H<sub>2</sub>S would not be hazardous to most fish and other aquatic wildlife, but concentrations in excess of 2.0 µg/l would constitute a long term hazard. However, EPA (A-37) suggests a permissible ambient goal of 207 µg/l based on health effects.

**Routes of Entry:** Inhalation of gas, ingestion, eye and skin contact.

**Harmful Effects and Symptoms:** *Local*—Palpebral edema, bulbar conjunctivitis, keratoconjunctivitis, and ocular lesions may occur when hydrogen sulfide comes in contact with the eyes. Photophobia and lacrimation may also develop. Direct irritation of the respiratory tract may cause rhinitis, pharyngitis, bronchitis, and pneumonia. Hydrogen sulfide may penetrate deep into the lungs and cause hemorrhagic pulmonary edema. Hydrogen sulfide's irritative effects are due to the formation of alkali sulfide when the gas comes in contact with moist tissues.

**Systemic**—Acute exposure may cause immediate coma which may occur with or without convulsions. Death may result with extreme rapidity from respiratory failure. Postmortem signs include a typical greenish cyanosis of the chest and face with green casts found in viscera and blood. The toxic action of hydrogen sulfide is thought to be due to inhibition of cytochrome oxidase by binding iron which is essential for cellular respiration. Subacute exposure results in headache, dizziness, staggering gait, and excitation suggestive of neurological damage, and nausea and diarrhea suggestive of gastritis.

Recovery is usually complete although rarely polyneuritis may develop as a result of vestibular and extrapyramidal tract damage. Tremors, weakness, and numbness of extremities may also occur. Physicians may observe a "rotten-egg breath" and abnormal electrocardiograms in victims. Systemic effects from chronic exposure to hydrogen sulfide have not been established.

**Points of Attack:** Respiratory system, lungs, eyes.

**Medical Surveillance:** Preplacement medical examinations should evaluate any preexisting neurological, eye, and respiratory conditions and any history of fainting seizures.

It is recommended by NIOSH that preplacement and periodic examinations

July 23, 1998

TEXAS NATURAL RESOURCE  
CONSERVATION COMMISSION

1998 JUL 27 PM 4: 03

OPA JD

JUL 28 1998

Chief Clerks Office MC-105  
Texas Natural Resource Conservation Commission  
P. O. Box 13087  
Austin, TX 78711-3087

CHIEF CLERKS OFFICE

CCO# 7733

Gentlemen:

Re: Dynegy Midstream, Inc. (formerly Warren NGL, Inc.)  
Air Quality Permit Nos. 6051 & 6052  
Henderson County, Texas

We are located on Bushwhacker Peninsula in Payne Springs approximately three miles south and only slightly west of the Dynegy plant referenced above. We are very much concerned about the emissions from this plant.

Our area has become a retirement area with more permanent, full-time residents rather than just "weekend" residents or commuters. With this change in demographics, there are more people here full-time to be exposed to the emissions produced by the Dynegy plant. We also have residents involved in exercise programs which include walking, jogging, running, cycling, gardening, etc. These activities, performed outdoors, further expose our residents to the dangers of contaminants in the air.

When winds are from the south as they are a good part of the time, emissions are blown away from us and toward some other less fortunate people. But, on the days when there is little wind, emissions drift over us. When performing activities outdoors we are often bothered with raw-feeling nasal passages and scratchy throats.

When we have low cloud cover with low ceiling and fog as is often the case in winter and/or stormy seasons, there is a further burning of the eyes along with a noxious odor that makes it impossible to stay outside for any length of time. Weather conditions act as a cap or umbrella which holds the emissions in place over us. Fire rising from the stack must surely constitute a fire hazard as well. At night the sky is filled with fiery light and a large plume of thick smoke collects overhead contaminating our air. When winds are from the north, we receive a direct shot of fumes and emissions.

We don't feel this company is acting responsibly by releasing emissions into the air. We don't feel they are acting responsibly by not advising local residents of risks associated with contaminants from their plant. And, we further feel they are not acting responsibly by not advising residents of action required to ensure the safety of the community in the event of failure of their plant and/or some other hazardous emergency associated with their operation.

Sincerely yours,

WAYNE McCREARY SR.  
Name  
109 SUMMER LN  
Address  
MABANK, TX 75147  
City, State, Zip

✓

000#7733

Texas NATURAL RESOURCE  
CONSERVATION COMMISSION

7-26-98

1998 JUL 28 PM 4:45

OPA <sup>19</sup>

DEAR SIR:

CHIEF CLERKS OFFICE

JUL 29 1998

I WOULD LIKE TO PROTEST THE ISSUANCE OF PERMITS 6051 AND 6052 TO DYNEGY MIDSTREAM INC FOR AN EXISTING NATURAL GAS PROCESSING PLANT AND SULFUR RECOVERY PLANT LOCATED ON ROUTE 2 APPROX. 4 MILES SOUTHWEST OF EUSTACE IN HENDERSON COUNTY TEXAS.

WE MOVED TO STAR HARBOR, TEXAS IN DECEMBER OF 1992. WE DID NOT KNOW WHAT THE PLANT PRODUCED OR THAT WE WERE EVEN IN THE R.O.E. OF IT, UNTIL WE GOT INVOLVED IN PIPELINE THAT WAS GOING TO RUN FROM THE WHITE WELL ON THE OPPOSITE SIDE OF THE LAKE TO THE PLANT.

AT THE TIME WE MOVED HERE THE PLANT WAS TRIDENT, THEN WARREN NGL, AND NOW DRNEGY MIDSTREAM INC. WE MOVED HERE FROM NEDERLAND, TEXAS TO GET IN CLEAN AIR. IF A PLANT HAS TO CHANGE NAMES THIS MANY TIMES SOMETHING MUST BE WRONG.

MY 94 YEAR OLD FATHER-IN-LAW LIVES WITH US AND HE HAS AN OXYGEN MACHINE IN HIS BEDROOM, ✓

THE AIR CONTAMINANTS THAT ARE SCHEDULED TO BE RELEASED COULD BE DETRIMENTAL TO HIS HEALTH AND EVERYONE WITHIN THE ROE. OF THIS PLANT. OF COURSE WE ALL KNOW THE DANGERS OF HYDROGEN SULFIDE.

I AM TOLD THE PLANT IS OPERATING AT ABOUT 40% CAPACITY BUT THIS IS GOING TO BE RAISED TO ABOUT 80% WHEN ~~AN~~ EXCESS GAS FROM A PLANT NEAR CANTON IS ADDED BY PIPELINE.

I APPRECIATE YOUR CONSIDERATION OF THESE PERMITS WILL BE GREATLY APPRECIATED.

O.R. PERDUE JR  
VIOLA PERDUE  
51 SUNSET BLVD S.H.  
MALAKOFF, TEXAS 75148  
PH 903-489-2171

Thanks  
O.R. Perdue,  
Viola Perdue

AS NATURAL RESOURCE  
PROTECTION COMMISSION

1998 JUL 29 PM 3:54

CHIEF CLERKS OFFICE

NDAP

JUL 30 1998

July 27, 1998

CCO#7733

TO WHOM IT MAY CONCERN:

I'm not requesting a hearing but to voice my strong opinion on the renewal of Air Quality Permit Nos. 6051 and 6052 to Dynegy Midstream, Inc.

The people of Cedar Creek deserve a clean environment as anyone else in this state. Just yesterday our subdivision was evacuated due to a leaking sour well next to our property. It now is admitted people have been smelling the leakage for over a week and NOTHING WAS DONE WHEN REPORTED TO AUTHORITIES. THE SCAREY PART IS THERE WAS NO EVACUATION PLAN IN PLACE.... JUST FRIENDS, NEIGHBORS CALLING ONE ANOTHER TO LEAVE...FINALLY (2 HOURS LATER) AUTHORITIES WERE ON THE SCENE CHECKING THE LEAK.

I live directly across the lake from this plant in Payne Springs and have a heart condition that is affected very easily to these types of emissions as I came very close to having a stroke yesterday breathing some of the flumes in the area that we had.

THE STATE MUST TAKE MORE CONTROL OF THESE SOUR GAS WELLS, PLANTS, ETC. TO PROTECT THE SAFETY OF THE POPULATION AROUND CEDAR CREEK LAKE NOW BEFORE IT'S TOTALLY TOO LATE.

SINCERELY,

*Karen and Bob Spence*

Karen and Bob Spence  
12 Forest Ridge  
Trinidad, Tx 75163  
(972) 661-3311

✓

07/27/98

12:26

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*This was fixed to me by a friend - as you saw. Good - no one takes our problems seriously!*

Dear Karen & Bob,

Just a little update on what happen at the well site. I called this a.m. to see if I could find-out any info. I was shuffled from the Sheriffs Dept. in Athens to the police in Toel, back to the Sheriffs office to several people, back to the Toel Fire Dept. The Chief there told me he went on the call on the 19<sup>th</sup>. The person who actually inspected it was the Game Warden! The Chief did not know what transpired on the 19<sup>th</sup> or yesterday. He told me to call Ultra Petro in Tyler. The number he gave me ended up to be a "safety" company. She in turn gave me another number in Grandbury for another safety company who does work for Ultra. The man I talked to is an engineer and had been out here yesterday. He knew about my original call on the 19<sup>th</sup>. The problem that day was not at the well site. He speculates I may have originated from the plant in Payne Springs because they burn off the gases and he did tell me the radius for contamination spreads well past the west of Hwy. 274. (another reason to write Austin on the public hearing!) The incident yesterday was a problem with the failure of a valve. There are 4 sensors on the well. Somehow, they don't yet know how, water got into the valve and made it go off.

He (Cecil Gritz) did give me his # (817-579-8260) and told me to keep it for future reference. You do the same. The Fire Chief said they have had a lot of odor problems from the sewage treatment plant on 274 by the spillway. I told him I noticed it going by there, but the odor was not the same I smelled on the 19<sup>th</sup>. Cecil said there are several water wells near the Wildwood

*Please help  
us - most  
are poor +  
don't have  
the means  
to be heard.*

*K. Spencer*