1.0 Introduction

Hydrogen Sulfide exposure can be fatal, the result of asphyxiation. Hydrogen Sulfide affects primarily the respiratory system. Hydrogen Sulfide is also a highly flammable gas. The Occupational Safety and Health Administration (OSHA) estimate that 85 percent of accidents involving asphyxiating and flammable gases can be prevented if proper safety precautions at job sites are initiated. This poses a serious problem for exposed workers and their employer. Various OSHA Standards establish uniform requirements to ensure that the hazards associated with asphyxiating and flammable gases in U.S. workplaces are evaluated, safety procedures are implemented, and that the proper hazard information is transmitted to all affected workers.

2.0 Policy

Sunbelt Controls will ensure that all potential sources of Hydrogen Sulfide within our facility(s) or host employers are evaluated. This standard practice instruction is intended to address comprehensively the issues of; evaluating and identifying potential sources of Hydrogen Sulfide, evaluating the associated potential hazards, communicating information concerning these hazards, and establishing appropriate procedures, and protective measures for employees.

3.0 Responsibility

The Sunbelt Controls Safety Officer is solely responsible for all facets of this program and has full authority to make necessary decisions to ensure success of the program. The Safety Officer is the sole person authorized to amend these instructions and is authorized to halt any operation of the company where there is danger of serious personal injury.

4.0 Written Program

Sunbelt Controls will review and evaluate this standard practice instruction in accordance with the following:

- On an annual basis
- When changes occur to governing regulatory sources that require revision
- When changes occur to related company procedures that require a revision
- When facility operational changes occur that requires a revision
- When there is an accident or close-call that relates to this area of safety.
- Anytime the procedures fail

Effective implementation of this program requires support from all levels of management. This written program will be communicated to all personnel that are affected by it. It encompasses the total workplace, regardless of the number of workers employed or the number of work shifts. It is designed to establish clear goals and objectives.

5.0 Related Programs

The following safety programs are to be used in consonance with this program:

- Process Safety Program
- Confined Space Entry Program
- Hazard Communication Program
- Air Contaminants Safety Program

6.0 Hazard Overview

Hydrogen Sulfide is a colorless gas possessing the disagreeable odor associated with rotten eggs. It is occasionally encountered naturally as the result of decay of organic waste. Sewage and swamp water, for example, typically contain dissolved hydrogen sulfide. Oil refining operations will also typically have Hydrogen Sulfide in the process. We sometimes hear that such materials "smell like sulfur." But elemental sulfur is an odorless solid; what is actually meant is that such materials smell like hydrogen sulfide. Some amount of hydrogen sulfide is almost always present in our atmosphere.

7.0 Health Effects

Continued inhalation in an atmosphere containing hydrogen sulfide causes dizziness and the onset of a headache. One deep breath of pure hydrogen sulfide is fatal; breathing a concentration of 600ppm by volume is fatal within 30 minutes. Since it possesses such a disagreeable odor, most people are initially aware of its presence. However, hydrogen sulfide also deadens the sense of smell rapidly. Thus individuals who remain in an atmosphere containing hydrogen sulfide become oblivious to its presence and may inhale dangerous or lethal amounts unknowingly. H2s affects the central nervous system which causes this degradation in ability to smell and can also affect the ability to breathe.

8.0 OSHA / NIOSH Overview

Hydrogen Sulfide is available industrially, mainly as a liquid, in containers. It is primarily used in the chemical industry to produce other sulfur-containing compounds, but hydrogen sulfide is also used in the metallurgical industry. In the workplace, OSHA regulates the exposure of employees to hydrogen sulfide. OSHA stipulates a permissible exposure limit of:

TABLE AC-1 - PERMISSIBLE EXPOSURE LIMITS		PEL			STEL	
Chemical Abstracts Registry No.	Chemical Name	PPM	mg/M3	Ceiling	PPM	mg/M3
7783064	Hydrogen sulfide H2S	10	14	50 ppm	15	21

CONTACT THE SAFETY DEPARTMENT IF IT IS ANTICIPATED THAT WE MAYBE EXPOSED TO H2S IN EXCESS OF 5PPM

Additional protection will be required (i.e. self-contained breathing apparatus (SCBA), airline respirators w/ escape tank, etc.)

9.0 Department of Transportation (DOT) Overview

The Department of Transportation regulates Hydrogen Sulfide as a poisonous gas. Containers are labeled POISON GAS and FLAMMABLE GAS, and their transport vehicles are similarly placarded.

10.0 National Fire Protection Association (NFPA) Overview

Description:	- colorless gas - offensive strong odor similar to that of rotten eggs
Fire and Explosion Hazard:	- flammable gas - can form an explosive when mixed with air
Flammable Range (% by volume):	4.3% - 45%
Ignition Temperature:	500°F
Vapor Density:	1,189 (air = 1 at 59°F
Boiling Point:	-76°F
Freezing Point:	-117°F
Chemical Abstract Service (CAS) Number:	7783-06-4

11.0 General Requirements

Sunbelt Controls will establish Hydrogen Sulfide operational procedures through the use of this document.

11.1 Facility Evaluation

Sunbelt Controls shall evaluate our facility(s) or host employer facilities to determine if any work area meets the criteria for designation as a Hydrogen Sulfide Hazard Area.

12.0 Permit-Required Confined Space Program

Sunbelt Controls will implement our confined space program when performing work in areas designated as a confined space. The permit-required confined space program will conform to the requirements of Title 8 of the California Code of Regulations, Section 5157OSHA 29 CFR 1910.146. Sunbelt Controls shall:

- Implement the measures necessary to prevent unauthorized entry
- Identify and evaluate the hazards of permit spaces before employees enter them

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12.1 Pre-Entry Requirements

Develop and implement the means, procedures, and practices necessary for safe permit space entry operations, including, but not limited to, the following:

- Specifying acceptable entry conditions
- Isolating the permit space
- Purging, inerting, flushing, or ventilating the permit space as necessary to eliminate or control atmospheric hazards
- Provide pedestrian, vehicle, or other barriers as necessary to protect entrants from external hazards

- Verify that conditions in the permit space are acceptable for entry throughout the duration of an authorized entry
- Develop and utilize checklists based on this standard practice instruction and Title 8 of the California Code of Regulations, Section 5157OSHA 29 CFR 1910.146.

12.2 Equipment Requirements

Provide the following equipment at no cost to employees, maintain that equipment properly, and ensure that employees are trained in the proper use of the equipment:

- Testing and monitoring equipment needed to determine if hazardous conditions exist or to verify that they do not exist
- Ventilating equipment needed to obtain acceptable air quality entry conditions
- Communications equipment necessary for communication between personnel involved in the entry operation
- Personal protective equipment insofar as feasible engineering and work practice controls do not adequately protect employees
- Lighting equipment needed to enable employees to see well enough to work safely and to exit the space quickly in an emergency
- Barriers and shields are required (as needed) to protect workers from pedestrian, and vehicular traffic
- Ladders, needed for safe ingress and egress by authorized entrants
- Rescue, Retrieval, and Emergency equipment needed to extract or treat injured personnel, except to the extent that the equipment and or service is provided by rescue services that are immediately available
- Any other equipment necessary for safe entry into and rescue from permitted spaces at our facility

12.2.1 Principal Equipment Needed to Conduct Operations – Listed below; intrinsically safe equipment and as a minimum will be maintained where required for confined space operations.

- Multi-gas monitors (Includes H2s)
- Ventilation equipment
- Rescue tripod/davit arm and winch system
- Body harnesses
- Extraction cable and lanyards
- Air compressors (as required)
- Supplied air respirators (as required)
- Air purifying respirators (as required)
- SCBA equipment (as required)
- Emergency escape breathing apparatus (as required)
- Radio communication system (as required)
- Signage (as required)
- Lock-out/tag-out equipment (as required)
- Intrinsically safe lighting equipment
- Personal protective clothing
- Hearing protection equipment
- Head protection equipment
- Eye protection equipment
- First aid kits
- Time keeping equipment
- Hand tools
- Escape ladders for depths of four feet or shoulder height
- Head protection equipment
- Eye protection equipment

13.0 Procedures for Atmospheric Testing. Atmospheric testing for Hydrogen Sulfide Hazard Areas is required for two distinct purposes: Evaluation of the hazards of the work area and verification that acceptable entry conditions for entry into that area exist.

13.1 Evaluation Testing

Sunbelt Controls will ensure that the atmosphere is analyzed using equipment of sufficient sensitivity and specificity to identify and evaluate any hazardous atmospheres that may exist or arise. Evaluation and interpretation of these data, and development of the entry procedure, will be done by, or reviewed by, a technically qualified professional (e.g., OSHA consultation service, or certified industrial hygienist, registered safety engineer, certified safety professional, certified marine engineer, etc.) based on evaluation of all serious hazards. The internal atmosphere will be tested, with a calibrated direct-reading instrument, for the following conditions in the order given:

- Oxygen Content **(19.5% - 23.5%)** OSHA Mandated
- Flammable Gases and Vapors OSHA Mandated
- Potential H2s Contaminants **(5ppm)** OSHA Mandated
- Airborne Combustible Dusts Site Specific

13.2 Verification Testing

The atmosphere of a work area designated as a permit space which may contain a hazardous atmosphere will be tested for residues of all contaminants identified by evaluation testing using permit specified equipment to determine that residual concentrations at the time of testing and entry are within the range of acceptable entry conditions. Results of testing (i.e., actual concentration, etc.) will be recorded on the permit in the space provided adjacent to the stipulated acceptable entry condition. The atmosphere will be verified, with a calibrated direct-reading instrument, for the following conditions in the order given:

- Oxygen Content **(19.5% - 23.5%)** OSHA Mandated
- Flammable Gases and Vapors OSHA Mandated
- Potential H2s Contaminants **(5ppm)** OSHA Mandated
- Airborne Combustible Dusts Site Specific

13.3 Duration of Testing

Measurement of values for each atmospheric parameter will be made for at least the minimum response time of the test instrument specified by the manufacturer.

13.3 Testing Stratified Atmospheres

When monitoring for entries involving a descent into atmospheres that may be stratified, the atmospheric envelope will be tested a distance of approximately 4 feet (1.22 m) in the direction of travel and to each side. If a sampling probe is used, the entrant's rate of progress will be slowed to accommodate the sampling speed and detector response. The stratified atmosphere will be tested, with a calibrated direct-reading instrument, for the following conditions in the order given:

- Oxygen Content **(19.5% - 23.5%)** OSHA Mandated
- Flammable Gases and Vapors OSHA Mandated

- Potential H2s Contaminants **(5ppm)** OSHA Mandated
- Airborne Combustible Dusts Site Specific

14.0 Process Safety Management of Highly Hazardous Chemicals

Sunbelt Controls has the potential for working with processes where Hydrogen Sulfide will be used. Hydrogen Sulfide has a threshold quantity (TQ) of 1500.00 Pounds. This means that where the quantities of Hydrogen Sulfide in the process exceed 1500.00 Pounds, the Process Safety Management Program as delineated in Title 8 of the California Code of Regulations, Section 5189OSHA 29 CFR 1910.119 will be triggered. Process safety management is the proactive identification, evaluation and mitigation or prevention of chemical releases that could occur as a result of failures in process procedures or equipment. The major objective of process safety management of highly hazardous chemicals is to prevent unwanted releases of hazardous chemicals especially into locations which could expose our employees and or community to serious hazards.

Each process that Sunbelt Controls works on will be evaluated as a separate entity. Where the material TQ exceeds the quantities delineated in Title 8 of the California Code of Regulations, Section 5189OSHA 29 CFR 1910.119, Sunbelt Controls will ensure that coordination is accomplished with the Process Safety Committee of the host company. The various lines of defense that have been incorporated into the design and operation of the process to prevent or mitigate the release of hazardous chemicals will be evaluated and strengthened where required to assure their effectiveness at each level. The following elements will be used in the evaluation process.

- Process design
- Process technology
- Operational and maintenance activities/procedures
- Non-routine tasks, activities and procedures
- Emergency preparedness plans and procedures
- Training programs
- Other elements which impact the process

15.0 Mechanical Integrity

Maintenance programs and schedules in processes where Hydrogen Sulfide is used will be reviewed to see if there are areas where "breakdown" maintenance is used rather than an on-going mechanical integrity program. Equipment used to process, store, or handle Hydrogen Sulfide needs to be designed, constructed, installed and maintained to minimize the risk of releases of such chemicals.

Elements of a mechanical integrity program include:

- Identification and categorization of equipment and instrumentation
- Inspections and tests
- Testing and inspection frequencies
- Development of maintenance procedures

- Training of maintenance personnel
- Establishment of criteria for acceptable test results, documentation of test and inspection results, and documentation of manufacturer recommendations as to mean time to failure for equipment and instrumentation

15.1 The First Safety Priority: Preventing a Release – the first safety priority for any process our employees are involved will be to ensure that the process is operated and maintained as designed, and to keep the chemicals contained.

15.2 The Second Safety Priority: Controlling a Release – the second safety priority will be to control release of chemicals through engineering controls such as; venting to scrubbers, flares, or to surge or overflow tanks which are designed to receive such chemicals, etc. Also included are; fixed fire protection systems, water spray, or deluge systems, monitor guns, dikes, designed drainage systems, and other systems which would control or mitigate hazardous chemicals once an unwanted release occurs.

16.0 Training

16.1 Types of Training

Sunbelt Controls will determine whether training required for specific jobs will be conducted in a classroom or on-the-job. The degree of training provided shall be determined by the complexity of the job and the Hydrogen Sulfide exposure hazards associated with the individual job.

16.1.1 Initial Training – Prior to job assignment, Sunbelt Controls shall provide training to ensure that the hazards associated with Hydrogen Sulfide are understood by employees and that the knowledge, skills and personal protective equipment required are acquired by employees. The training shall as a minimum include the following:

- Each authorized employee shall receive training in the recognition of applicable hazards involved with the particular job and job site, as well as the methods and means necessary for safe work
- The specific nature of the operation which could result in exposure to Hydrogen Sulfide
- The purpose, proper selection, fitting, use and limitation of personal protective equipment (PPE)
- The adverse health effects associated with excessive exposure to Hydrogen Sulfide
- The engineering controls and work practices associated with the employee's job assignment, including training of employees to follow relevant good work practices
- The contents of any compliance plan in effect
- The employee's right of access to records under Title 8 of the California Code of Regulations, Section 5194OSHA 29 CFR 1910.20.

16.1.2 Refresher Training – Scheduled refresher training will be conducted on annual basis.

17.0 Retraining

Retraining shall be provided for all affected employees as a minimum under the following conditions:

- Whenever there is a change in job assignments
- Whenever there is a change in personal protective equipment
- Whenever there is a change in equipment that presents a new hazard
- Whenever there is a change in processes that presents a new hazard
- Whenever their work takes them into hazardous areas
- Whenever there is a change in Hydrogen Sulfide safety procedures
- Whenever safety procedure fails resulting in a near-miss, illness, or injury

17.1 **Additional Retraining** – additional retraining shall also be conducted whenever a periodic inspection reveals, or whenever Sunbelt Controls has reason to believe, that there are deviations from or inadequacies in the employee's knowledge of known hazards, or use of equipment or procedures.

17.2 The retraining shall reestablish employee proficiency and introduce new equipment, or revised control methods and procedures, as necessary.

17.3 **Certification** – Sunbelt Controls shall certify that employee training has been accomplished and is being kept up to date. The certification shall contain a synopsis of the training conducted, each employee's name, and dates of training.

18.0 Work Operations

18.1 Work operations in which Hydrogen Sulfide may be encountered involve welding, burning, cutting, brazing, grinding, and abrasive blasting, and general pipe fitting work.

18.2 The equipment and materials used to accomplish work operations are those normally associated with sandblasting and painting operations.

18.3 Employee crew size will vary and employee job responsibilities will be that of their craft as stated in the company's policy manual. Specific additional responsibilities will be:

18.3.1 Superintendent/General Supervisor
The Superintendent/General Supervisor is responsible for monitoring procedure and to ensure compliance with this work practice.

18.3.2 Supervisors
The Supervisor(s) ensures that the initial determination for potential Hydrogen Sulfide or toxic exposure has been accomplished <u>before</u> work begins, supervises

the safe performance of work in accordance with this and other related work practices and assigns jobs only to qualified employees.

18.3.3 Employees

Employees are responsible for the proper use of the protective/safety equipment as assigned and directed, additionally they must abide by the requirements of this and site-specific work practices.

19.0 Monitoring and Measurement Procedures

19.1 **Eight Hour Time Weighted Average (TWA) Evaluations** – where possible eight-hour TWA's will be taken so that the average eight-hour exposure is based on a single eight-hour sample. Air samples will be taken in the employee's breathing zone and by qualified personnel.

19.2 **Ceiling Evaluations** – where possible, measurements to determine employee ceiling exposure will be taken during periods of maximum expected airborne concentrations of hydrogen Sulfide. Each measurement will consist of a fifteen (15) minute sample or series of consecutive samples totaling fifteen (15) minutes. Air samples will be taken in the employee's breathing zone and by qualified personnel.

19.3 **Peak and Above Ceiling Evaluations** – measurements to determine employee peak exposure will be taken during periods of maximum expected airborne concentrations of Hydrogen Sulfide. Each measurement will consist of a ten (10) minute sample or series of consecutive samples totaling ten (10) minutes. A minimum of three measurements will be taken on one work shift and the highest of all measurements taken will be assumed to be an estimate of the employee's exposure. Air samples will be taken in the employee's breathing zone and by qualified personnel.

19.4 **Sampling Methods** – Sampling and analysis will be conducted in accordance with acceptable industrial hygiene practices. Sampling data will be maintained for the duration of employment of the affected employee plus 30 years.

20.0 Spill and Leak Procedures

Spill and leak procedures will largely depend on the capability and emergency procedures of the host employer. Sunbelt Controls will coordinate with the host employer to ensure adequate procedures are in-place protection of all employees' (host and contractor) and the surrounding area. Part of the onsite orientation for facilities which utilize or produce Hydrogen Sulfide must include site-specific alarms and emergency procedures which shall include mandatory evacuation of said areas.

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

20.2 **Emergency Containment** – Hydrogen Sulfide exposure can be fatal. Only authorized and trained emergency response personnel should attempt containment. If you are not trained in containment of Hydrogen Sulfide Gas, evacuate the area in accordance with established procedures If Hydrogen Sulfide is spilled or leaked the following steps as a minimum should be taken.

- Remove all ignition sources.
- Ventilate the area of the spill or leak to disperse gas.
- If in 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.
- If in a liquid form, allow to vaporize.

21.0 Emergency First Aid Procedures – In the event of an emergency, institute first aid procedures and send for first aid or medical assistance in accordance with local procedures.

21.1 **Eye Exposure** – Wash immediately with large amounts of water; lifting the lower and upper lids occasionally, get medical attention as soon as possible.

21.2 **Skin Exposure** – Immediately flush with copious amounts of water. Remove any clothing contaminated, and flush exposed skin areas, get medical attention as soon as possible.

21.3 **Respiratory Exposure** – Get the victim to open, fresh air immediately. If breathing has stopped perform CPR. Keep the victim warm and at rest. Get medical attention as soon as possible.

21.4 **Rescue Considerations** – Don't become a second victim. Move the affected person from the hazardous area; if the exposed person has been overcome, initiate local emergency notification procedures. Understand the facility's emergency rescue procedures and know the locations of rescue equipment before the need arises.

22.0 Protective Clothing and Personal Protective Equipment (PPE)

Where engineering controls, administrative controls, and job hazard analyses do not eliminate all job hazards, employees will (where appropriate) wear personal protective equipment (PPE).

These include items such as caps, hair nets, face shields, safety goggles, glasses, hearing protection, foot-guards, gloves, etc. Supervisors will ensure that equipment selected will meet the following requirements:

- It will be appropriate for the particular hazard.
- It will be maintained in good condition.
- It will be properly stored when not in use, to prevent damage or loss.
- It will be kept clean, fully functional and sanitary.

22.1 Hazards associated with wear of protective clothing, PPE, personal clothing and jewelry. Protective clothing and PPE can present additional safety hazards. Supervisors will ensure workers wear appropriate clothing and PPE. These items will be worn so as not create additional hazards.

22.1.1 **Personal Clothing and Jewelry** – Personal clothing and jewelry will be monitored by the immediate supervisor. Clothing or jewelry that could become

entangled in tools, equipment or machinery or of an excessively flammable nature will be prohibited.

22.2 Documentation – PPE requirements will be documented on a "Protective Measures Determination" form and properly filed.

23.0 Tool Selection, Evaluation and Condition

The greatest hazards posed by tools usually result from misuse and/or improper maintenance. Tool selection sometimes is not considered a priority when arrangements are made to begin work. All employees will consider the following when selecting tools:

- Is the tool correct for the type work to be performed?
- Are guards installed properly and in good condition?
- Are grounding methods sufficient when working in wet conditions?
- Does the tool create sparks or heat? Has this been considered when working around flammable substances?
- Do impact tools such as chisels, wedges, or drift pins have mushroomed heads? The heads can shatter on impact, sending sharp fragments flying!
- Are wooden handled tools loose or splintered? This can result in the heads flying off and striking the user/coworkers!
- Are cutting tools sharp? Dull tools are more hazardous than sharp ones.
- Is the tool used on the proper working surface? Tools used on dirty or wet working surfaces can create a multitude of hazards.
- Are tools stored properly when not being used? Saw blades, knives, and scissors like sharp tools should be stored so that sharp edges are directed away from aisles and coworkers.
- Is there sufficient clearance for tools requiring swinging motions such as hammers, axes, picks, etc?
- Tools will be checked for excessive vibration.
- Have tools been modified beyond the manufacturers specification? And if so, have the modifications been approved by a "competent person"?

REFERENCES

Title 8 of the California Code of Regulations, Section 5189
OSHA 29 CFR 1910.119 (Process Safety)
Title 8 of the California Code of Regulations, Section 5156
OSHA 29 CFR 1910.146 (Confined Spaces)
Title 8 of the California Code of Regulations, Section 5157
OSHA 29 CFR 1910.1000 (Permissible Exposure Limits– Table AC-1)
Title 8 of the California Code of Regulations, Section 5194
OSHA 29 CFR 1910.1200 (Hazard Communication)
Title 8 of the California Code of Regulations, Section 3380 OSHA 29 CFR 1910.132-138 (Personal Protective Equipment – PPE)