1.0 Purpose

- This program covers Ardent policy related to Hydrogen Sulfide (H₂S) hazards in the workplace. The intent of this program is to provide employees with knowledge and guidelines enabling them to anticipate, recognize, evaluate, and control (H₂S) hazards and to protect themselves and others from unnecessary Hydrogen Sulfide exposure.
- Employees with exposure to or conducting any of the following operations could have a potential of exposure to Hydrogen Sulfide: Drilling Operations, Recycled Drilling Mud, Water from sour crude wells, Blowouts, Tank Gauging (tanks at producing, pipeline & refining operations), Field Maintenance, and, Tank batteries and wells, etc.

2.0 Scope

- The Hydrogen Sulfide Hazard Program and Policy is intended for support of and use by company operations both in business units and project operations. This program is hazard recognition and education focused and does not imply that any training associated with this program certifies or qualifies any employee to analyze worksites for Hydrogen Sulfide hazards, measure contaminants or determine safe exposure levels.

3.0 Regulatory References

- This Hydrogen Sulfide Program is primarily intended to satisfy the following regulatory requirements:
  - 29 CFR 1910.1000, 29 CFR 1926.64,

4.0 Policy

- Upon discovery or suspicion of hydrogen sulfide (H₂S) being present on a jobsite, Ardent employees are to stop the work immediately, evacuate the area and inform their supervisor.
- When monitor alarms sound vacate the area and do not re-enter. Notify or contact necessary personnel, and do not return to work area until clearance is given for re-entry.
• It is Ardent policy that employees shall not knowingly work on, open, or participate in anyway in operations that involve systems known to contain hydrogen sulfide (H₂S) until the system has been declared safe by a competent person.

• All employees assigned to jobsites where exposure to Hydrogen Sulfide may be possible shall participate in the identification, evaluation, and control of Hydrogen Sulfide hazards.

• Employees assigned to work in areas where exposure or possible exposure to Hydrogen Sulfide hazards exists will be required to monitor the immediate work area with a fixed field monitor or by utilizing a personal H₂S monitor.

• Personal H₂S monitors must be worn in the upper breathing zone on the outside of all clothing with the sensor facing outwards and unobstructed.

• Fixed field monitors as well as personal H₂S monitors must be set to alarm when the permissible exposure limit (PEL) of 20ppm for general industry is reached or exceeded and 10ppm for construction industry is reached or exceeded.

• 29 CFR 1910.1000 table Z-2 indicates the acceptable ceiling concentration for Hydrogen Sulfide is 20 parts per million (ppm). Ceiling concentrations shall not be exceeded at any point during an 8-hour shift. A peak of 50 parts per million (ppm), is permissible for 10 minutes, once only during an 8-hours shift. Exposures more than these values shall trigger written \((H₂S)\) Safe Work, Confined Space Entry and Permit to Work type procedures.

• Medical surveillance shall be limited to that required for long-term exposure.

5.0 Responsibilities

5.1 Management – Ardent Management is responsible for the following:
• Ensure that the HSE Management System includes a Hydrogen Sulfide policy and that the policy is reviewed and revised as necessary.
• Provide Hydrogen Sulfide \((H₂S)\) Hazard Training for all employees.
- Provide leadership and support for employees in communicating their responsibility to stop the work when Hydrogen Sulfide hazards are discovered or suspected.
- Provide resources to address and correct any Hydrogen Sulfide related events/concerns that arise.

5.2 Supervision – Ardent Supervision is responsible for the following:
- Understand and enforce the Hydrogen Sulfide Policy
- Implement site controls isolating employees from Hydrogen Sulfide hazards when Hydrogen Sulfide is discovered or suspected on a jobsite.
- Immediately inform management of any Hydrogen Sulfide exposures on a jobsite.
- Provide immediate on-the-spot training for all employees on the jobsite regarding Ardent Hydrogen Sulfide Policy and guidelines enabling employees to protect themselves and others from unnecessary Hydrogen Sulfide exposure.
- Contact a competent individual when Hydrogen Sulfide is discovered or suspected on a jobsite.

5.3 Employees – Ardent Employees are responsible for the following:
- Upon discovery or suspicion of Hydrogen Sulfide being present on a jobsite, employees are to stop the work immediately, evacuate the area and inform their supervisor.
- Protect themselves and others from unnecessary Hydrogen Sulfide exposure.
- Conduct operations in accordance with Ardent Provided Hydrogen Sulfide Hazard Training.
- Immediately report to a supervisor any changes, deficiency or breaches in site controls established to isolate employees from Hydrogen Sulfide hazards on a jobsite.
- Participate in JSA and hazard recognition activities. Make every effort to identify potential H₂S hazards during daily JSA’s.
- Follow all written (H₂S) Safe Work, Confined Entry and Permit to Work procedures.
- Respect all controlled access areas and Hydrogen Sulfide (H₂S) Hazard signs and postings.
- Employees must be aware of and follow all provisions of the site-specific contingency plan.
6.0 Hazard Recognition & Control

- Hydrogen sulfide ($\text{H}_2\text{S}$), is an extremely hazardous, toxic compound. It is a colorless, flammable gas that can be identified in relatively low concentrations, by a characteristic rotten egg odor. The gas occurs naturally in coal pits, sulfur springs, gas wells, and as a product of decaying sulfur-containing organic matter, particularly under low oxygen conditions. It is therefore commonly encountered in places such as sewers, sewage treatment plants ($\text{H}_2\text{S}$ is often called sewer gas),

- Hydrogen sulfide has a very low odor threshold, with its smell being easily perceptible at concentrations well below 1 part per million (ppm) in air. The odor increases as the gas becomes more concentrated, with the strong rotten egg smell recognizable up to 30 ppm. Above this level, the gas is reported to have a sickeningly sweet odor up to around 100 ppm. However, at concentrations above 100 ppm, a person’s ability to detect the gas is affected by rapid temporary paralysis of the olfactory nerves in the nose, leading to a loss of the sense of smell. This means that the gas can be present at dangerously high concentrations, with no perceivable odor. Prolonged exposure to lower concentrations can also result in similar effects of olfactory fatigue. This unusual property of hydrogen sulfide makes it extremely dangerous to rely totally on the sense of smell to warn of the presence of the gas.

6.1 Where do you find Hydrogen Sulfide?

- The gas occurs naturally in sewers, septic tanks, livestock waste pits, manholes and well pits. Hydrogen sulfide gas also can be found in groundwater, especially in wells near oil fields or in wells that penetrate shale or sandstone. Industrial sources of hydrogen sulfide include petroleum and natural gas extraction and refining, pulp and paper manufacturing, rayon textile production, leather tanning, chemical manufacturing and trucks that transport chemical wastes may release hydrogen sulfide gas.

- Hydrogen sulfide gas also is found in petroleum and natural gas. Natural gas can contain up to 28 percent hydrogen sulfide gas, so it may be an air pollutant near natural gas production areas and
petroleum refineries. The gas also can be produced by industries that work with sulfur compounds.

6.2 Health Hazards Associated with Hydrogen Sulfide

- **Inhalation** - H₂S is classified as a chemical asphyxiating gas. It inhibits cellular respiration and absorption of oxygen, causing biochemical suffocation. At 10-50 ppm, typical exposure symptoms include headache, dizziness, nausea, and vomiting, coughing, and breathing difficulty. At concentration of 50-200 ppm, symptoms include severe respiratory tract irritation, shock, convulsions, coma, and death in severe cases.

- **Absorption** - Because (H₂S) is so fast acting, absorption through skin is not generally a concern, although (H₂S) does affect and lead to eye problems.

6.3 Long Term Health Effects of Exposure to Hydrogen Sulfide

- Long term exposure to (H₂S) can result in chronic poisoning. Symptoms include eye irritation, acute conjunctivitis, bronchitis, dizziness, headaches, sensitivity to light and a gray-green line on the gums.

7.0 Controls & Protection

- **Engineering Controls** - Hydrogen Sulfide is an extremely dangerous toxic gas. Engineering controls are preferred as a method of reducing hazardous exposures. Wherever possible, exposure should be minimized by employing methods such as ventilation and isolation. Where engineering controls cannot adequately control levels of exposure, it may be necessary to supplement them with the use of suitable personal protective equipment (PPE) such as supplied-air respirators.

- **Safe Working Practices** – Any operation that exposes personnel to potential sources of Hydrogen Sulfide or Confined Spaces must utilize a permit to work process such as the Confined Space Entry Program. Established procedures ensure comprehensive consideration of all elements including hazard identification, safe work practices, PPE, emergency response plans and controlled access. Any work that must be conducted in a known or suspected
Hydrogen Sulfide hazard not fully controlled by engineering methods must follow the OSHA Confined Space Entry Standard 1910.146, and a written (H₂S) Safe Work Procedure approved by a Certified Industrial Hygienist or safety professional competent in (H₂S) hazards.

- **Protection** - Because of the potential severity of the hazard associated with this substance, stringent PPE control measures are necessary but are only a back-up to engineering and safe work practice controls. Ardent employees shall not work in locations with a measurable concentration of Hydrogen Sulfide (H₂S) gas unless a written Safe Work Procedure has been developed and approved by a competent individual for (H₂S) hazards.

- **Inhalation PPE** – Because of the nature of Hydrogen Sulfide, respiratory protection will be a primary component of any (H₂S) hazard control plan. Only a Certified Industrial Hygienist or safety professional competent in (H₂S) hazards and protection shall select and approve PPE for (H₂S) Safe Work Procedures. Respiratory protection will likely be of the following types:
  - Positive pressure, full-face piece Self-Contained Breathing Apparatus (SCBA)
  - Positive pressure, full-face piece Supplied-Air Respirator (SAR) with an auxiliary positive pressure SCBA.
  - Escape: Gas mask with organic vapor canister; or escape-type SCBA.

**8.0 First Aid & Exposure Response**

- If a person is overcome by H₂S gas, do not attempt to rescue unless you are properly trained, authorized, and have the proper level of personal protective equipment. At levels above 200 ppm, collapse, coma, and death due to respiratory failure can occur within seconds after only a few inhalations so you can be overcome very quickly. Multiple H₂S related fatalities are common because many co-workers attempt to rescue their partner and are overcome by the gas themselves.

- Emergency response and rescue will be part of any written (H₂S) Safe Work Procedure and Confined Space Entry Procedure. Follow the approved procedures and permit to work process. After the victim has been removed to a fresh air location, check for breathing.
If breathing has stopped, trained personnel should begin artificial respiration or, if the heart has stopped, cardiopulmonary resuscitation (CPR) immediately. Seek medical attention immediately.

9.0 Training

- Ardent will provide Hydrogen Sulfide training for all employees assigned to at-risk locations.

- Training Content - Training will cover the following topics:
  - Hydrogen Sulfide Hazard Training
  - Ardent Hydrogen Sulfide Policy
  - Responsibilities
  - Hazard Recognition & Control

- Personnel Training – Ardent personnel shall receive the following training:
  - All employees assigned to at-risk locations shall receive Hydrogen Sulfide Hazard training.

- Training Frequency - Training and re-training frequency shall be as follows:
  - Initial training shall take place when employees mobilize to job-sites with known Hydrogen Sulfide hazards.
  - Hydrogen Sulfide Hazard training shall be refreshed as needed as part of the Safety Meeting Program, Hazard Communication, and Industrial Hygiene agenda.
10.0 Reporting and Recordkeeping

- **Training** - All training shall be documented.

- **Reports** – All Hydrogen Sulfide related events shall be reported.

- **Incident Report** - All Hydrogen Sulfide exposure shall be recorded as incidents on a Supervisor Incident Report.

- **Near Miss Reports** - Failures in containment, control methods, isolation, etc., not resulting in employee exposure, but would have resulted in employee exposure if an employee had been in the immediate area shall be record as near miss events on an Ardent Near Miss Report.

- **Control & Retention** – Records associated with this program shall be handled in the following manner. H2S incidents shall be handled per the Incident Reporting and Record Keeping Program. Records shall be retained for a minimum of the employee’s duration of employment plus 30 years.