

# PROCEDURE

PET-HSE27-SF-PRD-00007

Hydrogen Sulphide (H<sub>2</sub>S) Management

PART OF  
A BETTER  
FUTURE



## Objective

To minimize the risk of harm to personnel through the application of a process to manage hydrogen sulphide (H<sub>2</sub>S) that may be present in the Asset and/or Field, over the life cycle period from discovery through to closure.

## Audience

Employees, contractors, and supervisory roles at operational locations managed by Petroleum Deepwater (Woodside Energy).

**Note:** This procedure applies to contractors, unless formally agreed to (and documented) through the *Contractor Management Procedure* (PET-SUP68-SU-PRD-00001).

## Content Administrator

Jason Flockton, Senior Personal Safety Adviser

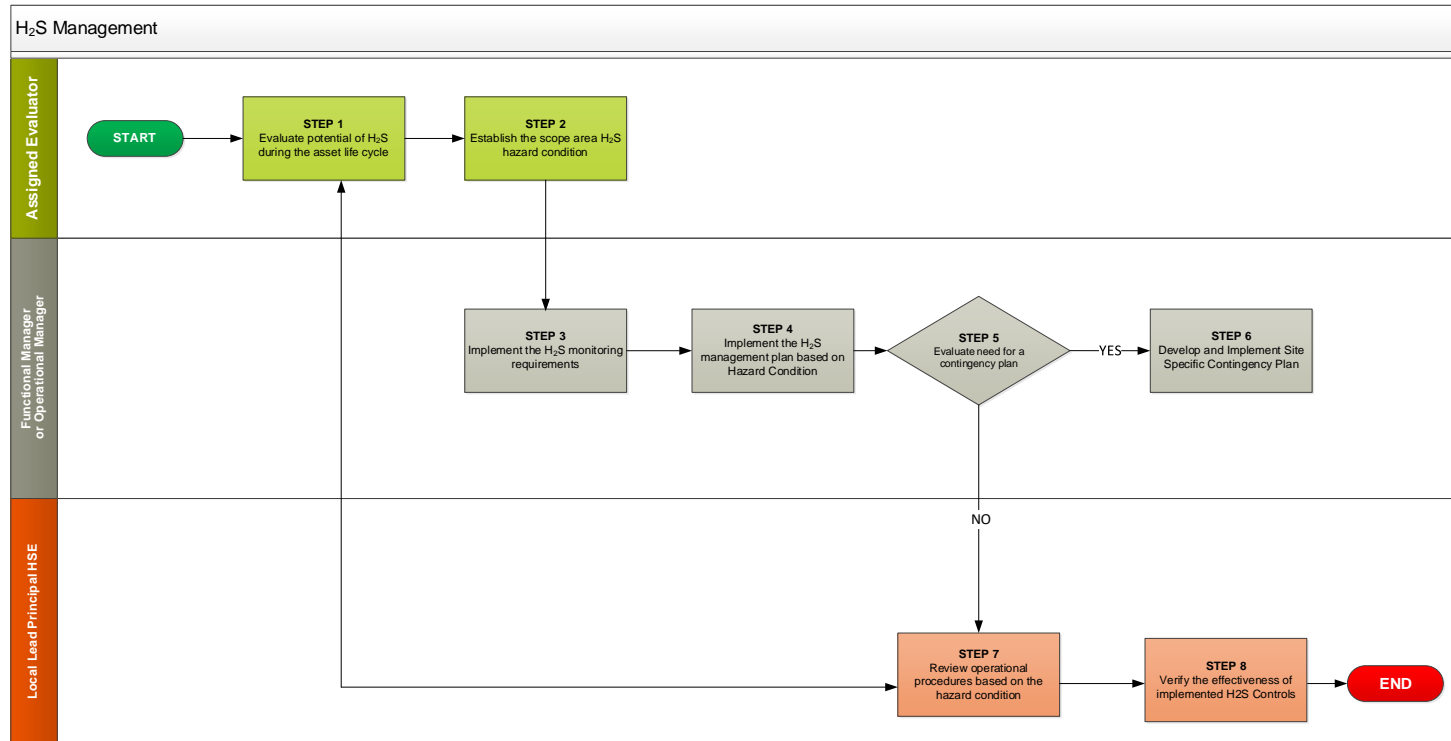
### Document Signatures (e-signatures are permissible)

	Business Role	Name	Signature
Approver	VP HSEQ Projects	Karelis Holuby	<i>Signature on file – refer to Memorandum: Heritage BHP Petroleum HSE MS Post-Merger Update</i>

### Disclaimer:

This document has been updated to meet post-merger requirements. Updates have been restricted to rebranding of logo, company name and revision number and date. Updates have not impacted the design or functionality, or taken away from original intent, of the document.

## Process Summary



## Procedure

### Step 1 – Evaluate the potential of H<sub>2</sub>S during the asset life cycle

- *Assigned Evaluator* to determine the potential likelihood and magnitude of Hydrogen Sulphide (H<sub>2</sub>S) within the **scope areas**. The **scope area** may be limited to a single well, a multi-well facility, a field, or the Asset (see [Appendix 1](#)). The agreed **scope area(s)** must be documented.
- *Assigned Evaluator* to make the determination using a risk-based approach (e.g., Process Hazard Analysis (PHA)) that can take into consideration existing risk assessments and relevant modelling and sampling data. Evaluation data may also include legacy data, industry, and local data from reliable sources inclusive of exploration, drilling and operations:
  - modelling data available through Reservoir, Process, and Dispersion models
  - sampling data available through fluid testing, chromatography, and stain tube and acetate tape test methods.

<b>Outputs</b>	<ol style="list-style-type: none"> <li>1. Scope area defined</li> <li>2. Risk Assessment (the potential likelihood and magnitude of H<sub>2</sub>S within the <b>scope area</b>)</li> </ol>
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### Step 2 – Establish the scope area H<sub>2</sub>S hazard condition

- *Assigned Evaluator* to define the H<sub>2</sub>S Hazard Condition(s) (see Table 1) of the **scope area** defined in Step 1.

H <sub>2</sub> S Hazard Condition		Condition Description	Working Concentration Range
<b>Condition 1</b>	<b>Low Hazard</b>	<b>Scope area</b> with routine operations in zones containing hydrogen sulphide that may be present in concentrations below the action level of 10 ppm.	<b>&lt;10 ppm</b>
<b>Condition 2</b>	<b>Medium Hazard</b>	<b>Scope area</b> where hydrogen sulphide is or potentially may be present above the action level of 10 ppm up to 99 ppm on the location.	<b>10 ppm to 99 ppm</b>
<b>Condition 3</b>	<b>High Hazard</b>	<b>Scope area</b> where hydrogen sulphide is or potentially may be present above 100 ppm	<b>≥100 ppm (IDLH)</b>

Table 1: H<sub>2</sub>S Hazard Conditions

<b>Outputs</b>	1. H <sub>2</sub> S Hazard Condition(s) identified for the <b>scope area</b>
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### Step 3 – Implement the H<sub>2</sub>S Monitoring Requirements (all hazard conditions)

- *Functional or Operational Manager*, with support from the *Local Lead Principal HSE* or *HSE Supervisor*, and/or *Surface Engineering*, to implement a H<sub>2</sub>S **monitoring program** for the **scope area**:
  - sampling to be completed at a minimum annually to determine if the H<sub>2</sub>S hazardous condition has changed
  - monitoring results to be documented using the *H<sub>2</sub>S Monitoring Record Form* (PET-HSE27-SF-FRM-00019) and maintained as a formal record
  - in cases where the **monitoring program** reveals H<sub>2</sub>S levels greater than 10 ppm, engage *Surface Engineering* or other support to determine the appropriate course of action to prevent and mitigate a loss of containment event (e.g., additional engineering controls).

**Note:** H<sub>2</sub>S monitoring is required for all **scope areas** irrespective of H<sub>2</sub>S Hazard Condition.

<b>Outputs</b>	1. Completion of the H <sub>2</sub> S <b>monitoring program</b> (at least annually)
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## Step 4 – Implement the H<sub>2</sub>S Management Plan based on Hazard Condition

- *Manager or Superintendent Operations*, with support from the *Local Lead Principal HSE or HSE Specialist*, to implement the H<sub>2</sub>S **management plan** for the **scope area**:
  - [Appendix 2](#) outlines the minimum controls required for the H<sub>2</sub>S **management plan** based on the given Hazard Condition.

**Note:** Where an operation is subject to regulatory requirements for H<sub>2</sub>S that are more stringent than this Procedure, these regulatory requirements take precedence. A gap assessment must be completed between the regulatory requirements and this Procedure, with aspects that exceed the local regulations implemented. A regulatory compliance plan and the Pet DW (WEL) required **management plan** can be one in the same.

**Outputs** 1. Implementation of Minimum H<sub>2</sub>S **management plan** requirements for Hazard Condition

## Step 5 – Evaluate Need for a Site-Specific Contingency Plan

- *Manager or Superintendent Operations*, with support from the *Surface Engineering and/or HSE team*, to use the following criteria to determine the need for a site-specific contingency plan (where no prior data exists, a contingency plan is required):
  - **Offshore Operations** – If H<sub>2</sub>S level at the facility is  $\geq 20$ ppm.
- If a contingency plan is not required skip to Step 7.

**Outputs** 1. H<sub>2</sub>S level determined for each offshore facility

## Step 6 – Develop and Implement Site-Specific Contingency Plan

- *Manager or Superintendent Operations*, with support from the *Local Lead Principal HSE*, to develop and implement a site-specific contingency plan:
  - for Offshore Operations, refer to local regulatory requirements (for example, USA Title 30 Code of Federal Regulations 250).

**Note:** The Site-Specific Contingency Plan may be a stand-alone document or be contained within the *Facility Emergency Response Plan*.

**Outputs** 1. Site Specific Contingency Plan

## Step 7 – Review operational procedures based on the hazard condition

- *Manager or Superintendent Operations* to initiate a review of Operating Procedures and Work Instructions to determine if changes are needed based on the H<sub>2</sub>S Hazard Condition. The review must address the following minimum hazards:
  - density of H<sub>2</sub>S greater than air, therefore the potential for H<sub>2</sub>S to accumulate in low areas or confined spaces
  - exposure of pyrophoric scales to oxygen and the associated fire risk
  - corrosive nature of H<sub>2</sub>S and its effect on processing equipment with the potential to result in a loss of containment
  - potential for the presence of H<sub>2</sub>S in enclosed spaces and due to bacterial activity
  - potential for injury due to exposure of soft tissue to H<sub>2</sub>S.
- *Local Lead Principal HSE or HSE Supervisor* to define the H<sub>2</sub>S specific emergency response protocols for Hazard Condition 2 and 3 **scope areas**, including the frequency of routine exercises to test response capability and effectiveness. This must include impacts to the community where that potential exists.

**Outputs** 1. Current and aligned Operating Procedures and Work Instructions

2. Define H<sub>2</sub>S specific emergency response protocols and exercises

## **Step 8 – Verify the effectiveness of implemented H<sub>2</sub>S controls**

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- *Local Lead Principal HSE or HSE specialist* to verify the controls in place to mitigate any H<sub>2</sub>S risk.

## Roles and Responsibilities

Role	Responsibilities
<p><b>Assigned Evaluator</b></p>	<p>Person who has responsibility to determine the potential likelihood and magnitude of H<sub>2</sub>S within a field or Production Unit. This is a process role assigned to an organizational position by local management. Positions that may fulfill this process role include, but are not limited to:</p> <ul style="list-style-type: none"> <li>▪ Exploration Geophysicist</li> <li>▪ Project Engineer</li> <li>▪ Drilling and Completions Engineer</li> <li>▪ Operations Process Safety Engineer</li> <li>▪ Closure Specialist</li> </ul>
<p><b>Functional Manager or Manager or Superintendent Operations</b></p>	<p>Person who has responsibility for establishing the controls (e.g., H<sub>2</sub>S <i>monitoring program</i>) for the identified Hazard Condition associated with the defined <i>scope area</i>. This is a process role assigned to an organizational position by local management. Positions that may fulfil this process role include, but are not limited to:</p> <ul style="list-style-type: none"> <li>▪ Project Director</li> <li>▪ Manager or Superintendent Drilling and Completions</li> <li>▪ Manager or Superintendent Operations</li> <li>▪ Closure Manager</li> </ul>
<p><b>Local Lead Principal HSE or HSE Specialist</b></p>	<p>Person who has responsibility for providing HSE technical support to field operations. This is a process role assigned to an organizational position by local management. Positions that may fulfil this process role include, but are not limited to:</p> <ul style="list-style-type: none"> <li>▪ Lead Principal HSE</li> <li>▪ HSE Specialist</li> </ul>

## Appendix 1. Asset Life Cycle H<sub>2</sub>S Management

Examples of H <sub>2</sub> S sources across on Asset life-cycle phases			
Exploration	Drilling and Completions	Operation	Closure
Reservoir	Reservoir	Well heads	Well heads
	Well casing	Process vessels	Process vessels
	Well off-loading equipment	Process fluid storage	Process fluid storage
	Sample catchers	Water injection systems	Water injection systems
	Frac ponds	Transmission piping	Transmission piping
		Sumps	Sumps and drains
		Storage and other pedestals	Storage and other pedestals
		Fuel storage	Fuel storage
		Ponds	Ponds and tanks
		Battery bank rooms	

Life Cycle Requirements			
Exploration	Drilling and Completions	Operation	Closure
Modelling	Modelling	Modelling	Sampling
	Sampling	Sampling	Monitoring Program
	Monitoring Program	Monitoring Program	Management Plan
	Management Plan	Management Plan	

**Appendix 2. H<sub>2</sub>S Management Plan Minimum Requirements**

H2S Hazardous Condition	Potential Concentrations	Equipment Requirements	Access Control Requirements	Training Requirements	Signage Requirements
<b>Condition 1 - Low</b>	< 10 ppm	<ul style="list-style-type: none"> <li>▪ None required specific to H<sub>2</sub>S</li> <li>▪ For monitoring activities a personal monitor is required</li> </ul>	<ul style="list-style-type: none"> <li>▪ None required specific to H<sub>2</sub>S</li> </ul>	<ul style="list-style-type: none"> <li>▪ H<sub>2</sub>S Awareness – refer to API recommended practices (RP) for minimum training requirements</li> <li>▪ Annual Refresher</li> </ul>	<ul style="list-style-type: none"> <li>▪ No signage required specific to H<sub>2</sub>S</li> </ul>
<b>Condition 2 - Medium</b>	10 ppm - 99 ppm	<ul style="list-style-type: none"> <li>▪ Monitoring Equipment                             <ul style="list-style-type: none"> <li>– Personal Monitors (required for monitoring)</li> <li>– Portable Multi Gas Monitoring Equipment</li> <li>– Consider Fixed Monitoring with audible and visual alerts. Where fixed monitoring is available, personal monitors are not required</li> </ul> </li> <li>▪ Wear a 30 minute self-contained (pressure demand) breathing apparatus (SCBA) or a supplied air respirator for controlled activities where the source of exposure to H<sub>2</sub>S is not removed (e.g., drilling activities, fluid sampling, breaking containment, and field instrumentation adjustments).</li> <li>▪ Wind direction indicators (windsocks or streamers)</li> </ul>	<ul style="list-style-type: none"> <li>▪ Access to low points, confined areas to be reviewed and access restricted as appropriate.</li> </ul>	<ul style="list-style-type: none"> <li>▪ H<sub>2</sub>S Awareness – refer to API RP for minimum training requirements</li> <li>▪ First Aid/CPR</li> <li>▪ Annual Fit Test for Respirators</li> <li>▪ Annual Refresher Training</li> <li>▪ Visitors and other non-essential personnel are <u>not</u> required to have training as long as they are in the presence of trained personnel but shall be briefed on route(s) of egress, emergency assembly area(s), applicable warning signals, and how to respond in the event of an emergency, including use of personal protective equipment, if required.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Offshore Facilities must install legible warning labels and signs at entry points to the areas with H<sub>2</sub>S.</li> <li>▪ Where onshore operations are underway warning flags in accordance with API RP shall be used (Green &lt;10 ppm, Yellow ≥ 10 and &lt;30 ppm, Red ≥ 30 ppm)</li> <li>▪ Signs must align with UN GHS</li> </ul>
<b>Condition 3 – High</b>	≥100 ppm (IDLH)	<ul style="list-style-type: none"> <li>▪ Monitoring Equipment                             <ul style="list-style-type: none"> <li>– Personal Monitors</li> <li>– Portable Multi Gas Monitoring Equipment</li> <li>– Remote Monitoring Required – Where facilities/sites are manned for operations</li> </ul> </li> <li>▪ Each person must carry an approved 5 to 15 min full faced escape pack wear a 30 min self-contained (pressure demand) breathing apparatus (SCBA) or a combination of full face-piece pressure demand supplied-air respirator with an auxiliary self-contained air supply for controlled activities where the source of exposure to H<sub>2</sub>S is not removed (e.g., drilling activities, fluid sampling, breaking containment, and field instrumentation adjustments).</li> <li>▪ Wind direction indicators (windsocks or streamers)</li> </ul>	<ul style="list-style-type: none"> <li>▪ Access to low points, confined areas to be reviewed and access restricted as appropriate.</li> </ul>	<ul style="list-style-type: none"> <li>▪ H<sub>2</sub>S Awareness – refer to API RP for minimum training requirements</li> <li>▪ First Aid CPR</li> <li>▪ Annual Fit Test for Respirators</li> <li>▪ Rescue Training for Rescue Team</li> <li>▪ Annual Refresher Training</li> <li>▪ Onsite Supervisors (if applicable)                             <ul style="list-style-type: none"> <li>– Contingency Plan Responsibilities</li> <li>– Effects of Hydrogen Sulphide on equipment components.</li> </ul> </li> <li>▪ Visitors and other non-essential personnel are <u>not</u> required to have training as long as they are in the presence of trained personnel but shall be briefed on route(s) of egress, emergency assembly area(s), applicable warning signals, and how to respond in the event of an emergency, including use of personal protective equipment, if required.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Offshore Facilities must install legible warning labels and signs at entry points to the areas with H<sub>2</sub>S.</li> <li>▪ Signs must align with UN GHS</li> </ul>

**Notes**

1. These requirements are aligned with American Petroleum Institute Recommended Practice (API RP) 49, 55 and 68
2. Petroleum Deepwater (WEL) actionable levels are based on Short Term Exposure Limit (STEL). This negates the requirement for any defined action at levels which present immediate danger to life and health (IDLH).
3. The action levels specified here are to be taken as the atmospheric concentration with the understanding that these are informed by the H<sub>2</sub>S levels of the fluid within the reservoir, process, storage or piping.
4. Where local statutory regulations stipulate requirements and standards in addition to and more stringent than those stated in this matrix, they must be complied with and have precedence, (e.g., action levels, specific signage for working at a H<sub>2</sub>S location).