Guidance on Hydrocarbon Release Reduction Plans

Making the UK the safest place to work in the worldwide oil and gas industry
INTRODUCTION

In 2010, the board of the Oil & Gas UK endorsed an initiative launched by Step Change in Safety to cut the number of hydrocarbon leaks from installations in the UKCS by 50%. The board requested companies to develop hydrocarbon leak reduction plans (HCR plans). In 2011 the Health and Safety Executive (HSE) in the UK requested Operating Companies to submit a copy of their HCR plans, and noted a marked difference in style and content. A workgroup set up by Step Change to explore options for reducing leaks, has reviewed company plans to identify best practice.

HSE VIEW

The UK HSE presented a view of HCR plans, concluding that the best plans:

- set a target of zero, and aim to continually improve
- identify requirements for additional resources or accommodation, such as budget or flotels
- identify requirements for additional personnel, including inspection and maintenance staff
- list specific leak reduction activities
- identify activity based on analysis of data
- have management focus
- promote leaks as a priority, through awareness days and activities

A “GOOD” PLAN

A set of industry plans was reviewed for common themes. A “good” HCR leak reduction has the following components:

- It describes the pertinent management systems and improvement activities aimed at reducing leaks – the “what to do” (Part 1):
  - learning from release incidents
  - integrity and maintenance activities
  - managing operational activities
  - proactive learning from industry
  - managing well integrity

- It describes the way in which you ensure attention is focussed on the issue and necessary activities are being carried out – the “how to do it” (Part 2):
  - leadership and engagement
  - resourcing
  - training and competence
  - targets and metrics
  - practices, monitoring and auditing

This document explores the current industry plans for these headings, gives an outline of what a good plan might include, and lists example activities from industry plans. The examples from industry plans are not exhaustive but do give a flavour of the types of activities that might be described under each section.

The appendix gives details of findings and recommendations to reduce HCRs from floating facilities and vessels.
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PART 1: WHAT TO DO

<table>
<thead>
<tr>
<th>SECTION: Learning from release incidents</th>
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</thead>
<tbody>
<tr>
<td>OVERVIEW: Demonstrate that you have a process that corroborates the size of release so that an appropriate level of investigation and resource is allocated. Treat the release as having the potential for worst credible consequences. Investigate individual incidents, learn lessons and draw patterns of causes from groups of incidents and near misses. Make references to specific incidents and the learning you gain.</td>
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EXAMPLES FROM INDUSTRY PLANS

**Quantity estimation**
- leak quantity is calculated or verified by a process engineer or process safety engineer

**Investigation**
- demonstrate an increased level of investigation standard for releases
- describe how your process follows up near miss as well as actual releases
- engage HSE and engineering leaders in agreeing terms of reference for leak investigations
- track leak investigation progress and quality assure investigations
- describe how human factors is incorporated into root cause analysis of releases
- leadership review of leak investigations

**Lessons learned**
- describe how releases are dealt with in the lessons learned process
- cite specific leak events along with the root causes, lessons learned, and corrective actions you have taken
- recognise that there are lessons from different operating modes: normal operation, turnarounds, maintenance
- leaders check that assets are receiving and acting on the lessons learned

**Analysis**
- show that you have analysed leak events and understand the split in terms of severity, themes, causes and facilities
- analyse groups of incidents for patterns of human factors, behaviour and culture
- communicate themes from annual analysis
- provide assets with individualised leak data and incidents
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SECTION: Integrity and maintenance activities

OVERVIEW: The inspection, maintenance and corrective activities that sustain the integrity of plant and prevent loss of containment. This section includes descriptions of inspection methodologies, key technologies and specific surveys on particular leak-prone systems. Includes means of preventing loss during and after maintenance and turnarounds.

EXAMPLES FROM INDUSTRY PLANS

Inspection methodology
- pressure systems inspection plans
- inspection processes
- risk-based inspection tool evolution and improvement
- reference RBI API 510, 570 standards
- anomaly identification and prioritisation
- defect management and closure
- prioritisation of inspection and integrity work in schedules, POB limits
- single provider and methodology for vibration and fatigue assessments
- baseline vibrations and fatigue surveys

Technology
- applying technology to improve inspection
- corrosion under insulation (CUI) scanning technology
- improved coating options
- embedding vibration knowledge in new modifications and projects

Specific surveys and assessments
- valve integrity surveys
- small bore / instrument tubing surveys
- vulnerability assessments
- turbine berth assessments

Turnarounds
- turnaround gated capital value process
- turnaround preparedness reviews
- tagging of small bore tubing in shutdowns
- leak testing standards
- line walking after breaches
- use of guidance on certification (GOC) for reinstatement after turnarounds and maintenance where breaking containment
- adherence to isolation, reinstatement and turnaround practices

Specific equipment areas
- seal ring identification during turnarounds
- bunker hose inspection and replacement
- flexible hose management
- revised design and installation practices for instrument tubing
- turbine vendor leak reduction measures
- “golden” small bore joints
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<table>
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<tr>
<th>SECTION:</th>
<th>Managing operational activities</th>
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<td>OVERVIEW:</td>
<td>Describes the operational controls that can be used to prevent and detect leaks. Includes means of preventing loss of containment through isolation and jointing practices, and the early detection of leaks by searches.</td>
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### EXAMPLES FROM INDUSTRY PLANS

**Leak searches**
- leak searches triggered by maintenance management system
- search teams and responsibilities
- vibration searches

**Management of leaks on discovery**
- leak / weep / seep definitions and reporting criteria
- weeps and seeps registers, and process for monitoring and managing

**Technology**
- ultrasonic leak detection
- FLIR leak detection

**Jointing**
- small bore policies – selection / storage / installation and maintenance
- up-to-date and verified jointing and small bore competence

**Other operations activities**
- identification of safety critical tasks with appropriate procedures, controls and human error analysis
- plant operations competence
- breaking containment registers and checklist
- interlock procedures and isolations
- safe isolation and plant reinstatement practices
- MoC control and actions
- corrosion inhibition delivery and performance
- sand removal
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<th>SECTION:</th>
<th>Proactive learning</th>
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<td>OVERVIEW:</td>
<td>As well as learning from incidents in your own company, describes how leak reduction lessons and best practices are learned from others in industry, and integrate these learnings in your own practices.</td>
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### EXAMPLES FROM INDUSTRY PLANS

**Drawing on industry practices**
- review of industry practices and gap analyse
- share with other operators of similar facilities
- HCR toolkit (Step Change)
- HSE guidance on hydrocarbon leak prevention
- HSE data on common industry equipment sources
- survey industry for best practice in procedure

**Specific topics**
- sustainability
- corrosion
- vibration
- small bore
- bolted joints
- flexible hoses
- isolations and reinstatement
- floating facilities (see relevant section at the end of this document)

**Integrating in own practices**
- documented guidance on hydrocarbon leak prevention
- folding learning back into practices
- bowtie causes and barriers
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### SECTION: Well integrity

### OVERVIEW:
The practices, processes and activities that ensure there is no unplanned escape of fluids from a well throughout the whole well life cycle from design through drilling, testing, completion, commissioning, operation, maintenance, intervention, workover, suspension and abandonment.

### EXAMPLES FROM INDUSTRY PLANS

**Well integrity management system**
- covers the complete well life cycle
- integrates with the overall asset integrity management and verification schemes
- describes management of change process
- describes response to the degradation or failure of well barriers
- describes roles, responsibilities, authorities and competency requirements for personnel involved in each stage of the well life cycle

**Well barriers**
- two barriers in place throughout the well life cycle or justification in place to explain why it is acceptable to proceed with less than two barriers
- barriers explicitly described at all stages
- procedures for the installation, testing and maintenance of well barriers in place
- recognition and management of the risks associated with the removal or well barriers

**Well design, construction and testing**
- includes the assessment and mitigation of subsurface hazards
- adequate for all anticipated well uses and conditions throughout the well life
- facilitates secure future suspension or abandonment
- avoid collision with adjacent wells
- well control equipment, procedures and drills specified
- recognition and management of the risks associated with bringing well fluids to surface and negative pressure testing

**Well commissioning, operation and maintenance**
- all information required to operate and maintain the well documented and readily accessible
- well operating criteria and response to change documented and readily accessible, including maximum allowable annulus pressures
- well operating equipment (including gauges and valves) readily accessible
- hazards associated with gas lift addressed
- inspection and maintenance procedures in place, including pressure, corrosion and fluid monitoring
- wells protected from, or resistant to, external damage, including over trawling and dropped objects
- removal of emergency shutdown systems assessed and mitigations in place when required

**Well suspension and abandonment**
- inspection and maintenance routines in place for suspended wells
- wells abandoned such that there can be no unplanned release of fluids
- well records archived
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### PART 2: HOW TO DO IT

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<td><strong>OVERVIEW:</strong> Demonstrates how the leadership in your organisation feels ownership or is made to feel accountable for leak reduction. Also includes how the wider organisation is engaged in the programme to reduce leaks.</td>
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### EXAMPLES FROM INDUSTRY PLANS

#### Mindfulness
- recognise past success is not a guarantee of future
- describe a sense of unease, dissatisfaction and desire for continuous improvement
- desire to eliminate entirely
- focus on major accident prevention
- understand problem
- clear distinction between process and personal safety

#### Leadership
- declared goal of reduction in corporate plans
- link to compensation
- time commitment
- clear priorities and targets are set
- executive sponsor or SPA or senior steering committee
- regular investigation review by leaders
- process safety leadership training

#### Engaging broadly
- HSE four part culture model for engagement
- hydrocarbon leaks engagement workshops
- methods of making leaks and consequences of leaks real for people
- communication plans
- different approaches for different audiences
- site time out for safety
- site-specific improvement plans

#### Engaging with industry
- engagement in Oil & Gas UK and Step Change workgroups
- acknowledge industry target
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<th>Resourcing</th>
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<td>OVERVIEW:</td>
<td>Describes the manpower, accommodation and financial resources that are applied to tackling leaks.</td>
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### EXAMPLES FROM INDUSTRY PLANS

**Manpower**
- level of manpower allocated to leak prevention activities, including plans for increases
- maintenance and inspection manpower

**Improved access**
- increased POB for maintenance activity
- additional accommodation
- flotel campaigns
- campaign maintenance
- walk to work schemes

**Finance**
- integrity spend
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### SECTION: Training and competence

### OVERVIEW:
Describes the competencies that are most relevant to leak prevention, and how they are sustained and improved.

### EXAMPLES FROM INDUSTRY PLANS

**Management of training and competence**
- focus on training and competence for most relevant HCR practices
- use of competence profiles
- refreshing, monitoring and sustaining competence levels for HCR practices
- review and update of training and competence
- refreshing of competence

**Awareness training**
- process safety workshop
- Spadeadam workshop
- education in reliability and integrity
- vibration

**Operating practices**
- safe isolation and reinstatement practices
- joint management system
- flexible hose and fittings
- pressure testing
- flange make up
- small bore fitting
- process and mechanical competence profiles for plant reinstatement

**Environmental training**
- environmental management
- oily discharge
- atmospheric emissions
- spill prevention and contingency planning
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SECTION: Targets and metrics

OVERVIEW: Describes the leading and lagging indicators that are used to track progress in leak reduction.

EXAMPLES FROM INDUSTRY PLANS

Understanding limitations of metrics
- knowledge of UK benchmarking position
- use of Birds triangle for releases, separate from a personal injury triangle
- leading and lagging indicators
- leading and lagging process safety KPIs

Management of metrics
- clear definitions of measures
- use of tartan / heat maps for complex data
- use of dashboards
- explain how information is reviewed and acted on
- tracking KPIs and objectives
- quality assurance of leak quantities

Leading metrics
- tartan / heat maps of critical measures for each installation
- integrity metric heat maps
- competence refreshers
- percentage of problematic inspection findings
- vessel inspections
- flexible hose inspections and remedials
- small bore inspections and remedials
- defined life replacement inspections and remedials
- weeps and seeps corrective workorders
- pipe work fabric maintenance anomaly work orders
- corrosion inhibition metrics
- safety critical backlogs
- GOC (guidance on certification) failure following SH1 / during service test

Lagging metrics
- tiered loss of containment measures
- joint management failures
### SECTION: Practices, monitoring and auditing

### OVERVIEW:
Describes how the activities necessary for leak reduction are monitored and audited.

### EXAMPLES FROM INDUSTRY PLANS

**Practices**
- key HCR practices identified
- practice users workshops and engagement
- standard monitoring / audit protocols and schedules

**Monitoring**
- sites self-assess implementation of HCR reduction practice
- turnaround no leaks verification process
- regular review of HCR investigations
- review of site monitoring across organisation to identify common themes

**Audit**
- audit of HCR practice compliance
APPENDIX

Floating production facilities (FPFs) and floating production, storage & offloading vessels (FPSOs)

OVERVIEW:
A collective of the majority of operators of floating facilities in the UK worked together to examine OIR12 data to investigate and identify the causes of hydrocarbon releases that may be specific to floating facilities.

FINDINGS

• comparing the populations of fixed and floating of facilities similar complexity, there have been a greater proportion of hydrocarbon released on the floating facilities

• floating facilities experience a disproportionate number of hydrocarbon releases on gas compression and utilities systems

• floating facilities experience a disproportionate number of non-process hydrocarbon releases, with diesel leaks being the most significant

• there is some evidence from the data that there is a greater rate of mechanical fatigue on floating facilities, possibly caused by the effect of constant motion of the floating vessel

RECOMMENDATIONS

Within their overall HCR plan FPSOs / FPFs should incorporate:

• focus on gas compression systems
• focus on diesel
• recognition that there is a fatigue mechanism unique to FPSOs / FPFs and design, construct, inspect and monitor with this threat in mind