bp Procedure

Control of Work

Applicability:	P&O - Production, Wells, Projects and bp Solutions
Issue Date:	15 May 2023
Issuing Authority:	Andrew Collins, SVP Production
Content Owner:	Mark Wolbers, VP Operations, bp Solutions
Unique Identifier:	100340
Revision Code:	B07

Document Information

Security Classification:	General
Next Review Date:	May 2025

Revision History

Revision Date	Revision Number	Approver	Revision
15 May 2023	B07	Andrew Collins	Seventh issue
30 Jun 2020	B06	Andrew Collins	Sixth issue
21 Oct 2019	B05	Andrew Collins	Fifth issue
12 Oct 2017	B04	Fawaz Bitar	Fourth issue
01 Jun 2015	B03	Steve James	Third issue
01 Dec 2014	B02	Steve James	Second issue
01 Jun 2014	B01	Steve James	First issue

Operating Management System (OMS) – Sub Elements and Group Essentials

OMS Sub Element	OMS Sub Element Title	Group Essentials
4.5	Control of Work	

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Tables

Figures

Foreword

This is the seventh issue of 100340 bp Procedure Control of Work, formerly titled Upstream Control of Work. This bp Procedure incorporates the following changes:

- More information on the use of the Life Saving Rules in CoW.
- Clarifications regarding Authorising de-isolations and executing de-isolations (section 8.7.5).
- Update to section 10 'managing temporary overrides' and Table 20 to improve efficiency and clarity.
- Clarifications in section 14 including:
    - Clarification of IsA LV1 original design intentions
    - Clarifications on when the non-conformant process can be used
    - Addition of cryogenic temperatures in the 'process isolation standards' in Table 26
    - Clarifications regarding use of cross-checking.
- Clarification on the use of ventilation in CSE.
- Updates to Figure 30 'atmospheric testing in a confined space' and Table 46 'confined space entry criteria'.
- Clarifications regarding the use of certificates and additional hyperlinks added to Table 36.
- Addition of certification process to replace SHM.
- Clarification of lifting requirements in line with 100572 bp Procedure Management of Lifting Operations and Lifting Equipment.
- Update to Figure 21 'selecting a test method' to make it easier to follow (section 19).
- Addition information regarding use of PSV and OPPD (learned from Culzean incident).
- Clarification of monitoring frequency for leaks and seeps with addition of flow-chart.
- Re-write of section 20 'Plant reinstatement' to improve clarity of intent and understanding.
- Clarification of rules regarding use of personal isolation on Type 1 locked valves.
- Additional Industrial Hygiene information in sections 14, 15, 16 and 24.
- Further clarifications on requirements throughout this bp Procedure and Annexes updated to align with changes.

See the bp Procedure update release communication which includes a copy of the document with all tracked changes.

Introduction

An effective and systematic Control of Work (CoW) process promotes a work environment where a task or activity can be completed safely and efficiently, without unplanned loss of containment and without harm to people or the environment, or damage to plant or equipment.

100340 bp Procedure Control of Work describes how to manage and implement CoW. It describes how to do this in a standard and structured way that meets applicable group Practices set out in section 2 below. It is intended that 100340 bp Procedure Control of Work:

- is adopted, over a transition period and following the appropriate Management of Change (MoC) procedures, across the bp operating functions to which it applies, and
- replaces existing local CoW procedures and practices.

By adopting and following 100340 bp Procedure Control of Work, each site will conform to all the requirements in the group and segment defined practices on CoW that apply and meet the Life Saving Rules.

1 Scope and exclusions

1.1 Where this procedure applies

100340 bp Procedure Control of Work applies to P&O - Production, Wells, Projects and bp Solutions. It does not apply to Operated-by-Others (OBO) facilities or to Non-Operated Joint Ventures (NOJVs).

It covers all CoW activities at the following facilities and assets:

- Production operated sites
- Wells owned rigs and surface equipment
- Wells contractor-operated rigs and equipment unless a bridging document is in place
- Brownfield projects executed by Projects at Production operated sites
- Projects controlled sites where the contract strategy specifies using a bp CoW system, rather than the contractor's safety management system.

1.2 Where Projects use a contractor's CoW process

The applicability matrix in Annex G provides guidance on Projects scenarios and whether a contractor's or bp's CoW process would typically be used. Factors to consider in this decision are as follows:

- Who is contractually in control of the worksite?
- Who is competent to manage the type of risk that is presented by the work?
- How will simultaneous operations (SIMOPS) between the project worksite and a bp-operated site be managed?

In cases such as greenfield construction work or a bp warehouse that are managed by a third-party, the choice of which CoW process to use is risk based and documented by the operating entities involved. This decision will be reflected in the contract strategy for that work and in bridging documents.

When Projects uses the contractor's safety management system, Projects completes a gap assessment to Verify that the contractor's system meets bp's requirements.

bp monitors contractor performance against bp requirements during work execution through oversight of the contractor's self-verification process.

1.3 Regulatory requirements

If 100340 bp Procedure Control of Work conflicts with any legal and regulatory requirements, comply with the higher standards.

100340 bp Procedure Control of Work creates a higher obligation, follow this bp Procedure and comply with legal and regulatory requirements that apply.

100340 bp Procedure Control of Work applies globally so it has not been specifically designed to meet legal or regulatory requirements in any particular jurisdiction. However, following 100340 bp Procedure Control of Work will usually support legal and regulatory compliance in relation to controlling the risks of work activities (for example application of the As Low As Reasonably Practicable (ALARP) principle in the UK).

2 References

2.1 Required references

The following documents are referenced in one or more requirements in this document. For dated references, only the version cited applies. For undated references, the latest version of the referenced document (including any amendments) applies.

ETP Library

GP 06-29	Corrosion Protection During Hydrotesting, Wet Lay Up, Flushing, and Commissioning Activities
GP 32-20	Site Inspection, Testing, and Commissioning of Plant
GP 32-40	In-Service Pressure Testing – Common Requirements
GP 42-10	Piping Systems (ASME B31.3)
GP 43-46	Pipeline Pre-Commissioning and Line Fill
GP 43-50	Pigging, Pig Launchers, and Receivers
EP-GIS 62-016	Specification for Ball, Plug, and Other Quarter Turn Valves –Common Requirements
GN 48-012	Selection of Hazard Identification and Risk Assessment Tools and Techniques

Production Library

100243	BP Procedure Global Operations Organization: Risk Management (GOO-GE-PRO-00001)
100577	BP Guide Build it Tight Flange Management (GOO-PM-GLN-00011)
100610	bp Procedure Production Electrical Safety Rules (GOO-OP-PRO-00004)
100033	BP Procedure Organisational Learning in GOO (GOO-OL-PRO-00001)
100695	BP Procedure Management of Temporary Equipment in GOO (GOO-OP-PRO-00005)

Projects Library

100291	BP Procedure Project Planning and Scheduling (GPO-PC-PRO-00025
GPO-CG-GLN-00009	Tightness Testing Guide

Wells Library

100023	BP Practice Well Handover
100218	BP Practice Pressure Testing (10-45)
100222	BP Practice Well Barriers (10-65)

OMS Library

GDP 4.5-0001	Group Defined Practice Control of Work
500229	bp Practice Lifting GDP 4.5-0003
500102	BP Practice Control of Work Integrated Practice

100241	BP Practice Diving (EP SDP 3.2-0001)
100572	bp Procedure Management of Lifting Operations and Lifting Equipment
500173	BP Practice Design and Operating Limits 5.3-0001 (GDP 5.3-0001)
EP SG 5.3-0003	Segment Guide EP SG 5.3-0003 Design and Operating Limits
100578	bp Procedure Activity Integration

2.2 Informative references

Unless stated otherwise in the content of this document, reference to the documents below is for information. Specific sections of the referenced documents will be given in the content of this document if conformance is required.

ETP Library

GP 06-29	Corrosion Protection During Hydrotesting, Wet Lay Up, Flushing, and Commissioning Activities
GP 12-60	Hazardous Area Electrical Installations
GIS 18-023	In-Service Welding and Material Specification for Hot Tap Fittings
GP 30-47	Alarm System Design and Management
GP 30-80	Safety Instrumented Systems (IEC 61511-1)
GP 30-82	Non-SIF Instrumented Independent Protection Layers
GP 42-32	Flanged Joints - Repair
GP 44-40	Design for Safe Isolation of Plant and Equipment
GP 44-60	Area Classification (API RP 500)
GP 44-65	Area Classification (EI 15)
GP 48-03	Layer of Protection Analysis (LOPA)
EP-GP-28-01	Flexible Hose Assemblies
EP GP 62-01	Valves
EP-GIS 62-016	Specification for Ball, Plug and Other Quarter Turn Valves – Common Requirements
GP 44-71	Pressure-relieving and Depressuring Systems (API 521)
GP 44-72	Sizing and Selection of Pressure-relieving Devices (API 520 Part 1)
GP 44-73	Installation of Pressure-relieving Devices (API 520 Part 2)
GP 44-74	Venting Atmospheric and Low-pressure Storage Tanks (API 2000)
GP 60-20	Inert Gas Systems
GP 44-31	Design and Location of Occupied Portable Buildings in Onshore and Offshore Facilities

OMS Library

GG 3.1-0002	Hazard Identification and Task Risk Assessment
500150	BP Record S&OR Barrier Families RCD 3.1-0001
500147	BP Record Group HSE Definitions (HSE ‘Definitions Dictionary’) RCD 4.4-0001
500195	bp Practice Use of Temporary Ladders GDP 4.5-0002

Production Library

100466	bp Procedure GOO Site Safety Critical Role Appointment (GOO-OP-PRO-00003)
100657	bp Procedure Production Asset 500 Meter Zone (GOO-LI-PRO-00001)

Wells Library

100251	BP Practice Wells Safety Management System Bridging (EP SDP 2.5 - 0004)

Other references

RD001-SP-GLN-800	Ground Disturbance Survey Guideline (RD001-SP-GLN-800-00003951)
TN 3.4-0050	BP Technical Note TN 3.4-0050 Hydrogen sulfide personal gas monitors

Industry standard

EEMUA 182	Specification for integral block and bleed valve manifolds for direct connection to pipework
API RP 14C	Recommended Practice for Analysis, Design, Installation, and Testing of Basic Surface Safety Systems for Offshore Production Platforms
API Spec 6D	Specification for Valves
API 609	Butterfly Valves: Double-flanged, Lug-and Wafer-type
API 53	Well Control Equipment Systems for drilling
OSHA 1910.147	The control of hazardous energy (lockout/tagout)
PAS 128-2014	Specification for underground utility detection, verification, and location
IEC 60038:2009	IEC standard voltages
IEC 60529	Degrees of protection provided by enclosures (IP Code)
IEC 60898-1:2015	Electrical accessories – Circuit-breakers for overcurrent protection for household and similar installations - Part 1: Circuit-breakers for a.c. operation
IEC 60898-2:2016	Electrical accessories - Circuit-breakers for overcurrent protection for household and similar installations - Part 2: Circuit-breakers for AC and DC operation
IEC 60947-2:2016	Low-voltage switchgear and controlgear - Part 2: Circuit- breakers
IEC 60947-3:2020	Low-voltage switchgear and controlgear - Part 3: Switches, disconnectors, switch-disconnectors and fuse- combination units
IEEE C37.13-2015	IEEE Standard for Low-Voltage AC Power Circuit Breakers Used in Enclosures
UL1066	UL Standard Power Circuit Breakers up to 1000 V AC and 1500 V DC Used in Enclosures
UL489	UL Standard Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures

ANSI C84.1-2020	American National Standard for Electric Power Systems and Equipment-Voltage Ratings (60 Hz)
ANSI/NEMA 250-2020	Enclosures for Electrical Equipment (1,000 Volts Maximum)
NFPA70E	Standard for Electrical Safety in the Workplace
BS EN 795:2012	Personal fall protection equipment. Anchor devices
HSE HSG258	A guide to local exhaust ventilation

2.2.1 Additional site or regional documents

To support full conformance with this bp Procedure, the site or Region may use additional site or regional documents to cover the following subjects where relevant.

- Scaffolding
- Ladders
- Chemical risk management (includes: SDS chemical inventory, chemical approval process and chemical risk assessment)
- Managing asbestos
- Hot and odd bolting
- Hot tapping
- Lifting
- Manual handling
- Low specific activity (LSA) and naturally occurring radioactive material (NORM) and radiation source management
- Thermal environment
- Noise management
- Hand-arm and whole-body vibration
- Rope access
- Fatigue management
- Human Performance.

3 Terms and definitions

For the purpose of this bp Procedure, the following terms and definitions apply:

The verbal forms used to express bp Requirements, Recommendations and Permissive Statements are:

- Shall - designates a bp Requirement.
- Should - designates a recommendation where conformance is not mandatory.
- May - designates a Permissive Statement, an option that is neither mandatory nor specifically recommended.

Affected Worker
An employee whose job requires the person to operate or use a machine or equipment on which servicing, or maintenance is being performed under lockout or tagout, or whose job requires the person to work in an area in which such servicing or maintenance is being performed.

Alteration (with respect to section 19)
A physical change in any component that has design implications that affect the pressure containing capability. This includes modifications that require cutting into or welding onto the pressure boundary of an existing system.

An alteration includes but is not limited to:

- welding onto a piping system
- installation of a cold work connector.

An alteration excludes:

- replacing gasket and bolts
- replacement of an existing pipe support with a bolted pipe support
- repair of a pipe support that does not involve welding onto the pressure boundary
- replacing a flanged spool or valve with a previously hydrostatically tested component.

Approve
Confirmation that the content of a document (for example a procedure or risk assessment) is accurate and meets bp’s needs.

Area
A bp entity-operated and controlled site is split up into areas to manage CoW. Each area is under the control of a single Area Authority (AA) and is geographically separate so that SIMOPS with another adjacent area is not an issue for the majority of tasks being executed.

Area Authority (AA)
A central figure in the CoW process who manages, authorises, and controls the CoW activities including SIMOPS in their designated area.

Arc Flash

The rapid release of energy during an arcing fault between electrical conductors.

Auditing

A formal or official examination and verification (for example of a process or task). Auditing includes monitoring, reviewing, and reporting on the audits outcome to the people who can implement any changes needed.

Authorise

A formal process to give permission to use a document or process (for example a permit or previously approved procedure).

Automation Systems

Collection of hardware and software that supports the safe, secure and reliable operation of an industrial process by making data available to personnel and taking pre-configured actions in response of data inputs.

Boundary Isolation

Method typically used for large scale plant maintenance shutdowns or turnarounds (TARs) that involves insertion of spades or spectacle blinds at identified boundary isolation points (battery limits).

bp Entity

An organisational unit within bp such as Production, Projects, or Wells.

bp-Operated Site

A bp site that performs field operations, handling hydrocarbons or operating machinery and applying bp’s Operating Management System (OMS).

bp Procedure

A document type that contains bp Requirements set out in ‘shall’ statements that focus on how something in a bp Policy or bp Practice is done.

Breaking Containment

The opening of any system for any reason, including inspection, repairs or modifications, where there is a risk from egress of toxic, flammable or otherwise hazardous materials (including consideration of pressure, volume and temperature).

Brownfield Site

A bp-operated site that has commissioned operating plant or plants, systems, equipment and facilities where Production, Wells, and Projects activities can be conducted. A brownfield site is normally a Production-controlled site.

Bump Test

The process of briefly exposing sensors in a gas detector (personal and portable) to an expected concentration of gas that is greater than the alarm set points to check for sensor and alarm functionality.

Certificate

A CoW document that verifies a worksite or job is prepared safely and in conformance with this bp Procedure. The use of CoW certificates is mandatory, and they are created during the planning phase of the job. These certificates record any actions or conditions and provide technical approval provided these actions are delivered (refer to section 18 and Annex C).

Certification Management Process

A systematic and integrated approach to managing and completing all project and/or maintenance phases resulting in the handover of a system from one party and its acceptance by another. Commonly referred to as system handover management and often known as Guidance on Certification (GOC).

Checklist

A CoW document that provides guidance for the user to aid checking the key issues and hazards when planning, during the risk assessment or as part of work execution. bp recommends these are used but they do not need to be signed and attached to the CoW documents.

Competence

The ability to perform responsibilities to a defined standard and is demonstrated by application of relevant individuals' knowledge, skills, and behaviours at the required competence profile for a role.

Confined Space

A space that meets all the following criteria:

- is large enough for an individual to enter fully
- has a limited or restricted means of entry or exit
- is not designed for continuous occupancy by the individual.

All confined space entries require permits to be issued in accordance with section 15.

> *The practice of cutting openings in tanks does not necessarily justify declassifying the tank as a confined space. The practice of cutting openings in tanks involves assessing the entry or exit limitations and restrictions before the tank can be declassified.*

Confined Space Entry (CSE)

Entry occurring as soon as any part of the entrant's body breaks the plane of an opening into a confined space.

Control Centre

The location from where a site, plant, equipment or facility is controlled, co-ordinated or monitored.

Controls

The term used by Hazard Identification and Task Risk Assessment (HITRA) to include both controls and mitigations. Controls are intended to reduce the risk of an event occurring, mitigations are intended to reduce the impact if the event occurs.

Control of Work (CoW)

An approved management system that is used to control work in a safe manner.

Created Opening

Any opening where:

- gratings, handrails, stair treads or kicker plates have been removed from structures, or
- damaged structures create a potential risk of falls or dropped objects, or both.

This includes equipment removal, hatches, trap doors, manholes, access ways and voids larger than 0.3m (12in) square.

Critical Equipment

Equipment considered to typically be involved in preventing or mitigating scenarios with unmitigated severities for health, safety, and environmental impacts greater than or equal to level E in accordance with 000030 bp Risk Policy and that aligns with 500150 BP Record S&OR Barrier Families RCD 3.1-0001.

Designated Worker - used in US only

A Performing Authority (PA) who has taken on the additional responsibility to protect the safety of other workers in their work group. The designated worker Verifies any applicable energy isolation (safe-out) is in place and assumes full responsibility for the safety of the workers in their group by using their personal lock and allowing them to work under the protection of their personal lock.

Electronic Management of Change (eMoC)

In the context of this Procedure, eMoC refers to management of change via the application of the eMoC Tool.

Emergent Work

Any new work, as defined by a work management system. Any opportunistic, discovered or break-in work and any other unscheduled work or activity.

Energy System

Systems that contain energy (for example pressure, thermal, chemical, hydraulic, mechanical, electrical, potential, and pneumatic).

Energised Electrical Work

Work or testing that meets either of the following criteria:

- on or in close proximity to exposed energised conductors (>50 V ac or dc)
- involves interaction with equipment where an increased likelihood of injury from an exposure to an Arc Flash hazard exists.

Exposed (as applied to live parts)

Capable of being inadvertently touched or approached nearer than a safe distance by a person.

General or dilution ventilation

The introduction of outside air into a space through mechanical means such as fans, air movers or eductors. It is appropriate to manage general air quality, thermal comfort and dilute non-toxic substances.

GOTCHA

System for retrieving a suspended person.

Greenfield Site

A site that is physically separate from a Production-operated site and has not been subject to hydrocarbon operations; typically, a construction site.

Gross Leak Test

Tightness test using air or nitrogen at low pressure to identify large leaks.

Ground Disturbance

A man-made cut, cavity, trench, or depression made in the ground by removing the covering material (for example earth or concrete) that is:

- deeper than 0.3m (12in) if made with hand tools (for example shovels and spades), or
- any depth if made with mechanical equipment, or sharp tools (e.g. picks, spikes, chisels).

Ground Fault Circuit Interrupter (GFCI)

Also called ground fault interrupter (GFI) or residual current device (RCD) is a device that shuts off an electric power circuit when it detects that current is flowing along an unintended path, such as through water or a person.

Guarded

Covered, shielded, fenced, enclosed or otherwise protected by suitable covers, casings, barriers, rails, screens, mats, or platforms to remove the likelihood of approach or contact by person or objects to a point of danger.

Handover

The detailed review (and communication process) of an operating unit's status, condition and ongoing work that is supported with a sign-off document.

Hazard

Condition or practice with the potential to cause harm to people, the environment, property, or company reputation.

Hazardous Area

A location where fire or explosion hazards could exist due to flammable gases or vapours, flammable liquids, combustible dust or ignitable fibres (refer to GP 12-60, GP 44-60, GP 44-61 and GP 44-65).

Hazardous Fluid

Fluid able to cause harm as a result of its physical and/or conditional properties (e.g. flammable, toxic, high pressure, high temperature).

Hazardous Material

Material able to cause harm because of its physical and/or conditional properties (for example flammable, toxic, corrosive, high pressure, high temperature).

Hot Work

Work that involves either creating or using a flame, spark or energy discharge that could act as the ignition source for a fire or explosion.

Human Performance

Understanding how people interact with each other, plant and processes as part of a system to help manage risk and keep safe.

Human Factors

Physical, psychological, and social characteristics that affect human interaction with plant and processes.

Hydrostatic Test

Pressure or tightness test using liquid, such as water, as the test medium.

Impact

Estimate of the consequences were a risk event to occur.
The word severity is commonly used in place of impact and has the same meaning in 100340 bp Procedure Control of Work and training modules.

In-Service Leak Test

Leak test using the process medium.

Interruption

A break in work (for example for coffee, prayer, smoke and lunch breaks, fire alarms, suspending work overnight, process upsets, emergency situations or shift changes).

Intrusive

Any action that has the potential to affect the process operation or compromise the integrity of the system. Examples include:

- applying overrides
- breaking containment (BC)
- exposure to electrical, pneumatic or other energy sources
- opening or breaking seals on any instrument, junction box or equipment
- disassemble for repair or maintenance purposes.

The following are examples of non-intrusive activity:

- line walking, measurement, surveying, drawing checks
- use of surface temperature/vibration probes
- use of cameras or thermal measurement devices
- attaching or detaching tags or labels.

Isolation

The secure and proven separation of plant and equipment from every source of energy (i.e. pressure, electrical and mechanical).

Job

A series of tasks that are typically performed in sequence to complete a piece of work.

Leak - Gas or Vapour

A gas or vapour release is classified as a leak if a portable gas detector reads 20% lower explosive limit (LEL) or more at a distance of 10cm (4in) downwind of the release.

Leak - Liquid

A liquid release is classified as a leak if dripping at a rate of four (4) or more drips per minute.

Life Saving Rules

The International Oil & Gas Producers (IOGP) set of rules that encompass the industry-standard for safety.

Lifting Engineer (LE)

A person who has been assessed as competent for management of lifting operations and lifting equipment.

Lifting Person in Charge (LPiC)

Individually physically present on-site with the accountability for directly controlling an individual lifting operation.

Likelihood

Estimate of the probability or frequency of a risk event occurring.

Limited Approach Boundary

An approach limit at a distance from an exposed energised electrical conductor or circuit part within which a shock hazard exists. This matches the definition of this term in NFPA70E.

Line of Fire

A term from IOGP Life Saving Rules with the intent to ‘Keep yourself and others out of the Line of Fire’ including avoidance of moving objects, vehicles, pressure release and dropped objects.

Live Equipment

Equipment that is in operation and is therefore a source of energy:

- in the form of electricity, process fluids, radioactive sources or hydraulic or pneumatic pressure
- that could be released or discharged in an uncontrolled manner if an incident occurred.

Local Exhaust Ventilation (LEV)

An engineering control to reduce exposures to airborne contaminants such as dust, mist, fume, vapour or gas in the workplace. An LEV is designed, maintained and tested appropriate for the task and type of contaminant to be removed at source.

Lock

A mechanical device, either key or combination type, that holds an energy-isolating device in the safe position, usually to prevent the machine or equipment energising.

Lockbox Method

A box that can be locked closed so that the contents inside the box cannot be removed without first removing a lock or locks. A lockbox is used for lockout and tagout methods to control the keys for multiple energy sources and multiple workers.

Locking Device

A device that utilises a positive means such as a lock, either key or combination type, to hold an energy isolating device in the safe position and prevent the energising of a machine or equipment. A locking device is substantial enough to prevent removal without the use of excessive force or unusual techniques (such as using bolt-cutters or other metal-cutting tools).

Lockout / Tagout (US)

Term used in the US and is defined by the Occupational Safety and Health Administration (OSHA) as:

- Lockout. The placement of a lockout device on an energy isolating device, in accordance with an established procedure, ensuring that the energy isolating device and the equipment being controlled cannot be operated until the lockout device is removed.
- Lockout device. A device that utilises a positive means such as a lock, either key or combination type, to hold an energy isolating device in the safe position and prevent the energising of a machine or equipment. Included are blank flanges and bolted slip blinds.
- Tagout. The placement of a tagout device on an energy isolating device, in accordance with an established procedure, to indicate that the energy isolating device and the equipment being controlled may not be operated until the tagout device is removed.
- Tagout device. A prominent warning device, such as a tag and a means of attachment, which can be securely fastened to an energy isolating device in accordance with an established procedure, to indicate that the energy isolating device and the equipment being controlled may not be operated until the tagout device is removed.

Long-Term Isolation (LTI)

An isolation that is in place with no active work ongoing or planned.

Loss of Primary Containment (LOPC)

An unplanned or uncontrolled release of material from Primary Containment, including non-toxic and non-flammable materials (e.g. steam, hot water, nitrogen, compressed CO_2, or compressed air). For more information, see 500147 BP Record Group HSE Definitions (HSE ‘Definitions Dictionary’) RCD 4.4-0001.

Management of Change (MoC)

In the context of this Procedure, MoC refers to application of Management of Change controlled via another central or regional bp Procedure and not the eMoC tool (see eMoC definition).

Mitigation

A mitigation reduces the impact (severity) of an incident if the top event occurs.

Monitoring

The regular inspection that a responsible and competent person performs to Verify activities are progressing safely and are on course to meet the objectives and performance targets.

Operating Tasks

Tasks performed by employees who run bp facilities and production units that require interaction with the plant and equipment and are involved in the tasks that Verify ongoing plant operations (e.g. taking samples or replacing filter elements).

Permit

A detailed document that contains the location, time, equipment to be worked on, hazard and controls used and the names of those authorising the work and performing the work.

Planning

Identifying and sequencing work including what needs to be done to prepare for and complete a task or work.

Plant

Land, building, and equipment.

Pneumatic Test

A pressure or tightness test using gas, such as nitrogen or air, as the test medium.

Practicable

If a task is capable of being done, physically or using available technology regardless of cost.

Pressure Test

A test performed to Verify the safety, reliability and leak tightness of pressure and piping equipment. Any new pressure or pipeline systems, or those that have undergone repair or alteration is pressure tested to the original code of construction.

Procedure

A detailed document, either paper or electronic, that sets out sequential or parallel actions that employees follow when they are performing a task. Also known as a site or standard operating procedure.

Process

A detailed description of a management system or a production operation.

Production Operated Site

A site with live hydrocarbon process and utility facilities, or commissioned equipment operated by Production.

Production or Wells or Projects Contractor-Controlled Site

A fabrication or construction yard, contractor workshop or a Projects greenfield site where bp has authorised the contractor through contractual agreement to execute and manage CoW under the contractor’s safety management system.

Projects Controlled Site

A Projects site where there is no hydrocarbon production and where areas designated as hazardous hydrocarbon areas are free of hydrocarbon, i.e.:

- a Projects greenfield site during construction through the commissioning phase with interfaces to live utility systems applying the CoW Procedure
- a Projects greenfield site within or adjacent to an operating site (for example an onshore plant expansion until tie-in to existing site operating plant and systems)
- a brownfield site Verified hydrocarbon-free and formally handed over to Projects by MoC, or start-up management certificate.

Quality Control Certification

Certification (for example SH1, MC1), which form part of the Certification Management Process.

Reasonably Practicable

That which is, or was at a particular time, reasonably able to be done to ensure health and safety, taking into account and weighing up all relevant matters including:

- the nature of the hazard or risk
- the likelihood of it occurring
- other risk management measures in place, and
- whether the resources (e.g. time, expertise, available technology), to implement additional measures are disproportionate with the risk reduction they are anticipated to deliver.

Regular (where referring to tasks)

Indicates actions that occur frequently enough to confirm the ongoing safety of the workforce. For some tasks, this might be every year, while for others it could be every few minutes.

Residual Risk

The level of risk that remains after risk reduction measures (controls) are taken into account.

Respiratory Protective Equipment (RPE)

A term covering air-purifying respirators and supplied air or self-contained breathing apparatus (SCBA).

Restricted Approach Boundary

An approach limit at a distance from an exposed energised conductor or circuit part within which there is an increased likelihood of electric shock, due to electrical arc-over combined with inadvertent movement, for personnel carrying out work. This matches the definition of this term in NFPA70E.

Review

Checking the accuracy and suitability of a document’s content.

Risk

A measure of loss or harm - or both - to people, the environment, compliance status, group reputation, assets, or business performance in terms of the product of the probability of an event occurring and the magnitude of its impact.

Risk Assessment

Estimating the significance of a risk based on potential Impact and Likelihood.

Roles

The documented description of an individual's functions within a CoW structure.

Role Management System

Web based system for managing CoW role assignment, eCoW user access and competency records.

Scheduling

Scheduling defines when the task can be done safely and efficiently.

Seep - Liquid

A liquid release is classified as a seep if dripping at a rate of less than four (4) drips per minute.

Seep - Gas or Vapour

A gas or vapour release is classified as a seep if a portable gas detector reads less than 20% lower explosive limit (LEL) at a distance of 10cm (4in) downwind.

Tell-tale signs of gas or vapour leaks and seeps are sound or smell; use soapy liquid to locate small pinhole leaks. These can also be detected using a forward looking infrared (FLIR) camera.

Shift Change

The period during which one work shift stops working and another one starts.

Simultaneous Operations (SIMOPS)

Separate tasks or works that take place at the same time with the potential to impact on each other.

Single Point of Accountability (SPA)

The person in the organisation who has been appointed as being responsible for the delivery and performance of a task.

Site

A bp entity-operated and controlled facility or asset. A site is under the control of a single Site Authority (SA) and is geographically separate so that SIMOPS with another adjacent site is not an issue.

Site Electrical Leader

The locally appointed electrical person with accountability to Verify and approve electrical CoW activities as defined by 100340 bp Procedure Control of Work. Typical roles used are Responsible Electrical Person (REP), Electrical Lead Engineer or Electrical Team Leader.

Site Lifting Co-ordinator

Person responsible to perform on-site lifting task verification. The SLC provides lift plan verification but does not create lifting plans, supervise or execute lifting operations.

Subject Matter Expert (SME)

An acknowledged authority in a particular field.

Site Operating Procedure (SOP)

A site-specific version of a procedure.

Switching Programme

A clearly identified sequence of operations on an electrical system that will safely achieve the required objective while minimising any loss of supply.

Task

An action or series of actions in support of a piece of work.

Task Risk Assessment (TRA)

A means of identifying work-related hazards, assessing the possibility of those hazards being realised, and defining the mitigating actions and controls required to reduce the risk.

Tightness Test

A test that is performed to ensure overall leak tightness of the system's mechanical connections before the process medium is introduced.

Verify / Verifies / Verified

Used when there is a requirement to confirm something has happened or been done. It can consist of reviewing documents, questioning others, or doing visual checks on site.

> *Verifying implies proving by comparison with an original or with established fact. Synonyms include establishing, substantiating, authenticating, proving, checking, testing, or validating.*

Work

An endeavour made up of several tasks.

Worker

A person who performs work tasks (maintenance or servicing) that would or potentially could expose the person to the harmful effects of hazardous energy, requiring the equipment being worked on to be isolated from the sources of hazardous energy. A worker is anyone who applies a personal lock or tag to an energy isolation device, including a lockbox, if used.

Work Planning

A systematic process of identifying and listing the work and determining the resources, such as people and equipment, and how long activities will take.

Worksite

The location of the work or tasks.

4 Symbols and abbreviations

For the purpose of this bp Procedure, the following symbols and abbreviations apply:

AA	Area Authority
AAA	Affected Area Authority
AC	Alternating Current
ACGIH	American Conference of Governmental Industrial Hygienists
ACT	Acceptance Criteria Table
AFAIT	Above Fluid Auto-Ignition Temperature.
AGT	Authorised Gas Tester
AIP	Abandoned In Place
ALARP	As Low As Reasonably Practicable
API	American Petroleum Institute
APM	Area Production Manager
APR	Air Purifying Respirator
ASME	American Society of Mechanical Engineers
ATC	Abrasive Task Certificate
ATEX	Appareils destinés à être utilisés en ATmosphères Explosives – EU minimum safety requirements for equipment in explosive atmospheres
BA	Breathing Apparatus
Barg	Bar gauge
BC	Breaking Containment
BDV	Blowdown Valve
BIT	Build It Tight
BPCS	Basic Process Control System
BSEE	Bureau of Safety and Environmental Enforcement
CDM	Construction and Design Management
CFA	Critical Fault Alarm
CHRA	Chemical Health Risk Assessment

CO	Carbon Monoxide
CO_2	Carbon Dioxide
CoW	Control of Work
CRT	Control Room Technician
CSE	Confined Space Entry
CSEA	Confined Space Entry Attendant
CSO / CSC	Car Sealed Open / Car Sealed Closed
DBB	Double Block and Bleed
DC	Direct Current
DHSV	Downhole Safety Valve
DPE	Double Piston Effect
eCoW	Electronic Control of Work System
ECP	Excavation Competent Person
EEMUA	Engineering Equipment and Material Users Association
EEWC	Energised Electrical Work Certificate
ERRP	Emergency Response and Rescue Plan
ERT	Emergency Response Team
ESD	Emergency Shutdown
ESDV	Emergency Shutdown Valve
Ex	ATEX certified electrical equipment for explosive atmospheres
FSSL	Facility Support Squad Leader
F&G	Fire and Gas
FLIR	Forward Looking Infrared Camera
FW	Fire Watcher
GDC	Ground Disturbance Certificate
GFCI	Ground Fault Circuit Interrupter
GOM	Gulf of Mexico
H&S	Health and Safety

H_2S	Hydrogen Sulphide
HAZID	Hazard Identification Process
HAZOP	Hazard and Operability Study
HiPo	High Potential
HITRA	Hazard Identification and Task Risk Assessment
HMA	Highly Managed Alarms
HP	High Pressure
HP / LP	High Pressure / Low Pressure Interface
HSE&C	Health, Safety, Environment and Carbon
HVAC	Heating, Ventilation and Air Conditioning System
HW	Hot Work
HWOF	Hot Work Open Flame
HWSP	Hot Work Spark Potential
IA	Issuing Authority
ICC	Isolation Confirmation Certificate
IDLH	Immediately Dangerous to Life or Health
IDP	Isolation and De-isolation Plan
IEC	International Electrotechnical Commission
IPL	Independent Protection Layers
IRATA	Industrial Rope Access Trade Association
IS	Intrinsically Safe
IsA	Isolating Authority
LC	Locked Closed
LEL	Lower Explosive Limit
LEV	Local Exhaust Ventilation
LFL	Lower Flammable Limit
LIP	Local Implementation Plan
LNG	Liquified Natural Gas

LO	Locked Open
LO/LC	Locked Open / Locked Closed
LoP	Layer of Protection
LOPA	Layers of Protection Analysis
LOPC	Loss of Primary Containment
LP	Low Pressure
LPG	Liquified Petroleum Gas
LRP	Low Risk Permit
L&S	Leaks and Seeps
LSA	Low Specific Activity
LSR	Life Saving Rules
LTEL	Long-Term Exposure Limit
LTI	Long-Term Isolation
LVR	Locked Valve Register
MAWP	Maximum Allowable Working Pressure
MC1	Mechanical Completion Certificate
MCB	Miniature Circuit Breaker
MMS	Maintenance Management System
MoC	Management of Change
MODU	Mobile Offshore Drilling Unit
MOV	Motor-Operated Valve
MPSOP	Maximum Potential System Operating Pressure
MTTR	Mean Time to Repair
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NGL	Natural Gas Liquid
N_2	Nitrogen
NIOSH	National Institute for Occupational Safety and Health

NORM	Naturally Occurring Radioactive Material
NPW	Non-Permit Work
NRV	Non-Return Valve
NUI	Normally Unattended Installation
O_2	Oxygen
OEL	Occupational Exposure Limit
ODM	Operations Discipline Manager
OIM	Operations Installation Manager
OMS	Operating Management System
OPPD	Overpressure Protection Device
ORA	Operational Risk Assessment
OSHA	Occupational Safety and Health Administration
OSM	Operations Site Manger
P&ID	Piping and Instrumentation Drawing
PA	Performing Authority
PBU	Pressure Build-Up
PCAH	Polycyclic aromatic hydrocarbons
PFPE	Personal Fall Protective Equipment
PID	Photo-Ionisation Detectors
PIFs	Performance Influencing Factors
PPE	Personal Protective Equipment
PRD	Pressure Relief Device
psig	Pounds per square inch gauge
PSV	Pressure Safety Valves
PTL	Production Team Lead
QC	Quality Control
RA	Risk Assessment
RAP	Risk Assessed Procedure

RBI	Risk Based Inspection
RC	Rescue Craft
RCD	Residual Current Device
RMS	Role Management System
ROV	Remotely Operated Vehicle
RP	Recommended Practice
RPE	Respiratory Protective Equipment
RPS	Radiation Protection Supervisor
RR	Residual Risk
RRF	Risk Reduction Factor
RV	Relief Valve
S&OR	Safety and Operational Risk
SA	Site Authority
SABA	Supplied Air Breathing Apparatus
SBV	Subsurface Barrier Valve
SCBA	Self-contained Breathing Apparatus
SCF	Standard Cubic Foot
SCM	Standard Cubic Meter
SCSSV	Surface Controlled Subsurface Safety Valve
SDS	Safety Data Sheet
SDV	Shutdown Valve
SEMS	Safety and Environmental Management Systems
SH1	System Handover Certificate
SIF	Safety Instrumented Function
SIL	Safety Integrity Level
SIMOPS	Simultaneous Operations
SIS	Safety Instrumented System
SLC	Site Lifting Co-ordinator

SME	Subject Matter Expert
SMS	Safety Management System
SOL	Safe Operating Limit
SOP	Site or Standard Operating Procedure
SORA	Safety Override Risk Assessment
SPA	Single Point Accountable person
SRA	Safety Related Alarm
SSV	Surface Safety Valve
STEL	Short Term Exposure Limit
STT	Sanction to Test
SV	Self-Verification
SVI	Single Valve Isolation
TAR	Turnaround
TBT	Toolbox Talk
TRA	Task Risk Assessment
TRAF	Task Risk Assessment Facilitator
UEL	Upper Explosive Limit
USCG	United States Coast Guard
UPS	Uninterruptable Power Supply
UXO	Unexploded Ordinance
VAC	Volts Alternating Current
VDC	Volts Direct Current
VOC	Volatile Organic Compounds
WAH	Working at Height
WBE	Well Barrier Elements
WHC	Well Handover Certificate
WOM	Wells Operations Manager
WSL	Well Site Leader

5 bp Requirements – Control of Work

5.1 Adopting this Control of Work procedure

a. Production, Wells, Projects and bp Solutions shall adopt 100340 bp Procedure Control of Work (referred to as 'this CoW Procedure' throughout this bp Procedure).

Guidance for adoption or changes can be found on the CoW SharePoint.

5.2 Control of Work requirements

a. The requirements and any associated recommendations for carrying out CoW activities are set out in sections 5 to 28 of this CoW Procedure.

5.3 Roles, responsibilities, and delegating authority

a. Site organisations shall be structured to deliver the CoW roles as set out in this CoW Procedure.

CoW roles and responsibilities are in Annex A.

b. On rare occasions, some of the CoW roles and responsibilities may be delegated, split, or merged. In these circumstances, use an MoC process, and check anyone in a CoW role is Verified as competent.

c. Any delegating, splitting or merging of CoW roles and responsibilities shall be subject to agreement by the relevant S&OR Regional Operations Authority and the entity CoW Programme Manager.

d. The Area Authority (AA) shall be a bp employee or full-time equivalent (FTE) contractor at the supervisory level.

The following delegations do not require an MoC:

e. The Operations Discipline Manager (ODM) may Approve the delegation of Site Lifting Co-ordinator (SLC) role from Site Authority (SA) to another person who has achieved the required level of competence, but the SA remains accountable. If delegation is requested to a position outside the operation's organisation, then approval will be required from the VP Production.

f. The SA may delegate authority when away from site. Authority can only be delegated to someone who is competent in the CoW role. Record this delegation of authority in the shift handover log.

g. Some onshore facilities do not have the SA on site on a 24-hour basis, so delegation of authority may be regularly performed. Document this in the local implementation plan (LIP).

h. If the SA is off-site and the task requires immediate intervention, the AA shall contact the SA to discuss the task and seek authorisation or approval through electronic Control of Work (eCoW) or by email from the SA.

i. An AA may delegate certain individual tasks to another competent AA or IA. However, the accountability remains with the AA delegating the task. Tasks that can be delegated are listed in Table J.1.

j. The Performing Authority (PA) delegates to another PA with the equivalent competence if they cannot be present for CoW related activities (e.g. developing a permit to work or taking part in a task risk assessment).

5.4 Transfer between entities

a. Document the handover of any CoW roles and responsibilities in an MoC if a Production-operated site, or part of a Production-operated site, is handed over to a Projects-operated site and this CoW Procedure still applies.

b. To transfer any CoW roles and responsibilities to or from Wells, use the well handover process (see section 18.8 for more detail).

5.5 Bridging documents

a. bp requires that a bridging document be in place if:

1. a bp contractor carries out work at or adjacent to a facility or asset within the scope of this CoW Procedure using the contractor's safety management system (SMS), or
2. the work will not be governed by the bp Control of Work system in place at that facility or asset.

This bridging document governs the interface between the contractor's work management system and bp's CoW system and requirements.

Examples of when a bridging document is required include the following:

- a Projects-controlled greenfield site when at or adjacent to a Production-operated site
- a mobile offshore drilling unit (MODU) or jack-up with a Wells interface but no Production interface or connection to production or existing platforms (new wells)
- a contractor vessel working within a 500m[1] zone of a Production-operated offshore facility
- subsea architecture when working on the surface or subsurface.

For more detail on bridging document content, refer to 100251 bp Practice Wells Safety Management System Bridging (EP SDP 2.5 - 0004).

b. In Projects, complete gap assessments and bridging documents when the contractor's CoW process is used. Guidance is provided in GPO-HS-GLN-00013 bp Guide GPO Personal Safety Guide.

c. Bridging documents shall include the following:

1. evidence that the risk assessment has been carried out for the work.
2. SA authorisation of the bridging or interface requirements, including SIMOPS and any interface isolations (IDP)
3. identification of communication requirements (for example regular check-ins)
4. identified CoW roles and responsibilities, including isolation
5. CoW isolations and specific controls associated with diving, subsea, and wells tasks
6. an assigned, accountable person for the CoW activity
7. a record of the interfaces and handovers.

5.6 Amending existing site content

a. The CoW process relies on accurate site content stored within the eCoW software. New sites add data to the software prior to go-live, while existing sites may need to update their data to keep it accurate. The below link identifies the correct process for data updates to equipment lists and site graphics.

CoW website link – change flow chart

6 Conformance and deviations

6.1 Conforming with and adopting this CoW Procedure

a. All sites and projects within the scope described at section 1.1:

1. determine the timing and implementation plan needed to adopt this CoW Procedure in place of existing local CoW procedures
2. adopt this CoW Procedure in line with the conformance plan for OMS Group Essential 4.5.1 and the 500102 BP Practice Control of Work Integrated Practice.

b. The implementation plan shall include:

1. adopting eCoW
2. authorising this CoW Procedure to be adopted for use on the sites in place of the previous local CoW procedures through an LIP described in section 6.2
3. recording the change through a completed MoC.

c. The overall time frame for adopting this CoW Procedure is managed through OMS conformance plans, as adopting this CoW Procedure is the required approach for conforming to 500102 BP Practice Control of Work Integrated Practice.

d. The single point accountable person (SPA) role for the management of CoW process in the bp entities are:

1. SVP Production with 'agree' by the VP S&ORA.
2. SVP Projects with 'agree' by the VP S&ORA
3. SVP Wells with 'agree' by the VP S&ORA.

6.2 Local implementation

a. Adoption of this CoW Procedure by all sites and projects shall occur through an LIP and will be maintained post go-live.

b. The CoW LIP shall include a direct link (hyperlink) to the CoW Procedure in the OMS library and shall not change or replace any of its content.

c. The LIP is a single document that contains all regional or site-specific CoW instructions or guidance – or both - which are not in this CoW Procedure and may include the following:

1. logistical requirements (for example location of keys, management of lockboxes, contact information, location of document storage)
2. regular delegation of authority
3. application of CoW roles to local organisational posts
4. local legislative or regulatory requirements
5. approved deviations not documented in eCoW
6. any non-conformance, including any requirements that may form a higher or different standard
7. use of local prompt cards, checklists, or certificates
8. location or links to items such as CSE register
9. site maps or plans (or links to these) showing the AAs Areas of responsibilities and the physical limits for each Area.

d. ODM will be appointed with regional accountability for the LIP and the CoW Programme Manager shall Approve its content.

e. The region is responsible for keeping their LIP up-to-date. If any changes are required, they send the proposed LIP to the CoW Programme Manager and if Approved, this will be uploaded to the central site.

f. Regional LIPs are stored centrally and can be accessed here.

6.3 Local procedures

a. The documents listed as informative references in section 2.2.1 might reference this CoW Procedure but shall not contradict it or add additional CoW requirements.

6.4 How to use this CoW Procedure

The following approach has been applied through the document.

6.4.1 Bulleting structure

A section of text in black is information, facts, context, or explanation. Any bulleting used without an alphanumeric is expected to be read and understood but does not contain bp requirements.

For example:

- Example of a non-requirement bullet.

Blue italics provides information that can be helpful.

Any text that is bulleted with either a letter, or a number as a sub-bullet of a letter, is a bp requirement. Text that is bulleted in this way does not need the word 'shall' to be considered a requirement. All of these bullets are treated as 'shalls' unless we specifically use a 'should' or a 'may' within the bullet.

For example:

a. Example of a requirement bullet.

 1. Detail or items forming part of the requirement.

6.4.2 Use of verbs

In this CoW Procedure, the electronic CoW tool (eCoW) and any associated supporting and guidance documents, we have used the following verbs in the manner defined below to help with clarity:

Approve: Used when we expect you to confirm that the content of a document (for example a procedure or risk assessment), is accurate and meets bp's needs.

Authorise: Used when you need to give permission to use a document or process (for example a permit or previously Approved procedure).

Review: Used when we expect you to check the accuracy and suitability of a document's content.

Verify: Used when we expect you to do more than just check a document and there is a requirement to confirm something has happened or been done as well as reviewing documents. Examples are questioning others or doing visual checks on site.

6.4.3 Use of superscript

Where a numerical superscript has been added to 'values' used in the text, they provide the source of the referenced value listed in Annex L.

For example:

For stainless steel tanks and vessels, monitor the water used for flushing to Verify it contains only low levels of chlorides (less than 50 ppm[40]) to avoid the risk of stress corrosion cracking of the vessel. Promptly drain and clear water after flushing.

6.5 Deviations

a. If a site or project asks to deviate from adopting all, or any requirement, of this CoW Procedure, the request shall be:

   1. based on a risk assessment, which includes defining and documenting the risk reduction measures the site or project will apply

   2. submitted by the asset to the central CoW team by raising a deviation request in eCoW.

b. The CoW Programme Manager consults with the GDP owner if the deviation request also involves a deviation from any of the requirements contained in 500102 BP Practice Control of Work Integrated Practice.

c. Agreed deviations are recorded and managed through eCoW.

7 An overview of the Control of Work process

The CoW process is fundamental to achieving safe, reliable, and compliant operations. If the principles of CoW are applied, the following are possible:

- planning, risk assessing, and authorising activities will provide a means to safely execute, monitor and complete work.
- recording and applying any lessons learned and self-verification during the process will achieve continual improvement of work.

Production uses the eight-step process shown in Figure 4.

At every step, it is critical to write and speak clearly and to Verify the quality of documentation.

7.1 Who delivers Control of Work

a. This CoW Procedure describes a single and consistent CoW organisation structure and a hierarchy of roles. Each of the CoW roles are:

   1. held by individuals who are trained and assessed as competent
   2. consistent across Production, Wells, Projects and bp Solutions
   3. part of an individual's overall roles and responsibilities.

b. The core CoW role hierarchy is shown in Figure 1 with the five core CoW roles and supporting roles as follows:

   1. The Site Authority (SA):
      a) leads CoW and has overall accountability for CoW and for implementing this CoW Procedure at the site.
      b) Verifies adequate and competent resources, including people and equipment, are in place for every designated site CoW role.
      c) Verifies everyone involved in CoW on their site conforms to this CoW Procedure.
   2. The Area Authority (AA):
      a) leads CoW for a designated Area within the site and is responsible for all CoW activity within that Area.
      b) Only one person shall be AA for a specific Area at one time.
      c) There can be more than one AA at site who work together with the SA to manage CoW across the whole site.
   3. The Issuing Authority (IA):
      a) helps AAs to deliver the CoW workload and
      b) may Verify, issue and close permits when delegated by AA.
   4. The Performing Authority (PA):
      a) is responsible for the safe execution of work and for accepting permits from either an AA or IA.
      b) Performs the task or supervises the work party performing the task.
      c) May be responsible for more than one task at a time if the AA Verifies that the tasks can be safely managed simultaneously. When making this

decision, the AA considers factors including the locations of tasks and whether the PA can conform to the monitoring requirements for each task.

d) A PA usually manages one confined space entry (CSE) or hot work open flame (HWOF) task at a time. However, this expectation may be relaxed if the plant is isolated and hydrocarbon-free (for example in a TAR or during project construction).

e) Operations being executed off-Production Facility on Subsea Infrastructure tied to the facility shall have the PA at the location of work execution control (i.e. Inspection, maintenance and repair, or Installation Vessel, Remotely Operated Vehicle (ROV), AUV).

5. The Isolating Authority (IsA) is responsible for designing and executing isolations. There can be multiple IsAs at site, covering the isolation disciplines as follows:

- Process
- Control - covering instrumentation, control and telecommunications
- Electrical LV1 (low voltage 1)
- Electrical LV2 (low voltage 2)
- Electrical HV (high voltage).

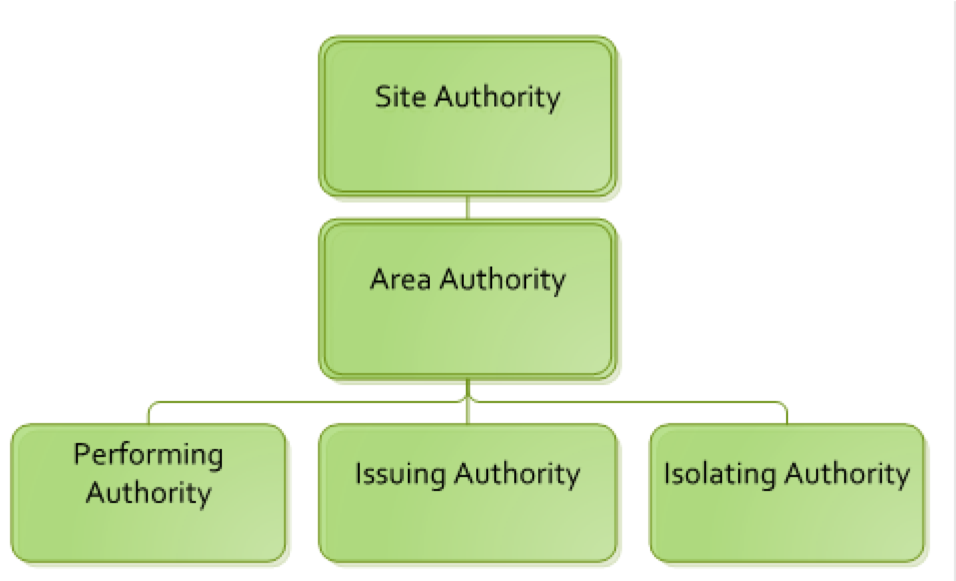


Figure 1 - Core CoW role hierarchy

6. Supporting Roles

The CoW Procedure also defines the following supporting roles with specialist skills that are called on as applicable. There are three types of supporting roles:

- eCoW roles (training, competence and assignment managed within RMS)
- Field CoW roles (training and competency managed within RMS)
- CoW certificate approval roles.

1. eCoW roles:

a) Authorised Gas Tester 1

b) Authorised Gas Tester 2
c) Task Risk Assessment Facilitator
d) Functional Authority
e) Isolator
f) LOLC Mover
g) LOLC Data Manager
h) LOLC Operational Inspection
i) Control Room Technician.

2. Field CoW roles:
a) Authorised Gas Tester 3
b) Fire Watcher
c) Confined Space Entry Attendant
d) Leak Test SPA.

3. CoW certificate Approver roles:
a) Site Electrical Leader
b) Site Lifting Co-ordinator
c) Site Engineer
d) Facility Support Squad Leader

Details of CoW roles are in Annex A.

7.2 How we execute work safely

This section summarises the risk assessment and work control methods we use to execute work safely. Later sections of this CoW Procedure cover these in more detail.

7.2.1 Risk assessment

a. Risk assess all tasks before they begin, using one of the following methods:

1. Task risk assessment (TRA): follow the Hazard Identification and Task Risk Assessment (HITRA) process for Level 1 and Level 2 when performing all tasks. See section 9 for more detail.

2. Safety override risk assessment (SORA): use this to assess risk when work involves overriding a safety instrumented protective system and relief valves. See section 10 for more detail.

3. Operational risk assessment (ORA): use this to assess risk when operating in an abnormal operating condition. See section 11 for more detail.

b. Isolation risk assessment: use Isolation and De-Isolation Plan (IDP) to risk assess isolation, de-isolation and having the isolation in place. See section 14 for more detail.

1. Risk assessed procedures or site operating procedures. See section 8.3.3 and OMS 4.1 for more detail.

2. Leaks and seeps risk assessment. See section 25 for more detail.

3. Personal dynamic risk assessments based on competence but not necessarily documented. See section 8.3.2 for examples of non-permit work (NPW).

7.2.2 Task description

a. When creating the tasks, include 'what', 'where', 'how' and 'who' in the description. For example:
   1. What is the activity and what tools are involved?
   2. Where is the equipment or location?
   3. How will the task be carried out and what is the sequence it will be done in?
   4. Who is involved and what techniques will they use?

b. A clear understanding of the task and how it is going to be carried out in sufficient detail, including relevant task steps, is required and helps to:
   1. identify the hazards
   2. understand the scope limitation
   3. identify potential SIMOPS
   4. select the correct TRA team members.

c. Breaking a task into task steps is required to:
   1. identify the sequence of activities
   2. align hazards and controls to the correct step in the task
   3. define when in the sequence to apply the controls, and
   4. structure the toolbox talk (TBT).

7.2.3 Hazards and controls

a. Identifying the hazards and consequences in a structured and succinct way will help develop suitable and sufficient controls. The format for recording hazards is as follows (see Figure 2):
   1. select energy source from the 14 in HITRA
   2. determine the type of hazard as defined by HITRA - Process, Worksite or Task
   3. what: say what the hazard is
   4. where: say where the hazard is
   5. how: say how the hazard can cause harm.

b. Once you have recorded this information, the control format is as follows (see Figure 2):
   1. determine the type of control (L1- L6) according to the hierarchy of controls
   2. who: say who you expect to apply the control
   3. what: say what the control is
   4. when: say when it needs to be in place and effective.

When writing hazards and controls, provide sufficient detail to be clear, but keep it as simple and as short as possible.
Use the hierarchy of controls to help select the most appropriate control measures.

Hazard

- **What** is the hazard?
- **Where** is the hazard?
- **How** Can the hazard cause harm?

Control

- **Who** Is going to do the control?
- **What** Are they going to do?
- **When** are they going to do it?

Example

Hazardous process material
Ignition of unplanned release of hydrocarbon gas from adjacent pipework whilst Ex cabinet is open, resulting in fire or explosion with up to two fatalities.

Example

L5
PA to verify that continuous atmospheric gas testing for hydrocarbons is in place at the worksite whilst the Ex cabinet is open. Stop work and close Ex cabinet if the hydrocarbon content is 10% lower explosive limit (LEL) or higher.

Figure 2 - Hazard and control format

7.2.4 Work control methods

Section 8.3 describes four methods to manage activities:

a. Permit-managed activity: bp uses the following five colour-coded permit types:
   1. Cold work (CW) is blue
   2. Breaking containment (BC) is black
   3. Hot work spark potential (HWSP) is yellow
   4. Hot work open flame (HWOF) is red
   5. Confined space entry (CSE) is green.

b. Low risk permits (LRPs): these are used to effectively and efficiently control regularly executed lower risk tasks (within Area I on Table B.4). An LRP may be CW, BC, or HWSP. See section 8.3.4.

c. Risk assessed procedures (RAPs): used for operational activities that are repeatable, periodic, and predictable. RAPs are procedures that provide step-by-step instructions to complete tasks safely. In Production, these are often called SOPs. RAP activity can be tracked within eCoW to manage SIMOPS.

d. SIMOPS
   1. Non-permit work (NPW): used for very low-risk activity that is non-intrusive and does not require tools or equipment that involves disturbing operating or process equipment. NPW activity can be tracked within eCoW to manage SIMOPS.
   2. Habitats: used to create a safe work environment. Habitats can be tracked within eCoW to manage SIMOPS.

3. Temporary equipment: when temporary equipment is kept on site (e.g. lighting towers, heaters, cranes), that may create a SIMOPS hazard, then these can be tracked within eCoW.
4. Road closures: when a road is closed or access restricted, that may affect emergency response, it can be tracked in eCoW.
5. Created opening: openings where gratings, handrails, stair treads or kicker plates have been removed from structures or damage has occurred resulting in a temporary opening that could present fall or dropped object hazards.
6. Well handover: where the CoW management of well equipment moves from one party to another.
7. Other: all other SIMOPS activities.

These methods are described in more detail in section 8.3.

7.2.5 Worksite visits

a. Worksite visits are fundamental to the safe planning and execution of work. There are four types of worksite visits within CoW:

1. Risk assessment - the TRA team visit the worksite together to identify the task, worksite, and process hazards involved in carrying out the task at the actual location. The AA may delegate their role in level 1 TRA site visits to an IA.
2. Work start - on the day of execution, the relevant individuals (see Figure 6) visit the worksite before work starts to Verify the conditions are as described on the permit and to take part in the TBT where necessary.
3. Monitoring - to Verify that the work is in conformance with the permit and that no new hazards have emerged. The AA may specify additional monitoring to be performed by an AA or IA. Gas testing is also considered a monitoring task, which is completed by an Authorised Gas Tester (AGT).
4. Work completion - PA and AA (or IA) visit the worksite either together, or individually, to Verify all work is complete and the site has been left in a clean, safe and ready to use condition before the permit is moved from complete to closed.

7.3 Templates

a. Templates are documents within eCoW that are Approved and authorised for use by the SA for up to three years.

There are four types of templates:

- low risk permits for tasks with residual risk in risk Area I and meeting the requirements of section 8.3.4
- permits for tasks with residual risk in risk Area I or II and may have associated certificates
- isolation and de-isolation plan (IDP)
- safety override risk assessment (SORA).

Templates are controlled and created by a team who have considered their suitability for repeated use.

A document created from a template is a new document in an Approved state, with a unique number and all the information from the template.

The document follows the normal workflow and additional information may be added.

b. Create and use templates whenever possible to maintain consistency and deliver efficiency.

7.4 Human Performance

Human Factors (performance) are the physical, psychological, and social characteristics that affect human interaction with plant and processes.

People will make mistakes (errors), but actions are rarely malicious and usually make sense to people at the time. People's behaviour and the mistakes (errors) they make are typically due to underlying conditions and systems. Further information can be found on the Human Performance webpage.

As part of CoW risk assessment processes, it is important to consider how a mistake (error), or behaviour might introduce a hazard or make one of our controls less effective. Once a potential mistake (error) or undesirable behaviour is identified, it is then important to understand what Performance Influencing Factors (PIFs) can influence the likelihood of these occurring and apply controls accordingly.

The Task Improvement Process (TIP) may be used at a planning stage, to help identify potential errors and factors that could make errors more likely.

Figure 3 identifies PIFs which are things that can prompt a person to make a mistake (error) or cause an undesirable behaviour. It can be helpful to use these PIFs to help identify and mitigate human performance risks associated with the tasks being assessed. As with any other control, the hierarchy of controls applies. Eliminating a task or introducing engineering controls which are inherently less reliant on human performance may be the most effective way of reducing risk, whereas administrative controls are more likely to be affected by the potential for human error.

For more information, see the Tip Help Sheet which provides further information and suggestions on ways to improve the task and mitigate the risks.

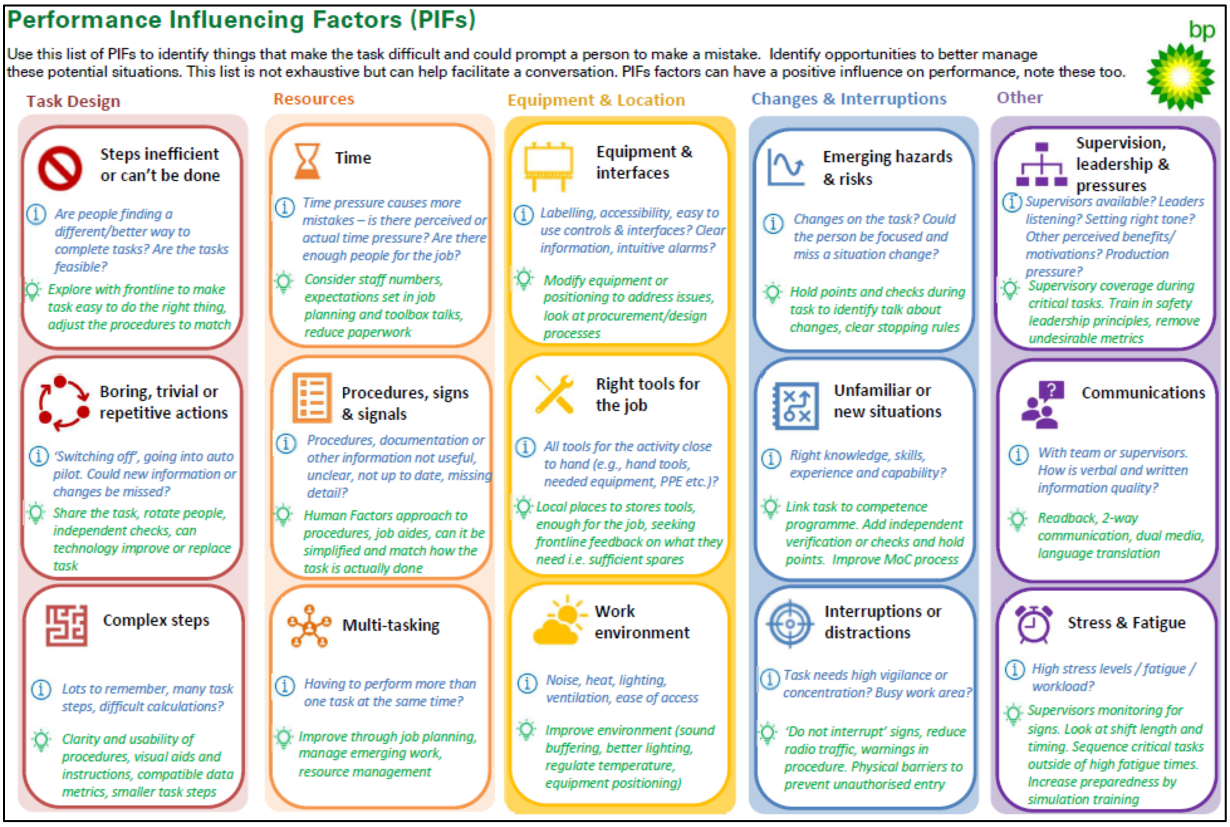


Figure 3 - Performance Influencing Factors (PIFs)

It is also important to consider how Human Factors can influence the quality of the risk assessment process:

- Place an emphasis on making CoW documentation easy to read and logical
- To help identify hazards, consider asking the following questions:
  - What hazards may be present that you may not be able to see with naked eye?
  - What hazards may not be present all the time but affect you only at some points during the job?
  - What hazards may depend on other things happening?
- A team-based approach is required but be aware of group behaviours, where team members want to adhere to social norms. To help manage these:
  - watch for team members just following the leader
  - include an expert or independent person who can raise doubts
  - offer a second chance to raise concerns at a later time or date
  - encourage and provide opportunities for quieter members of the team to be more vocal about insights, doubts, or concerns.
- Effective communication is a fundamental part of an effective CoW process. To ensure communication is effective:
  - use the phonetic alphabet (e.g. alpha, bravo…)
  - apply three-way communication protocol (state, check, confirm)
    - Supervisor: 'Start steam pump XYZ-123.'
    - Operator: 'I understand that you want me to start steam pump XYZ-123.'
    - Supervisor: 'Correct.'

- for tasks requiring non-verbal communication (e.g. hand signals), Verify that everyone knows the signals to be used, can demonstrate them, and all team members have the same understanding of what the signals mean
- encourage two-way, face-to-face communication
- encourage questions, clarification and challenge
- allow sufficient time for communication.

Below are examples of processes currently within CoW that are designed to improve human performance and reduce the risk of error:

- preparing permits and IDPs over 2 weeks before the planned start date means people have the time to do it properly
- task risk assessments are broken down into task steps to understand how the task is going to be carried out and to reduce the likelihood of missing hazards
- involving a PA in the risk assessment who is familiar with the task, and visiting the site, means that all the hazards are more likely to be identified
- only including value adding controls in risk assessments means that people are more likely to remember and implement the key risk reducing controls
- having simple and clear hazard and control statements means everyone knows who should be doing what and when to prevent the hazards causing harm
- reviewing workload at the daily meetings reduces the risk of overloading individuals
- having handover and toolbox talk meetings allows you to check the physical and mental state of people to see if they are fit to perform a task
- discussing only the task steps that are going to be done in a toolbox talk means that people are more likely to remember and implement the relevant controls
- completing a pre-work start visit allows any new hazards to be identified before work starts that may have been missed or not there when the risk assessment was done
- cross checking of isolations minimises the risk of the wrong equipment being isolated, deisolated, or incorrectly isolated.

7.5 Simultaneous operations (SIMOPS)

Simultaneous operations (SIMOPS) are not just the interaction of large sets of activities, but also include small, individual tasks at the worksite.

a. Manage simultaneous operations (SIMOPS) throughout the CoW process by assessing and resolving any risks from SIMOPS during work planning and execution, then:

   1. rescheduling the task, or
   2. changing the task scope or controls.

b. Consider SIMOPS especially during TAR, construction, commissioning, subsea, wells, and drilling activities due to the volume and variety of work taking place within an Area.

   Examples of SIMOPS are as follows:

- working at height with individuals working below
- lifting operations and any other activity in the same work Area

- breaking containment and hot work
- any work encroaching on exclusion zones created by, for example, lifting, leak testing and radiation
- combined activities (for example fabrication, welding, rigging, painting, and cleaning)
- when an Area that is formally handed over to Projects or Wells contains currently operating process plant and equipment
- when work-over, drilling rig or rig-less activities are close to a fixed facility that is operational or under construction (for example well clean-up, testing, flaring)
- marine operations within a 500m[1] zone of a bp offshore facility
- subsea operations on a system tied back to the bp facility
- helicopter operations with crane operations.
- activities that may interact because they involve the same system, such as instrument work on a lube oil pump and mechanical work on lube oil filter.

7.5.1 SIMOPS matrix

For all the local activities with a SIMOPS potential, a matrix may be created which summarises the interaction between each of the simultaneous activities identified. This matrix identifies activities that are:

- prohibited from being conducted concurrently
- allowed to be conducted concurrently
- conducted concurrently but subject to specific mitigation controls or conditions.

8 Control of Work (CoW) process

1 Plan
CoW planning and scheduling

- Accurately define the full scope of work.
- Break job down into tasks and task steps.
- Schedule Level 2 risk assessments and isolations.
- Identify any supplementary certificates required.

2 Risk assess
HITRA

- Visit the worksite to identify hazards and controls.
- Apply HITRA hierarchy of controls.
- Involve the right people in the risk assessment.
- Agree the initial and residual risks using the risk matrix.

3 Prepare
Prepare worksite and create CoW documents

- Agree the CoW document pack.
- Verify controls are adequate and deliverable.
- Prepare isolation plan, including overrides and process steps.
- Identify the correct worksite and equipment to be worked on.

4 Authorise
Authorisation at daily CoW meeting

- Consider workload and cumulative risk.
- Consider SIMOPS.
- SA sets expectations and quality checks a sample of documents.
- Agree the plan for the next day.
- Review emergent work.

5 Execute
Issue permit and start work

- Inspect worksite to Verify the TRA conditions are correct.
- Issue the CoW documentation.
- Hold a quality toolbox talk.
- Stop any unsafe work and manage interruptions.

6 Monitor

- Monitor work as agreed in risk assessment.
- Monitor controls identified are in place.
- Monitor isolation integrity.
- Monitor conformance with scope.

7 Complete
Suspend or complete work

- Decide when to suspend a task.
- Agree what happens when work is complete.
- PA tells AA about the task status when a permit is suspended or completed.
- Consider de-isolation requirements.

8 Learn
Lessons learned and closure

- Get feedback from the PA.
- Track all actions to completion.
- Update documents and plans with lessons learned.

Figure 4 - Control of Work (CoW) eight-step process

8.1 Step 1: Planning and scheduling

Step 1 explains how to plan and schedule CoW activity and helps execute work safely and reliably.

> *Planning defines what is to be worked on, the sequence of tasks to be carried out and the resources required to-do these tasks.*
>
> *Scheduling defines when a task can be done safely and efficiently (within site constraints) when it is integrated into a schedule with other activities or tasks.*

Planning and scheduling are about delivering an integrated schedule that:

- accurately reflects the tasks to be carried out
- identifies the resources (for example people and equipment) needed to do the work
- assesses the time required to complete the work safely.

a. Integrated and Production sites follow 100578 bp Procedure Activity Integration.

b. Greenfield projects may apply 100578 bp Procedure Activity integration, or 100291 BP Procedure Project Planning and Scheduling (GPO-PC-PRO-00025).

c. Where 100291 BP Procedure Project Planning and Scheduling (GPO-PC-PRO-00025) is used, the statements with red asterisks (*) in section 8.1 and its sub-sections are optional.

8.1.1 Planning

a. The planner breaks the job down into tasks or confirms the breakdown generated from computerised maintenance management system (CMMS) or a project planning tool, as applicable.

> *A job is a series of tasks to complete a piece of work that are typically performed in sequence.*
>
> *A task is a distinct activity within a job; that is, distinct enough in terms of work content, trade skills, or type of risk to merit its own CoW requirements.*

b. When creating the tasks, include 'what', 'where', 'how' and 'who' in the description. For example:

1. What is the activity and what tools are involved?
2. Where is the equipment or location?
3. How will the task be carried out and what is the sequence it will be done in?
4. Who is involved and what techniques will they use?

c. The quality of the task description is key to communication, understanding the scope of the task, and the quality of risk assessments. Planners shall determine and record in the CMMS or planning and scheduling system the following:

1. if the task requires a Level 2 TRA
2. if the task requires a full isolation. Personal isolations do not need to be scheduled as specific tasks.

   The AA may assist planners in determining the individual CoW tasks needed for the isolation either during the planning of the job or following development of the IDP.
3. The PA by name or by discipline type responsible for the task (for example Instrument).

Planners may make these determinations by consulting with others such as the AA, operations planner, PA, team leaders and HSE&C Site advisors or using section 8 and section 9 of this CoW Procedure.

The planner may use the information in the work pack or detailed job plans held within the CMMS or provided by a project or vendor to help them answer these questions.

8.1.2 Scheduling

a. To achieve a robust schedule, the scheduler works with the functional SPAs to answer the following questions:

   1. Does the schedule identify individual tasks and how they might interact with one another?
   2. Are Level 2 TRAs scheduled?*
   3. Are isolations scheduled (excluding personal)?*
   4. Are SIMOPS identified?

8.1.3 Reviewing the schedule

a. The schedule review is not a one-off review but is done whenever the schedule is changed or when more detail becomes available throughout the schedule progression to execution.

b. The AA, working with the operations planner, shall review the schedule throughout the Activity Integration (AI)* 12-week life cycle and Verify that the schedule provides for each of the following:

   1. meets the CoW 6 and 2 week execution readiness requirements listed in Table 1, or is managed as emergent work
   2. incorporates sufficient time and resource requirements, including people and equipment, to:
      a) prepare the worksite and CoW documents
      b) design and implement isolations
      c) engage appropriate specialists and mobilise vendors as applicable
      d) gather relevant documents (for example drawings, safety data sheets, photographs, and relevant QC certificates)
      e) complete all other required CoW preparation activities (for example lifting or emergency response plans)
      f) de-isolation and reinstatement of equipment, including line walks, leak tests.
   3. manages SIMOPS conflicts. The AA identifies any Affected Area Authorities (AAAs) and agrees with them how to avoid or manage any conflicts
   4. jobs that have been broken down into appropriate and manageable CoW tasks that allow risk assessments to be carried out at the task level
   5. correctly sequences tasks that depend on each other.

c. The AA identifies whether the task causes an abnormal operating condition (described in section 11), and if an ORA is required.

8.1.4 Emergent work

The need to manage new, emergent or discovered work will inevitably occur. It is work that is not on the current execution schedule and mainly involves breakdown work.

a. The SA may allow emergent work that is critical to continued safety, integrity and business plan delivery to be completed that is not included in the current execution schedule.

b. Individuals follow the steps of assessing risk and preparing for emergent work as they do with any other work.

8.1.5 Activity Integration (AI) and eCoW interface

Primavera (P6) and eCoW are integrated to allow both systems to display schedule and CoW document status information. This supports optimisation of the schedule.

8.1.6 Schedule execution readiness criteria for CoW

a. The site team use the planning dashboard in eCoW and P6 to confirm CoW readiness for activities on the site schedule, focusing on 6 weeks through execution. Table 1 shows the CoW site execution readiness criteria. The Site Manager is the Approver of the integrated site schedule at 6 weeks through execution.

Table 1 - CoW requirements to be checked at planning gates

Six-week execution readiness	Two-week execution readiness
Level 2 TRA planned	All CoW documents Verified
IDP design planned	IDP Approved

8.2 Step 2: Risk assessment

a. Risk assess all tasks using HITRA methodology to:

1. determine the task or task steps to be risk assessed, and how they will be executed
2. identify hazards and their potential impact (consequence), and
3. determine the initial risk level (Level 2 TRA) based on the likelihood (probability) of the impact occurring.

b. The initial risk level is then reduced by identifying and implementing controls to give a resulting residual risk level.

c. HITRA methodology has two levels of risk assessment:

1. Level 1 risk assessments for lower risk activity.
2. Level 2 risk assessments, which are more rigorous and semi-quantitative for higher risk activity.

For more guidance on HITRA, see GG 3.1-0002 Hazard Identification and Task Risk Assessment. More details on how to apply HITRA are provided in section 9.

For more guidance on Hazard identification, see GN 48-012 Selection of Hazard Identification and Risk Assessment Tools and Techniques.

d. To simplify and highlight task-specific controls, avoid recording site safety standards as controls in the risk assessment. For example, the following would not normally be included in the risk assessment:

1. PPE compliance. Detail any special PPE that is required for a task and is not part of the site standard for plant access in the TRA.
2. Chemical Risk Assessment document
3. jewellery policy
4. hearing protection. However, include additional PPE required for noise generated by the task.
5. adhering to site rules for driving
6. site drug and alcohol policies
7. controlling vehicles on onshore sites and getting access to hazardous or classified areas
8. having three points of contact when using stairways or ladders
9. competence of workers
10. Safety Data Sheet (SDS), assessments for materials that are commonly used on site (e.g. N_2, WD40, diesel, crude oil)
11. manual handling assessments for commonly occurring tasks (reference to the relevant manual handling risk assessment can be included).

e. Where a task based chemical risk assessment is needed to determine chemical exposure risk and the controls required, the chemical hazard and controls shall be included in the risk assessment with a reference to the chemical risk assessment document number.

f. The Chemical Risk Assessment shall be readily available for review by any of the work crew. Include the controls required by chemical Risk Assessment, SDS, or manual handling assessments in the TRA.

g. Site safety standards are managed through site induction, signage, self-verification, and site behavioural safety systems such as IRIS observations and SOC.

h. The risk assessment team shall focus on key hazards and controls and avoid cluttering permits and risk assessments with low value controls, expectations of good workmanship and safe work practices. The PA delivers, or leads the work party to deliver, good work standards.

Examples of low value controls, good work standards and safe work practices that would not normally be included on permits:

- following procedures
- generic tripping hazard statements. However, if a specific tripping hazard were evident, then it is included.
- controls for low-risk, regularly used substances such as common releasing fluids, sealants and lubricants (for example WD-40 and copper grease)
- duplicated controls
- obvious instructions (for example 'Tools to be in good condition', 'Comply with LOLER', 'Wear PPE', 'PPE to be in good condition', 'Certified scaffold to be used')
- see attached chemical risk (or SDS), or manual handing assessment
- escape routes to be always kept clear
- no one crosses barriers without the work party's permission
- remove barriers at the end of the task
- no smoking, drinking, eating gum, sweets, tobacco, or using lip salve
- always use correct manual handling techniques
- wear the correct gloves
- wear kneepads when kneeling for prolonged periods.

8.2.1 Escalating to a Level 2 task risk assessment

a. If anyone involved in a Level 1 TRA is not satisfied that the proposed controls will adequately control a hazard, complete a Level 2 TRA.

b. Examples of situations that could escalate a Level 1 TRA to a Level 2 TRA include the following:

1. the task is new or unfamiliar to the AA, IA, or PA
2. the task is affected by other activities that increase its complexity
3. the task site location has restricted access, or associated SIMOPS, or both
4. non-conformant isolations
5. additional or increased risks are identified during the Level 1 TRA.

8.2.2 How to use an existing task risk assessment

The preferred method is to use a template. It can be appropriate to copy and reuse an existing TRA. Once copied, all approvals from the original TRA are removed by eCoW. For frequently performed tasks, consider creating a permit template instead of copying an existing TRA. See section 8.3.11.

a. The AA shall Verify that the TRA is suitable for the new task by:

   1. visiting the worksite with the PA to confirm or update the TRA
   2. reviewing any feedback or lessons learned on the permit that was copied
   3. confirming the task scope is identical to that described in the TRA, and
   4. confirming the documented hazards and controls are still relevant.

b. Approvals for Level 1 TRA follow the normal process and may be Approved by the AA.

c. For a Level 2 TRA, see sections 9.2 and 9.5, which include a requirement for a new TRA team to be formed with approval based on the residual risk.

8.2.3 How to Approve a task risk assessment

a. The risk assessment Approver is selected from the HITRA approval Table B.5 based on the residual risk agreed by the TRA team using the risk matrix in Table B.4. The Approver shall consider the following when they are approving the TRA:

   1. Can the task or hazards be eliminated or substituted, or are there engineering controls that could be applied to mitigate or reduce the level of residual risk?
   2. Apply the hierarchy of controls, see section 9.3
   3. Have task, process, and worksite hazards been documented?
   4. Can the task be conducted safely with the identified controls?
   5. Do identified controls include relevant LSR actions?
   6. Has the risk assessment considered human performance and how it may impact the reliability of the task being performed?
   7. Are the identified controls suitable for reducing the initial risk to the residual risk rating? See section 9.3.
   8. Are additional capabilities or resources (for example people or equipment) needed to complete the task?
   9. Have alternatives to further reduce the risk been considered (for example shutting down equipment, rescheduling the work or carrying out the work during a turnaround)?
   10. Are additional risk assessment techniques required (for example layer of protection analysis (LOPA), process hazard analysis, major accident risk and bow-tie)?
   11. Did the TRA team include an appropriate number of competent people, and did they have advice from technical authorities or specialists?
   12. Have contingency and emergency response and rescue plans been considered?
   13. Have monitoring requirements been clearly specified?

8.2.4 When a purple or blue residual risk is the outcome of a risk assessment

a. When a task is identified as having a residual risk in the purple or blue C+ area of the group 8x8 matrix, follow the additional requirements of the entity risk management procedure.

The facility Risk Champion, Risk Advisor, Risk Tag, or equivalent can provide guidance on the entity risk management procedure.

8.2.5 How to manage cumulative residual risk

a. The SA leads a discussion with the team at the daily CoW meeting to decide whether the overall risk associated with all the tasks to be carried out is manageable. This is known as cumulative residual risk. The team shall consider the following:

1. Human Factors (for example skills, competence, and workload)
2. SIMOPS and support resources (for example emergency response capability)
3. overall workload for the team available and if the total number of tasks scheduled needs to be changed.

Cumulative residual risk includes residual risk from all live CoW documents.

The eCoW-calculated cumulative residual risk provides guidance to help the SA manage the number of activities planned and SIMOPS. It informs the discussion described above by highlighting potential changes in the typical risk level associated with CoW on the site. It is not a definitive measure of the level of risk, nor does it replace any data reported through the risk management process under OMS 3.1.

8.3 Step 3: Prepare worksite and create Control of Work documents

a. The PA and AA work together to agree, compile and draft the documents needed to perform the task. They request all required supplementary certificates.

b. The PA and AA review the permit to work to Verify it sufficiently describes the task, location, start time, duration, and any known risks and limitations.

c. Table 2 summarises the key requirements for CoW document types and their approval levels. Table 3 lists minimum risk assessment approval levels.

d. Roles in Table 3 listed with an asterisk (*), can only Approve if they also hold the role of a Functional Authority in eCoW.

Table 2 – An overview of Control of Work requirement

	RAP	**LRP CW,BC, HWSP**	**CW**	**BC**	**HWSP**	**HWOF** Non-hazardous area	**HWOF** Hazardous area	**CSE**
Risk assessment	Integral in RAP	Level 2	Level 1 or Level 2				Level 2	
Risk assessment approval	Integral in RAP	Select from HITRA approval table based on residual risk See **Table 3** for minimum approval levels						
Permit verify	N/A	AA (SA or IA when delegated by AA)						
Authorisation	AA	AA for risk Area I SA for all other risk areas					SA	
Permit re-authorisation	N/A	SA						
Site visit and TBT	See **Figure 6** – Site visit and TBT flowchart							
Permit issue and re-issue	N/A	AA, or IA when delegated by AA						
Monitoring	As specified in the Permit, SORA, ORA, RAP, or IDP							
Isolations	Personal	Personal or full					Full	

Table 3 – Minimum task risk assessment approval levels

SA	**APM ***	**VP***	**Wells Superintendent***	**Wells Operations Manager***
Confined space entry	HWOF in hazardous area with a primary control	Hot tapping	Man riding	Perforating with non-radio safe guns
Abrasive tasks on live equipment as per section **18.6**	HWOF within 11m (35ft)[2] of live equipment	HWOF in a hazardous area without a primary control	Fracking or perforating	Fracking with energised fluids or nitrogen
Service or hydrostatic testing using flammable or toxic fluids	Mechanical device or plug as a secondary barrier that is non-pressure containing.	Mechanical device or plug for primary isolation	Coiled tubing	

SA	APM *	VP*	Wells Superintendent*	Wells Operations Manager*
Personnel basket on crane		Inert entry into CSE		

8.3.1 Permit life cycle

The permit life cycle from drafting through to closure consists of 10 states and may involve the PA, IA, AA, and SA depending on the permit type. The 10 states are presented in Table 4 and Figure 5.

Table 4 – Permit 10 life cycle states

1	Draft	The PA and AA or IA conduct the risk assessment (include TRA facilitator for Level 2). Anyone who has a CoW role can document the risk assessment and permit requirements within eCoW.
2	TRA Approved	The risk assessment approval is based on the residual risk agreed in the risk assessment, unless **Table 3** sets a minimum approval level.
3	Ready to Verify	The PA may draft the permits including any required attachments and then informs the AA that the permit is ready to Verify and signs the permit in eCoW. The AA can Verify without this state being used.
4	Verified	The AA, IA or SA Verifies that all the required CoW documents and supplementary certificates are in place and Approved before they take them to the daily meeting.
5	Authorised	The SA or AA authorises the use of the permit. **Table 2** sets out the authorisation level, which depends on the residual risk level. The authorisation period is based on risk and can be up to 14 days. The SA may re-authorise the permits for continued use if needed (this is possible in any permit state).
6	Issued	The AA, IA (when delegated), or SA (when delegated), issues or re-issues permits to the PA.
7	Live	The PA accepts the permit from the AA or IA or SA.
8	Suspended	At any time between live and completed, the permit can be suspended. When this occurs, the PA specifies a reason in the eCoW feedback box. If the permit is suspended at shift end the PA states when the permit is next needed. Permits can also be suspended for the following reasons: • Within a shift so that a task that needs to interface with another task can be completed. For example, welding and non-destructive testing of the welds. • Within shift to suspend HWOF permit whilst BC is live. • For sanction to test (STT). • The task is on hold awaiting spares or resources.
9	Completed	The PA does this when the task is finished, and feedback has been provided.
10	Closed	The AA or IA closes the permit once they have inspected the worksite. Ideally, the inspection is completed with the PA, however this is not always reasonably practicable and may therefore be done independently. The AA or IA may delegate the site inspection to a technician, but the AA or IA is responsible for closing the permit within 24 hours[3] of permit completion.

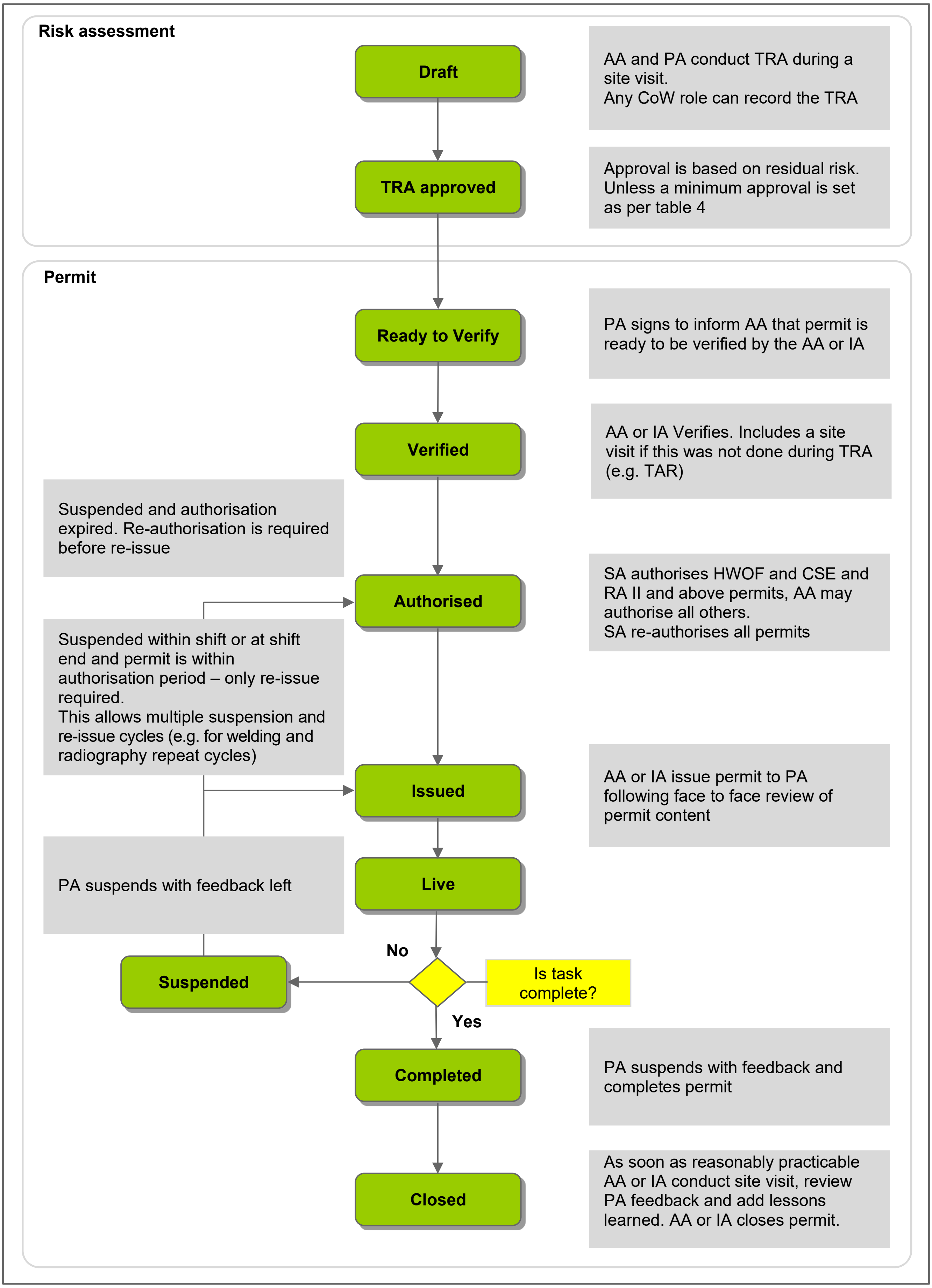


Figure 5 – Permit life cycle flow

8.3.2 Non-permit work

a. Non-permit work (NPW) is very low-risk activity that is trusted to each individual's competence along with their ability to manage worksite hazards covered by site safety standards. Non-permit activities shall be non-intrusive, low risk, and not require tools and equipment that involve disturbing operating or process equipment.

The activity may be tracked to manage SIMOPS, but the tasks are not subject to any other formal recording.

b. The relevant AA considers SIMOPS before authorising these activities and may track these activities using the non-permit function within eCoW.

Table 5 – Examples of non-permit work

The following examples may be managed as non-permit work:
1. Administrative tasks such as checking drawings or documents, taking notes and readings or doing self-verification checks. 2. Worksite visits (for example for risk assessments, job scoping or visual inspections). 3. Substation entry where there is no risk of injury from live electrical conductors. 4. Housekeeping in plant areas that does not involve powered tools. 5. Using hand-held devices certified for the area of use or intrinsically safe devices, such as cameras, IR cameras and gas test monitors for detecting leaks. 6. Attaching and detaching tags and labels using side cutters for wire and plastic ties. 7. Checks on equipment such as extinguishers, eye-wash stations, BA boxes, spill kits, first aid boxes and life belts. 8. Catering and hotel activity. 9. Workshop activities in a non-hazardous area that are covered by workshop procedures. 10. Window cleaning from ground level, excluding situations where working at height would apply. 11. Electrical competent people accessing LV control panels or enclosures for non-intrusive visual inspections in a non-hazardous area (this provided that the enclosure is engineered to be safely opened without dismantling, and all live conductors inside are protected to at least IP2X). 12. Operating electrical equipment via control stations provided for that purpose. 13. Infrequent resetting of breakers that have tripped due to overload, provided they are designed to be safely accessible without dismantling, with no exposure to live conductors.and does not compromise any applicable hazardous area certfication. 14. Line walking, punch listing and as-building.

8.3.3 Risk assessed procedure

Risk assessed procedures (RAP) are used for operational activities that are repeatable, periodic, and predictable. They provide step-by-step instruction to complete a specific task safely and may be the most appropriate way to manage some tasks that do not require full isolations. Site operating procedures (SOPs) that have been risk assessed are RAPs.

a. RAPs shall be:

   1. performed by competent personnel and authorised for SIMOPS by the AA for the area in which the activity is being carried out
   2. performed using equipment specifically designed for the task (for example operating drilling equipment or a pig launcher)
   3. tracked using eCoW where a potential for SIMOPS is identified
   4. limited to personal isolations only
   5. assigned a start and finish date

6. authorised for use by an AA in their area after they Verify that the RAP is within its periodic review date, the activity has been planned and SIMOPS considered
7. used only after the PA has:
    a) countersigned the RAP in eCoW each time they start or finish working, and when a PA hands over to another PA
    b) informed the AA or IA when they start or finish work.
8. supported by a separate TRA if an existing procedure is not already risk assessed (e.g. manufacture procedure, equipment manuals).

b. The RAP or SOP covers the risk management of the task and identifies the task hazards, risks, and controls. It might not fully cover the worksite situational or process hazards, or risks that might emerge when a task is being performed. In cases like these, a TBT form is used to cover the worksite or situational risk review. This allows the PA and work party to:
    1. identify worksite and process hazards
    2. consider SIMOPS, and
    3. Verify the conditions and hazards at the worksite on the day of execution match those described in the procedure before work starts.

c. RAPs shall contain the following to assist in SIMOPS management:
    1. a detailed task description
    2. a residual risk number for use within eCoW for calculating cumulative residual risk
    3. a unique number or identifier and issue and revision dates.

d. The approval level is either based on residual risk and defined by the HITRA approval table in Table B.5 or the entity procedure for procedures in OMS 4.1.

e. Once authorised, the RAP status is then live in eCoW until the PA completes the work and the AA closes the RAP. When the RAP goes past the set finish date, the status changes to ‘overdue’.

f. Individually assess all personal isolation tasks as distinct steps within the procedure.

g. If a full isolation is required, a RAP shall not be used without a permit to manage the task. The AA may attach a procedure to the permit.

Table 6 – Examples of when SOPs or RAPs may be used without a permit

The following are examples of when you may use SOPs or RAPs without a permit:
1. Startup or shutdown of a well. 2. Startup or shutdown of a compressor or pump. 3. Operating valves to control process parameters. 4. Preparing a section of plant using fixed drain and vent systems that does not involve breaking containment. 5. Preparing a section of plant for isolation by connecting hoses to closed drains or vent systems using personal isolation. 6. Commissioning activities such as loop testing or valve stroking. 7. Normal drilling operations and well interventions. 8. Inspection.
The following are examples of when you shall not use SOPs or RAPs unless they are managed by a permit:
1. Carrying out an intrusive maintenance task on a piece of equipment, unless the equipment is specifically designed to allow intrusive maintenance during operation (e.g. duplex filters). 2. Preparing a section of plant for isolation by connecting hoses to closed drains or vent systems using a full isolation. 3. Fitting or removing temporary spool pieces, fittings or blinds (for example for flushing, draining or venting involving a full isolation). 4. Confined space entry (CSE), hot work open flame (HWOF) or ground disturbance. 5. Working on live energy systems. 6. Any activity requiring a full isolation. 7. A task performed using equipment that is not specifically designed for the task.

8.3.4 Low risk permit

A low risk permit (LRP) effectively and efficiently controls low-risk work. LRPs differ from other permits in three ways:

- can only be created from a template based on a Level 2 TRA
- used by people who are familiar with the worksite and have a thorough knowledge of the task
- no worksite visit needed by operations before work starts.

An LRP is a specific version of a cold work, hot work spark potential, or breaking containment permit created from a template.

a. To use an LRP, the following conditions shall be met:

   1. only used by people who are familiar with the worksite and have a thorough knowledge of the task
   2. the task is well defined and easy to identify at the worksite
   3. the task is performed by one main discipline with an additional single supporting discipline if required. For example, a mechanic removing filters may need an instrument technician to remove an instrument connection.
   4. at the work start visit, the PA Verifies that the task, worksite and process hazards have been identified, assessed and are appropriately controlled
   5. the PA Verifies that there are no SIMOPS issues immediately before starting the task

6. the AA discusses the LRP at the daily CoW meeting if the scope introduces a SIMOPS risk. An AA or IA can subsequently issue it to the PA.
7. can be authorised for up to 14[4] days
8. can be re-issued within the authorised period
9. the AA or IA does not need to visit the worksite for LRPs, but they visit a sample of tasks to Verify permit conditions are as stated. If any change occurs to the way the task is executed or additional hazards are identified, then the AA closes the existing LRP and creates a new one.
10. only full isolations, or conformant personal isolations can be used with an LRP
11. for LRPs expected to be completed within one shift, the PA may apply personal isolation if all the requirements of section 14.13 are met
12. the LRP may be used for up to 4 hours[5] after the shift end to accommodate overtime working on the task. The AA uses the countersignature feature in eCoW to authorise this extended working.

8.3.5 Using low risk permit templates

A low risk permit template includes an Approved Level 2 TRA.

a. Review template at the interval set by the SA when they authorised the template for use. The interval depends on the task risks and likelihood of changes and shall not be more than 3 years[6].
b. The AA Verifies that the TRA selected fully addresses the scope and risks for the proposed task.
c. The SA regularly reviews a sample of LRPs using the permit quality assessment self-verification to Verify quality is being maintained.

8.3.6 Creating a low risk permit template

a. To create an LRP template, the following conditions shall be met:
   1. The initial risk is in risk Area I or II:
      a) the residual risk is in risk Area I
      b) the hazards at the worksite, or worksites, considered for the task are predictable and stable
      c) a Level 2 TRA is used to create the template to Verify that both the task is suitable for an LRP, and the risk assessment is high quality.

   Table 7 shows activities that may be considered suitable for an LRP. This is not a comprehensive list. If the Level 2 TRA concludes that the residual risk is in Area I, then tasks outside of the scope of these examples may be considered.

Table 7 – Examples of when a low risk permit may be used

The following may be LRP tasks:
1. Overriding a single device for calibration or fault finding is acceptable provided the SORA controls are met (for example a fire and gas detector or level switch).
2. Checks that do not affect the integrity of the system.
3. Opening of low voltage electrical junction boxes or panels to inspect or test.
4. Opening, but not working on, live electrical junction boxes in hazardous areas that contain only IS circuits.
5. Brush painting where the paint and the area to be painted present low risks.
6. Re-lamping.
7. Maintenance work on office equipment.
8. Using non-certified portable electrical equipment, or other equipment such as cameras and non IS test equipment in hazardous areas.
9. Scaffolding work (excluding overside working, cantilevered, load bearing, over hazards such as critical safety systems, rotating equipment, transformers, exhaust ducts and water).
10. Hydrocarbon sampling using a permanent, Approved sample point.
11. BA cylinder refilling operations using Approved and installed filling systems.
12. Workshop activities not covered by workshop procedures.
13. Lifeboat equipment checks (excluding launching lifeboats).
14. Planned maintenance on communications and public address systems.
15. Filter change-outs.
16. Using hand tools on installed and Approved equipment to grease and top -lube oils where considered low-risk. Low-risk examples include: gearboxes, fin fan louvres, low-pressure utilities and low-pressure hydrocarbons (<10[7] barg or 150 psig US). If working on higher pressure hydrocarbon valves consider the possibility of leaks if the nipple ball does not re-seat.

8.3.7 Cold work permit

Cold work permits are used for tasks that do not include breaking containment or potential sources of ignition from sparks or open flames. Cold work may involve a wide range of hazards.

Cold work can involve higher risk tasks. Do not assume that the task is lower risk because it is being managed using a cold work permit.

Some jobs involving activities in Table 8 may need specialist tools and equipment. Some of these tasks may have to be covered by hot work spark potential if they involve tools or equipment that introduce a spark potential.

Table 8 – Examples of when a cold work permit may be used

The following activities are examples of when a cold work permit may be used:
1. Lifting and rigging operations. 2. Air driven impact wrenches, nibblers or low speed hacksaws (excluding potential hydrogen atmospheres). 3. Pressure testing piping and equipment. 4. Water jetting, wet grit blasting or water cutting. 5. Work with radioactive sources, fixed and mobile. 6. Stripping or disturbing asbestos and other mineral fibres. 7. Work on vessels or equipment contaminated with LSA scale or NORM. 8. Painting operations with brushes or rollers. 9. Removing or installing handrails, gratings, hatches or fixed ladders using cold work methods. 10. Erecting or dismantling scaffolding. 11. Insulation activities. 12. Temporary use of hazardous substances in areas not designed for this (for example cleaning and dosing tasks). 13. Work near, but not within, the safe clearance distance of overhead electrical cables or other unprotected live electrical equipment. 14. Electrical work on isolated and proven dead circuits using tools that do not have spark potential. 15. Electrical work with no access to live conductors (for example cable pulling, cable tray installation). 16. Diving activities. 17. Non intrusive ROV activities.

8.3.8 Breaking containment permit

A breaking containment permit highlights the increased risks of tasks that breach the designed containment envelope on any system, or material.

Highlighting these tasks helps avoid clashes with other work on the facility (that is, SIMOPS).

Table 9 – Examples of when a breaking containment permit may be used

The following activities are examples of when a breaking containment permit may be used:
1. Opening up any process or plant system where there is a risk from toxic, flammable or other kinds of hazardous substances. 2. Construction, maintenance, overhaul or repair work involving breaking containment. 3. Spading or blinding and de-spading systems. 4. Sampling hydrocarbon products by any means other than an Approved sample point. 5. Use of equipment or work on small pipework systems, strainers, filters, or valves contaminated with pyrophoric scale, where water flooding is used as a control measure.

a. The IsA shall:
   1. understand where and how the BC will take place
   2. demonstrate the isolation, prove zero energy to the PA and attend the initial BC
   3. understand the process and possible process safety implications of the isolation and be able to implement the contingency plan if there is an incident, and
   4. be able to contact the control centre from the worksite and the emergency response teams if required (e.g. through radio contact).

8.3.9 Hot work spark potential permit

Hot work spark potential permit is for work with equipment and tools that may create low-energy sparks when used normally or because of errors or malfunctions.

Table 10 – Examples of when a hot work spark potential permit may be used

The following activities are examples of when a hot work spark potential permit may be used:
1. Using mains or battery-powered electrical equipment that is not certified for use in the relevant hazardous area such as: a) electrical test equipment and hand-held instruments b) power tools, including cordless drills, saws, impact wrenches c) inspection, measurement and survey tools d) digital cameras, phones, laptops, tablets and similar battery-powered devices e) Radiography (x-ray source), if battery-powered f) Scissor lifts and forklifts. 2. Needle guns. 3. Dry grit or shot blasting. 4. Using powered equipment that may generate a friction spark. 5. Work that defeats or removes the Ex protection concept of equipment located in a hazardous area. Examples include opening of live non-intrinsically safe electrical equipment, or removing pressurised supply to Ex equipment reliant on pressurisation. 6. Energised electrical work. 7. Proving dead of electrical equipment. 8. Opening live electrical junction boxes where the terminals are exposed to the atmosphere. 9. Using cartridge-operated fixing tools. 10. Operating protected portable diesel engines not tied into fire and gas systems. 11. Using internal combustion engines for portable temporary equipment, such as cranes, compressors, pumps and generators. These have several features that are considered ignition sources due to: a) the presence of hot exhaust gases b) hot surfaces, such as exhaust manifolds and pipework instrumentation and electrical systems c) potential overspeed due to ingress of flammable atmospheres into the engine's air intake. 12. Activities that may generate static electricity (for example transfer, draining or taking samples of low conductivity liquids, manual tank gauging, dry grit blasting, HP/ EHP water jetting, steam cleaning, paint spraying). 13. Using any other equipment that may generate sparks when it is being operated.

8.3.10 Hot work open flame permit

a. Hot work open flame (HWOF) is any work with equipment and tools that, when used within their design parameters, are likely to ignite a flammable or explosive atmosphere, solid materials, or liquids. While HWOF is live, suspend any breaking containment on any flammable materials in the same area.

Table 11 – Examples of when to use a hot work open flame permit

The following activities are examples of when to use a hot work open flame permit:
1. Open flames, including welding, flame cutting, air arcing and soldering.
2. Electrical welding, such as arc, MIG and TIG.
3. Equipment operating above 392°C / 738°F[8], except in authorised workshops (for example.electrical induction pre-heating, stress relieving, using high temperature thermal calibrators or hot-air blowers).
4. Steam generators (unless they are electrical and rated for the hazardous area).
5. Power grinding, air or electrically powered or similar activities that create sparks.
6. Any activity that has the potential to create a continuous or intermittent uncontrolled ignition source.
7. Splicing fibre optics.
8. Use of equipment or work on large pipework systems, heat exchangers or vessels contaminated with pyrophoric scale.

When the following operations are covered by an SOP, a HWOF permit is not required:

- normal operation of site flares systems and process equipment that are designed to have open flames as part of their design (for example inert gas generators or fired heaters)
- lighting of flare systems using installed portable igniters or guns.

8.3.11 Permit templates

A permit template can be created from an existing permit or directly as a template.

a. A permit template is an Approved Level 1 or 2 TRA and shall:

1. have residual risk in risk Area I or II
2. be reviewed at the interval set by SA when they authorised the risk assessment for use. The interval set depends on the task risks and likelihood of changes and shall not be more than three years.
3. be Verified by the AA that the TRA selected fully addresses the scope and risks for the proposed task
4. have a work start visit by the AA or IA and PA to Verify that the task, worksite and process hazards have been identified, assessed and are appropriately controlled.

8.3.12 Confined space entry permit

For a description of confined space and how to manage confined spaces see section 15.

Occupational Safety and Health Administration (OSHA) has defined two types of confined space: those requiring permits and a non-permit required confined space. In Production, Wells, Projects and bp Solutions, permits are used to manage entry to all confined spaces. This means OSHA requirements are met by operating to the more stringent CoW standard. Additional requirements for OSHA permit-required confined spaces may still apply depending on the circumstance.

a. Entry to any confined space requires a confined space entry (CSE) permit. It does not allow any form of work other than entry for visual inspection or atmospheric testing. Do the following if work in a confined space is needed:

1. Apply for a permit, to cover the task being executed.
2. Cross-reference by linking the task permit to the CSE permit using the live-live permit dependency.

b. The AA shall maintain the CSE permit as valid throughout the life of the associated permit.

c. When work is complete, the AA shall Verify that all permits to work associated or linked with the CSE are completed before the CSE permit is signed off by the AA as closed.

d. The AGT1 shall record all gas test results on the CSE permit. Repeat these tests after any interruption to CSE work. If the tests identify any change, the AGT1 shall stop the work and notify the AA.

e. An AGT shall continuously monitor the levels of oxygen and flammable or toxic gas within the confined space.

The gas monitoring is set up by an AGT1 but can be monitored by an AGT3.

f. The PA is accountable for suspending a CSE permit if unacceptable conditions arise (for example internal temperatures are too high to work, access needs to be modified, or the scope of work changes).

g. If blasting or other activities have created a dust-filled atmosphere, then clear the confined space of dust before allowing re-entry without respiratory protection.

h. Each site shall have a CSE register. See section 15.8.

Table 12 – Examples of confined space

The following would typically be considered a confined space:
1. process vessels and exchanger
2. fired heaters
3. road and rail tankers
4. habitats with access or ventilation limitation see section 13 and 15
5. pipelines, pig receivers and launchers
6. silos, vats and tanks
7. floating roofs of hydrocarbon storage tanks
8. sewers and manholes
9. flues, ducts, ceiling voids, box girders and lift shafts
10. trenches and excavations of more than 1.2m (4 ft)[9], deep. (if they meet the criteria for a confined space)
11. pits, sumps and culverts
12. voids between modules and in legs on offshore installations
13. vessel or column skirts and crane pedestals
14. flare tips
15. any space or partially enclosed space where there is a risk of death or serious injury from hazardous substances or dangerous levels of contaminants accumulating, and ventilation is restricted.

8.3.13 Permit dependencies

a. The eCoW software has a feature to link permits to help manage tasks that need to be sequenced. This feature is used to avoid human error.

b. There are three dependency types:

1. **Permit Live – Live**: this covers a circumstance in which someone needs to create a permit that links to another permit. It establishes a rule that the permit being created cannot go live unless the linked permit is already live. For example, if the permit being created is for cleaning the internals of a vessel,

reference it on the CSE permit for that vessel. The permit cannot be issued for cleaning unless the permit for CSE had already been issued and is live. In this example, it would not be possible to suspend the CSE permit unless the cleaning permit had been suspended first.

2. **Permit Live – Not Live:** this type of linking works in reverse to that of linking for Live – Live. For example, if a permit is being created for painting the internals of a vessel and there is a permit for blasting the surfaces in preparation for painting, a Live – Not Live dependency may be used so that the blasting and painting permits cannot both be live at the same time.

3. **Permit Start – Finish:** this creates a dependency from the permit being created to another permit, enforcing a rule that this permit cannot start until the referenced permit is completed. For instance, if you applied this dependency to a permit for replacing a nucleonic level transmitter to a vessel, it would not be able to go live until the permit for vessel CSE had first been completed.

c. In the case of Live – Live and Start – Finish dependency, the direction of referencing is critical. It shall always be from the dependent permit to the one it is dependent upon. For example:

   1. Live – Live the permit for cleaning the internals would be dependent on the CSE permit.

   2. Start – Finish the permit to replace the nucleonic level transmitter to a vessel would be dependent on the CSE permit.

8.3.14 How to identify equipment associated with a task

It is essential for effective CoW that you correctly identify field equipment associated with a task before issuing a permit.

a. It is good practice to use equipment ID tags for any task. Use them:

   1. if the site labelling or marking systems are missing or not clear

   2. for all new tie-ins to existing systems

   3. if it is necessary to identify redundant equipment.

b. The equipment ID tag format shall, as a minimum, identify the following:

   1. equipment number

   2. permit or Isolation Confirmation Certificate (ICC) number

   3. the name of the person who placed the tag

   4. the date it was placed.

If access to the worksite is not reasonably practicable before work starts, marked-up photographs may be used to identify the work location. For example, if the work is going to be done by a rope access technician, then this approach can be used.

8.3.15 How to Verify CoW documents

a. The AA, IA or SA Verifies that CoW documentation includes the following:

   1. the correct level of TRA has been applied

   2. all the required supplementary certificates are Approved and attached or linked

   3. the date and time when work may start and a time limit that the permit remains valid

4. monitoring frequency requirements as specified in the TRA
5. a description of the task the team is carrying out and that the permit is not covering a combination of tasks (that is, the whole job)
6. a detailed description of the type of task the team is going to perform. This includes the scope, any tools and equipment they will use, and how they will do the work.
7. worksite location
8. hazards associated with the task, process, and the worksite, with details of the associated controls in place to manage the risk, including any Emergency Response and Rescue Plans (ERRP), if applicable
9. contingency plan
10. SIMOPS.

b. All permits including LRPs shall be Verified before the two-week planning gate. Verification requires all supplementary certificates to be attached and Approved.

8.4 Step 4: Authorise

a. To control work effectively, it is vital that a structured CoW meeting is held every day to discuss the previous day's CoW delivery, current status and authorise the following day's activities. The team at the meeting considers the time and resources, including whether they need specialists to carry out scheduled activities safely and effectively.

8.4.1 What the AA reviews before the daily Control of Work meeting

a. All scheduled tasks have Verified CoW documents.

b. Applicable energy isolations and supplementary certificates are in place or planned before the task starts.

8.4.2 Who attends the daily Control of Work meeting

a. The SA shall chair the meeting.

b. As a minimum, the following people shall attend:

1. AAs
2. PAs, when requested by the SA.

c. The SA may include others as required (e.g. planner, maintenance team lead, HSE&C Site advisor or schedulers).

8.4.3 What the agenda covers

a. Firstly, this meeting reviews the tasks that were being worked on the previous day. Outstanding work, required actions and lessons learned will be discussed, including any impacts these may have on the schedule.

b. Next, the meeting reviews all work that is scheduled for the following day, including emergent work and ongoing work to achieve the following:

1. raise awareness of and manage possible SIMOPS for planned activities
2. review the cumulative residual risk of the scheduled work and plant operation
3. identify where countersignatures from an Affected Area Authority (AAA) are required and inform the AAA
4. Verify that the PAs are able to oversee the task by checking they are not assigned to other tasks that might stop them from being able to do this effectively
5. review the AAs workload for the following day to Verify they can manage all the planned activities
6. review any opportunities to learn from CoW self-verification checks completed and feedback from PAs
7. highlight any activities with LSR implications
8. decide if the tasks can proceed as scheduled or not. The SA takes this decision.
9. agree and assign self-verification.

c. The AAAs shall Verify the following:

1. they have informed everyone working within their area that might be affected by the adjacent work. This is critical, especially when the task involves hot work or breaking containment.

2. controls are in place, and everyone understands the potential impact on their own tasks
3. the AAA has signed the permit to record their agreement for the task to proceed using the countersignature function within eCoW.

d. The daily CoW meeting also verifies, if applicable, that CoW bridging and interface requirements are in place for:
1. handing over a remote area CoW to a Wells or Projects contractor, or
2. vessels working within an offshore platform's 500[1]m zone.

e. Finally, this meeting is where the SA reinforces expectations and shares opportunities to learn from self-verification activities. The SA uses information from management reports and metrics to focus attention on areas that need to be self-verified.

Examples of meeting format can be found in the CoW SharePoint site.

8.4.4 Managing the meeting

Displays, dashboards and summaries are available in eCoW to help the SA conduct a thorough and efficient meeting.

a. It is important that the following be reviewed as part of approving the planned work for the next day:
1. the graphical overview with filters showing permits, LRPs, isolations, ORAs, SORAs and any SIMOPS activity such as NPWs or RAPs
2. the operational dashboard to show overall conformance, metrics and workload
3. the cumulative residual risk, showing all the residual risks from all live CoW documents within eCoW.

8.4.5 Authorising permits

a. The level of authority needed to authorise a permit is set out in Table 2. The AA may only authorise permits where residual risk is in Area I. All other permits require the SA to authorise them. Permits are typically authorised before or after the daily CoW meeting.

b. Authorisation period is risk based, up to a maximum of 14[4] days.

8.4.6 Re-authorising permits

a. The SA is the only role that can re-authorise permits and may do this at any time and in any permit state. The maximum periods in section 8.4.5b apply.

b. The SA shall Verify, typically by asking the AA, that any controls are still in place and SIMOPS conditions are still acceptable before a permit is re-authorised.

8.5 Step 5: Execute

Clear and accurate communication is important because the control is passing from the AA to PA when the permit is issued and accepted.

8.5.1 Issue and accept permits

a. Before starting work and immediately before or after issuing the permit, the AA or IA and the PA shall Verify:

   1. conditions have not changed since the TRA and permit were being prepared
   2. any controls the permit specifies will be in place before work starts
   3. isolations are in place and meet the requirements of this CoW Procedure, checking for positive isolation for HWOF and CSE tasks
   4. pre-requisite TRA controls are in place and fully effective.

b. Figure 6 identifies when site visits are required.

c. For low risk permits, the PA shall inspect the worksite and Verify controls are in place after the permit has been issued.

d. The AA or IA shall communicate the hazards and controls and any SIMOPS to the PA before they issue the permit.

e. The PA shall be a different person to the IA or the AA (that is, a person cannot issue a permit to themselves).

f. The AA agrees with the PA which competent person is assigned to fire watcher (FW), authorised gas tester (AGT) or confined space entry attendant (CSEA).

g. All Permits may be used for up to 4 hours[5] after the shift end to accommodate overtime working on the task. The AA uses the countersignature feature in eCoW to authorise this extended working.

8.5.2 Pre-work activities

a. After a permit is issued, but before the TBT, the PA checks that all equipment, including task-specific PPE used, is fit for purpose and correctly certificated. For example:

   1. lifting equipment has no obvious damage and has the correct colour code
   2. load limiting devices and alarms are functional
   3. all loads are checked for potential secondary dropped objects
   4. the proposed users are competent to use all equipment and task-specific PPE specified in the permit and supplementary certificates.

8.5.3 Work execution

a. The PA does the following:

   1. monitors the sites whilst they are present or when they visit, if they are the PA for more than one task. This monitoring is only recorded when specific monitoring tasks are assigned to PA in the TRA.
   2. keeps the worksite in a clean and safe condition and work within the scope covered by the permit
   3. Verifies the controls specified on the permit are followed

4. reports any unsafe work that requires a stoppage to the AA or IA.

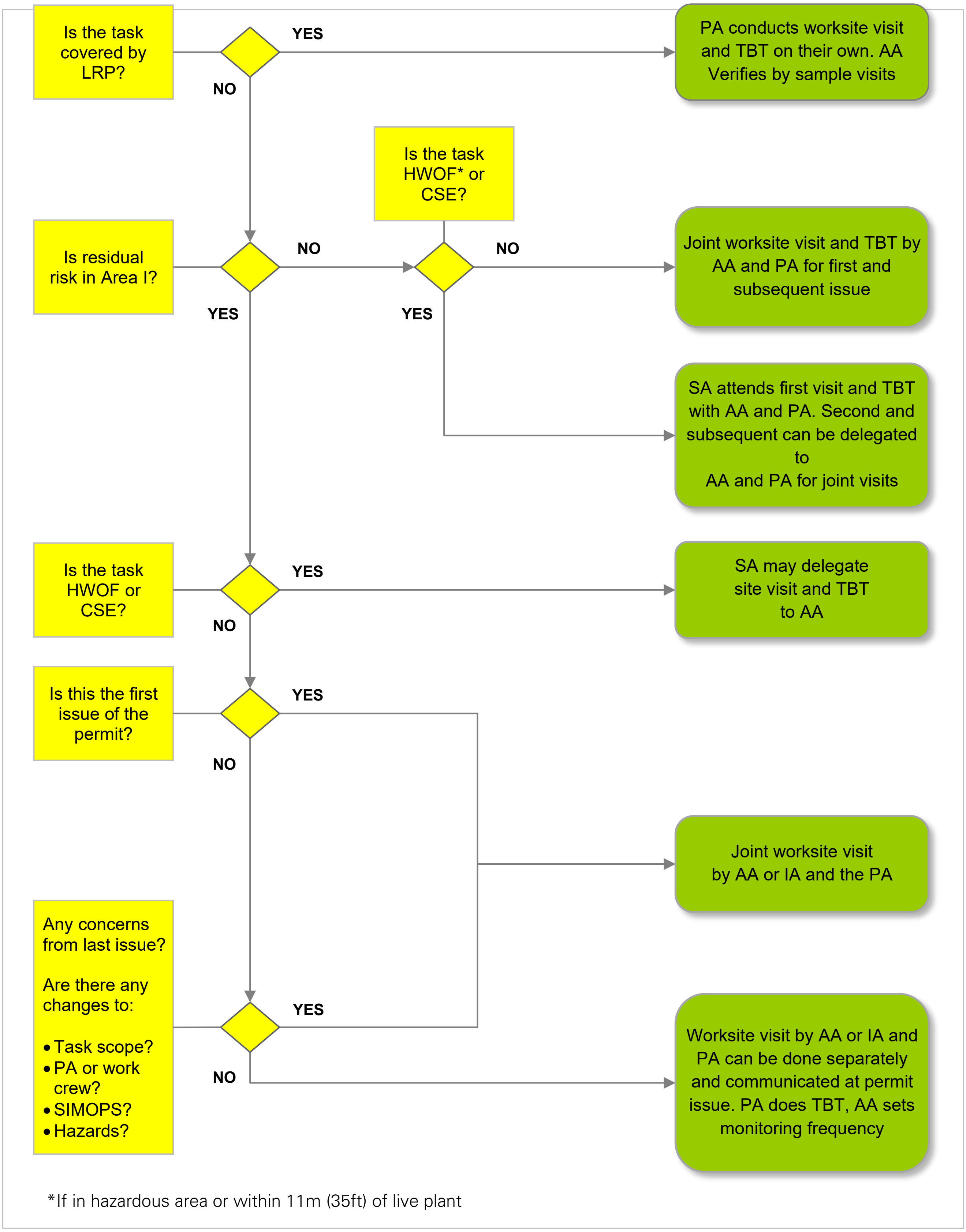


Figure 6 – Site visit and TBT flowchart

8.5.4 Toolbox talks

a. Before work starts, the PA shall conduct a TBT at the worksite with the people who will carry out the task. The first TBT each day should cover a summary of the overall permit scope, detailed review of hazards and controls for the next step. For each subsequent step, another short TBT is required to discuss the hazards and controls associated with that step. A TBT is also required after breaks (e.g. lunch).

b. For LRPs, the AA Verifies the worksite visit and TBT by sample visits.

c. The SA shall visit the worksite with the AA before work starts and attend first TBT for the following activities:

   1. for CSE permits with residual risk in Area II or above, or

   2. HWOF tasks in hazardous areas or within 11m (35ft) of live plant with residual risk in Area II or above.

d. For subsequent permit issuance (associated with 8.5.4c, the SA may delegate the site visit. See Figure 6 and Table 13 for details.

e. For HWOF/CSE tasks that do not fit the criteria in 8.5.4c, the SA may delegate visits to the AA.

f. For risk Area I permits that are not HWOF or CSE, the PA and AA, or IA conduct a joint worksite inspection on the first issue of the permit, or when there are any concerns/change to task scope, PA, or work crew, SIMOPS and hazards.

g. On subsequent permit issue and when there are no concerns/change to task scope, PA or work crew, SIMOPS or hazards, the AA or IA may conduct a site visit separate to the PA but shall communicate this with the PA at permit issue. The PA conducts TBT and AA can add or adjust monitoring frequency as required.

h. The AA attends any TBT that has residual risk in areas II or above.

A TBT is a vital part of the process to Verify that everyone understands the scope, hazards, controls, and monitoring that the TRA covers. The TBT allows the people involved in the work to:

- discuss the scope and approach to the work to Verify that they understand the task steps, job interruption events and contingencies
- raise any concerns about the task, and
- identify any hazards that have not been addressed in the TRA process, for example, performance influencing factors which can cause mistakes.

i. At this stage, inform the work party about any relevant ERRPs that are in place for the task and what will be required of them if there is an emergency.

j. Everyone involved in carrying out the task shall fully understand the TRA. The conversation shall cover:

   1. the full scope of work

   2. details of the task steps involved

   3. hazards and risks identified for each step in the task

   4. all controls identified, including contingency plans and Life Saving Rules

   5. the isolations in place to control energy sources

   6. any SIMOPS issues identified, and

    7. an individual's fitness and ability to perform the task (e.g. fatigue, working at height or access to confined space).

k. Risk reviews are held when the work stops, and the team checks for new or changing hazards and risks. Typically, these are the tasks steps, but other risk review points may be agreed or may emerge while the task is executed.

l. The PA keeps the language of the TBT clear and simple, especially for complex technical tasks. If English is not the work party's first language, the PA may make a good-quality translation in appropriate language before work starts. The TBT is performed at the worksite unless barriers (for example high noise levels) hamper the discussion.

m. All attendees of the TBT sign the work party declaration section of the permit to confirm that they have identified the equipment they are working on and understand the hazards, and controls.

n. The PA Verifies that when additional people join the work party, they understand the hazards, controls and supplementary certificates, including ERRP referenced on the permit. These additional people sign the work party declaration section of the TBT.

o. The PA Verifies the work party declaration form is updated when anyone leaves the work party.

p. If anyone at this stage identifies additional hazards or thinks the controls are inadequate, then the job shall stop. It shall not start again until the AA has reviewed the TRA and Verifies:

    1. the risk assessment is suitable and sufficient and gives permission for work to continue, or

    2. when additional controls are required and have been put in place, either:

        a) record on the paper copy of the TBT with changes signed by the AA. Typically, these controls relate to housekeeping, weather, or fatigue, or

        b) where there is a change in scope or hazards, or a significant change to controls, the risk assessment is updated, and the permit reissued.

Some example topics to cover as part of the TBT are described in Table 13.

Table 13 – Toolbox talk guidelines

Item	Considerations and prompts
Task scope	The task description and what the permit does and does not cover.
Weather conditions	Weather and sea state.
The work party	Competence and experience. Familiarity with the installation and system they are working on. Performance influencing factors such as repetitive actions, poor communication, fatigue (e.g. extended shifts) or distractions. Fit and able to perform the task (e.g. working at height or access to confined space). Expected behaviour and operating discipline (e.g. Line of Fire and awareness of relevant Life Saving Rules understood). *Go to HSE Carbon for further guidance on Line of Fire hazards*
The worksite	Access, egress, or awkward working position. Ground conditions. Temperature and humidity if it is relevant to the task. Lighting. Location.
Plant and equipment status	Identify the correct equipment. Physical condition of the plant and equipment. Current operating status of plant and equipment. Any isolation in place.
Current adjacent worksites	Can this task affect other worksites? Can other worksites affect this task?
Controls	Are they in place as stated in the TRA and understood by the work party? Review attached certificates (for example ERRPs, lifting plans).
Hold points	The task steps and any additional agreed points that allow for hazards and risk review.
Interruptions and 'Stop the job' events	If the resources to deliver the ERRP are not available. Changes in weather and site conditions. If the task goes outside the permit's scope. An unplanned activity introduces SIMOPS. Additional hazards that have not been assessed or inadequate controls are identified. The PA stresses that anyone has the authority and obligation to stop unsafe work or report unsafe conditions.
Contingency plan	Everyone understands the contingency plan and any emergency response plans in place. Everyone knows the location of emergency response equipment (e.g. extinguishers, alarm call points, showers, escape sets and muster points).

8.5.5 Displaying a live permit

a. Work may start once all personnel in the work party have signed the work party declaration section of the permit.

b. The PA posts the signed permit in an accessible area that is close to the worksite where it is unlikely to be damaged and is protected from the weather.

c. The posted documents at site include supplementary certificates but the other attachments are at the AA's discretion.

8.5.6 How to stop unsafe work and manage interruptions

Documents issued to people carrying out CoW work state:

Everyone has the authority and obligation to stop any work they consider to be unsafe.

a. Anyone shall stop the task if:
    1. the work scope or worksite conditions change, or new hazards are identified
    2. they think that the permit to work or controls are not appropriate or no longer apply
    3. the task goes outside the permit's scope
    4. an unplanned activity introduces a SIMOPS hazard that could affect the task
    5. changes in weather or site conditions that require additional controls.

b. If anyone stops the task for any of the reasons above, the PA shall immediately tell the AA.

c. The AA shall review the task, worksite, and process hazards with the PA. The permit and risk assessment can be modified and re-Approved to incorporate any changes or additional risks. The level of approval needed depends on the residual risk and may mean that a TRA team has to reconvene.

d. For events that stopped or interrupted the job due to safety concerns:
    1. the PA records this in the eCoW feedback
    2. the SA Verifies the events are reviewed and if required they are entered into IRIS (for example, where Life Saving Rules where applicable, have been breached).

8.5.6.1 All work interruptions

a. The PA or delegated work crew member checks that the worksite and tools are left in a safe and orderly condition. Any tools that are no longer required after the interruption are removed. This may not be possible in an emergency or evacuation.

b. The CSEA Verifies everyone is out of the CSE and installs a temporary guardrail and signage to prevent entry to the confined space when the site is not attended.

c. For CSE, check the continuous gas monitor, or retest the atmosphere, before entering the confined space again.

8.5.6.2 Short interruptions

a. For short interruptions (for example for meals, prayers, coffee, smoking, collecting tools or equipment), the PA shall reassess the site conditions and check that the controls still apply.

8.5.6.3 Longer interruptions

a. For longer interruptions (for example site alarms, bad weather), the following shall happen:
    1. The PA Verifies, if safe to do so, that when a task is interrupted, the worksite is left in a safe and orderly condition and any equipment being used is shut down or isolated.

2. The PA informs the AA when leaving the worksite to determine if the permit is completed or suspended. The AA may decide the PA does not need to suspend the permit if the site alarm is confirmed as false.
3. The PA reassesses the worksite area to confirm that nothing has changed that impacts the task or worksite safety.
4. For CSE, the atmosphere is re-tested before access is allowed.

8.5.6.4 Emergency interruptions

a. For an emergency interruption (for example an emergency muster following a gas release), the following shall happen:
   1. All equipment is shutdown and isolated if it is safe to do so.
   2. Permits are returned to the AA when it is safe to do so.
   3. The AA suspends active permits after personnel leave the worksite or when requested to do so by the site incident manager. The 'Suspend all' function in eCoW can be used to do this.
   4. Once the SA has authorised the restart of the work, the AA or IA Verifies that it is safe to restart work after the emergency and re-issues or Verifies that permits are still active.
   5. The PA or delegated work crew member reassesses the worksite area to confirm that nothing has changed that impacts the task or worksite safety.

b. When personnel return to a confined space, the atmosphere is verified non-hazardous before they re-enter.

More details on how to record stop-the-job events are provided in section 8.5.6.

8.6 Step 6: Monitor

a. Monitoring or checking the worksite is essential to managing any worksite safely. How often a task is monitored and the level of verification that might be required may change depending on the level of risk involved. The frequency and type of worksite monitoring shall be defined in the risk assessment for the task.

b. When they are visiting a worksite, the AA or IA shall immediately stop the task and suspend the permit to work in the following circumstances:

1. they observe unsafe conditions for the work being carried out
2. they observe LSR are not being followed
3. they observe that the work does not conform to the work permit's conditions
4. the work crew tells them they have stopped the work because the task is unsafe
5. they observe any new SIMOPS risks.

8.6.1 How to monitor tasks managed by permits

a. The AA or IA visits the worksite to monitor the activity at the frequency recorded in the TRA. When they have completed a monitoring visit, the AA or IA signs and adds any appropriate brief comments into the permit's work monitoring section under the heading 'worksite monitoring'.

b. The monitoring is recorded in eCoW along with any comments.

c. As part of worksite monitoring, the AA or IA shall Verify the following:

1. isolation integrity is proven, and zero energy demonstrated
2. everyone on the work party understands the work scope, the hazards associated with it, and the controls in place for the task
3. everyone has signed the work party declaration to say they participated and understood the TBT
4. the requirements detailed in the permit are being followed
5. the task described in the permit is the actual task being conducted
6. all necessary paperwork has been completed and controls are in place
7. worksite monitoring has been completed in line with the risk assessment
8. emergency response requirements are in place, everyone on the work party understands them, and they have been tested, if applicable
9. the work party understands the contingency plans
10. there are no new conflicts with SIMOPS activities
11. site housekeeping standard is good so that additional hazards are not created.

d. The monitoring frequency is risk based and shall include consideration of the following:

1. type, complexity, risk level, SIMOPS and amount of activity in the schedule
2. CoW incidents, near misses, HIPOs, and self-verification findings for similar work
3. PA and work team familiarity with the work and the site or work location. Consider those new to the site (green or orange hats).

8.6.2 How to monitor tasks managed by low risk permits

a. The PA shall monitor the task during execution.

b. Low-risk activities do not have to have additional monitoring unless a risk assessment identifies that monitoring is needed.

c. Self-verification is used to provide sample testing for conformance on these tasks. Sample around 10%[10] of the total low-risk tasks.

8.6.3 How to monitor other Control of Work activities

All the workflows in eCoW (IDP, SIMOPS, Leaks & Seeps, SORA and ORA) have the functionality to assign and track monitoring.

The type and frequency of monitoring is decided in the risk assessment or by the AA for each workflow. All monitoring for live or active workflows are brought together by eCoW under the task monitoring screen where they can be checked and updated.

8.6.4 How to monitor remote and lone working

a. The AA and the PA who will be the lone worker evaluate the risks associated with an individual working alone on a case-by-case basis.

b. All ongoing tasks are recorded at a central location so that all work in progress is visible to the AA.

c. The form of the communication protocol and the required numbers of people are decided during the TRA.

d. The AA checks the agreed communication protocol before giving permission for work to start. The PA informs the AA when the task starts, at the frequency specified in the risk assessment, and when it is complete.

e. At a change or end of shift, the PA returns the permit to the issuing centre. A scanned copy may be emailed if it is not possible to visit the issuing centre.

f. In residual risk Area II or above, a second person shall be ready to summon help, assist – or both – if an emergency happens.

> *For example, lone workers can sign in and out with security or operations personnel. The lone worker might be asked to call or visit – or both – the security or operations contact person to confirm the lone worker is safe.*
>
> *You can find more about what you need to do in section 8.6.5 Communications protocol.*
>
> *You can also find more information on lone working ERRPs in section 18.5.*

8.6.5 Communications protocol

a. Personnel working on their own shall use a communications protocol that includes the means of communication, the frequency of contact, and main and backup contacts.

> *Effective ways of getting help can include telephones, cellular phones, portable two-way radios, personal alarms, and computer-based systems. The communication protocol allows a worker who needs help to send a message or signal to someone who can help him or her.*

b. The AA and PA shall:

1. discuss and agree how communication will be managed

2. test the agreed communication method that will be used to keep in contact with the lone worker
3. agree the actions to take if a lone worker needs to be rescued in an emergency.

8.7 Step 7: Complete

a. When any task is finished, the PA:

1. inspects the worksite to Verify it has been left safe and tidy
2. returns to the AA or IA at the issuing location to have a face-to-face conversation. Where a face-to-face meeting is not reasonably practicable, they may have a telephone conversation, but care is required to make sure the handover is clear
3. agrees, with the AA or IA, if the permit is to be suspended or completed.

b. When suspending a permit, the PA includes the date and time they want it re-issued.

c. All permits in eCoW contain a section for PA feedback. Table 14 shows the three feedback options available to complete before suspending or completing a permit.

Table 14 – PA Feedback in eCoW

	No issues Work completed as planned. Plant is fully restored to normal operating condition. Site has been left safe and tidy.
	Suggested improvements Job completed and plant is back to normal operating condition. The worksite has been left in a safe and tidy condition. Suggestions to improve CoW efficiency or future task execution
	Worksite status is abnormal or job interruptions The plant is not fully operational and cannot be used. Events were recorded that stopped or interrupted the job or there were problems with the site's condition. Job interruptions that were resolved and allowed work to be completed are still recorded.

8.7.1 Suspending permits

a. The PA shall suspend permits to work for the following reasons:

1. shift handover
2. Work is completed for the day, if it is not a 24-hour operation
3. Work is partly completed and waiting for a sanction to test (STT)
4. Work is suspended due to materials or resources not being available (for example people or equipment)
5. anyone has identified new or additional hazards that cannot be managed through the TBT
6. emergency interruptions or evacuations (for example site general alarm).

b. When a task is suspended, the PA Verifies the following:

1. the permit and any associated supplementary certificates are returned to the permit issuing centre because it is important that the PA can discuss the task progress or completion and hand over the permit in person to the AA or IA.
2. personal isolations, tags and any personal locks are removed.

c. In an emergency or evacuation, the AA shall Verify that all live permits and their associated supplementary certificates are suspended when personnel leave the worksite or when it is safe to do so.

d. The AA or IA shall update eCoW to accurately reflect the works status and decide which supplementary certificates can be closed, suspended, or kept live.

e. The AA or IA shall inform appropriate IsAs, especially in the case of breaking of containment work, so that additional monitoring can take place on valve isolation integrity.

8.7.2 Re-issuing permits

a. Before the AA, IA or SA re-issues a permit after work has been suspended, they shall Verify the following:

1. the task description is still accurate for the task being done
2. hazards and controls identified in the TRA are still relevant
3. any SIMOPS originally identified have not changed
4. the conditions at the worksite have not changed
5. feedback from the PA was positive or identified issues have been addressed
6. the supplementary certificates are valid for the duration of the associated task.

b. If the AA, IA or SA decides that conditions have changed and the permit is no longer appropriate, then conduct a new TRA and issue a new permit.

8.7.3 Re-authorising permits

a. Before the SA re-authorises a permit, they shall:

1. Verify the same items for a permit re-issue as listed in 8.7.2a
2. decide on the period of authorisation (up to 14[4] days).

8.7.4 Closing a permit

a. The AA or IA visits the worksite after a permit has been completed. They inspect the worksite area and shall Verify the following:

1. the task detailed on the permit has been completed
2. safety systems and the isolation status are the same as recorded in the IDP linked to the permit
3. the area has been cleared of any debris and all materials and tools are either stored in a safe and orderly way or removed from the worksite
4. fittings and equipment removed or dismantled during the work have been left in a safe condition
5. the area has been cleaned as required and any spills and contaminants removed and disposed of safely.

b. The AA or IA may delegate the site inspection to a technician who is not the PA, but the AA or IA is responsible for closing the permit.

c. The AA may decide a site inspection is not necessary for some non-intrusive LRPs, (for example using a camera).

d. The permit shall be closed within 24[3] hours of its completion.

8.7.5 Authorising de-isolation

a. The AA shall:

   1. visit the worksite to Verify that the operating equipment and plant are ready for reinstatement
   2. Verify that all work and linked permits are completed
   3. review the IDP and Verify there are no SIMOPS interactions before authorising the de-isolation
   4. authorise de-isolation points in order, individually or groups, as appropriate
   5. inform the relevant IsAs that the equipment is ready for de-isolation
   6. minimise the time between removing the positive isolation and leak test
   7. Verify appropriate pressure build-up (PBU) monitoring is included in the IDP for the valved isolation envelope, when removing positive isolation.

8.7.6 Executing de-isolation

a. Complete the following before and during de-isolating plant or equipment:

   1. the discipline IsA or isolator removes the securing devices and tags in the order described in the IDP and authorised by the AA
   2. the relevant IsA or isolator signs-off each isolation point on the IDP to confirm that it has been de-isolated.

b. Once de-isolation and leak testing have been safely completed, the AA Verifies that:

   1. the plant or equipment has been de-isolated, tested and line-walked
   2. the pre-start certificate is completed, and normal operations can resume.

For more information on plant re-instatement, see section 20.

8.7.7 Crew change and shift handover - PA

To maintain safety and continuity on any job, it is important that shift handovers and crew changes are carried out effectively.

a. The outgoing and oncoming PA, and AA or IAs review the permit to Verify that everyone fully understands it.

b. The outgoing PA shall suspend the permit and leave the worksite in a safe and tidy condition. The oncoming PA then accepts the re-issued permit from the oncoming AA or IA to confirm they accept the task at the worksite.

c. If the task continues over the shift change, the outgoing PA and AA or IA and the oncoming PA and AA or IA shall conduct the handover at the worksite.

d. The outgoing PA records the status of the task in the paper or electronic handover log.

e. If the PA who accepted the permit is unable to carry out their agreed duties, another PA may take over responsibility for the permit at any time by using the take over responsibility function within eCoW.

f. A PA may hand over to a new PA during the shift without stopping the job using the take over responsibility function in eCoW. The new PA agrees the handover with the AA and records this by signing the work party declaration section of the permit.

8.7.8 Crew change for AA or SA

a. The oncoming AA or SA reviews all live permits in their area of accountability. The oncoming person takes over responsibility for any live permits by using the 'take over responsibility function' within eCoW. This takeover function may also be used at any time to transfer responsibility to another AA or SA.

b. The outgoing person documents all CoW-related information (for example the status of locked valves and isolations) in an electronic or paper-controlled shift handover log. This provides a detailed account of all work.

c. The outgoing person details the permit status to the oncoming person as part of the detailed handover process.

d. The detailed handover is done verbally (e.g. face to face, via an online call or by telephone).

e. During this handover, discuss the following:

    1. the status of all ongoing permits, isolations, RAPs, ORAs, locked valve changes, and overrides and inhibits

    2. any work stoppages that have occurred during the shift

    3. any SIMOPS

    4. changes in worksite conditions, controls in place, or monitoring requirements.

f. The oncoming AA assesses if they need to visit the worksite to check that the controls in any particular permit are adequate (for example for activities with residual risk in Area II and above).

g. If the oncoming AA decides they need to visit the worksite, then they suspend the permit until they have inspected the worksite. They sign the permit only when they are satisfied that the controls are adequate.

8.7.9 Retaining documents

Control of Work documents are retained by eCoW for 5 years[11]. This is performed automatically by the archiving process within the software.

a. The AA Verifies the following:

    1. paper permits and attached supplementary certificates such as lifting plans, ICCs, and excavation certificates are retained for one month unless local regulations require a longer period (see LIP).

    2. if the paper backup system is used, CoW documents are not retained by eCoW. These documents have to be retained in hard copy for five years.

    3. on OSHA sites in GOM, CSE permits, and TBT paper records are kept for one year so the confined space programmes can be reviewed.

8.8 Step 8: Learn: learning opportunities and closure

a. Once a task is completed, it is important that any learning opportunities, including all instances of work being stopped, are recorded and any necessary improvements are incorporated into the process.

b. The AA reviews PA feedback (see section 8.7) and decides on the best way to handle improvements. The AA then does the following:

   1. within eCoW, raises and tracks an action for improvements that are local and concerned with the CoW process

   2. Verifies actions are recorded in the local action-tracking tool for improvements outside the CoW process

   3. creates a knowledge item in eCoW linked to a system, equipment, location, or document.

c. The SA Verifies the Knowledge Base in eCoW is maintained to systematically capture useful information about the site and enable visibility at point of use. Examples of items that might be included are passing valves, access restrictions, or CSE access requirements.

d. The SA Verifies learning opportunities with the potential to make a significant contribution to safe, compliant, or reliable operations are communicated to the entity's Organisational Learning Specialist or Advisor, either in-region or above-region.

   The operating entities (Production, Projects, and Wells) operate formal organisational learning procedures, based on GDP 2.4-0001, as follows:

   - *100033 BP Procedure Organisational Learning in GOO (GOO-OL-PRO-00001)*
   - *GPO-LE-PRO-00001 BP Practice GPO Organisational Learning*
   - *100373 BP Procedure GWO Organisational Learning*

   The preferred way to Verify people can become aware of, implement – and continue to implement – lessons learned, is to codify them within OMS by updating existing bp Practices and bp Procedures.

e. The SA shares CoW opportunities to learn with the workforce and Verifies that they are applied at their site by:

   1. confirming that any areas that need action are assigned to personnel with the authority to resolve them in a timely fashion

   2. monitoring and tracking each action to Verify it is closed.

9 Risk assessment

9.1 Risk assessing tasks

Hazard identification and task risk assessment (HITRA) is the bp method for systematically examining an individual task to:

- identify the hazards
- evaluate the risks, and
- specify appropriate controls for each hazard.

a. Risk assess all tasks using the HITRA Level 1 or Level 2 risk assessment methods:

   1. Level 1 TRA is the minimum level of risk assessment required for any task.
   2. Level 2 TRA is for higher level of risk, or more complex tasks, or both.

b. TRAs include task-specific ERRPs that require an action or actions over and above normal operation emergency alarms and site ERRP.

   The HITRA process uses the concept of residual risk to decide whether the task can be safely executed and who will Approve a risk assessment or authorise a permit. Throughout this CoW Procedure, we use the term approval for risk assessments and authorising for permits.

   Residual risk is defined as the level of risk that remains after controls are taken into account. The risk matrix shows five risk areas and the HITRA approval table shows who is the Approver for each risk area; see Table B.4 and Table B.5.

c. If the proposed task has a residual risk in Area IV, C+ or V, then the work shall not progress. Follow the requirements of the appropriate entity risk management procedure to manage these risks.

9.2 The process for identifying hazards

a. The risk assessment team do the following:

   1. visit the worksite together to identify the task, worksite, and process hazards involved in carrying out the task at the actual location. Use the LSR to help identify these hazards. They consider the characteristics listed in Table 15
   2. use a systematic method of identifying hazards, using the HITRA 14 sources of energy (see Table B.3) to reinforce their personal knowledge and experience; they may use a prompt card to help
   3. make sure they fully understand the task and its implications
   4. identify specific hazards associated with adjacent plant and equipment and to any activities taking place or planned to take place that could affect the task they are assessing
   5. list the controls needed for each hazard or risk they have identified by applying the hierarchy of controls L1-L6
   6. consider the full task or set of task steps required to execute the work scope
   7. consider the methods they will use to execute the task or tasks
   8. identify risk review points or hold points that will help the work crew focus on the hazards associated with the task step and identify and assess any new or changing hazards.

Table 15 - Risk assessment characteristics

Characteristics	Examples
The characteristics of the plant and systems directly involved.	Quality and type of process inventories in equipment and pipework. Pressure, noise, temperature and thermal environment, vibration, stability, voltage, hazardous substance (e.g. benzene, H_2S, mercury, LSA scale, sand, wax, and sludge).
The sensitivity of the location on the site or installation (that is, how close it is to other critical plant or systems).	HVAC intakes, flare header, explosive store, control room, NGL separator, risers, small bore pipework, ESDV, potable water systems, structural support members, and tankage. Fire and gas detection and deluge systems. Environmental risks in the area (for example, drains, open scuppers and water courses).
Critical activities necessary to perform the task.	Lifting, draining fluid, inerting, isolation, proving dead, flushing, entry into confined spaces, working at height, electrical testing, transporting materials, equipment and wastes, using power tools, hot work, grinding, bolting, and using cables and hoses.
Human Factors involved in the task.	Personnel experience and competence, environmental conditions (e.g. noise, temperature, wind, sea state), health (including fatigue, illness, and injuries) and performance pressures. Are written procedures, communications and the layout and labelling of controls and equipment clear and adequate? Is it likely or easy for mistakes to be made?
The possibility of the task being affected by simultaneous activities within the task or by other unrelated tasks taking place nearby.	Access, egress, muster points, and SIMOPS.
The failure of equipment. Consider the equipment failing, including catastrophic failure, under load test, or during lifting operations.	Chain block, rigging, hoses, joints, or seals.
Equipment condition and status.	Windmilling of fans such as HVAC and fin fans.

b. When a site visit is not reasonably practicable (for example, for TAR preparation or project design) the PA, AA, or IA can perform TRAs based on drawings, models, or images of the facility. In these circumstances, visit the site to Verify hazards, controls, and site conditions before the permit is signed off as Verified.

9.3 How to use the hierarchy of controls

When selecting controls, it is important to consider how effective each control will be when it is applied. More than one control may be needed to reduce the risk associated with a task.

a. Use the hierarchy of controls in Figure 7 to select one or more control.

b. To follow the hierarchy of controls, consider the controls in each category. Begin with L1 and move through to L6 in accordance with Table 16.

c. As controls are identified, the TRA team considers the interdependencies of the controls and the impact to overall task risk.

d. Moving down the hierarchy of controls from L1 to L6, controls become less effective and less reliable. As a result, controls in categories L5 or L6 (or any combination of these) cannot move the residual risk more than one box on the risk matrix for either impact or likelihood.

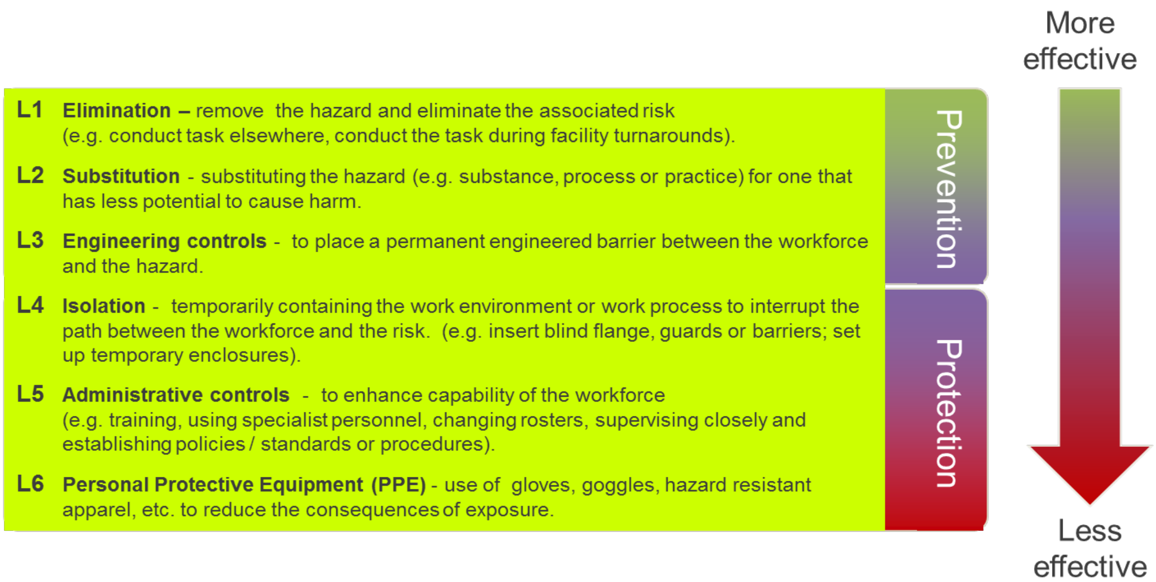


Figure 7 - Hierarchy of controls

Table 16 - Controls

Category	Description	Guidance
L1	These remove the hazard, eliminate the associated risk, and are the most effective controls.	This is the preferred solution but check that it does not introduce a new hazard.
L2–L3	These controls are preventative and primarily reduce the impact of the risk.	These can also reduce likelihood. Even with a number of controls it is unusual to credibly reduce either the impact or likelihood by more than one order of magnitude (i.e. one box on the matrix).
L4–L5	These controls are mostly protective and have a limited ability to reduce impact, as they primarily reduce likelihood.	It is unusual that the likelihood can be moved by more than one box on the matrix. If a number of controls have a common failure (e.g. the people involved) then this limits the credit that can be claimed.
L6	These controls are task-specific PPE above the site safety standard that could reduce the likelihood or consequences of exposure.	As these controls are heavily influenced by Human Factors, even multiple L6s are unlikely to lower the risk significantly, therefore when using these controls, limit resulting movement on the risk matrix to no more than one box.

9.4 How to perform a Level 1 task risk assessment

a. Level 1 TRA is a detailed review of the task and task steps at the worksite that identifies hazards involved in completing the task. It considers the task, worksite, and process hazards. Record the selected controls in the Level 1 TRA, which is part of the permit to work.

b. If more than one team is performing the task, a PA representative from each team shall be part of the risk assessment.

c. The PA and AA or IA, with other key personnel involved in the task contributing as needed, shall conduct the Level 1 TRA at the worksite by doing the following:

1. identifying the risks associated with the hazards by using their collective knowledge and experience of the task, process, and worksite

   This includes identifying the scope, methods, equipment, and tools to be used.

2. identifying the controls to control or mitigate the risks they find

3. documenting the risk assessment findings in the TRA form, including the hazards and controls, as discussed by the PA and AA during the worksite visit.

d. With the controls in place and using the risk matrix, the AA shall:

1. use their judgment to select the residual risk level, and

2. record the residual risk level and Approve the TRA if the risk level falls in risk Area I on the risk matrix.

Examples of tasks that may be carried out using a Level 1 TRA are as follows:

- Radiography. Verify that the source is not strong enough to set off or interfere with other nucleonic instruments.
- BC work on isolations that conform to the isolation requirements in this CoW Procedure
- Category 1 lifting operations
- Erecting, dismantling, or modifying scaffolding that is not over side or connected to live plant piping or equipment
- Installing or removing insulation or cladding
- Connecting and disconnecting hoses to low hazard systems
- Flushing and purging at low pressures, less than 10[7] barg (150 psig)
- HWOF in a non-hazardous area (that is, an area free of hydrocarbon and hazardous materials).

Confined spaces free from hydrocarbon and located in a non-hazardous area require a Level 2 TRA.

Table 17 - Level 1 TRA process

Step	**What to do**	**Using eCoW** *Using paper TRA forms*
1	Answer the questions opposite.	Do we fully understand the task and how it will be carried out? Does this task have to be done? Does it have to be done at the proposed time?
2	Break down the work scope into tasks to carry out TRA at task level.	See section **8.1.1** of this CoW Procedure.
3	Determine the level of risk assessment required for each task.	See section **9** in this CoW Procedure or ask the AA.
4	A Level 1 TRA that has been previously completed for this task can be used. If one does exist, Verify the task, worksite, and process conditions are applicable and (where applicable) update it to reflect the current conditions.	TRA search features in eCoW.
5	Visit the worksite to conduct the Level 1 TRA.	Make notes on a blank or partially completed L1 form and then transfer to eCoW. *Alternatively, transfer manually to the paper L1 form.*
6	Identify all the hazards associated with the task, worksite, and process using the 14 HITRA sources of energy. Discuss and consider the potential risks (hazard impact and likelihood of it happening) associated with the identified hazards.	Select the energy source and type of hazard (Process, Task or Worksite). Record what the hazard is and how it causes harm. Provide some detail about where the hazard is located or coming from. *Record the sources of energy.*

Step	What to do	Using eCoW *Using paper TRA forms*
7	Identify and specify the additional controls that can be applied to mitigate or eliminate each hazard identified. Test these hazards against the LSRs to confirm relevant controls are considered. Use hierarchy of controls to help select the strongest controls. Consider what can go wrong and have controls to mitigate as a contingency (e.g. having spill kit available, knowing which ERRP to follow, and knowing which emergency shutdown procedures are required).	Record the controls that are being used. Use the HITRA hierarchy of controls in section **9.3** to select a type of control. Write the control in simple language stating who does what and when. A control is typically an observable action. Provide enough detail but keep it simple and clear.
8	Evaluate the residual risk. This is the risk with controls in place and site safety standards being followed.	Use the 8x8 risk matrix in eCoW to select residual risk. When you hover your cursor over each box a summary of the HSE and business impact table and the likelihood of it occurring appears. *Use the HSE and business impact table and 8x8 matrix in* **Table B.4** *First, select the impact (consequence) on the HSE and business impact table (A-H) and the likelihood (probability) of the risks occurring.* *Plot the impact level versus likelihood figure on the risk matrix to get a residual risk figure.*
9	Record the residual risk figure on the Level 1 TRA form.	eCoW automatically transfers the residual risk selected on the matrix to the L1 form. *Manually record the residual risk on the Level 1 TRA form.*
10	If anyone involved in the risk assessment is not completely satisfied that the proposed controls will adequately control a hazard, complete a Level 2 TRA.	Examples of situations that would escalate a Level 1 TRA to a Level 2 TRA are listed in section **8.2.1**
11	Select Approver for the TRA based on residual risk.	eCoW automatically assigns approval level based on residual risk agreed in step 8. *Use the HITRA-approval table to select the correct Approver based on residual risk agreed in step 8.*
12	Approve TRA.	Using eCoW the Approver approves the Level 1 TRA. The PA signs when they accept the permit with the RA included. *The Approver signs the Level 1 TRA form.*

9.5 How to perform a Level 2 task risk assessment

a. Complete a Level 2 TRA when a task involves hazards or complexities that require a more detailed assessment. All TRAs require input from those who will be performing the task or from people who have the equivalent skills, knowledge, or experience.

Level 2 TRAs can also require input from experts from outside the normal site or installation team.

b. Supporting documents are used to help identify hazards and controls. Examples include isolation plans, ventilation plans, lifting plans and ERRPs. These documents may be in draft form at this stage.

c. For tasks identified with an initial risk in risk Area IV or above, the TRA facilitator shall be independent of the AA's area and the team performing the task that requires the Level 2 TRA.

Examples include an HWOF not meeting the five primary risk controls, or abrasive task on live equipment.

d. Minimum TRA team is AA or delegate, PA and facilitator. It is essential that the team has the skills and knowledge for the scope being assessed, and has engineering, HSE or technical input as required.

e. The AA may be facilitator for risk III or below but there still has to be a minimum of three and the AAs core role is to facilitate.

f. If the Facilitator is the AA, then the TRA team still requires operational input from a person who is experienced with the area. Typically, another AA, SA, IA, or Production Team Leader (PTL), or equivalent operational roles in Wells, or Projects. The expectation is that signing in CoW will have three separate names, typically AA, PA and Facilitator.

g. During the TRA, the team shall consider and agree answers to questions that will cover the task thoroughly. The TRA checklist in Table D.7 contains example questions.

h. Once team members are familiar with the scope of the task to be carried out, the team lists all the significant hazards for each task step. They do this by group discussion, with the facilitator making sure that each team member has enough opportunity to express their views.

i. The facilitator Verifies that the TRA team follows the HITRA process described in Table 18.

Table 18 - Level 2 TRA process

Step	What to do	Using eCoW *Using paper TRA forms*
1	Answer the questions opposite.	Do we fully understand the task and how it will be carried out? Does this task have to be done? Does this task have to be done now?
2	The AA appoints a TRA facilitator for the risk assessment meeting and process. The facilitator gathers relevant documents (e.g. TRA documents, drawings, safety data sheets, photographs, procedures, historical information on incidents, CoW lessons learned and previous TRAs).	Select a user who is a TRA facilitator from the Risk Assessment Team dropdown menu. *Record the name of the TRA facilitator on the Level 2 TRA form.*
3	The Level 2 TRA team is a minimum of three including the facilitator. The facilitator assembles a team including the AA or delegate and PA, and Verifies they understand the process and the objective of the TRA. The AA attends risk assessments for HWOF or CSE and where the initial risk is in Area III or above. The team includes people with the experience, skills and competencies it needs. The team collectively has knowledge of the scope of work and any specific tools or equipment to be used. For example, for a risk assessment involving diving and subsea tasks, team members would include a diving supervisor or subsea competent person.	Select and record all users participating in the TRA from the Risk Assessment Team dropdown menu. *Record all users participating in the TRA on the Level 2 TRA form.*
4	TRA team members visit the worksite and confirm they understand the work area's layout and the potential worksite and process hazards. They consider the characteristics in **Table 15**.	Make notes on a blank or partially completed Level 2 TRA form and then transfer to eCoW. *Alternatively, transfer manually to the paper L2 form.*

Step	What to do	Using eCoW *Using paper TRA forms*
5	The TRA members do the following: • Review the information provided such as CoW documents that could include policies and procedures, other risk reviews (for example, HAZOPS or HAZIDS, audit reports, inspection reports, lessons learned, HiPo / MiA /HVL announcements and the Level 1 TRA, if one applies). • Document their feedback from the worksite visit. • Break the task down into task steps.	Use the eCoW functionality to record the task steps. *Write task steps on the Level 2 TRA form.*
6	A Level 2 TRA that has been previously completed before for this task can be used. If one does exist, re-check the task, worksite, and process conditions and (where applicable) update it to reflect the current conditions.	TRA search features in eCoW. *Copy from existing controlled paper documents.*
7	TRA team identifies all the hazards associated with each task step using the 14 HITRA energy sources (including SIMOPS).	Record what the hazard is and how it causes harm. Provide some detail about where the hazard is located or coming from. Select the sources of energy.
8	TRA team identifies the risks associated with the hazards. Evaluate the impact (consequence) and likelihood (probability) of the identified risks occurring by using the impact level matrices. Consider the impact in the following categories: • The health and safety of everyone, whether or not they are directly involved in the task. • Environmental. • Business.	Use the 8x8 HITRA matrix in eCoW to record initial risk level for each hazard. *Record impact (consequence) letter and the likelihood (probability) number on the Level 2 TRA form for each hazard.*
9	TRA team specifies the additional controls using the hierarchy of controls to eliminate, reduce, or mitigate the initial risk, including testing against the LSRs. Consider any interdependencies of the controls and their impact on the overall risk. Consider what can go wrong and have controls to mitigate as a contingency (e.g. having spill kit available, knowing which ERRP to follow, and knowing which emergency shutdown procedures are required).	Record what controls are being used. These shall relate to one of the six hierarchy of control levels. Use the HITRA hierarchy of controls in the CoW Procedure to select a type of control. See Table 16. Detail how the controls need to be implemented. This relates to an observable action. Provide enough detail to communicate the following: where, when, who, or required limits.
10	TRA team evaluates the residual risk for each hazard. The identified residual risk figure has the identified additional controls in place.	Use the 8x8 risk matrix in eCoW to select residual risk. When you hover your cursor over each box, you get a summary of the HSE and business impact table and the likelihood of it occurring. *Use the HSE and business impact table and 8x8 matrix in* ***Table B.4*** *First, select the impact (consequence) on the HSE and business impact table and identify the impact level from A-H with controls in place.* *Identify the likelihood (probability) of the risks occurring.* *Plot the impact level versus likelihood figure on the risk matrix. This then provides a residual risk figure.*

Step	What to do	Using eCoW *Using paper TRA forms*
11	TRA facilitator records the residual risk figure for each hazard on the Level 2 TRA form.	eCoW automatically transfers the residual risk selected on the matrix to the Level 2 TRA form. *Manually record the residual risk on the Level 2 TRA form.*
12	TRA facilitator selects Approver for the risk assessment based on the highest residual risk.	eCoW automatically assigns approval level based on the highest residual risk. Check Table 3 for minimum approval levels *Use HITRA approval table and **Table 3** to select the correct Approver based on residual risk.*
13	When the Level 2 TRA is completed, all team members sign the TRA form, by hand or electronically, to indicate they agree the content.	Each team member signs in eCoW. *Each team member signs the Level 2 TRA form.*
14	Approve TRA.	Using eCoW, the Approver approves the Level 2 TRA. If the Approver wishes to recommend changes or additions, they can return TRA to the team for reassessing. *The Approver signs the Level 2 TRA form.*

Table 19 - Mandatory Level 2 risk assessment

Assess the following tasks using a Level 2 risk assessment: (asterisk items may be covered by a functionally Approved RAP)
1. Lifting over or in close proximity to live equipment. 2. Lifting live equipment or pipework. 3. Category 3 lifts. 4. Temporarily suspended or supported loads where a fatality is a credible consequence (see section **22.13** Lifting operations involving lifting personnel including man-riding*. 5. Non-conformant isolations (within IDP). 6. Tasks that use a mechanical device for a secondary isolation. 7. Hot work open flame work in CSE, hazardous or hydrocarbon containing areas, including working on or near (within 11m or 35ft[2]) live equipment. 8. Confined space entry (the level of TRA for work inside the confined space depends on the task). 9. Cutting installed electrical cables that cannot be positively identified as defined in section **22.5**. 10. Introducing an HP to LP interface. 11. Ground disturbance where there are or might be underground services. 12. Working over water (where the water constitutes a hazard) or near unprotected edges where there are no fixed access platforms, walkways or installed certified scaffolds. 13. Working at height where there are no fixed access platforms, walkways, or installed certified scaffolds or other safe platform as defined in section **17**. 14. Erecting, dismantling or modifying scaffolding where site conditions (see section **17**) require considering additional hazards (e.g. over side, over live equipment or close to bare electrical conductors). 15. Hot tapping. 16. Installing engineered clamps. 17. Working with any material that has the potential for concentrations to be greater than any statutory occupational exposure limit. 18. Working with asbestos (except non-friable asbestos jointing removal or disturbance, which may be Level 1 TRA). 19. Diving operations. 20. Hot and odd bolting. 21. Using explosive. 22. All subsea isolations (within IDP). 23. Overriding interlocked systems using the master key. 24. Use of drones (e.g. for inspection purposes). 25. Creating a low risk permit template. 26. Breaking containment when the isolation envelope contains a valve that is known to pass. 27. Working on a pressurised accumulator. 28. Working close to energised overhead powerlines. 29. Created openings where criteria defined in section **22.1.6** are met. 30. Fracking*. 31. Perforating. 32. Coiled tubing*. 33. Slip and cut drill line*. 34. BOP nipple up/down*. 35. Riser handling*. 36. Well flow back using temporary equipment*. 37. Wellhead or Xmas tree change*. 38. Leak testing or purging using; temporary equipment, gas cylinders, quads, or pumps, or a specialist contractor.

9.6 Risk assessing isolations

a. Isolation, like all other activity, is risk assessed. All stages of the isolation process shall be covered. See section 14 for details.

b. One of the following documents may be used to record the risk assessment:

   1. an IDP using the add risk function to record the additional hazards and controls before the action or isolation step it applies to
   2. a SOP where the hazards and controls are explicit
   3. an existing procedure where the risk assessment is covered in a permit
   4. a permit that has a Level 1 or a Level 2 TRA included (for example inserting a spade or blind).

c. Include the isolation execution risk assessment as part of the isolation procedure, IDP, or permit, so a second or separate risk assessment is not needed.

d. See section 14 for detail on completing isolation design and execution.

10 Managing temporary overrides

A temporary override is any action or system that inhibits a protective device from performing its function while the equipment or facility being protected remains in service. A protective device may provide safety, environmental or commercial protection. This section describes the process for managing temporary overrides. This includes the tracking of overrides where the equipment or process being protected is out of service. The application of a permanent override is considered a design change and shall not follow this process.

Historically, overrides have also been referred to as bypasses, inhibits, or defeats.

An override might be applied to:

- enable device calibration or maintenance
- enable proof testing (without the function activating)
- continue operation with faulty equipment failed to the tripped state
- continue operation with faulty equipment failed but showing the normal operating healthy state.
- temporarily suppress function for startup
- a device or piece of equipment that is temporarily not in use (e.g. TAR, or redundant equipment).

10.1 Types and methods of temporary overrides

- Instrumented layers of protection (LoP)
- Pressure relief devices
- Startup using engineered switches or interlocks.

10.1.1 Instrumented layers of protection

a. Managing the overrides of LoPs including inhibiting or overriding signals associated with the following:

   1. safety instrumented functions (SIF)
   2. safety related controllers (SRC)
   3. SRI-SIS or SRI-BPCS interlocks
   4. highly managed alarms (HMA) (see GP 30-47 Alarm System Design and Management for definition of HMAs)
   5. fire and gas functions
   6. hazardous area equipment purge systems
   7. devices defined in the local regulations, including subsea BSEE, API RP 14C, and USCG.

Most of the above functions are normally defined in the layers of protection analysis (LOPA), but there are exceptions. Some sub-categories of highly managed alarms are assumed in the SIF SIL calculations or allocated in alarm rationalisation reviews. Fire and gas (F&G) functions are not normally credited with reducing risk in a LOPA. Safety-related alarms are a subset of highly managed alarms. The hazardous area certification of some equipment relies on purge systems to prevent gas ingress into the enclosure which may contain spark producing components (e.g. gas chromatographs and HV motors).

10.1.2 Pressure relief devices

a. Override management is used for isolating, disabling, or removing a pressure relief device (PRD) when an alternative relief route with full capacity cannot be provided. PRD include pressure relief valves, bursting disks, blowdown valves, depressurisation valves and vacuum breakers.

10.1.3 Startup or engineered equipment overrides

Startup overrides are designed to be automatically removed when process conditions are healthy or when they time out (for example low level trip on separator commissioning).

Engineered equipment overrides are designed to allow the manual bypass of a protection device for a short period of time and are typically provided with a visual indicator (e.g. coloured light). Engineered equipment overrides in this context, includes fire suppression on machinery enclosures, however it excludes instrumented protection layers (IPLs).

Use of these engineering equipment overrides do not require a record in eCoW. Start-up and engineered equipment overrides are managed using a SOP or instructions, unless they are used outside of their design intent. An example would be intentionally extending the time before the override is automatically removed when an ORA or MoC, or both are required, in addition to an override in eCoW.

10.2 Methods of applying temporary overrides

1. Override switches (for example, key switches and HMI software buttons)
2. Forced (over-written) software values
3. Temporarily wired links or ‘jumpers’
4. Blocking the view of ‘line of sight’ F&G devices
5. Valve jammers
6. Startup override without auto-timer resets
7. Disabling alarm activation
8. Using hand jacks or hand wheels on actuated valves
9. Using bypasses around actuated valves
10. Placing LoP process controllers in manual
11. Pinned pneumatic or hydraulic safety relay
12. Isolations valves for safety devices (for example, SCSSV, level safety bridles, pressure safety instruments)
13. Three-way valve on SSV/SDV/BDV (trapped pressure)
14. Sensing line selector valves for PSHL testing
15. Fusible caps on SSV
16. Where we do not have 100% backup, isolation valves on inlet or outlet of:
    a) pressure relief valves
    b) bursting discs

c) vacuum breakers

d) depressurisation or blowdown valves.

17. Disabling or isolating pilot valves on relief devices

10.3 Process for managing temporary overrides

The following four steps are used:

- risk assess
- authorise their use
- apply overrides
- review active overrides.

10.3.1 Risk assessing temporary overrides

a. All overrides shall be risk assessed to consider the risk of both operating without a protective device in place, and the unplanned activation of a protective device.

Table 20 - Managing temporary overrides

<table>
<tr><th>Type of protection function</th><th>Barrier Type</th><th>SORA level required</th><th>Maximum authorization</th></tr>
<tr><td>SIF LoP with IL 3 (see note 1), IL 2 or IL 1)</td><td>P7</td><td rowspan="3">2</td><td>MTTR or 7 days [12]
(whichever is shorter)</td></tr>
<tr><td>Pressure relief devices without 100% duty standby</td><td>P5</td><td rowspan="6">7 days [13]</td></tr>
<tr><td>ESD and blowdown systems, F&G actions, and emergency alarms, platform abandonment or muster alarms (see note 2)</td><td>M3</td></tr>
<tr><td>Safety Related Interlock (BPCS and SIS) or Safety Related Controller (in LOPA)</td><td>P6</td><td rowspan="6">1</td></tr>
<tr><td>Safety Related Alarm (in LOPA)</td><td>P8</td></tr>
<tr><td>F&G detector or emergency shutdown stations (see note 3)</td><td>M6</td></tr>
<tr><td>Other highly managed alarms (CFA and MA) (see note 4)</td><td></td></tr>
<tr><td>Devices on plant out of service with a proven isolation (see note 5)</td><td></td><td rowspan="2">No maximum, Review every 90 days [14]</td></tr>
<tr><td>Other trip functions with no risk reduction or IL rating
(see note 6 for function testing within a shift)</td><td></td></tr>
</table>

Notes:

1. *A Level 2 SORA can be used in this case to manage the risk associated with losing one channel while testing only. If you have a fault or failure and wish to override the complete SIF to re-start or continue operations, then because this is an IL3 with a high level of risk reduction, implement an ORA rather than a SORA.*
2. *ESD – emergency shutdown – examples: platform abandonment, process shutdown, deluge activation*

   F&G actions: one or more inputs or outputs where the design function is compromised. Example: If the F&G system needs 6 out of 9 detectors active in a fire area to initiate an automated action, isolating more than 3 detectors would compromise the design and require a SORA
3. *A SORA level 2 is required if an emergency shutdown station is required to have more than one of its automated actions bypassed at the same time (e.g. shutdown and deluge)*
4. *CFA – Critical Fault Alarm. Examples include: UPS status, fire pump availability warning, refuge pressurisation alarms, SIF*

Type of protection function	Barrier Type	SORA level required	Maximum authorization
diagnostic alarm. *MA – Mitigation Alarm. Examples include: F&G detection, safety shower activation, collision detection.* 5. *Protection from the device is not required if the hazard it protects against is not present. for example where process equipment has been isolated and hydrocarbons removed, as a result SORA level and maximum duration are changed.* 6. *Other trip functions with no IL rating, designed to be function tested, which are overridden within a shift for testing, do not require a formal override record or a SORA.*			

b. The risk assessment is conducted using a SORA (Level 1 or 2) if the override is expected to be in place for less than the maximum duration defined in Table 20.

c. If the override is expected to be in place for longer than the maximum duration or is in place and exceeds the maximum duration manage the risk using an ORA instead of a SORA.

d. When assessing the risk of applying an override, use Table 20 to determine the level and timing of SORA (or ORA) required. If the override is to be applied by modifying SIS logic, an eMoC is required, in addition to the SORA, even if temporary. The override is recorded in eCoW.

For relevant scenarios, the LOPA is used to understand the risk reduction assigned to the LoP, and to identify controls in the SORA which could result in an equivalent or greater level of risk reduction.

An override applied using software in an Integrated Control & Safety System (ICSS) HMI such as Emerson, Honeywell and Yokogawa are considered an override. Forces are considered logic changes.

10.3.2 Authorising use of temporary overrides

a. Override records are specific to a single device being overridden with a specific SORA. Where multiple overrides are required, individual override certificates are created for each device.

For examples, see Figure 8.

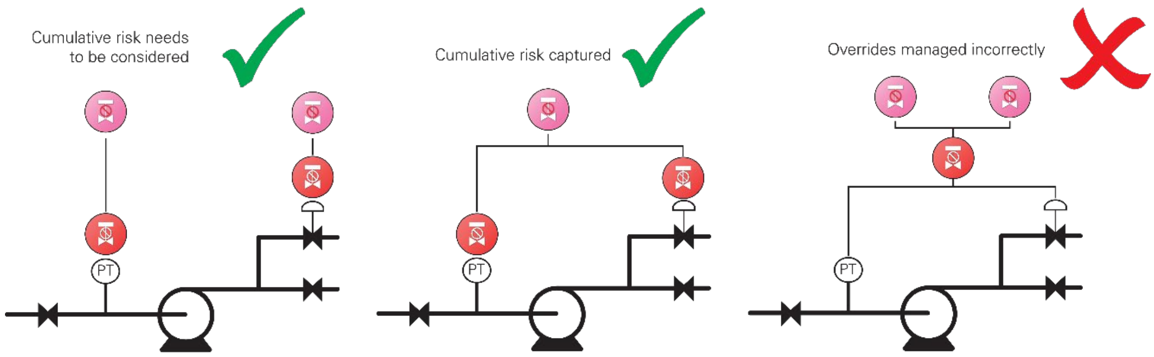


Figure 8 - SORA and Override Relationship Examples

b. Overrides are recorded in eCoW and authorised for the expected time that the override will be in place in line with Table 20.

c. The CRT may authorise the override record for up to one shift (Level 1 SORA).

d. The AA authorises all overrides with Level 2 SORAs, or Level 1 SORAs that are in place for longer than one shift.

e. Within the authorisation period, an override can be applied or removed as required. Record application and removal in eCoW.

f. If the override is required for an activity covered by a permit, IDP, or SOP, then link or attach these documents.

g. When the override needs to be in place beyond the maximum authorisation identified in Table 20, an ORA needs to replace the SORA and be attached to the override. In these circumstances, the requirement for an ORA cannot be replaced by the application of a new override.

h. Where there exists a regional requirement to notify regulatory advisors, the APM shall Verify that this has been completed within the required timeframe.

10.3.3 Applying a temporary override

a. The physical application and removal of the override is recorded within eCoW.

b. If the override is physically applied by anyone other than the CRT, they may record this using the counter signature in eCoW.

10.3.4 Reviewing temporary overrides

a. The CRT Verifies that any live overrides are recorded in the shift handover.

b. The SA reviews the status of overrides to re-evaluate the overall risks and identify any additional hazards that might be present due to a change in operational conditions or project activities. This is completed weekly using dashboards and recorded in the SA log.

c. The Site Engineer should lead an engineering review to identify overrides that are used frequently (that is, more than once a month) to help identify and resolve root causes (for example problematic sensors). This is typically completed every 90 days. These reviews are not recorded in eCoW.

10.4 Safety override risk assessment (SORA)

A safety override risk assessment (SORA) is a systematic risk management process that:

- evaluates the risks associated with applying an override
- evaluates the risk of unplanned activation of the device
- defines the controls to be in place while the override is applied to sufficiently control the residual risk and continue operating
- is not intended to duplicate the enduring risk already assessed in LOPA.

a. There are two types of SORA used in CoW:

   1. Level 1 for lower risk overrides (e.g. protective functions with no or low risk reduction credited in LOPA).

   2. Level 2 for higher risk overrides (e.g. ESD system override).

b. SORA templates should be prepared, Approved, and authorised by the site for expected activities such as planned maintenance or operational activities.

c. For unforeseen activities where a SORA does not exist and cannot be created due to time or resource limitations, create an ORA using the unplanned ORA timeline defined in section 11.7.

d. A SORA template can only be used to manage the overriding of more than one device if all the devices:

   1. perform the same function on the same piece of equipment

   2. have the same hazards and require the same controls.

e. If the SORA exceeds, or is predicted to exceed, the maximum durations stated in Table 20, replace it with an ORA.

   It is common for SORAs to be refreshed when HAZOP and LOPA are revalidated.

10.5 SORA team

a. The Level 1 SORA team is a minimum of 2 people, typically the AA and CRT.

b. The Level 2 SORA team shall include the following as a minimum:

   1. an experienced Engineer (Leader)

   2. AA or CRT or preferably both

   3. Discipline engineers with experience of the equipment or process being overridden (e.g. Process, Instrument and Control, or Electrical)

10.6 Approving a SORA template

a. The SORA is Approved according to the residual risk.

b. In addition to the normal considerations covered in section 8.2.3, the Approver shall consider the following questions before approving the SORA:

   1. What is the justification for not isolating or shutting down the equipment, plant, or facility?

   2. Has the risk assessment sufficiently addressed the risk associated with operating without the protective device?

   3. Has the risk assessment sufficiently addressed the risk of an unplanned activation of the device whilst it is being overridden (e.g. with effective controls)?

c. After the SORA has been Approved, the SA uses eCoW to authorise its use as a template. The SA may delegate this to the AA for Level 1 SORAs. The SORA template can be authorised for up to 3[6] years.

d. Follow the additional requirements of the entity risk management procedure when an override with a residual risk in the purple or blue area of the Group 8x8 matrix is identified.

   The facility Risk Champion, Risk Advisor, Risk Tag, or equivalent (e.g. process safety and risk superintendent) can provide guidance on your entity risk management procedure.

10.7 Using a SORA

All SORAs are created from authorised templates. When attaching a SORA to an override you can:

- select a SORA that is already live and attached to another override, or
- create a SORA by adding a SORA from a template.

a. Before using an authorised SORA template, the AA or delegate (SA, IA, or CRT), signs to Verify the following:

   1. Site conditions have not changed
   2. the controls still apply
   3. the SORA includes any known lessons learned
   4. the cumulative residual risk associated with other live CoW documents including SORA or ORA, has been considered. For example, other IPLs that are out of service on the same system.

11 Operational risk assessment

Operational risk assessment (ORA) is a systematic risk assessment process completed by a team and led by the SA or delegate to assess an abnormal operating condition.

The ORA determines:

- if it is safe to operate or continue operating with the abnormal operating condition, and
- the controls required to reduce the residual risk to an acceptable level for the continued operation.

An ORA records that the abnormal condition has been assessed and mitigated, and acts as a bridge until the abnormal condition is:

- resolved or fixed, or
- Authorised as part of a design change (MoC).

11.1 When an operational risk assessment is required

a. ORA are required for abnormal conditions listed in Table 21.

b. Operating control systems, automation systems, telecoms systems and SIS with faults or failures in fault-tolerant (for example, dual redundant) sub-systems and infrastructure. Examples of sub-systems and infrastructure are communications networks, power supplies and controllers.

> *Although, these systems can appear to have a degree of redundancy, there are often common cause failures that are not immediately obvious and that can give rise to operational or process safety risks.*

c. Regulatory devices covered by subsea Bureau of Safety and Environmental Enforcement (BSEE), API RP 14C, and United States Coast Guard (USCG) that need to be operated in an abnormal condition.

d. Where there exists a regional requirement to notify regulatory advisors, the ODM shall Verify that this has been completed within the required timeframe.

Table 21 - When an ORA is required

<table>
<tr><td rowspan="2">1</td><td colspan="3">Operating a plant, equipment or systems:
• without safety or protective functions (not covered by a live Approved safety override risk assessment (SORA)
• with any part of a safety critical element that fails to meet its designed performance standard
• that does not meet design, performance, integrity, or regulatory standards.
Examples include the following:</td></tr>
<tr><td>• Machinery over-speed.
• Blowdown and flare systems.
• Interlocks.
• Failed or passing wellhead master valves or well diverter or shutdown valves not meeting performance standard for closure time.
• Pressure relief devices.</td><td>• Navigational aids.
• Ballast systems.
• Mooring systems.
• Loss of data or communications ESD systems.
• Shutdown control systems.
• Defective containment system (hydrocarbon and non-hydrocarbon).</td><td>• Fire suppression systems including monitors, halon, and automatic sprinklers.
• Building pressurisation systems (HVAC).
• Emergency lighting.
• Emergency generation and UPS
• Passive fire protection.
• Fire water systems.
• Deluge systems.
• Lifeboats and life rafts.
• Emergency escape systems.</td></tr>
<tr><td>2</td><td colspan="3">Abnormal operation or deviations not covered by Approved SOPs that can create operational, safety and environmental risks.</td></tr>
<tr><td rowspan="2">3</td><td colspan="3">Changes to organisational capability that can compromise the safe operation of the facility. Examples include the following:</td></tr>
<tr><td>• Reduced emergency response capability.</td><td>• Minimum staffing.</td><td>• Shortage of key personnel or skill.</td></tr>
<tr><td rowspan="2">4</td><td colspan="3">Operating the plant and equipment with known integrity defects that affect the design boundaries, for example:</td></tr>
<tr><td>• Reduced pipe wall thickness</td><td>• Passing valves</td><td>•</td></tr>
<tr><td>5</td><td colspan="3">Overriding instrumented protection functions beyond the durations stated in Table 20</td></tr>
<tr><td>6</td><td colspan="3">Applying an isolation that causes an abnormal operating condition.</td></tr>
<tr><td>7</td><td colspan="3">Isolating all or part of an automation system that creates or has the potential to create an abnormal condition.</td></tr>
</table>

8	Operating the plant or equipment outside the safe operating envelope but inside the safe design envelope (refer to 500173 BP Practice Design and Operating Limits 5.3-0001 (GDP 5.3-0001)).
9	A deviation or failure to meet a performance standard, known as a FOP, and where operational personnel have to actively manage the deviation or fault.
10	Using a master key on an interlocked valve sequence or leaving an interlocked sequence in an abnormal position for an extended period of time (96 hours[18]).

11.2 When an operational risk assessment is not required

a. Examples of when an ORA is not required include the following:

1. abnormal conditions that only have potential to create commercial risks, except when required to replace a timed out or expired SORA
2. overdue or deferred maintenance
3. loss of redundancy of equipment
4. for a design change covered by an authorised MoC process
5. amending an Approved procedure
6. assessing whether to put redundant equipment into operation.

b. An ORA is not needed if a FOP that relates to historical performance shows that:

1. the associated functional technical assessment has been completed
2. this assessment concludes that no ongoing action to manage the identified issues is needed.

11.3 How to perform an operational risk assessment

The ORA identifies the difference in risk that results from continuing to operate with the identified fault or abnormal operating condition present compared to the risk present for the normal operating case.

The ORA is divided into four parts:

- the normal operating case (refer to, for example, operating design parameters and equipment performance standards)
- the abnormal condition
- the risk assessment
- plan to return to normal operations.

a. A competent team of at least three people with relevant skills and experience shall complete the ORA. The relevant skills and experience consist of:

1. leader (SA or delegate: for example, Well Site Leader (WSL) or PTL)
2. AA or Operations representative and
3. experts from relevant fields, such as an HSE&C Site advisor and engineer or engineers from a relevant discipline.

b. During the ORA, take account of any other live ORAs and SORAs that might affect the condition you are considering. Take account of any other site scheduled activities or faulty or weakened safety barriers as these could influence the risk assessment. Review relevant information (for example operational procedures, P&IDs, LOPA, HAZOP, MAR, organisational charts, and trip registers) and use quantified data where it is available to aid in assessing risk.

c. Identify controls using the hierarchy of controls.

11.4 How to record an operational risk assessment

a. Follow these steps to record an ORA:

1. Specify the location of the abnormal event.
2. Create a title (that is a short and clear description of the condition).
3. Describe the normal operating condition.
4. Describe the abnormal condition.
5. Explain and record why the equipment concerned is not being shut down or isolated.
6. Describe the history and any sequence of events that led to the abnormal condition arising. Document any relevant history associated with the site, plant, equipment, or device that the ORA affects.
7. Identify the normal operating risk using the 8x8 matrix. This is the risk associated with operating the equipment or system, assuming it operates according to the original design, with trips functioning correctly, alarms working, and procedures being adhered to.
8. Identify the original design intent of the equipment or system, including its original purpose and the hazards it is designed to manage. HAZOP and LOPA studies may help to determine this normal operating risk. In the absence of applicable information, the ORA team engages discipline engineers to provide technical input.
9. Identify the most credible worst-case event that the item is designed to protect against. Evaluate multiple failure scenarios, if applicable.
10. Describe why the normal operating risk level was selected.
11. The risk assessment team record in eCoW the name of team members and their role in the ORA process (for example AA or discipline engineer).
12. Perform the risk assessment. For the abnormal condition or conditions that are being risk assessed, identify what has failed or may fail, the impact (consequence) that this has and the hazards and risks it presents. The risk assessment includes a reference to the barrier that has failed or may fail.
13. Evaluate impact (consequence) and likelihood (probability) in the same manner as for the normal case. The impact is unlikely to have changed but the likelihood usually changes due to the failed barrier.
14. Use the 8x8 risk matrix to assess the initial risk for this case and record this for the abnormal condition.

b. Use a barrier model by doing the following:

1. Identify an initiating event for the scenario to occur.

2. Identify all other failures that need to occur at the same time for the stated scenario to happen (these are the barriers). Barriers include those that occur before and after the initiating event.
3. Evaluate the likelihood (probability) of the initiating event occurring and of each barrier failing. Ask the process safety or discipline engineer for information and use the experience and judgement of the risk assessment team members. Select a suitable overall likelihood score and provide the reason for selection.

c. Identify all potential controls that could reduce:
   1. the impact (consequence) on continuing operations
   2. the likelihood (probability) of the problem affecting continuing operations; for each identified control, state whether it will be implemented or not.
d. Choose the controls that will be used and assess the residual risk for each of these using the 8x8 risk matrix.
e. For each control being implemented, state how this will happen. For example, if a technician is expected to monitor a parameter and take action, then a procedure will have to be effectively implemented or monitoring will need to be managed using eCoW.
f. The overall risk is selected by eCoW using the highest residual risk for the selected controls.
g. Specify the date the abnormal condition was found.
h. Specify the expected date for the abnormal condition to be removed.
i. Record the team's recommendation and, if applicable, the plan to resolve or remove the identified fault. This is at a high level and simply states the activity or action required to allow the ORA to be removed. It does not need to contain details of project work or engineering work needed to do this, but it requires a reference number for the maintenance work order, IRIS event or MoC.
j. Attach link or reference any supporting materials used (for example P&IDs, HAZOP, LOPA, SRS, MAR/MAH, design case or safety case information, organisational charts, operational procedures).
k. Record any monitoring requirements with how often this needs to be done.
l. The team agrees the risk assessment by signing in eCoW.
m. The SA authorises the ORA for up to 90 days[16], at which point it becomes live and any monitoring requirements start.

11.5 Timeline to complete an operational risk assessment

The timeline to complete an ORA varies depending on:

- the complexity of the risk assessment
- the availability of people to complete the risk assessment process, and
- the level of approval needed for the ORA.

11.6 Planned operational risk assessment timeline

a. If a planned activity or isolation is going to create an abnormal operation, then complete an ORA before the task is Verified at the two-week gate.

b. The ORA is authorised by the SA to meet the schedule date of the activity or isolation.

11.7 Unplanned operational risk assessment timeline

a. In cases of an immediate threat to process safety, integrity or production, the SA may decide to continue operating under abnormal conditions without first fully documenting the ORA process based on an initial risk analysis. Examples of this would be using existing controls or adding controls to mitigate or eliminate the initial risk. If the SA decides to continue operating under abnormal conditions, do the following:

   1. The SA gives an initial approval based on information and expertise available at the time. This approval is recorded on a draft ORA within eCoW along with a clear rationale for the decision.

   2. The SA discusses the preliminary ORA with the APM as soon as reasonably practicable and gains approval.

   3. The ORA is fully documented, including all applicable data, as soon as reasonably practicable, but no later than 72 hours[17] after the initial approval. The documented ORA will include input from relevant Subject Matter Experts (SMEs).

b. If during the process, purple or blue C+ initial risks are identified, the SA, in combination with the APM or relevant entity manager, will decide whether to continue to operate while the risk assessment is being completed, or to shut down and isolate.

c. The SA immediately discusses any potential initial approval and reason for not shutting down with the site team. This can be recorded on the first page of a draft ORA within eCoW. The SA then adds a countersignature to this draft as confirmation of initial approval.

This draft forms the basis of the full ORA once completed.

11.8 Approving an operational risk assessment

The level of approval required for an ORA is based on residual risk, in line with the HITRA approval table.

a. When approving the ORA, the Approver shall Verify if:

   1. operating condition complies with regulatory requirements

   2. the validity period to operate in an abnormal situation is suitable based on the risk assessment, and

   3. the remedial plan to resolve the root cause of the abnormal operating condition is suitable.

b. After the ORA has been Approved, the SA authorises its use.

c. Approval of ORAs for purple and blue C+ risks (risk matrix areas IV or V) can take some time, as they require review and input from various personnel. Pending approval of these high-risk ORAs, the SA can issue the ORA, providing this has been Approved by the relevant APM. In this instance, approval consists of an electronic countersignature in eCoW or email from the APM.

d. This is a pragmatic solution to help complete the ORA approval process and shall not be used to shortcut or delay the approval process.

e. Follow the additional requirements of the entity risk management procedure when an abnormal operating condition with a residual risk in the purple or blue area of the group 8x8 matrix is identified.

The facility Risk Champion, Risk Advisor, Risk Tag, or equivalent can provide guidance on your Entity Risk Management Procedure.

11.9 Monitoring operational risk assessments

a. All ORAs are listed in eCoW. The software helps the AA track all actions associated with each ORA, including actions:

   1. required to support close-out or resolve the original fault condition
   2. identified as a result of verification, and
   3. to Verify controls are in place and effective.

b. Confirm in eCoW any monitoring requirements that are agreed in the risk assessment which:

   1. remind the user when to monitor
   2. record completion of the monitoring using an electronic signature.

c. The SA shall review active ORAs weekly:

   1. consider the cumulative risk of all active ORAs
   2. Verify that monitoring is being delivered as planned
   3. Verify plans are in place and progressing to correct the root causes
   4. document any deviations in validity or scope, or changes to the controls identified in an ORA.

d. The APM re-authorises all ORAs for continued use every 90 days[16]. When the 90-day authorisation occurs, the APM shall:

   1. consider the cumulative risk of all live ORAs and SORAs and the status of the remedial plan to correct the root cause of an abnormal operating condition
   2. consult the Facility Support Squad Leader as part of the 90-day review to gain the wider context of cumulative risk that may exist due to inspection, maintenance or MoC status
   3. review the monitoring records and any completed self-verification checks to Verify that the controls agreed in the risk assessment are being delivered and are effective.

See the overview graphics in eCoW for all ongoing activity.

11.10 Using existing operational risk assessments

a. The eCoW system contains Approved ORAs for similar abnormal operating conditions. This allows ORA teams to copy these or modify them provided they have been reviewed and risk assessed. Risk assessment teams shall:

   1. Verify the conditions are the same and defined controls still apply
   2. review any previous lessons learned
   3. require the necessary re-approval based on the residual risk level and re-authorisation by the SA.

12 Hot work

Hot work (HW) is a task or activity that involves using or creating an open flame, spark or energy discharge that could ignite a fire or explosion, or both.

a. bp policy is to avoid hot work in hazardous areas and on or near live equipment wherever reasonably practicable. It is the role of engineers and planners to plan the work to minimise the need for hot work and provide effective alternatives during the design and planning phase.

b. A hot work permit is needed for work involving any open flame or spark potential devices.

12.1 Hot work spark potential

a. Hot work spark potential (HWSP) is a task or the temporary use of equipment that has the potential to generate sufficient heat or sparks to ignite flammable materials or atmospheres.

b. A HWSP permit is used to manage the hazards and controls associated with a task of this type in any area. Hazardous and non-hazardous locations require this permit to sufficiently control potential hazards from SIMOPS or other flammable materials in these areas.

c. The risk assessment will decide if atmospheric monitoring is required and define type and frequency. bp recommends that continuous atmospheric monitoring in the form of fixed or personal monitors be used for the duration of the task in hazardous locations.

Continuous monitoring is recommended based on historic incidents in which flammable material entered the work area.

12.2 Hot work open flame

a. Before agreeing to allow hot work open flame (HWOF) work in a hazardous area or within 11m (35ft)[2] of any live equipment, the SA and AA shall follow the hierarchy of controls to Verify that HWOF is the only way the work can reasonably be done.

b. When they have considered all the alternatives and conclude that HWOF work is still needed, the SA Verifies the following:

1. Hazardous area - Level 2 TRA is completed (or level 2 template used) and at least one primary control is mandatory with the APM as minimum approval. If one of these five primary controls has not been applied, then the VP Operations or VP Wells is the minimum approval level.

2. Non-hazardous area, but within 11m (35ft)[2] of live equipment, the Level 2 TRA shall consider flammable materials within the 11m (35ft)[2] and use appropriate controls. This may include a primary control. The APM is the minimum TRA approval level.

3. Non-hazardous area – minimum Level 1 TRA with approval based on residual risk.

12.3 Primary controls

a. Schedule the task during a planned shutdown or during TARs when the site has been depressurised, isolated, and is free from:

1. hydrocarbons
2. flammable and toxic materials or atmospheres, or both.

This is a HITRA elimination control measure.

b. Remove the equipment that requires HWOF tasks to a location outside the hazardous area.

This is a HITRA elimination control measure.

c. Perform the task in a pressurised, designated workshop on the site that has been specifically designed for hot work, with standalone gas detection and shutdown systems.

This is a HITRA engineering control measure.

d. Use alternative cold work engineering solutions.

This is a HITRA elimination, substitution or engineering control measure.

e. Use a pressurised habitat conformant with section 13.3.

This is a HITRA isolation control measure.

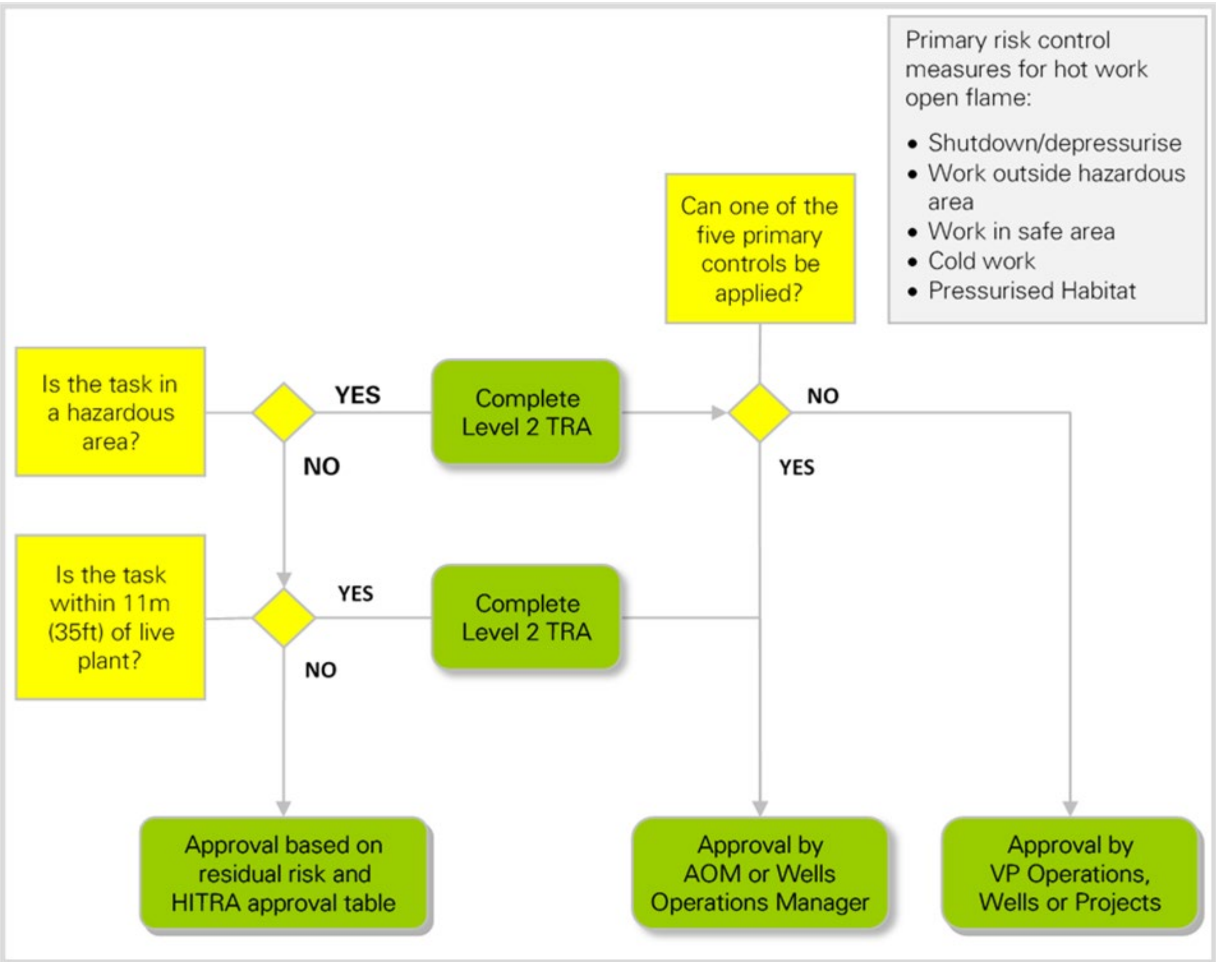


Figure 9 - Hot work open flame (HWOF) TRA approval flowchart

12.4 Preparing for hot work open flame

a. Apply the following requirements:

1. Alternatives to avoid hot work are considered and documented in the TRA.
2. Equipment is positively isolated, depressurised, and Verified as hydrocarbon-free after cleaning, purging, or flushing, as applicable.
3. The TRA covers the following points as a minimum:
    a) SIMOPS
    b) Isolation and de-isolation requirements
    c) Process hazards and plant stability
    d) Stored energy from associated process systems.
4. Potential fuel sources or combustible materials have been:
    a) identified
    b) isolated
    c) removed from the immediate worksite.
5. Continuous gas monitoring for LEL, is required for all HWOF activities.
6. The TRA and permit to work identify ERRPs, emergency response personnel, and equipment specific to the HWOF task.
7. The number of personnel involved in the task is minimised.
8. The length of exposure time is reduced by planning the task effectively and efficiently.
9. When welding the TRA shall Verify:
    a) exposure to any welding fume released is adequately controlled using engineering controls (typically Local Exhaust Ventilation (LEV))
    b) suitable controls are provided for all welding activities, irrelevant of duration or location
    c) where engineering controls alone cannot control exposure, then suitable RPE will be used to control risk from any residual fume.

For more information, see external regulator guidance (e.g. LEV guidance HSG258)

RPE guidance HSG53, IARC monographs on evaluation of carcinogenic risks to humans. Volume 118.

12.5 Executing hot work open flame

a. Before executing HWOF, do the following:

1. Consider SIMOPS and stop any conflicting tasks (for example BC).
2. Verify all other areas that the HW can affect (for example a work area immediately below) are cleaned and free from combustible materials, open drains or seal pots are plugged or filled with water or covered with a fire blanket.
3. For drainage gullies that are impractical to fully cover, test for the presence of flammable gases and vapours before a HWOF permit is issued.

4. Do an initial gas test in the area where the work is to be done before issuing the permit. Test again immediately before starting work to Verify the LEL is below 1%[18].
5. Monitor atmosphere continuously throughout the hot work task.
6. For gas cylinders:
    a) Place them remotely from the worksite and Verify they are fitted with certified flash back arrestors and isolating valves, complete with pressure gauge.
    b) When they are not being used, isolate them and depressurise hoses.
    c) Obtain agreement from the fire team or ERT on where to site them.
    d) Segregate hoses and inspect for leaks before and after they are used.
7. Inspect welding equipment and leads before they are used.
8. Identify potential sources of releases and leak points close to the HW location (for example valves, flanges, vents, drains). In checking local flanges, consider if you need to remove lagging boxes to do a gas test.
9. Consider using flame-retardant barriers around and under the HW location to contain any sparks that the work generates.
10. Make sure everyone involved is familiar with the emergency response plan.
11. Check that atmospheric monitoring and fire extinguishing equipment is available.
12. The PA to Verify a fire watcher is present to monitor hot work whilst work is ongoing and for 30[19] minutes after work is completed.
13. Provide safe access and egress to enable people to escape from the location quickly and safely if conditions suddenly change.
14. Make the fire team aware of the location of any pressurised cylinders used in HW tasks.
15. Tell relevant people (e.g. control room, ER team) when HWOF is starting.

12.5.1 Fire watcher at hot work open flame

a. A fire watcher shall be present during the execution of HWOF activities and stop hot work operations if unsafe conditions develop.

b. The fire watcher shall do the following:
    1. Raise the alarm if there is a fire, incident or hydrocarbon release.
    2. Monitor the worksite to Verify that safe conditions are being maintained during hot work operations.
    3. Read, understand and adhere to the TRA and permit requirements.
    4. Agree with the AA and PA how to communicate the start of an HWOF task, during breaks and when the task is completed.
    5. Demonstrate understanding of their emergency duties including atmospheric monitor alarm activation points, and the action to take if the alarm activates.

c. The fire watcher shall Verify the following:
    1. Suitable firefighting equipment is available, certified and ready to use.

2. Flammable materials have been cleared away from the worksite.
3. Drains remain covered and sealed while the task is being carried out.
4. Sparks and weld spatter are contained within the habitat.
5. They know where the following are:
    a) the nearest manual alarm call point
    b) the emergency shutdown button
    c) the emergency shutdown for portable engine-driven equipment such as generators and compressors.
6. Continuous gas monitoring is completed as defined in the permit.

12.6 For pressurised habitats

a. The AA completes an inspection of the habitat and all auxiliary equipment every shift before work starts to confirm they meet requirements.

b. The AGT1 or 2 performs gas detection and Verifies it is below 1% LEL[18] at the suction hose entry point, and then any AGT monitors for gas continuously.

c. If the habitat is in use for an extended time, the AA determines the periodic inspection requirements during the risk assessment, typically weekly and records completed inspections on the permit.

d. The AA Verifies the positive pressure habitat air supply inlet is located as close as possible to or within a non-hazardous area.

12.7 Executing hot work open flame in designated pressurised buildings

a. Where specifically designed pressurised workshops or modules are used for HWOF tasks, the AA Verifies the following as part of the permit control:
    1. The workshop or module pressurisation is maintaining the design positive pressure.
    2. The gas detection and shutdown system is operating as designed.
    3. Module penetration seals are in place.
    4. It is a designated non-hazardous area and recorded as such on the hazardous area drawing.
    5. The level of risk assessment used will depend on the task being carried out.
    6. The ventilation is adequate for the task being executed.

13 Temporary habitats

A habitat is a temporary construction used to protect people, a worksite, or both, from weather and interference from surrounding processes or tasks. Temporary habitats are made from scaffold framing and lightweight fabric walls and lightweight fabric roof or similar materials.

a. Avoid breaking containment within any habitat where reasonably practicable.

b. If BC cannot be avoided, then specifically identify the hazards and controls in the task risk assessment.

c. Avoid flanges or valves or other potential areas of hydrocarbon release on live equipment within any habitat where reasonably practicable.

d. If flanges or valves or other potential areas of hydrocarbon release are contained within a habitat, then identify specific hazards and controls in the TRA.

e. Do not require their own permit but are included in the permit for the task.

f. Habitats used for hot work should be made from flame retardant materials.

There are three types of temporary habitats, which the following three sections detail.

13.1 Type 1 – Weather protection habitat

a. This is a sheeted structure (usually scaffolding). It has a significant opening or openings to provide full and free airflow (usually with one open side) and has the following characteristics:

   1. protects people and equipment from the weather
   2. can be used to store equipment
   3. can be in any area but shall not enclose any equipment, flanges or valves
   4. cold work or HWSP may be done under a permit.

b. May be tracked for SIMOPS in eCoW.

13.2 Type 2 – Containment habitat

This enclosed habitat provides containment of the working area preventing the escape of sparks and protection from surrounding plant conditions and weather. Containment habitats:

a. shall be ventilated with a minimum of 20[20] air changes per hour either by natural ventilation or mechanically assisted with air movers for general ventilation purposes.

b. may be used for cold work or HWSP activities in a hazardous area and for HWOF in non-hazardous areas.

c. may be used in hazardous area for HWOF during TAR if the plant or site is shut down, depressurised and drained or vented (may not be proven hydrocarbon free). This is the only exception to the requirement for a type 3 habitat in sections 12.2 and 12.3.

d. may be tracked for SIMOPS in eCoW.

13.3 Type 3 – Positive pressure habitat

The controlled overpressure within the habitat provides a barrier preventing the ingress of hydrocarbons or other hazardous gases during hot work operations.

a. Type 3 habitats are for HWOF activities in a hazardous area.

b. They are tracked in eCoW.

13.4 Designing and building habitats

a. Follow the requirements marked with a '✓' in Table 22 when designing and building a habitat.

Table 22 - Design and build requirements for habitats

	Design and build requirements for habitats	Habitat type		
		1	2	3
1	Pressurised habitat certificate is required.			✓
2	There are adequate openings or natural ventilation to avoid the possible build-up of dangerous gases. Consider if the prevailing wind direction can maintain a good airflow.	✓	✓	
3	Exits are marked clearly outside and inside the habitat, capable of being opened from either inside or outside and open to a safe area.	✓	✓	✓
4	AA checks the Internal lighting levels are suitable to perform the task safely.	✓	✓	✓
5	Consider use of local exhaust ventilation where hazardous substances will be used or generated inside the habitat to control exposures below the occupational exposure limit (OEL) (e.g. welding, cutting, chemical application). Required performance of general or local exhaust ventilation is determined based on the nature of the contaminant to be diluted, or removed at the point of generation, and the environment into which the contaminant will be exhausted. Consult Industrial Hygienist for technical requirements.		✓	✓
6	Air movers are sealed into the structure of the habitat and there is no opportunity for short circuiting air movement.		✓	✓
7	The habitat can be kept at suitable internal temperature for people working inside it taking account of both internal and external thermal loading it (e.g. climate control is considered).		✓	✓
8	The type, location, and number of detectors are selected to cover detection in the inlet duct, within and around the habitat.		✓	✓
9	Decide if the proposed habitat is a CSE as defined by section 15.		✓	✓
10	Where reasonably practicable doors have windows or means of seeing access route.		✓	✓
11	The exhaust vent is located away from the inlet to provide adequate air circulation.		✓	✓
12	Auxiliary equipment is certified for use in the hazardous area.		✓	✓
13	Constructed from fire retardant materials to prevent hot materials escaping the habitat.		✓	
14	The habitat material, including the floors, sides, and roof, is non-combustible and prevents hot materials getting out from the habitat.			✓
15	If the distance between the habitat walls and hot work is less than 1.5m (5ft)[21], protect the habitat wall with fire blankets.		✓	✓
16	A local gas detector monitors the air supply from a safe zone.			✓
17	Gas detection within the inlet duct is located in a section of the duct that is positively pressurised and triggers closure of the duct and prevents any hydrocarbons from entering the habitat.			✓

	Design and build requirements for habitats	Habitat type		
		1	2	3
18	The habitat is pressurised with circulating air from a safe zone away from harmful fumes, taking into account the wind direction and release sources. Air for the inlet duct is from at least 5m inside a safe zone.			✓
19	Designed to maintain a positive pressure. This is between 25-50 Pa or 0.1-0.2[22]in water gauge. Manometer installed at entrance outside the habitat and a pressure alarm that is set to provide an audible signal at 25Pa or 0.1 in water gauge (it needs a time delay, typically 10 seconds, to avoid spurious alarms when access doors are used).			✓
20	If access or walkways are obstructed, suitable barriers and warning signs are erected.	✓	✓	✓
21	If the completed habitat is going to be CSE, and the habitat cannot be completed from the outside: • the permit to build the habitat shall be specific about when work stops, and • a CSE permit is required to complete construction.		✓	✓
22	Any flammable materials are removed from around and under the habitat before work starts.		✓	✓
23	Protect inlet and outlet ducts and make sure they aren't blocked.		✓	✓
24	Habitats are designed and erected by specialist habitat suppliers or trained competent people.			✓
25	A competent person inspects the habitat and its auxiliary equipment to Verify that it is fully operational and meets requirements and any applicable country regulatory requirements.			✓
26	Verify the following: • Gas detection starts an audible and visual alarm. • The pressurisation air pump is only isolated on gas detection in the inlet duct. • All non-hazardous area rated equipment within the pressurised habitat, as well as services and supplies to the habitat, are isolated.			✓
27	The AA completes the habitat certificate to confirm the habitat choice and suitability and identify potential hazards.			✓

13.5 Using habitats

a. Follow the requirements marked with a '✓' in Table 23 when using habitats.

Table 23 - Requirements when using a habitat

	Requirements when using a habitat TRA - where this is a control in risk assessment	Habitat type		
		1	2	3
1	Track the habitat in eCoW using the SIMOPS feature – include its unique number on the permit.			✓
2	Atmospheric testing is performed before anyone enters the habitat.		✓	✓
3	An ERRP is in place.		✓	✓
4	The risk assessment determines the maximum number of people allowed in the habitat for emergency response purposes.		✓	✓
5	The habitat is maintained, along with any auxiliary equipment, and a competent person inspects it weekly for as long as it is in place.		TRA	✓
6	Verify the effectiveness of any general and local exhaust ventilation before the task starts and periodically during the task. Consult Industrial Hygienist for technical requirements.		✓	✓
7	Monitor the concentration of hazardous substances inside the habitat to assess personal exposures. Consult Industrial Hygienist to establish acceptable limits.		✓	✓
8	CSE certification and controls, including gas test, are in place before entry.		CSE only	
9	The entry attendant is able to communicate with those inside the habitat and be outside the habitat whenever it is occupied.		TRA	✓
10	The entry attendant monitors the positive pressure using a slanting pipe fluid manometer and a pressure alarm that is set to provide an audible signal at 25Pa[23] when fitted.			✓
11	There are at least two people in the habitat, with one as fire watcher.		✓	✓
12	There are no gas cylinders inside the habitat.		✓	✓
13	Remove all hoses and torches from the habitat during breaks and on task completion.		✓	✓
14	Monitor inlet and outlet ducts and make sure they are not blocked; consider using guards.		TRA	✓
15	Put signs on both ends of the ducts with 'For Habitat Use – Do Not Remove'.		TRA	✓
16	Have a foam extinguisher inside and dry powder extinguisher outside the habitat. CO_2 and dry powder extinguishers can be asphyxiants inside habitats and shall only be used if specifically covered in the risk assessment.		✓	✓
17	A pressure-set firewater hose with spraying nozzle is laid out from the nearest hydrant and the fire watcher is able to easily operate the hose from outside the habitat. If firewater is not available or cannot be used due to ambient conditions, the risk assessment shall specify a suitable fire response plan and equipment.		✓	✓

14 Isolation management

By conforming to this isolation management process, equipment and plant will be safely and reliably isolated, de-isolated, reinstated and restarted.

The intent is always to reduce risk to as low as reasonably practicable (ALARP). The risk is a combination of the activities to isolate, deisolate and reinstate as well as the duration in place and the risk inherent with the design. Isolations are designed to the highest isolation standard, considering overall risk and cost. This means in many cases the isolation is to a standard above the minimum set in Table 26 & Table 29. For example, where the table specifies a single valve isolation but there is a double block and bleed which can be easily used then to meet the intent of ALARP, use the DBB.

Where the standards in Table 26 & Table 29 cannot be met this is managed as a non-conformant isolation.

The isolation process consists of the following key activities:

- Reviewing the task to be carried out under isolation so that the isolation design envelope is suitable for the full scope of the task.
- Designing and risk assessing the isolation and de-isolation to the highest reasonably practicable standard and in conformance with this CoW Procedure.
- Preparing for the isolation, which can include depressurising, de-energising and releasing stored energy, draining, venting, purging, and washing out.
- Reviewing the impact of any nearby work or operations on shared systems.
- Isolating equipment and plant, which can include providing suitable access and egress.
- Proving isolation integrity – zero energy and proving dead.
- Including contingency plans.
- Monitoring isolation integrity during task execution.
- Partially de-isolating to facilitate testing (STT).
- Leak testing.
- Verification of QC Certification.
- Pre-startup certificate (see section 20).
- Full de-isolation.
- Reinstatement.

The isolation and de-isolation plan (IDP) is the foundation for safely and efficiently managing isolations and de-isolations. The IDP is effectively a combined isolation and de-isolation list, procedure and risk assessment.

a. Manage and risk assess isolations using an IDP as an integrated document covering isolation and de-isolation points, actions to implement and the risk assessment.

b. Occasionally, when it is not reasonably practicable to use an IDP as an integrated document (for example the effort involved in copying an existing large isolation procedure is significant), it is possible to use two documents, as follows:

   1. an IDP to record isolation points

2. risk assessment and implementation actions recorded in a procedure explaining how to execute the isolation. Where this option is chosen, the procedure shall be attached to the IDP. Approval of the IDP or procedure means that the content has been risk assessed to the equivalent of a Level 1 risk assessment.

c. As a minimum, a Level 2 risk assessment is required and attached to the IDP when:

3. the overall residual risk is in Area II or above, or

4. the isolation is non conformant, or

5. a long term isolation cannot be positively isolated.

d. IDPs, or SOPs where used, shall include plant preparation and all the steps needed to execute the isolations and de-isolations in the correct sequence. Examples include removing blanks or caps ≤ 50mm (≤ 2in) for gas testing, venting, draining, or fitting hoses needed to implement the isolation.

e. Develop an IDP for all full isolations. They are stored in eCoW and can be reused provided the AA has Verified and Approved them. The AA may delegate verification to an IsA if the isolation involves a single discipline and is simple in nature.

14.1 Isolating authorities

a. There are five types of isolating authorities (IsAs) as follows:

Table 24 - Isolating authorities

	Extent of authority level			
Isolating authority types	Process isolations	Low voltage equipment for non-electrical work*	Low voltage equipment for electrical work*	High voltage equipment*
Process	✓	✗	✗	✗
Instrument	✓***	✓**	✓**	✗
Electrical LV1 (See section 14.1.1)	✗	✓	✗	✗
Electrical LV2	✗	✓	✓	✗
Electrical HV	✗	✓	✓	✓

* Defined in section 14.18 and Table 29
** Limited to control and instrument systems up to 240 V ac or 120 V dc[24].
*** 19mm ($^3/_4$in) max pipe, tubing and valve size and <50 barg if the task involves breaking containment.
*** Pneumatic and hydraulic supply and return lines to instruments or actuators (excludes scope with accumulators, PSVs, pumps etc).

b. Where IsAs are not assessed as technically competent on all equipment in their respective isolating authority type, the extent of authority shall be managed by a local process and documented in the LIP.

c. IsAs are responsible for the following:

1. Designing IDPs in their specific discipline to meet the requirements of this CoW Procedure. When required, IsAs may consult with others such as discipline engineers to help with isolation design.

2. Implementing isolations in accordance with the IDP.
3. Demonstrating isolation integrity to the PA before work begins (e.g. spades in place, valves closed, bleeds effective or proving electrical equipment is dead at point of work).
4. Demonstrating zero energy immediately before breaking containment.
5. Monitoring the integrity of isolations throughout their life cycle.
6. De-isolating in accordance with the IDP.

d. Isolation and de-isolation may also be conducted by a discipline Isolator. However, if an Isolator performs these actions a discipline specific IsA cross-checks.

14.1.1 IsA Electrical LV1

The IsA Electrical LV1 is intended to improve efficiency of simple, low voltage electrical isolations.

a. These isolations are:

1. for non-electrical work only where the IsA Electrical LV1 is also the PA
2. limited to points that do not require access to the internals of any equipment or the use of tools.

14.2 Designing the isolation and de-isolation plan

a. The IsA shall consider the following when designing an IDP:

1. A site visit to provide accurate understanding of the task, worksite and process hazards associated with an isolation as well as confirming the isolation can be applied in field as per design.
2. Selecting the highest reasonably practicable isolation standard. In making this choice, consider if implementing the higher standard results in greater overall residual risk.

   For example, additional risk from gaining access, increased workload, lifting, breaking containment.

3. The order of implementing the isolation and de-isolation of points.

   For example, isolation of pressure safety valves (PSV) downstream block valve is the last point isolated and is the first to be de-isolated.

4. High Pressure/Low Pressure (HP/LP) interfaces and how to manage the risks associated with them.
5. Proving dead or zero energy.
6. Breaking containment on small bore pipework.
7. People’s access and egress needs while implementing isolations.

   Monitoring points are accessible whilst the isolation is being implemented and in place.

8. Whether a site will be unmanned with isolations in place.
9. Selecting isolations as close as reasonably practicable to a vessel or worksite, to maximise integrity and make it easier to monitor the work.
10. When the risk assessment determines that executing the isolation close to the vessel or worksite introduces a greater risk, then design the isolation with the

isolation points further away from the worksite. Document this as a hazard with mitigating control in the TRA. Examples would be because of access, lifting over live equipment or the method of isolation.

11. The risk of the activities to isolate, deisolate and reinstate as well as the duration in place and the risk inherent with the design.
12. Draining, flushing, purging, or venting equipment, and the potential for reverse flow into other systems.
13. Specific requirements for vents and nozzles associated with CSE.
14. The ability to prove isolation integrity prior to removing a positive isolation.
15. Requirements for LV or HV electrical isolation and de-isolation.
16. Any changes to the equipment to enable the isolation or de-isolation.
17. A contingency plan in the event of any isolation failure.
18. Functional testing requirements and the need for sanction to test.
19. Leak testing and reinstatement.
20. Line-walking.
21. QC Certification requirements including system handover.
22. Pre-start requirements (see section 20 and C.9 pre-start certificate).
23. If the isolation would create the need for an ORA or an override.
24. Isolations on small bore piping can carry the equivalent hazards of larger pipework. When designing isolations for breaking containment on small bore piping and tubing, assess the hazards associated with the type of fluid and pressure. In particular, assess the potential consequences from the released volume if the isolation fails.

b. Use the IDP considerations and prompts in Table 25 to help with the design.

14.2.1 Approving an IDP

a. The AA shall consider the following when they are approving the IDP:

1. Has the isolation been designed to the highest isolation standard so far as is reasonably practicable?
2. When the IDP contains a non-conformant isolation, Verify the non-conformant risk assessment team included an appropriate mix of people with relevant competencies, including technical authorities or specialists where needed.
3. Verify the IDP is suitable for the task identified in any linked permits and can deliver any controls or requirements identified in the permit TRA and, if applicable, the non-conformant, isolation risk assessment.
4. Verify the IDP does not create an abnormal condition, or where it does, a suitable (e.g. scope and duration), Approved ORA is attached.
5. Has the IDP applied the hierarchy of controls? see section 9.3.
6. Have monitoring requirements been clearly specified?
7. Where cross-checking has been de-selected, is it conformant with section 14.6?
8. Can the isolation be conducted safely with the identified controls?

9. Are the identified controls suitable for the scope?
10. If the residual risk is Area II or above, has an L2 RA been completed?
11. Where an L2 RA has been completed, have the specific controls related to the IDP application been included in the IDP?
12. Have suitable and sufficient re-instatement activities been included as part of the de-isolation plan?
13. Will the de-isolation plan safely return equipment to service?
14. Have contingency and emergency response and rescue plans been considered?

Table 25 – IDP design considerations and prompts

IDP design considerations and prompts	
Process conditions • Pressure and temperature stability. • Gas and, or liquid ratio. • Flashing fluid. • Toxics (e.g. hydrocarbons, H_2S).	**Isolation location** • Access and, or egress. • Number of persons at risk. • Size of pipework. • Potential leak volume.
Isolation integrity • Potential dead-legs. • Potential for enhanced corrosion.	**Checks whilst performing isolation** • Likelihood of significant vibration. • Valve position indicators – are they accurate and easy to read? • Pipework support adequate.
Equipment and process • Types of valves available. • Can valve integrity be tested? • False result from valve integrity test. • Likelihood of blockages (e.g. wax, debris, fluid solidifying). • Valves or obstructions (e.g. NRV, control valve, strainer) between the isolation valve and the vent or drain valves. • Any history of leakage (e.g. passing valve lists or lessons learned records). • Can pressure be locked-in? • Likelihood of reverse flow. • Possible migration from other systems.	**Equipment** • Blockage of vents, drains or both. • Over pressurisation or overfilling. • Hydrostatic load on pipe work and vessels. • Vacuum effects within vessels or equipment during draining. • Design capacity of any flaring, venting, or draining systems. • Gaskets containing asbestos. • Working on threaded connections such as threaded plugs whilst equipment is pressurised. • Bleed and drain hose implications (e.g. HP/LP interface, overfill of sumps or liquids to the flare system). • Electrical trace heating and process impact.
Process • Volatile vapours released from a liquid. • Formation of an explosive atmosphere. • Disposal of fluids, (e.g. contaminated water). • Valve freezing or embrittlement effects on steel pipe work due to auto-refrigeration. • Incompatible chemicals (e.g. acid and water). • Chemical reactions between cleaning materials and a tank or its fittings (e.g. acidic cleaning fluid attacking a blanking spade installed for isolation).	**Process** • Pyrophoric scale in systems that contain H_2S. • Explosions and fires caused by the sudden mixing of water with hot oil. • Static electricity as an ignition source or cause of electric shock during steam cleaning or high-pressure water jetting if equipment is not earth bonded. • Possible asphyxiation through personnel exposure to nitrogen or other asphyxiates.

IDP design considerations and prompts	
	• Accidental spillage and freezing effects of liquid nitrogen. • Temporary connection of equipment or services for return to service (e.g.N_2 bottles, quads or bulk systems).

14.3 Documenting the isolation and de-isolation plan

a. The IsA shall document the following when developing the IDP:

1. All points of isolation and de-isolation including the associated methods.
2. Hazards and controls.
3. Action steps for prove dead or zero energy checks, or confirmation of actions (e.g. a spare PSV is lined-up, or export operations are not planned for the duration).
4. Action steps are used:
    a) to identify where a permit is required for intervention activities such as removing blinds to fit tapped flanges and hoses for draining or flushing activities
    b) to cover removal/fitting hoses, blanks, blinds, caps, plugs and similar items where the person executing the isolation is competent and local contracts allow these activities
    c) for operational verification steps such as confirming a spare PSV is lined-up before starting to isolate, or export operations are not planned for the duration of the isolation.
5. Contingency plan (see section 14.4).
6. Actions to Verify isolation integrity such as PBU monitoring or inspection.
7. Tests required to confirm the integrity of the equipment before re-energising or introducing process or utility fluids.
8. All items that are moved from normal operational positions for example:
    a) the addition or removal of pressure gauges, bleeds, drains, hoses
    b) removal of caps, plugs or blanks
    c) alarm and trip overrides
    d) software defeats, keys and maintenance overrides
    e) operational steps such as venting, draining, depressurisation and flushing
    f) testing or sampling for hazards
    g) locking valves or placing control of safety valves in manual
    h) removing restriction orifices
    i) installing or removing temporary spools, and
    j) high voltage bus bar or circuit earths/grounds.
9. Isolation drawings (PIDs, electrical line diagrams or loop drawings), sketches or photographs providing enough detail to accurately and clearly show how the system is going to be isolated.

b. The AA Verifies the accuracy of isolation documents used.

c. If an isolation point in the IDP cannot be isolated or an action cannot be implemented, then it is recorded in the IDP by the IsA, with a comment to explain the reason.

The IDP process meets the requirements of OSHA 1910.147 Control of hazardous energy (lockout/tagout).

14.4 Contingency plans

a. In the event of isolation failure once the isolation is in place, the contingency plan addresses the following:

1. the location of the applicable ESD facilities
2. the location of additional valves and the expected specific actions to be taken by, for example IsA or CRT, and which operating procedures to follow.
3. spill containment
4. how to respond to a loss of primary containment.

b. When creating a contingency plan, consider credible failures that are impacted by such things as how long the isolation will be in place, process stability, volume of material involved, volume of material before next possible isolation, temperature and pressure, location of other equipment and hazards.

14.5 Conformant and non-conformant isolations

a. The non-conformant process shall only be used where specifically stated.

b. Complete a Level 2 risk assessments for all non-conformant isolations, irrespective of when they are identified. Approval is based on residual risk.

The primary intent is to determine the additional hazards and the additional controls required when relying upon a potentially less secure and less reliable method of isolation than the CoW isolation standards in Table 26 and Table 29.

c. The SA is responsible for managing the non-conformant isolations using the dashboards and to decide if engineering solutions are needed to correct repetitive non-conformant isolations.

14.6 Cross-checking isolations

a. To reduce the risk of human error, all full (non-personal) isolations and de-isolations (including STT) should be cross-checked by a different person.

b. An AA, IsA or Isolator can cross-check. However, if an Isolator has applied the isolations, then this shall be cross-checked by an IsA of the correct discipline.

c. Cross-checking consists of the following physical checks:

1. Correct equipment (e.g. pump, switchboard) has been selected.
2. Correct isolation or de-isolation point as identified on the IDP.
3. Correct method of isolation (for example isolator open or blank fitted).
4. Correct isolated or de-isolated state as identified on the IDP.
5. Isolation is secured or removed.
6. Tags are correctly fitted and legible, and or removed.

d. Human error can occur to anyone at any time and cross-checking can mitigate against this. However, for low impact (consequence) activities only, and for isolations that meet the criteria below, the IsA and AA may decide that cross-checking is not required for selected isolation points:

   1. Non-hazardous utilities such as water or air at low pressure <10 barg (150 psig)[25].
   2. Low volume of utilities such as diesel, hydraulics, and lube oil.
   3. Low-pressure <10 barg (150 psig)[26] and low volume process fluids.
   4. Switched isolations of low voltages where activity does not require access to exposed electrical components (e.g. changing fan belts, changing light bulbs, changing HVAC filters) Clearly tag the isolations.
   5. Isolation of voltages up to and including 50 V ac or 120 V[24] ripple-free dc

      Low volume in this context is less than a process safety tier 2 event as defined in API RP754 table 2. A link to this can be found in BP Record-Group HSE definitions RCD 4.4-0001. If unsure, consult with a site engineer.

e. Cross-check all isolations not included in 14.6d.

f. A discipline IsA shall cross-check all isolations applied by an Isolator.

14.7 Sanction to test

a. Use sanction to test (STT) when there is a requirement to temporarily de-isolate part or all of an isolation so that a test or task can be completed to Verify:

   1. the integrity of equipment, in the case of a leak test, or
   2. the result of maintenance (for example to test the seal condition on a pump).

      STT allows for the temporary reinstatement of power or the moving of valves to perform the test.

b. These movements require strict control. The AA shall Approve and record all movements in the IDP.

c. STT is normally applied for tests lasting less than one shift. However, if STT is extended for longer than one shift, oncoming and outgoing AAs, IsAs and PAs shall perform a specific handover.

d. The PA, working with the AA and IsA, identifies the need for an STT as early as possible in the planning process so that it is considered when the IDP is being designed.

e. The cycle for STT shall be as follows:

   1. The AA and IsA agree the isolation points to be temporarily de-isolated.
   2. The IsA checks the integrity of the isolation before making any changes.
   3. The AA suspends all other permits linked with the work or cross-referenced on the ICC. All other permits to work on the isolated system are suspended for the duration of the test.
   4. The AA decides if there are any additional monitoring requirements for the STT and includes them in the STT permit.
   5. The AA authorises de-isolation for STT.
   6. The IsA de-isolates the points identified for STT and updates the IDP.

7. Troubleshooting can take place while under the STT using personal isolations within the envelope of the original ICC. Include troubleshooting tasks in the STT permit.
8. The PA is issued with a new permit to carry out the STT work – cross-referenced to the ICC.
9. The IsA monitors isolation integrity as detailed in the risk assessment throughout the test period.
10. After the STT work is completed, the PA returns the permit to AA following suspension or completion.
11. The AA requests the IsA to replace isolations if the test is unsuccessful; these shall be isolated to the previous standard. If the test is successful, the IsA moves the STT isolations to, or Verifies they are in, the final position.
12. The AA signs off the ICC as complete when all isolations have been signed to confirm they are in the final positions.

14.8 Identifying and recording isolation points

a. Identify all isolation points using a unique sequential number that is detailed on the IDP.

b. For overlapping isolations where some isolation points are common to more than one isolation, these points shall have a separate locking device and tag for each isolation.

c. Include marked up drawings as follows:
   1. Highlight each isolation point with a unique isolation point number.
   2. Where helpful, highlight the pipework and equipment that form the isolated envelope.

d. The colour code used for marking up drawings for process isolations and control hydraulic or pneumatic lines is:
   1. red for valves isolated closed or spades or blanks inserted
   2. green for valves isolated open
   3. blue denoting a bleed point.

e. The colour code used for marking up drawings on electrical isolations is:
   1. red for isolation point closed (i.e. energised) or circuit reconnected
   2. green for electrical isolation point opened (i.e. de-energised) or circuit disconnected
   3. yellow to indicate application of an earth or ground.

14.9 Amending isolations

a. The amend isolation process is used in circumstances where the original design is not adequate or applicable or there is a change in current conditions.

   For example, the isolation envelope needs to be extended after installation because of a passing valve.

b. Suspend all work under the isolation before the amend isolation process is used.

c. No work shall take place under an isolation in the Amend state.

d. The AA may authorise the amendment of any isolations in any state.

e. Following the amendment of the design, the approval and authorisation process follows the same rules as a normal isolation:

1. Changed design for every discipline is signed by the relevant IsA.
2. AA Approves the overall changed design.
3. Any new points are authorised for isolation, confirmed and cross-checked (if cross-checking is required).
4. Points authorised for de-isolation are confirmed and cross-checked (if cross-checking is required).

f. The AA signs to complete the amendments. This puts the isolation back to the state it was in, and the normal workflow can resume.

eCoW will display a warning message for any permit being issued against the amended isolation to alert the IA or AA that there have been changes to the design of the isolation

14.10 Securing isolations

a. The IsA or Isolator shall secure isolations using a locking device (lockout) and tag with a yellow isolation tag. Use locking devices that are substantial enough to prevent unapproved or accidental removal (a minimum of 25kg (50lb)[27] break strength).

b. If isolation points are used for more than one IDP, they shall have a separate locking device and isolation tag for each.

c. When using padlocks, the IsA shall:

1. follow the local implementation plan, to manage locks and keys
2. record individual key numbers for each isolation point on the IDP.

d. Isolation locking devices could be of the multi-hasp type to allow each work party to apply locks and to cover multiple isolations on the same energy source. If this is not reasonably practicable, a lockout box might be used.

Figure 10 - Example of multi-hasp for use on an electrical isolation

e. For non-diving subsea isolations, see section 14.23.

14.10.1 Securing process isolations

a. Lock or immobilise process isolations to prevent unauthorised operation using one of the following methods:

1. Wire locking loops that require considerable effort to force the valve from the locked position, such as Pro-Lock. In US, the Occupational Safety and Health

Administration (OSHA) requires a padlock to be used and this can be fitted to the Pro-Lock.

bp recommends using yellow coloured Pro-Locks to give additional indication and consistency with the yellow isolation tag.

2. Padlock and chains that would take considerable effort to force the valve from the locked position. The AA shall secure and manage the keys using either a master key cabinet or individual key safes and a system of record.
3. Specifically designed valve isolation devices where wire locking loops or chains are ineffective.
4. Specifically designed tamper-proof valve interlocks. The AA shall control activation of the interlock, using the master key held at the site.

b. If the IsA needs to isolate a valve that cannot be locked or immobilised using one of the four methods above, the Isolator or IsA may:
   1. remove the valve handle, if this is reasonably practicable, or
   2. use a suitable fitting to prevent the valve from moving.

c. Secure and record LO/LC valves if they form part of an isolation. This is a requirement even if they are not moved to implement the isolation. Update the LO/LC register whenever any LO/LC valve is moved.

d. Pneumatically and hydraulically operated valves that fail closed shall have any stored energy removed and their control lines physically disconnected so that no stored energy is present in accordance with section 14.19.

e. Where it is not reasonably practicable to disconnect the hydraulic or pneumatic lines the following shall be applied as a minimum:
   1. Pneumatic supplies and returns to/from instrumentation and control equipment (for example actuated valves, analysers, purge systems) shall be:
      a) isolated as close as possible to the device to be worked on (that is, either at a local isolation valve, at the nearest header off-take or and the distribution manifold) and
      b) vented using regulator drain or vent ports.
   2. Hydraulic supplies to actuated valves shall be isolated as close as possible to the device to be worked on; in conformance with Table 26 (SV, DBB or positive isolation).

f. Record supply and return isolation lines as separate isolation points in the IDP.

g. Pneumatically and hydraulically operated valves that fail open shall not be used for isolation. If no other alternative is reasonably practicable, and they are prevented from moving, they can be used and classed as non-conformant.

h. Electrically operated valves shall have the power supply isolated (as per section 14.18) and hand-jack manually locked.

i. If the valve cannot be physically immobilised, it shall not be used for isolation.

j. It is not necessary to lock bleed valves, as they need to be opened periodically to check the integrity of the isolation. These bleed points still require isolation point tags stating within the comments box that they are a bleed.

14.10.2 Securing electrical isolations

a. Lock or immobilise electrical isolations to prevent unauthorised operation.

b. If fuses or links form part of the isolation device, the IsA shall provide a secure means of storing the fuses or links after removal.

c. For work involving multiple work parties, each work party shall be able to apply a personal lock; alternatively, a lockbox or multi-hasp can be used.

d. Where personal locks are used as part of an isolation (as in 14.10.2(c)), the site shall have a process to manage their use.

e. An isolation device may have a withdrawable element that exposes energised conductors, parts, or equipment when the withdrawable element is removed. In this case, access to the exposed conductors, parts or equipment shall be securely blocked (for example by locking 'closed' the bus bar and circuit shutters mounted on the fixed portion of a switchgear cubicle).

f. An isolation tag shall be fixed to each electrical point of isolation.

14.10.3 Using lockout and tagout in US

Lockout is when a lockout device is installed on all sources of hazardous energy so that it cannot be disconnected unless the lock is forcibly removed.

Tagout is defined as installing a tagout device on all sources of hazardous energy, such that operation of the disconnecting means is prohibited.

a. In US, conformant electrical isolations are secured by lockout.

b. The lockout device shall include:

   1. a lock (either keyed or combination)

   2. a method of identifying the individual who installed the lockout device.

c. Electrical isolations secured by tagout only, are treated as non-conformant and controlled as per section 14.5. In this case, the non-conformant isolation Level 2 risk assessment identifies additional safety measures to mitigate the lower standard of securing the isolation (meeting requirement of OSHA 1910.147).

14.11 Securing isolation lockboxes in US

a. For US sites, personal locks and lockboxes are used in addition to the bp labelling and securing devices.

b. When working under the energy isolation all workers shall be protected by their own personal lock, or locks, or the personal lock or locks of their designated worker.

c. The designated worker shall keep the key to the lock or locks prior to issuing the permit. The PA or a worker may be the designated worker.

14.11.1 Before starting the task detailed in the permit

a. Complete the following prior to issuing the permit:

   1. Isolator attaches their device locks to the isolated equipment.

   2. Workers physically Verify the isolation and zero energy state.

   3. Workers affix their personal lock or locks and tag onto the appropriate energy isolation device, or devices, or lockbox.

   4. Workers initial and enter time on the work party declaration.

Any worker has the right to apply their own personal lock and is responsible for the safekeeping of their key.

14.11.2 Methods of using locks and lockboxes

a. For each task, it shall be clear which of the following three methods will be used. Only one method per task is allowed.

   1. Method 1 – personal locks only

      a) Each worker places their personal lock, or locks, directly on the energy isolation device, or devices.

   2. Method 2 – using a lockbox

      a) Isolator places the device lock key, or keys, in the lockbox that pertains to that isolation.

      b) Isolator secures the lockbox with the operations control lock and a tag describing the work, date and ICC number to the lockbox.

      c) Workers affix their personal lock on the lockbox with a tag that includes the name of the person or group applying the tag and a contact method.

   3. Method 3 – working under PA personal lock

      a) A worker or workers can agree to work under a designated worker personal lock.

      b) The designated worker affixes their personal lock and tag onto the lockbox.

      c) Designated workers initial next to each of their worker's name on the work party declaration.

b. A worker can choose to work under their PA. If this method is chosen, a worker cannot assume they can work under their PA/designated worker's personal lock. There shall be a mutual agreement between the worker and the PA/designated worker and the PA/designated worker initials next to the worker's name on the work party declaration.

14.11.3 End of shift

a. At the end of a shift, the worker or workers, and the PA shall complete the following:

   1. The PA notifies the AA or IA that work is completed.

   2. The PA and workers remove their personal lock, or locks, and sign off the work party declaration prior to closing or suspending the permit.

   3. In situations where the permit scope is incomplete or equipment is inoperable, before suspending or completing the permit, the worker or workers, or PA – or all of these – complete the following:

      a) On the lockbox, or energy isolation device (or devices), replace personal locks with:

         1) the control lock, or craft lock or both, and

         2) tags.

      b) There may be more than one control lock and craft lock.

      c) The PA shall notify the IA or AA that the job is incomplete and one or more control locks, or craft locks – or both – have been attached to the lockbox.

14.11.4 Sanction to test with locks and lockboxes

a. For interruption of energy isolation for temporary testing, follow the steps below:

   1. The IsA will notify the PA and Verify all Affected Workers and non-essential personnel are clear of the area.

   2. Workers and PA will remove personal, control and craft locks from the lockbox and sign off the work party declaration.

   3. When the testing or repositioning is complete, the Isolator or IsA will need to re-establish energy isolation and achieve safe energy state. The PA and IsA Verify integrity of the energy isolation and then re-apply locks as appropriate.

14.11.5 De-isolation with locks and lockboxes

a. When the work is completed, all workers and the PA shall:

   1. remove their personal locks and control or craft locks (or both types of lock)

   2. sign-off the work party declaration.

b. The PA Verifies that all personnel in their group have completed the work party declaration by initialling next to each worker's name on the work party declaration.

14.11.6 Removing an absent worker's personal or craft lock

a. Authorisation for removing a personal lock of a worker who is not available is controlled through a permit. The permit shall be authorised by the SA after verification that the HSE&C Site Advisor was part of the RA team.

b. To remove a personal lock of a worker who is not available, the AA shall:

   1. Verify that the worker is not in the work area

   2. Verify the safety and integrity of the equipment to be re-energised before removing the lock and isolation tag

   3. make all reasonable efforts to contact the worker and contact their supervisor, or supervisors, to inform them that their personal lock and isolation tag has been removed (or that they failed to sign out)

   4. Verify that the worker is informed that their personal lock and tag has been removed before the worker resumes work.

14.12 Tagging isolations

a. Identify all isolation points, including bleeds, using the standard isolation tag.

b. If the valve is a single valve with 2 seats but one actuating device (e.g. handle or wheel), then treat it as a single valve and one isolation point.

c. If a valve has two actuating devices operating separate seals, treat these as separate isolation points.

The isolation tag includes a clear 'Do Not Operate' warning and can withstand the environment to which they are exposed.

They have the following information from the IDP printed on them:

- Point number.
- ICC number.
- Equipment number.

- Isolated state.
- Reason for isolation.
- Point-specific comments.

d. Self-verification is used to confirm that the tags are legible and that locks are in place and in good condition.

Full Isolation	Personal Isolation
	

Figure 11 - Isolation tags

14.13 Personal isolations

a. Personal isolations can be used for operational and maintenance tasks where the PA is also the Isolator or IsA and where the isolation is required for no more than a single shift.

b. A personal isolation can be extended for up to 4 hours[5] if the PA works beyond the shift to complete a task. If the requirement for isolation goes beyond one shift (plus four hours possible extension), then it is replaced by a full isolation.

c. Personal isolations shall conform to the following:

1. Designed and implemented by an Isolator or IsA of the correct discipline.
2. Either the Isolator or IsA (as relevant) is present at all times when the task is in progress, or the isolation is in place. The Isolator or IsA may leave the worksite for short interruptions such as meal breaks, provided the isolation is left in a safe condition, with all covers, caps, blanks, or barriers in place.
3. The isolation is risk assessed as low risk (i.e. risk Area I in the risk matrix) and identified in a permit, LRP or RAP.

   There may be situations where the task associated with the isolation has a residual risk greater than Area 1. 14.13c(3) refers to the isolation only.

4. Process isolations meet the process isolation standard detailed in Table 26.
5. Electrical isolations meet the electrical isolation standard detailed in Table 29.

6. Instrument isolations can include process and electrical isolations and shall conform to the associated standards as detailed in section 14.19 and in sections 14.14.1 and 14.18.1.
7. The process for non-conformant isolations cannot be applied for personal isolations.
8. Isolation points are identified and clearly documented in the permit, IDPs, procedures, or on up-to-date marked-up drawings such as P&ID, electrical line diagrams, instrument loop diagrams, sketches, or photographs.
9. The isolation envelope should be small and manageable, with no more than two valve isolations and a drain or vent, and one electrical isolation. The valve isolations could be single valve (SVI), double block and bleed (DBB) or a combination. For example:
10. two SVIs
11. two DBBs
12. one SVI and one DBB
13. All isolations should be visible to the Isolator or IsA from the task location. The only exception is the electrical isolation.
14. Type 1 locked valves cannot be moved under personal isolations, except where conducting online testing as per section **23.4.3**.
15. Isolation integrity is proven before starting the task.
16. Before authorising a task involving a personal isolation, the AA confirms that the individual performing the isolation is competent to complete the task and the isolation.
17. The Isolator or IsA tags each isolation point using yellow personal isolation tags handwritten with isolation point, isolated state, name of isolator and date.
18. The Isolator or IsA locks isolation points using a tamper-proof method such as locks, locked chains, or security seals such as Pro-Locks.

d. Personal isolation shall not apply to isolations that require multiple discipline isolation points unless the following requirements are met:
   1. All the isolation tasks included in a permit, LRP or RAP are risk assessed as risk Area I.
   2. The PA is competent to perform all the isolations included in the task, such as process, electrical or instrument isolations.

e. Examples of where a personal isolation, instead of a full isolation, could apply are:
   1. replacing filters or duplex filters, after proving the filters' isolation integrity
   2. low-voltage maintenance tasks
   3. vent and drain hose installations
   4. repairing, replacing, troubleshooting and function testing instrument devices and valve actuators
   5. replacing and troubleshooting automation systems.

f. Electrical personal isolations are not allowed on:
   1. high voltage equipment

2. safety systems (e.g. fire and gas or emergency shutdown (ESD) panels or sections of these) where the isolation would inhibit operation of part, or all, of the safety system
3. equipment fed from more than one source.

g. Personal isolations are allowed on one or more inputs or outputs provided the design function is not compromised (e.g. If a Fire and Gas system needs 6 out of 9 detectors active in a fire area, personal isolations can be used to work on up to 3, leaving 6 operational).

h. When closing a permit, the AA shall Verify the personal isolation has been removed and the plant line-up is correct.

14.14 Process isolation

Process isolation is defined as the separation of plant and equipment from every source of energy in such a way that the separation is secure (for example by means of an air gap, a spade, or a closed valve).

a. The following shall not be used for isolation:
1. PSVs
2. Control valves
3. Non-return valves (check valves)
4. Deck seals
5. Globe valves.
6. Category A type butterfly valves, as defined in API Std 609
7. Category B type butterfly valves, as defined in API Std 609 (in process or hazardous utility fluid)

An exception to 14.14(a)6 & 7 can be found in section 14.22.

8. Pneumatically and hydraulically operated valves that fail open or fail last. If no other alternative is reasonably practicable, and they are prevented from moving (particularly important for fail open, where at least one force is trying to push them open), they can be used, but the non-conformant process is used.
9. Steam traps
10. Any other valves that are not capable of providing a reliable seal due to their design or condition such as a damaged seal.

Globe valves and butterfly valves are intended for controlling function and might not provide adequate isolation after being in service for a period of time. Globe valves and butterfly valves are not intended to be used for tight shutoff applications.

b. Three-way ball or plug valves may be considered for isolation if there is no other alternative, but these are considered non-conformant and the IDP shall be explicit on how to manage and identify the open and closed ports. As an exception to this requirement, swapping duplex filters using three way valves can be considered conformant.

c. Emergency Shutdown (ESD) actuated valves shall only be used in valve isolation service when:
1. the valves are fail closed and confirmed as in the closed position
2. the integrity of the ESD valves has been proven, and

3. one of the following applies:
    a) the valves are designed to be manually disabled and locked closed, or
    b) the valve actuator energy sources, electrical, pneumatic or hydraulic, have been isolated and disconnected as per section 14.10.1.

d. Electrically operated valves shall have the power supply isolated (as per section 14.8) and hand-jack manually locked.

e. If an electrically operated valve cannot be physically immobilised, it shall not be used for isolation.

14.14.1 Process isolation standard

a. Table 26 details the minimum process isolation standard and is used as the decision tool for designing an isolation. If the standards in Table 26 cannot be met, the isolation is classed as non-conformant. If this occurs, follow the process described in section 14.5.

b. The following are considered when designing process isolations:
    1. Hazardous nature of the fluid (e.g. fluid type and toxicity). See section 14.14.2.
    2. Operating conditions (for example volume, pressure, and temperature).
    3. Process equipment, pipeline, and pipework layout.
    4. The consequence and contingency plan if the isolation were to fail.
    5. SIMOPS.

c. Document the maximum potential system operating pressure (MPSOP) in either of the following:
    1. Controlled process design documentation (as per EP SG 5.3-0003 Design and Operating Limits Table 6 -1):
        a) process flow diagrams, process data sheets, P&IDs
        b) documented and Approved safe operating limits (SOL).

d. If a change to the MPSOP is required, an Approved eMoC is required.

Table 26 - Minimum process valve isolation standards

Maximum potential system operating pressure Is the maximum pressure the system can be exposed to in service. This may be the MAWP, SOL or design pressure but is more likely to be limited by installed layers of protection (e.g. PSVs HP trips), pump or compressor limitations or by field depletion.	≤ 10 barg (150 psig)[26]	> 10 barg (150 psig)[26] and < 50 barg (725 psig)	≥ 50 barg (725 psig)
Maximum operating temperature	≤60°C (140°F)	>60°C (140°F) and <100°C (212°F)	≥100°C (212°F) Or AFAIT
Normal operating temperature			≤ -50°C (-58°F)
Process fluids and hazardous utilities	V = SVI I = SVI	V = SVI I = DBB	V = DBB I = DBB
Non-hazardous utilities	V = SVI I = SVI	V = SVI I = SVI	V = SVI I = SVI
Isolation for small piping (that is diameter nominal (DN)20 or nominal pipe size (NPS) ¾' nominal bore and smaller diameter), including instrument tubing, shall meet the minimum requirements of this table where the system design allows. Where it is not possible to meet the above requirements, the isolation shall conform to the Single Valve Isolation (SVI) requirements of this CoW Procedure (see section 14.14.7) and the risks associated with the isolation shall be managed in the risk assessment for the task (either in a permit or IDP).			
An isolation method that cannot meet the isolation standards in this table is classed as non-conformant. If this occurs, follow the process described in section 14.5 conformant and non-conformant isolations.			

I	Valving required to allow intrusive maintenance without positive isolation (if positive isolation presents a greater risk).	V	Valving required to allow the installation of blank flanges and spades (positive isolation).
SVI	Single valve isolation.	DBB	Double block and bleed
		AFAIT	Above fluid auto-ignition temperature.
Source: GP 44-40 Design for Safe Isolation of Plant and Equipment			

14.14.2 Hazardous and non-hazardous systems

Systems are designated as either hazardous or non-hazardous depending on their physical or conditional properties, or both (examples are shown in Table I.1).

a. Designation of hazardous shall be based on an assessment of the physical properties or conditions present during the isolation or de-isolation.

Typically, this assessment is completed during design and evaluates operating conditions and physical properties in recognition of the isolation philosophy (e.g. isolating under full operating mode versus isolating under shutdown conditions).

1. Physical properties may include:
   a) flammability
   b) toxicity
   c) radioactivity.
2. Conditional properties may include:
   a) pressure
   b) temperature
   c) energy
   d) electrical
   e) mechanical
   f) hydraulic
   g) pneumatic
   h) chemical
   i) gravitational
   j) vacuum.

b. Non-hazardous utilities in contact with a hazardous fluid or into which a hazardous fluid might leak (e.g. through an exchanger tube leak) are classified as hazardous. Seawater, hypochlorite, and other systems subject to sea pressure on marine systems are treated as hazardous.

14.14.3 Positive isolation

a. Positive isolation is the most secure method of process isolation. It shall be achieved by either of the following:

1. Removing a pipework section and bolting, clamping or fitting blank flanges rated for full line design pressure to the live ends.
2. Witnessed insertions by:
   a) inserting between bolted or clamped flanges, a blind plate or spade
   b) replacing a spacer (slip ring) with a blind plate or spade, or

c) swinging a spectacle plate.

b. When installing any of the above, new gaskets shall be installed rated to the pipe design specifications, both upstream and downstream.

c. Rated blinds shall, where reasonably practicable, be installed at the flange closest to the vessel, tank or equipment being isolated.

   Rated in this context means the same specification as the pipework.

   For positive isolation leak testing requirements, see section 19.21.

d. Apply positive isolation for the following:

   1. Confined space entry, including all process and ancillary service lines.
   2. Long-term isolations.
   3. Isolations involving HP/LP interfaces where there is a potential risk of over pressurising an LP system.
   4. New pipework tie-ins to existing plants that are not yet commissioned.
   5. Boundary isolations.
   6. Tasks that include a primary source of ignition (for example work on hydrocarbon systems involving an HWOF).
   7. Process fluids at or above their auto-ignition temperature.
   8. When carrying out breaking containment tasks, which result in open ended pipework or equipment being left dependent on valve isolation, for longer than one shift.

e. If positive isolation cannot be achieved and double block and bleed (DBB) is identified as a lower risk option or the only reasonably practicable means of isolation, class it as non-conformant.

f. When planning isolations for remote sites or Normally Unmanned Installations (NUIs), consider positive isolation for any isolation left in place when these sites are unmanned.

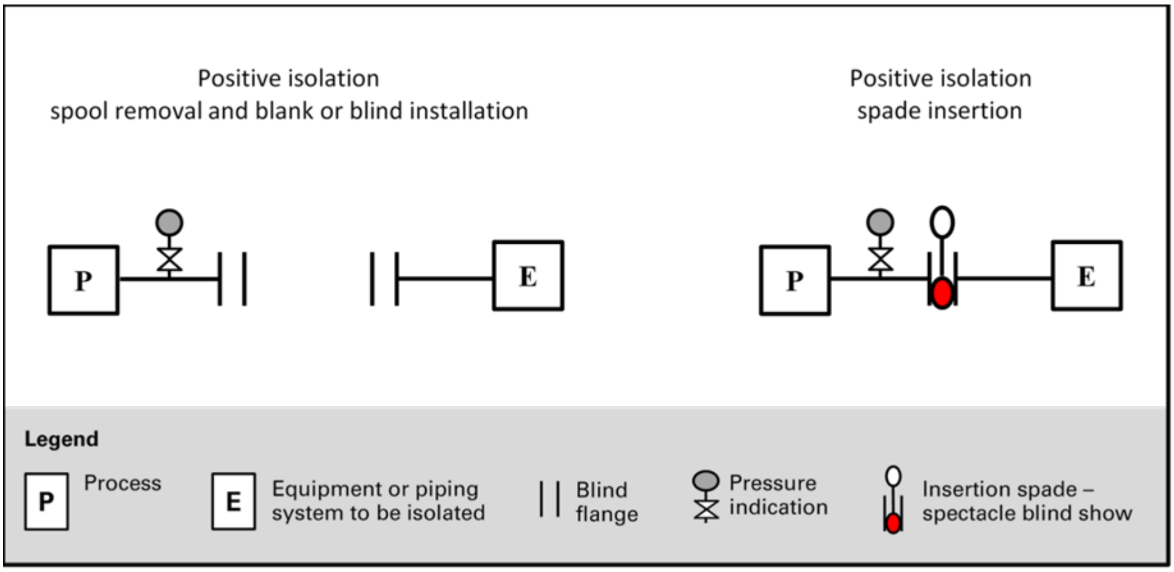


Figure 12 - Positive isolation – typical installation drawing

14.14.4 Isolating to achieve positive process isolation

When applying positive isolations, valved isolations may be required to allow breaking of containment and subsequent installation of the positive isolation.

a. Isolations that are applied to allow blank flanges or spades (positive isolation) shall meet the standards identified in section 14.14.1 and Table 26.

b. There are two options for managing the positive isolation:

   1. Applying a positive isolation using a single IDP:

      a) The valves upstream and downstream of the positive isolation are isolated and recorded in the IDP.

      b) A permit is issued for applying the positive isolation.

      c) The positive isolation is recorded as a separate isolation point in the IDP. Use the amend isolation feature in eCoW to do this.

   2. Applying a positive isolation using two IDPs:

      a) The isolation valves are isolated and recorded in the IDP number 1.

      b) A permit is issued for applying the positive isolation.

      c) IDP 2 is used to record the positive isolation

c. When designing the positive isolation consider both the ability to prove isolation integrity before application of the positive isolation, and also prior to removal of the positive isolation.

14.14.5 Double block and bleed

a. Double block and bleed (DBB) is classified as the next highest level of process isolation, after positive isolation, and the highest level of valve isolation integrity.

b. Use any of the following three methods for DBB isolation:

   1. Closing two block valves in series with a vent connection in the interconnecting pipe.

All block valve types that conform to this subsection are further described in EP GP 62-01 Valves.

2. An integral body (or manifold) having two isolating valves and a vent valve.

   For more information on valves that are suitable for this application, refer to EEMUA 182 Issue Specification for Integral Block and Bleed Valve Manifolds for Direct Connection to Pipework.

3. Single valves of a type that provides a double seal in a single body and with a bleed between the seals.

   The three definitions above are classified as DIB (double isolation and bleed) in the valve industry standards.

c. Conventional cavity relieving ball valves are not designed to be the only valve in a DBB isolation as they cannot provide double isolation and bleed function. They can be used as part of the isolation but will only receive credit as one valve.

14.14.6 Creating DBB isolations with double piston ball valves

a. Double piston ball valves, sometimes referred to as double piston effect (DPE) ball valves, may be suitable for use as both valves in a DBB isolation. However, they shall only be used if specifically designed for this purpose.

b. If designed for this purpose, double piston ball valves require a robust testing process each time they are used as part of a DBB isolation, to prove the effectiveness of the seals. Therefore, where no alternative exists, a ball valve with one or both seats as DPE shall only be considered as both valves in a DBB isolation if:

1. SMEs have Verified and documented that the valve has been designed and tested for this purpose, and

2. the valve is seat-tested in situ following the sequence defined in EP GIS 62-016 Specification for Ball, Plug, and Other Quarter Turn Valves – Common Requirements.

   Definitions for valves that are designed to meet these specifications can be found in API 6D Specification for Valves.

   EP-GIS 62-016 Specification for Ball, Plug, and Other Quarter Turn Valves – Common Requirements section 15.1 and/or API 6D Specification for Valves, provides requirements for design and testing.

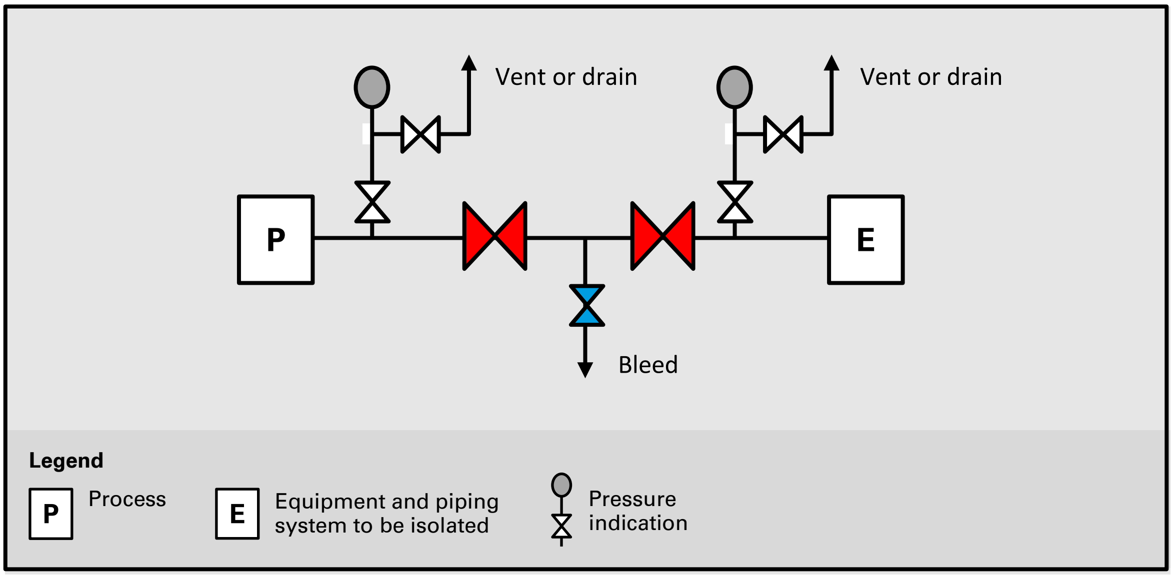


Figure 13 - Valved isolation – double block and bleed isolation

14.14.7 Single valve isolation

Single valve isolation (SVI) is classified as the lowest level of valve isolation integrity.

a. SVI consists of closing a single valve. Additional security can be achieved by closing several valves in series, but the absence of a bleed or vent in the intervening volume means they are classed as SVI. This kind of isolation may pose a hazard from trapped pressure due to thermal expansion.

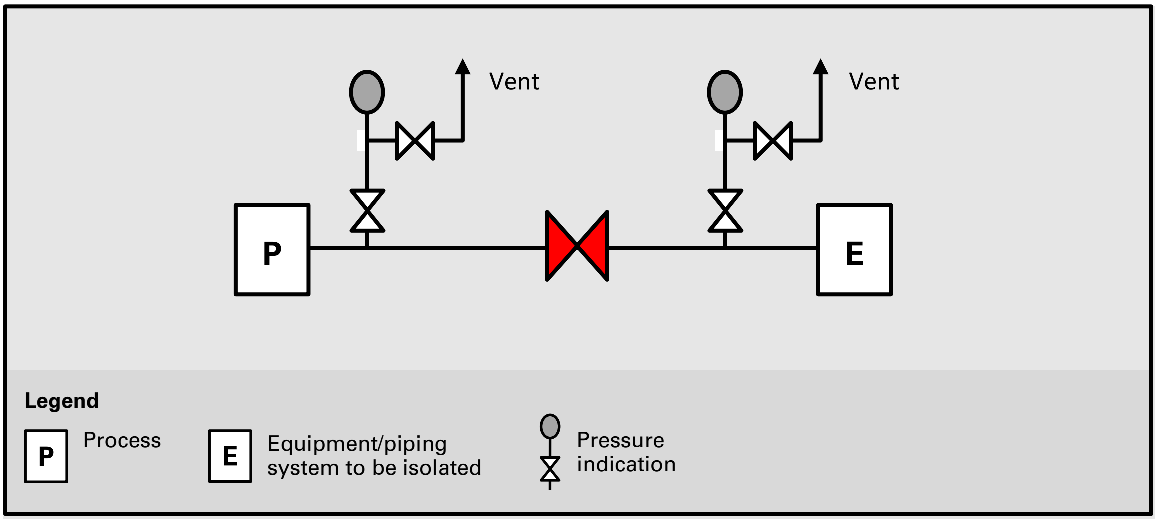


Figure 14 - Valved isolation – single valve isolation

14.14.8 Other isolation devices

a. Non-vented devices shall not be used as primary isolation devices.

b. Use of novel isolation methods such as gel injection, frozen plugs, mechanical plugs, Valvetight DBB-Saver may be considered where no other reasonably practicable option exists. Their use is a non-conformant isolation and shall be covered by a level 2 TRA, approved by VP operations, and supported by an approved engineering assessment (e.g. EQ, or MoC).

c. Devices such as mechanical plugs, frozen plugs, or inflatable devices (e.g. bags, balloons, bladders) may be used as vapour or liquid seal, if the following requirements are met:

    1. They are downstream of an isolation valve or positive isolation.
    2. A Level 2 TRA has been completed and approved by the APM.
    3. Vapour barrier is recorded as a control on the risk assessment.
    4. The hazard of ejection and Line of Fire is included as a minimum on the risk assessment.
    5. A mechanical seal plug certificate is used.

d. Monitor and control the pressure differential across these devices.

e. Regularly monitor devices that are provided with vents, vent lines, or both, to Verify that the vent has not been compromised by cold temperatures, restricted, or blocked by debris. The risk assessment will specify how regularly this has to be done.

14.14.9 Integrity testing valve isolations

Integrity testing is Verifying that the isolation does not pass and is conducted when isolating the equipment. Once the isolation is in place, conduct PBU monitoring of the isolation as described in section 14.14.12.

It is important to understand the two main ways that a valve provides isolation:

- Passive sealing action: valves that rely primarily on the presence of differential pressure to create a seal; for example:
    - trunnion mounted ball valve
    - floating ball valve
    - slab type gate valve
    - parallel slide gate valve.
- Positive sealing action: valves in which the sealing force is applied mechanically as part of valve operation; for example:
    - parallel expanding type gate valve
    - split wedge gate valve
    - ‘orbit’ type ball valve
    - expanding type plug valve
    - ‘wedge’ plug.

Additional information can be found in EP GP 62-01 Valves.

a. To prove isolation integrity, the Isolator or IsA shall perform integrity tests before confirming the isolation is in place for each isolation point.

   Figure 15, Figure 16 and Figure 17 include generic procedures for testing SVI and DBB isolations using integrity tests. The minimum duration of the integrity test depends on the size of the isolated cavity being monitored, the precision of the gauge being used to monitor pressure and the leak rate detection precision required.

   When testing for integrity, it is best practice to test with the process medium and in the normal direction of flow.

Pressure gauges normally give accurate indications only over the middle part of their range and gauges designed to measure high pressures often give poor response at low pressures. A lower range gauge will typically give a more accurate reading of PBU, but caution is necessary to protect the gauge from excessive pressure (e.g. pressure limiting device).

b. Separately test the integrity of both valves and seals.

c. The bleed valve is closed between periodic integrity checks unless the risk assessment indicates that keeping the bleed valve open is a safer alternative.

d. If the risk assessment indicates keeping the valve open is the safer option, conduct periodic integrity checks with the bleed valve closed.

e. For 14.14.9 (c) and (d) above, the bleed valve shall vent to a safe location, either to atmosphere or to a closed vent or flare system.

f. The PBU duration tool can be used to estimate the minimum duration for PBU integrity testing gas-service.

g. An observable pressure rise or fall (e.g. using an analogue pressure gauge of a suitable range), or leakage during the integrity test indicates that the valve is passing fluids. Corrective actions can sometimes eliminate valve seat leakage (for example opening and closing valve, flushing valve, greasing valve). Test the isolation integrity again following any corrective action.

h. If the valve continues to pass fluids, use an alternate isolation design (e.g. additional isolation valves, positive isolation, and revised isolation boundary). If an alternate isolation design is not reasonably practicable, then the isolation is classed as non-conformant; include the risks of working downstream of the leaking valve in the risk assessment.

i. Any decision to break containment when the isolation envelope contains a valve that is known to pass, shall be treated as non-conformant and managed using a Level 2 TRA.

j. For isolations in gas service, the results of the PBU integrity test may be used to estimate the leakage rate and potential hazard distances in support of the risk assessment (e.g. using the CoW leak dispersion estimator tool).

k. For isolations in flashing liquid service, the CoW leak dispersion estimator tool may be used to estimate hazard distances associated with flashed vapour provided the liquid leakage rate is estimated or measured.

l. The CoW leak dispersion estimator tool is not designed to be applied to gas or flashed vapours that are denser than air and therefore shall not be used.

m. The risk assessment shall consider the following:

   1. Fluid characteristics:

      a) Flammability and auto ignition temperature

      b) Toxicity and other hazardous characteristics for personnel exposure (e.g. asphyxiation)

      c) Vapour pressure

      d) Density.

   2. Source conditions:

      a) Operating pressure and temperature

b) Potential for leakage rate to increase quickly (seat erosion).

3. Local environment:

a) Distance to ignition sources

b) Ambient conditions (wind speed, ventilation rate, temperature)

c) Potential for escalation to nearby equipment.

4. Contingency:

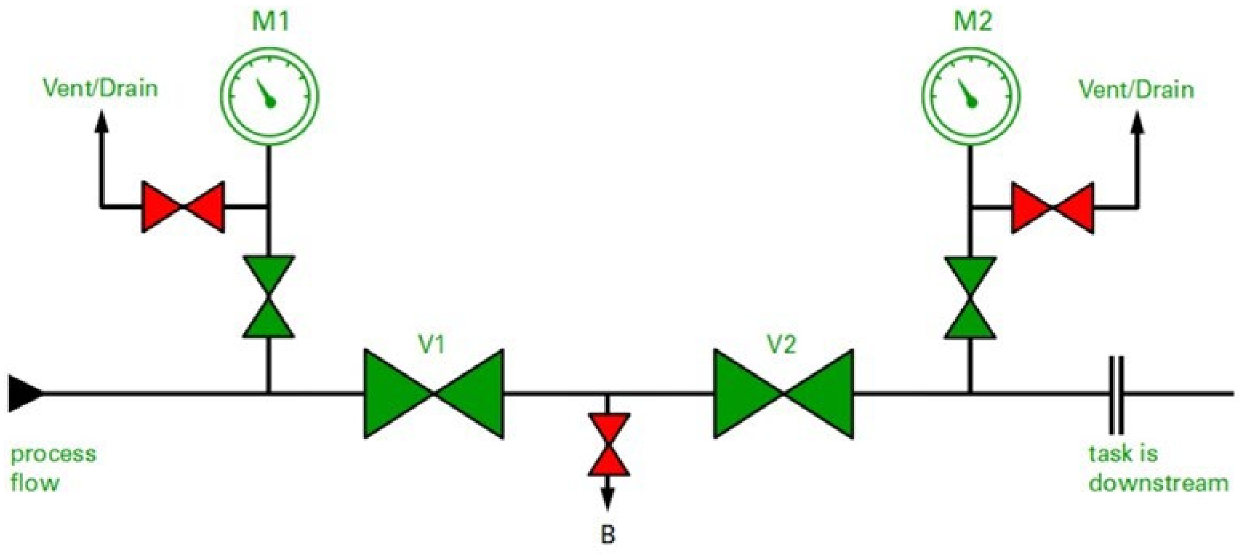
a) Availability of additional upstream isolation points

b) Volume contained within the isolation.

n. Calibrated pressure gauges or pressure recording devices being used for valve integrity testing shall either be rated to maximum operating pressure or fitted with overpressure protection (e.g. gauge saver. *note*: Snubbers provide pressure spike protection, not overpressure protection). Check the pressure testing equipment before use to Verify that they are of the correct range, and calibrated. Check all bleed points being used for integrity testing for fouling or blocking, because any restrictions or blockages may give false results.

o. When applying isolations across an HP/LP interface, prove the integrity of the HP side of the isolation to confirm that the LP downstream system cannot be over pressured.

Isolation integrity test for double block and bleed (two valves)



Key

V1 - First (upstream) isolation valve from live system.

M1 - Live side-monitoring point (pressure gauge or vent/drain).

V2 - Second (downstream) isolation valve from live system.

M2 - Monitoring point between valves and break point (pressure gauge or vent/drain).

B - Bleed point between the isolation valves.

Procedure

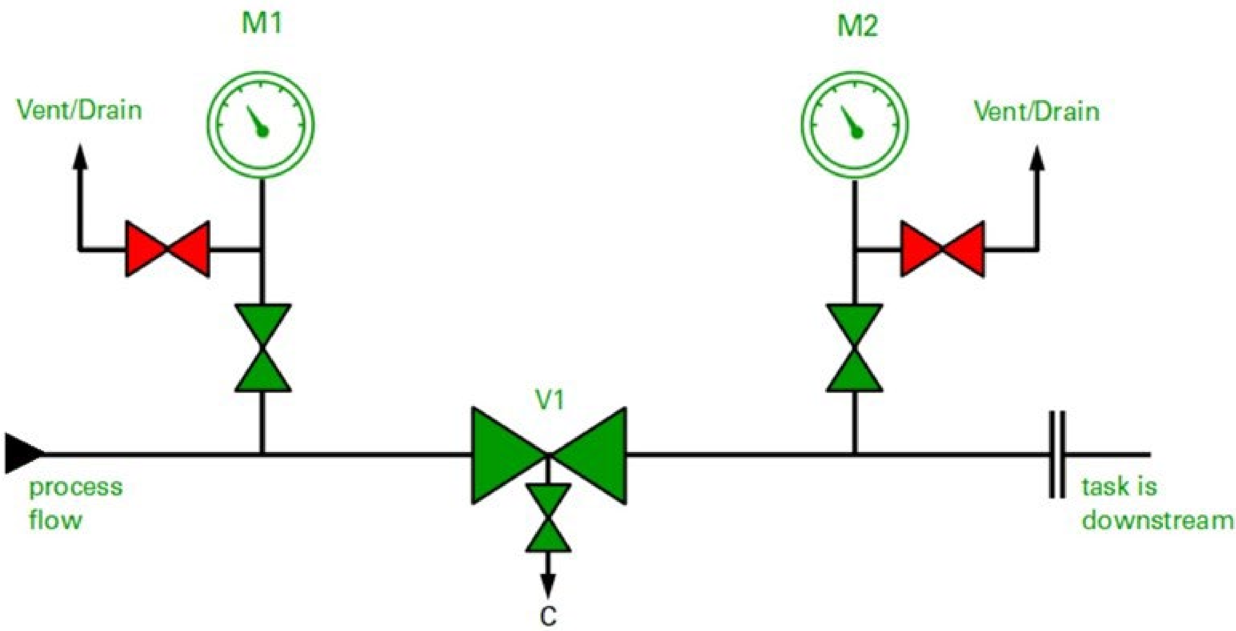
1. If possible, Verify tappings at M1, M2 and B are not blocked and pressure gauges, where installed, are operating.
2. Close downstream valve V2 and secure in closed position.
3. Record pressure at monitoring points M1 and M2.
4. Vent/drain section of line to be broken and monitor at M2 until the pressure is zero.
5. Close vent/drain at break point and monitor at M2. Use the PBU tool to determine monitoring time, or for small volumes, monitor for a minimum of 10 minutes[28]. No pressure build-up at M2 indicates the integrity of the downstream valve V2.
6. Close upstream valve V1 and secure in closed position.
7. Record pressure at M1 and B.
8. Vent/drain between V1 and V2 (B) and monitor at B until pressure is zero.
9. Close vent/drain (B) and monitor at M1 and B for a minimum of 10 minutes[28]. No pressure build-up at B indicates integrity of upstream valve V1.
10. Leave vent/drain (B) in closed position to allow further monitoring.

Isolation summary

Both block valves are now closed and secured. The bleed valve is closed but not locked. It is possible for pressure to build up between the two block valves so it is essential to regularly monitor the isolation; you may fit a suitable calibrated pressure gauge to the vent to monitor for any pressure.

Figure 15 - Double block and bleed isolation integrity test (two valves)

Isolation integrity test for bp-Approved double sealed, single valve



Key

M1 - Live (upstream) side monitoring point.

M2 - Monitoring point between valve and break point (downstream).

C - Cavity drain (between seals).

Procedure

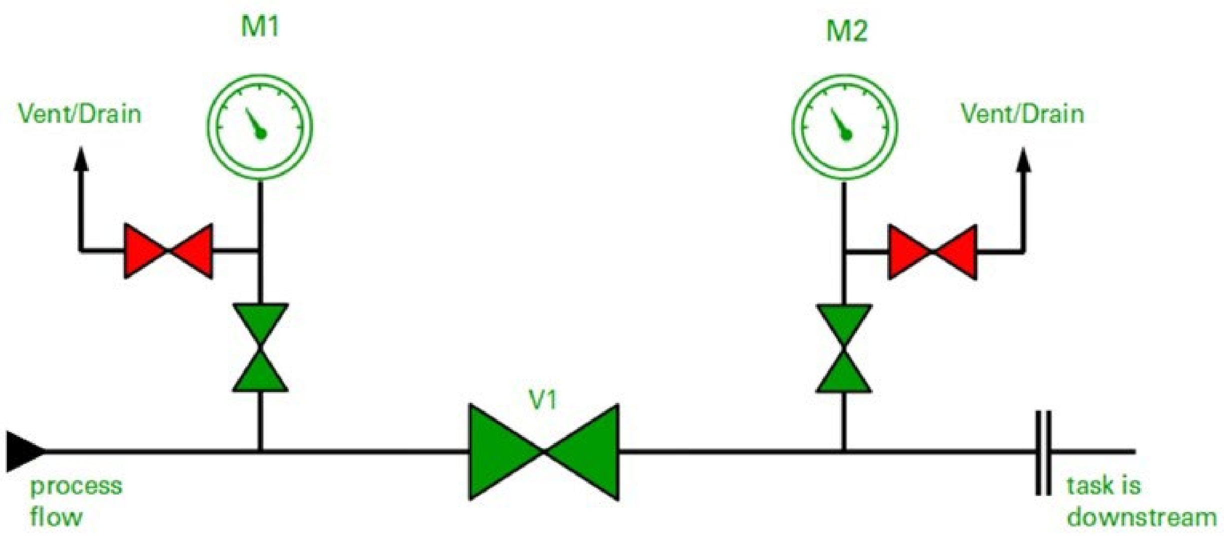
1. If possible, Verify tappings at M1, M2 and C are not blocked and pressure gauges, where installed, are operating.
2. Close isolation valve and secure in closed position.
3. Record pressure at M1, C (in cavity) and M2.
4. Vent/drain downstream section of line to be broken and monitor pressure at M2 until pressure is zero.
5. Close vent/drain at break point and monitor at M2 and C for a minimum of 10 minutes[28]. No pressure build-up at M2 and no pressure fall-off at C indicates integrity of downstream seal.
6. Record pressure at M1 and C.
7. Vent/drain off fluid in cavity (between seals) and monitor at C until the pressure is zero.
8. Close cavity vent/drain (C) and monitor at M1 and C for a minimum of 10 minutes[28]. No pressure build-up at C indicates integrity of upstream seal.
9. Leave vent/drain C in closed position to allow further monitoring.

Isolation summary

The double sealed, single block valve is now closed and secured. The bleed valve is closed but not locked. Any fluid passing through the upstream seal will be detected at the cavity drain C. It is essential to regularly monitor the isolation; a suitable calibrated pressure gauge may be fitted to the vent to monitor the pressure.

Figure 16 - Isolation integrity test (bp-Approved double sealed, single valve)

Isolation integrity test for single valve isolation



Key

M1 - Live (upstream) side monitoring point.

M2 - Monitoring point between valve and break point (downstream).

Procedure

1. Verify tappings at M1 and M2 are not blocked and pressure gauges, where installed, are operating.
2. Close isolation valve and secure in closed position.
3. Record pressure at M1 and M2.
4. Vent/drain downstream section of line to be broken into and monitor at M2 until pressure is zero.
5. Close downstream vent/drain and monitor at M2. Use the PBU tool to determine monitoring time, or for small volumes, monitor for a minimum of 10 minutes[28]. Zero pressure build-up at M2 indicates integrity of single valve.
6. Leave downstream vent/drain at break point in closed position to allow further monitoring.

Isolation summary

The single isolation valve is now closed and secured, and the downstream vent/drain is closed. Any fluid passing through the single valve seal would be monitored at the frequency agreed in the risk assessment.

Figure 17 - Single valve isolation integrity test

14.14.10 Integrity testing flare, vent and drain valves

When a single flare, vent or drain valve forms part of an isolation, it may not be possible to test the valve integrity.

a. Use a risk assessment to manage the hazards and controls in place for working on a valve where the integrity has not been Verified.

b. If the following criteria are met, then the risk assessment can either be included as a task step within the IDP or a hazard in the TRA for the task:

   1. Valve does not have any known integrity issues.
   2. The flare, vent or drain system maximum potential system operating back pressure in normal and emergency operation is less than 10 barg (150 psig)[26].
   3. The risk assessment identifies a contingency plan.

c. The valve may be classed as non-conformant, and the non-conformant process followed.

14.14.11 Process isolation integrity on unmanned sites

People may not be permanently present on normally unmanned installations (NUIs) and remote unattended sites whilst an isolation is in place.

a. In these circumstances, the first people to return to the facility shall confirm isolation integrity before continuing work on the isolated equipment.

14.14.12 Monitoring process isolation points

a. Monitor the integrity of each isolation point to detect any leakage or deterioration that may be caused by for example, vibration, disturbance, or changing pressure upstream.

b. Monitoring shall include checking zero energy through bleed valves or pressure build-up, or both.

c. The IsA shall specify the frequency of PBU monitoring for each bleed valve in the IDP. For each isolation, there shall be a minimum of one monitoring point.

d. An Isolator or IsA records the PBU results in eCoW.

e. For each isolation, as a minimum, complete the PBU monitoring before work starts on the isolated system and at least once per shift for all isolations that are Live in place (LTI are risk based. See section 14.28).

f. PBU checks are typically not needed when a system is positively isolated.

g. If zero PBU is not achieved when monitoring the integrity of an isolation, consider additional actions, such as maintaining or exercising isolation valves and carrying out further integrity tests.

14.14.13 Pressure build up (PBU) equipment

a. The choice of equipment used for PBU tests may affect the accuracy of the tests and the time taken to conduct them. The equipment needs to accurately reflect the pressure, be of a suitable pressure range and sensitivity, and allow safe attachment, pressurisation and depressuring after use.

b. Typically, the equipment would use one of three options below:

   1. A pressure gauge attached to a suitable flange or screwed fitting (e.g. rated and sized for the equipment they are being attached to).

   2. A procured, purpose made system such as the Crystal XP2i with snap-tite quick connect fittings.

   3. A fabricated rig with the ability to attach to flanged or screwed fittings and with the facility to safely depressure if necessary, after use.

c. Good practice when choosing a suitable gauge suggests either:

   1. Choosing one that is rated 30% higher than the normal operating pressure of the system being tested. This allows for protection of the gauge while maintaining a reasonable accuracy, or

   2. Using a lower rated gauge that is protected by an engineered overpressure device. This will allow a more accurate identification of PBU.

d. Some of the modern digital gauges can work accurately over a much wider range (e.g. Crystal system).

14.15 Isolating pressure relief devices

a. Only remove or isolate pressure relief devices (relief valves, rupture discs or vacuum breakers) by applying the following hierarchy of controls:

1. During a plant shutdown where positive isolation and zero energy is proven.
2. System isolated, depressurised, and thermal relief provided where required (Verify relief requirements with process SME).
3. The standby relief valve (100% capacity) is brought into service to allow removal of the duty valve.
4. Providing adequate alternative relief path – documented through an Approved SORA.
5. Using a SORA with additional controls that demonstrates the relief capacity available is adequate (reference or attach any Approved engineering calculations).
6. Removal whilst the pressure hazard exists and no SORA available use an Approved ORA.

b. If a thermal relief is provided on an isolated system that still contains hydrocarbons, a SORA attached to the override shall cover its use as a control.

c. Where a site has spared (100% capacity redundancy) relief valves, the spare or standby shall be online before taking the duty relief valve offline.

d. The position of the isolation valves around duty and standby relief valves are as per the P&ID. The inlet to the spare valve may be open or closed depending on the design and if credit has been taken during LOPA.

e. The changeover of relief valves is a critical activity and shall be controlled by an interlock system or an Approved IDP or SOP detailing the sequence of valve changeover and integrity verification.

f. Use the locked valve register to record any movement of locked valves associated with spared relief valves that have been moved whilst switching from duty to standby relief valves.

The movement of the locked valves around spared relief valves do not have to be marked up on P&IDs.

14.16 Isolating stored or accumulated mechanical or electrical energy sources

a. To avoid any accidental movement of machinery or sudden releases of any form of mechanical, electrical or pressure energy, safely release or discharge and then isolate all identified energy sources.

Batteries remain live and cannot be easily discharged. Follow section 22.3 for any work on battery systems.

b. For hydraulic, pneumatic and process-powered machinery, isolate the source of energy.

c. Isolate engine-driven machinery by shutting off the engine fuel supply and then isolating all the starting systems. Make safe electrically driven machinery by switching off the power supply to the motor and then isolating all electrical supplies.

d. For beam pumps, when working within or around the pump structure, immobilise the horse head and counterweight.

e. Safely release residual mechanical, electrical or pressure energy as follows:

1. Mechanical: run down high and low speed-rotating elements, release springs and charged springs within electric circuit breakers.
2. Electrical: discharge capacitors and isolate. Follow section 22.3 for any work on battery systems.
3. Hydraulic: depressurise accumulators and pressurised pipework.
4. Pneumatic: depressurise the system.
5. Services: depressurise, vent, purge or drain steam, gas or fuel.

f. Even if machinery powered systems are disconnected or engines and motors are prevented from starting, there may still be a foreseeable risk to people working on the machinery if it were to move. If this may happen, fit a device such as a properly engineered chock or wedge to lock the machinery in a safe position.

14.17 Isolating systems containing pulsation dampeners and accumulators

a. Whenever reasonably practicable, depressurise all pipework and the pre-charge of any pulsation dampeners or accumulators within the isolation envelope.

b. If the pulsation dampener or accumulator cannot be isolated or the risk of depressurising is higher than working on the pressurised pulsation dampener or accumulator, treat as non-conformant and complete an L2 risk assessment. The risk assessment shall determine the residual risk of keeping the unit at pressure whilst the task is being executed and consider, as a minimum:

1. the history of the unit (for example maintenance, previous failures)
2. stored energy risk versus the execution of an isolation envelope
3. how close the task is to the accumulator, and
4. the duration and frequency of the task.

For example:

- During drilling operations, the rig pump pulsation dampener (pre-charged to approximately 900psi with nitrogen) is not to be bled down when work is needed on the rig pump fluid ends. The Level 2 TRA considers if maintenance has been completed to reduce probability of the diaphragm rupturing. Typically, pulsation dampener diaphragms are changed out annually during continuous drilling operations and every two years on warm-stacked rigs.
- If an isolation envelope includes a pulsation dampener containing a pre-charge pressure, then the Level 2 TRA evaluates the residual risk of leaving the pulsation dampener at pressure, while removing, cleaning, and reinstating the pump suction strainer. The pulsation dampener does not have adequate isolation and it is not possible to provide positive isolation due to the existing pipe configuration.

Table 27 - Pulsation dampener and accumulator non-conformant RA prompt

Risk assessment discussion points – for a non-conformant isolation containing stored energy within pulsation dampeners and accumulators.	
Hazards to consider	**Controls to consider**
Failure of the pulsation dampener or accumulator bladder causing a sudden release of stored energy into the isolation envelope while work is being carried out on the isolation envelope. *The hazard identifies what the pre-charge medium is and how it will cause harm to people or plant. For example, nitrogen may asphyxiate people working on the isolation envelope and those in the surrounding area.* *A sudden release of pressure could harm people working on the isolation envelope and anyone nearby.* Consider other media (for example hydrocarbons).	Maintenance - Confirm the pulsation dampener or accumulator bladder has preventative maintenance routines established in the CMMS and that they have been maintained accordingly. Pulsation dampener or accumulator bladder failure – Confirm there is no history of failure with this or similar pulsation dampener or accumulator bladder type and duties. If there are any known failures, then the task shall not continue. Can positive isolation be safely applied and removed to minimise the exposure time of the stored energy?
Failure of pulsation dampener or accumulator bladder causing a slow release of stored energy while work is being carried out on the isolation envelope. *The hazard identifies the pre-charge medium and how it will cause harm to people or plant. For example, nitrogen could asphyxiate people working on the isolation envelope.* Consider other media (for example hydrocarbons).	Consider how long the isolation will be in place. Minimise the duration (for example by having like-for-like replacement available, or tools and equipment ready at the worksite). Consider the amount of stored energy in relation to the isolation envelope and how to reduce the associated risks. Is the task taking place close to the stored energy? If so, do not work on the pulsation dampener, accumulator or connecting pipework. Monitor pulsation dampener or accumulator pre-charge pressure for a defined period, (for example one hour before confirming the ICC is in place), to Verify no pressure reduction. Work shall not continue if any pressure decay is observed. Can additional relief paths (open ends) be considered to reduce the pressure effect during sudden failure? Are there any other barriers between the stored energy and the work face that could reduce the effect of failure of the pulsation dampener or accumulator? For example, is the accumulator part of a pump seal arrangement? Erect barriers and warning signs around the worksite, particularly focusing on open ends, to restrict entry. Consider the need for oxygen monitoring if the dampener or accumulator pre-charge is an asphyxiant. Consider ventilation or draining. Consider the cumulative risk of numerous pulsation dampeners or accumulators within one isolation envelope.

14.18 Electrical isolation

An electrical isolation is achieved by disconnecting all sources of electrical energy from equipment to create an adequate air gap that can be secured to prevent the equipment being energised.

a. All electrical work shall, where reasonably practicable, take place when the equipment is isolated in accordance with this CoW Procedure.

b. Where it is not reasonably practicable to isolate electrical equipment in accordance with this CoW Procedure, energised electrical work shall conform to section 22.2.

c. The term electrical isolation is applicable to all equipment where electrical energy may be present. The isolation of electrical energy to instrument and control equipment shall be regarded as electrical isolation and performed in accordance with this section 14.18.

d. All references to Electrical IsA in this CoW Procedure apply equally to Instrument IsA when performing electrical isolation for control and instrument work activities as detailed in Table 29.

e. IEC 60038 and NEMA C84.1 use different classifications of voltage. For the purposes of this CoW Procedure, the classification in Table 28 is used.

f. For Trinidad, Low voltage is up to and including 600 Vac, or 1000 Vdc. High voltage is above 600 Vac, or 1000 Vdc

Table 28 - Voltage classification

Voltage classification[34]	Voltage range
ELV (extra low voltage)	Up to and including 50 V ac or 120 V ripple-free dc
LV (low voltage)	Up to and including 1,000 V ac, or 1,500 V dc
HV (high voltage)	Above 1,000 V ac, or 1,500 V dc

14.18.1 Electrical isolation standards

a. Table 29 details the minimum electrical isolation standard, depending on isolation type and voltage. If the equipment is able to provide a higher level of isolation, then apply the higher standard.

b. Table 29 can be supplemented with equipment-specific procedures where required.

c. If the standard in Table 29 cannot be met, the isolation is classed as non-conformant. If this occurs, follow the process described in section 14.5.

d. Individually isolate auxiliary circuits on major items of equipment for control, indication and protection purposes. Examples include motor heaters, heat tracing, lube oil heaters, starter motors, indicators, and annunciators.

Table 29 - Minimum electrical isolation standards

Work activity	Voltage[35] level	Minimum IsA Level	Isolation standard	Disconnect and prove isolation integrity	Earth	Secure	Label or Tag
Non-electrical	≤1000 V ac (1500 V dc)	LV1	Full or personal	Yes		Yes	Yes
Non-electrical	>1000 V ac (1500 V dc)	HV	Full	Yes		Yes	Yes
Electrical	< 50 V ac or dc	LV2	Full or personal	Yes			Yes
Electrical	≥50 V ac or dc ≤1000 V ac (1500 V dc)	LV2	Full or personal	Yes		Yes	Yes
Electrical	>1000 V (1500 V dc)	HV	Full	Yes	Yes	Yes	Yes
Electrical (instrument and control)	<50 V ac or dc	Instrument	Full or personal	Yes			Yes
Electrical (instrument and control)	≥50 V ac/dc <240 V ac (120 V dc)[24]	Instrument	Full or personal	Yes		Yes	Yes

14.18.2 Electrical disconnections

a. Disconnect the equipment, using one of the methods in listed in 14.18.2c from every source of electrical energy before working on, or near, any part that is live or is likely to be live.

b. Disconnect all ungrounded conductors. This includes ungrounded neutrals. Additionally, where the work creates an ignition risk in hazardous areas, grounded neutrals are disconnected. Where there is no facility to do so, the task is risk assessed to agree controls to manage the risk of not disconnecting.

c. The point of disconnection shall be an air gap that can be secured in the open position for example:

   1. Racking a breaker or contactor out to create an air gap from the bus bar.
   2. Fuse withdrawal.
   3. Opening a link.

4. Disconnecting terminal.
5. Cable disconnection. If cable disconnection is used to achieve neutral isolation, see section 14.18.2.1 for additional precautions.
6. Removing a plug from a socket.
7. Using an isolator, switch, MCB or MCCB designed to an appropriate standard for example:
    - IEC 60898 Parts 1 & 2: Electrical accessories – circuit-breakers for overcurrent protection for household and similar installations.
    - IEC 60947 Part 2: Low-voltage switchgear and control gear - circuit breakers.
    - IEC 60947 Part 3: Low-voltage switchgear and control gear - switches, disconnectors, switch disconnectors and fused combination units.
    - IEEE C37.13: IEEE Standard for low-voltage AC power circuit breakers used in enclosures.
    - UL1066: UL standard for safety low-voltage AC and DC power circuit breakers used in enclosures.
    - UL489: UL standard for safety moulded-case circuit breakers, moulded-case switches and circuit breakers.
    - Other isolation standard Approved by the Site Electrical Leader.

d. Electrical work on control and instrument equipment <50V ac or dc[29], that does not meet the standards in section 14.18.2c.7 (e.g. older types of disconnect terminals) may be used if Approved by the Site Electrical Leader.

e. Electrical control devices such as push buttons or selector switches shall not be used as a means of disconnection.

f. Electrical control circuits or devices shall not be used as the means of isolation for the equipment they control.

14.18.2.1 Disconnection of neutrals

Neutral conductors are to be considered as live conductors. Depending upon the earthing/grounding arrangement and condition, it is possible that neutral conductors may be at any potential between earth/ground and line voltage. In some circumstances, neutral conductors may appear to be at earth/ground potential, but disconnection may remove the neutral connection to earth/ground. This may result in the neutral voltage rising to a hazardous voltage.

a. When isolating a neutral, the isolation should be achieved via a disconnecting device (see section 14.18.2), and then proving dead.

b. When a neutral disconnecting device is not installed and disconnection is achieved by manual/physical cable disconnection, the following additional precautions shall be taken before disconnection:

1. Treat as Energised Electrical Work if line voltage is >50V – see section 22.2. Risk assess using an Energized Electrical Work Certificate, detailing the following method:
    a) Identify the location of the system neutral-earth connection
    b) Prove dead all conductors (line and neutral)

c) If the neutral disconnection has the effect of separating any part of a neutral-earth/ground circuit, then:

1) Verify that there is no current flowing in the neutral, for example using a clip-on ammeter.

2) Install temporary earth/ground connection(s) to maintain earth/ground connection (see section 14.18.5 for installing earth/ground connections). An earth/ground connection is required between the point of disconnection and any potential source of supply.

14.18.3 Cable disconnections

a. Where equipment has been isolated and removed, the risk of potential re-energisation of the cable is mitigated as follows:

1. Where reasonably practicable, terminate the cable in a suitable termination box, otherwise, the disconnected cable may be left capped, taped, or 'bagged' in the field, with the conductors either insulated or connected together to earth/ground.

2. When the cable is going to be disconnected for more than one shift, record the disconnection as an isolation point in the IDP.

3. Cable disconnection using a single IDP:

   a) The electrical supply is isolated and recorded in the IDP.

   b) The hazards and controls associated with performing the cable disconnection are recorded in the IDP steps or permit.

   c) The disconnected cable is recorded as a separate isolation point in the IDP.

4. Cable re-connection using a single IDP:

   a) The hazards and controls associated with performing the cable reconnection are recorded in the IDP steps or permit.

   b) The electrical supply is Verified as isolated as a step in the IDP.

   c) The cable is reconnected, and point updated.

   d) The electrical supply is de-isolated, and testing is performed as per steps within the IDP.

5. Cable disconnection using two IDPs:

   a) The electrical supply is isolated and recorded in IDP 1.

   b) IDP 1 moved to isolation in place.

   c) IDP 2 for cable disconnection moved to in-progress and permit issued with IDP1 attached.

   d) Cable disconnected and IDP 2 moved to isolation in place.

6. Cable re-connection using two IDPs:

   a) IDP 2 moved to de-isolation and reconnection permit issued.

   b) Cable reconnected and IDP 2 complete

   c) IDP 1 moved to de-isolation.

14.18.4 Proving electrical isolation integrity

a. Treat all electrical conductors as live until proven dead.

b. Prove electrical isolation integrity for all isolations before work begins as follows:

14.18.4.1 Isolation integrity for non-electrical work

This type of isolation is only for work where there is no risk of contact with electrical conductors.

a. Prove the isolation integrity by one or both of the following methods:

   1. Visual confirmation of the isolation local to the equipment (such as a plug removed from its socket, physically traceable to the equipment). This is regarded as effective if the disconnection is made secure to prevent re-energisation.

   2. Demonstrating the isolation by operating a push button or other normal operating controls. This is a positive demonstration using the following method:

      a) Prior to isolation, the equipment should be energised (e.g. running or otherwise visibly energised).

      b) The equipment is then isolated and tested by attempting to start it (with all stop controls and interlocks, or any other overriding control function in a position to allow starting).

      c) Following successful demonstration of the lack of start, leave all stop controls and interlocks in position that will prevent starting.

b. If neither method can be achieved, use the isolation standard for electrical work, or treat the isolation as non-conformant.

14.18.4.2 Isolation integrity for electrical work with proving dead

a. This type of isolation is used where there is a risk of contact with electrical conductors, or where this CoW Procedure requires a ‘positive isolation’, the electrical isolation shall be done to this standard.

b. The electrical IsA shall prove the isolation integrity by completing all of the following steps:

   1. demonstrating the points of isolation to the PA

   2. demonstrating correct identification of equipment and isolation point by either of the following methods:

      a) Visual confirmation of the isolation local to the equipment (such as a plug removed from its socket, physically traceable to the equipment).

      b) demonstrating that:

         - the isolation point, interconnecting cable, and equipment are identified by unique, and permanently-fixed tag numbers,
         - the tagging correlates between the isolation point, both ends of the cable, and the connected equipment, and
         - the tagging matches the tagging on the interconnection drawing.

   3. proving dead at the point of isolation in cases where:

      a) the air gap provided by the isolating device is not clearly visible, and

b) equipment design provides access through an engineered feature (e.g. this may include a panel door but does not include equipment dismantling or deconstruction).

4. proving dead at the point or points of work; the PA shall witness this test or prove dead themselves (if they are competent to do so) before starting work on any conductor.

c. Use an approved live line tester to prove dead.

1. Prove the tester both before and after use.
2. Prove dead the conductor between circuit and earth or ground. Where there is a neutral or the system is unearthed or ungrounded, also prove dead the conductors between all of the circuit conductors.
3. After testing with an applied voltage, discharge a conductor to earth using Approved discharging equipment. Once discharged, the conductor shall again be proven dead.
4. Include proving dead activities as actions in the IDP. If the task of proving dead at the point of work is covered by a separate permit, then include reference number of the permit in the IDP.
5. An IDP with appropriate controls or a hot work spark potential permit shall include proving dead of equipment.

14.18.5 Earthing or grounding

The term ‘ground’ tends to be used in US, and ‘earth’ used elsewhere. For the purpose of this section, the terms are considered to mean the same.

a. Apply earths to electrical equipment in the following circumstances:

1. Prior to working on HV electrical conductors.
2. Prior to working on LV electrical conductors where there is a danger of re-energisation (for example becoming charged from another source such as by electromagnetic induction).
3. To discharge capacitors.

b. Include earths in the isolation design and record on the IDP. They are normally applied at the isolation point. However additional local earths may be required if the point of work is remote from the point of isolation.

c. Only apply earthing devices after all isolation devices have been opened and after the circuit has been proven dead where practicable. In cases where the earthing device is a ‘facility integral within arc-rated switchgear’, voltage indicators can be used instead of proving dead.

d. If the electric circuit can be energised from more than one source, apply earths between the point of work and each source.

e. Where equipment is earthed via a switch or circuit breaker, lock the earth connection, where practicable. Apply the lock to operating handles or mechanical trip push buttons.

f. An earthing notice shall be posted at the point where an earth connection has been applied.

g. Use specifically designed earthing devices or leads to apply earth connections.

h. Avoid contact with conductors during application of earthing devices, for example by:
    1. using earthing devices integral within arc-rated equipment
    2. using earthing bonds with insulated handles
    3. where required to make bolted connections, first apply a temporary earth hook, with insulated handle, to earth the conductors before completing the bolted connection using insulated tools.

i. The earthing devices shall be rated for the available fault duty where the conductors or circuit parts being de-energised could contact other exposed energised conductors or circuit parts.

j. For switchgear, the correct operation of the earthing or grounding device, where permitted by design, is visually confirmed after either applying or removing the device.

k. Make the earth connection before attaching the earth bond to the conductors.

14.19 Instrument and control isolations

a. Instrument isolations may include process and electrical isolations and shall conform to the associated standards as detailed here and in sections 14.14.1 and 14.18.1.

b. It is good practice to isolate all voltages wherever reasonably practicable. However, the approach shall minimise overall risk and in the case of systems <50 V[29] ac or dc, this may be delivered by working live.

c. The following shall be applied as a minimum:
    1. Isolate all pneumatic supplies to instrumentation and control equipment (for example actuated valves, analysers, purge systems) as close as possible to the device to be worked on (that is, either at a local isolation valve, at the nearest header off-take or the distribution manifold).
    2. Disconnect and tag the supply tubing at a suitable location.
    3. Isolate all hydraulic supplies to actuated valves as close as possible to the device to be worked on.
    4. Disconnect, cap and tag the supply tubing at a suitable location.
    5. Where hydraulic supplies to actuated valve disconnection is not reasonably practicable or where it introduces a higher risk (e.g. due to contamination, air ingress) then either:
        a) use a double block and bleed configuration on the hydraulic supply, or
        b) class the isolation non-conformant.
    6. When a DBB isolation is required (see Table 26), it is permissible to use a combination of the pipe-class isolation valve at the process line/equipment and valves/manifolds local to the instrument.
    7. When a DBB isolation is required (see Table 26) but not available, it is permissible to use single valve isolation for small bore (≤ 20mm, ¾in[30]) piping and tubing connections to instrumentation provided that all risks are addressed in the task risk assessment or the IDP.
    8. When you need to test, or work on, or close to energised instrumentation circuits, consider and control the following hazards:

a) Electric shock from instrumentation circuits operating <50 V[29] ac or dc is relatively low risk and work may proceed without an energised electrical work certificate

b) Ignition from an accidental spark

c) Injury from an electric arc is low. However, the individuals carrying out the work shall be competent and use Approved test equipment and tools

d) Process upset or trip during the work.

9. When removing instruments, use rated caps, plugs or blanks on open connections.

14.20 Automation systems

a. Electrical isolation of automation system components and sub-systems shall be performed following the principles detailed in section 14.19. Isolations will normally be performed using plugs, fuses, MCBs or MCCBs.

b. An ORA shall be carried out when isolating all or part of an automation system that creates or has the potential to create an abnormal operating condition.

14.21 Well equipment specific isolations

a. For all isolations on well equipment, 100222BP Practice Well Barriers (10-65) shall be followed.

A well barrier is an envelope of one or more dependent well barrier elements (WBEs) that prevent fluids from flowing unintentionally from the formation or well into another formation or to the surface.

b. Isolation of the well from the process plant shall be controlled through an IDP and ICC and will include the flow line isolation valves and, where applicable, the wing valve (e.g. where there are no plans to remove it). Hydraulic supplies or control to the upper master valve (SSV) and the downhole safety valve (SSSV) are normally handed over to GWO and not included in the ICC.

c. This isolation is implemented and controlled by Production. It is normally removed when the activity has concluded and the well has been handed over back to Production, except for some well intervention activities requiring the well to flow back to the plant. In these cases, the sanction to test (STT) process is used to request and authorise de-isolation.

The operation of the Christmas tree and wellhead valves that are not part of the IDP/ICC because they need to be operated during well intervention shall be managed through a risk assessed procedure for the task. These are typically the swab valve, the upper master valve and the lower master valve but can also include wing or annulus valves for specific GWO activities.

d. Valves requiring prompt access for emergency or operational purposes during well work activities do not require to be locked. In such a case, the following shall be applied:

1. Document in the permit or RAP the operational steps for these valves.

2. The operator of the valves is competent in the task and the requirements in the permit or RAP.

3. Tag the specific valves involved in the emergency/operational process to remain open or closed during the task execution.

14.21.1 Breaking containment in well operations

a. In well operations, the isolation methods for breaking containment are applied and Verified to their respective acceptance criteria table (ACT) described in 100222 BP Practice Well Barriers (10-65).

14.21.2 Mud pits and rig floor isolations

a. For isolations and de-isolations required for CSE to a mud pit, the following shall be done:

   1. Develop an IDP that identifies all isolation and de-isolation points, including fluid transfer and supply lines.
   2. When the IDP cannot meet the CSE requirements of section 15 of this CoW Procedure, classify the isolation as non-conformant.
   3. Record and monitor the isolations integrity as defined in the IDP.

14.21.3 Slip and cut activities in global wells

a. When a drilling line needs to be replaced due to fatigue, a new line is unspooled from the storage reel and slipped through the crown block, traveling block sheaves and draw works spool. The excess is cut off and discarded.

b. During this operation, the driller has sole control of the draw works. The slip and cut isolation method and task execution strategy are defined in the RAP by Wells in the region for each type of equipment. This usually involves the AA, WSL, and Wells Superintendent.

c. The minimum isolation requirement for this task to prevent unwanted draw works rotation is personal isolation, and can include:

   1. disabling control screens/ select stand-by mode or equivalent
   2. switching to slip and cut mode, or Movement Inhibiting Procedure as a way of preventing unwanted movement
   3. isolating associated energy sources, utilizing personal isolations placed by the respective Isolator discipline.

14.22 Requirements for the use of CAT A & CAT B butterfly valves

a. When there is no alternative to using butterfly valves due to rig, or marine vessel design, treat the isolation as non-conformant.

b. If the following criteria are met, then the isolation can be considered conformant, and the risk assessment can either be included as an action within the IDP or hazards and controls in the TRA for the task:

   1. The system pressure is less than 10[26]Bar (150 psig) or for systems containing sea water, potable water, or sewage grey water the limit is <50barg(725psi)[31.]
   2. The butterfly valve does not have any known integrity issues and isolation integrity can be proven. The method of proving integrity will be identified by an action if the butterfly valve is incorporated within an IDP or as a specific control within a TRA if used as part of a personal isolation.
   3. PBU monitoring is identified within the IDP, permit, or LRP.
   4. The risk assessment includes a contingency plan, which will be identified within the TRA when a butterfly valve is used for a personal isolation or as part

of the contingency plan in step 4 of an IDP when a butterfly valve is used within a full IDP.

5. The TRA covers the hazardous nature of the fluid (e.g. fluid type and toxicity).

14.23 Non-diving subsea isolations

a. Isolations for non-diving subsea operations differ from topsides isolations. The risk assessment shall consider the consequence of both ingress of seawater as well as discharge of the process fluid to the environment.

b. Subsea Well P&A activities, deconstruction and decommissioning may require permanent modification or long-term isolations. Any isolation shall be conformant with the isolation requirements established by this CoW Procedure (including long-term isolations).

c. Wells breaking containment isolations shall be managed under the applicable 100222 BP Practice Well Barriers (10-65).

d. All subsea isolations shall be Level 2 risk assessed, as part of the IDP. Isolation requirements described are for CoW activities occurring downstream of the wing valve on the subsea tree to the pipeline pig trap. Examples of operations that require isolations are as follows:

1. Removing a jumper.
2. Horizontal or vertical tree choke change-out.
3. Subsea control module change-out.
4. Removing pressure caps from a subsea manifold.
5. Removing or replacing (or both removing and replacing) ancillary subsea equipment (e.g. flow meters, chemical injection meter valves, logic caps).
6. Removing control flying leads (includes chemical, hydraulic and annulus monitoring lines).

The requirements for tree cap removal isolations are defined in 100222 BP Practice Well Barriers (10-65).

Typical subsea isolation arrangements in bp subsea fields are listed below. For each one, the approval is based on the residual risk identified during the Level 2 TRA:

- Double block (both tested) with pressure monitoring.
- Double block (both tested) without pressure monitoring.
- Single valve isolation, with two valves in series (one not tested).
- Single valve (tested).
- Tested combinations of self-sealing poppets and valves.
- Tested pressure plugs.
- Tested pressure caps.
- Tested debris caps.

e. Table 30 shows the common valve types that may be considered for isolations when the Level 2 TRA risks are Approved.

Table 30 - Commonly used devices for subsea isolations

Type	Intervention
Slab/gate	All
Ball	All
Needle	All
Poppet	SCM, flying leads
All = All interventions including breaking containment of main process piping. **SCM, flying leads** = Removal of subsea control module or flying leads for non-hazardous fluids.	

f. The valve shall be manual, locked-out actuated fail 'as is', or a locked-out actuated failed closed type.

g. In subsea isolations:

  1. Non-return valves, check valves, and choke valves shall not be used for isolation to prevent fluid movement.

  2. Dummy hot stabs shall not be used for isolation, unless the design of the hot stab sealing system meets the requirements of the fluid to be isolated.

h. The acceptability of valves being used for subsea isolation depends on the level of residual risk identified during the Level 2 TRA. To determine the level of residual risk, consider the following:

  1. Failure rates on valve failures shall be based on industry/vendor data.

  2. Valves that are actuated remotely and fail in a closed position can be software inhibited within the master control system provided an increased likelihood of failure is considered.

  3. Valves that have been tested but are subsequently opened and closed one time prior to performing an intervention may be considered as isolations providing an increased likelihood of failure is considered.

  4. Testing of isolations with a reverse differential pressure test will only be acceptable for positive sealing valves (i.e. if the seal is mechanically energised such as needle valves).

  5. Trapped pressure between two isolation valves at a pressure higher than the fluid being isolated may decrease the likelihood of failure of the isolation when only one valve can be tested in the direction of flow. However, the risk assessment shall be based on only single valve isolation.

  6. Certain valve types may be subject to unseating after testing because of changes in pressure within the valve cavity or, for hydraulically actuated valves, changes in hydraulic pressure. Interventions planning would take this into account and address this risk through a procedure.

i. The following minimum testing requirements shall be considered:

1. Two independent isolations shall be established before intrusive works can commence and where possible, both are tested in the direction of potential hazard flow. This can be achieved with either a positive or a negative test.
2. The required differential test pressure is the maximum that may exist between the ambient pressure and the internal process fluid during the intervention. The differential test pressure is established taking into account changes as a consequence of temperature effects, shutdowns, startups, and varying operating conditions.
3. If an isolation cannot be tested to the maximum differential pressure, the test is conducted to the highest practical differential pressure at the time of the test in the direction to which it could be exposed. The theoretical effect of increasing the differential pressure on the sealing performance shall be accounted for when assessing the acceptability of a lower differential pressure test.
4. The allowable pressure test acceptance criteria shall be defined for each assembly or defined for individual tests required on a variety of components or features. Refer to 100222 BP Practice Well Barriers (10-65) and 100218 BP Practice Pressure Testing (10-45) for specific acceptance criteria.

14.24 Diving operations isolations

a. Diving operations have specific isolation requirements; for more information refer to 100241 BP Practice Diving (EP SDP 3.2-0001).

b. If you are supporting a diving operation, you shall do the following, as far as is reasonably practicable:

1. Remove all hazardous materials from inside the system that is being worked on.
2. Put mechanical barriers in place to isolate the system satisfactorily from any potential source of energy.

14.25 Boundary isolations and when to use them

The term boundary isolation is often used to describe the complete isolation of a process unit at the battery limit. A boundary isolation can also mean the isolation of one or more systems within the process unit.

Boundary isolations are typically used for large-scale plant maintenance shutdowns or TARs.

a. Boundary isolations may be used when the full inventory of hazardous materials (see Table I.1) are removed or evacuated from the complete system within the boundary isolation.

b. The boundary positive isolation may be used as the main isolation to enable multiple tasks to be executed efficiently under the boundary control.

c. When boundary isolations are applied and used, they shall conform to the following:

1. They are positive isolations.
2. The full inventory of hazardous process fluids, or hazardous utilities fluids have been removed from the complete system.
3. Tasks within an existing boundary isolation are assessed to help decide if additional isolation is required (for example if there is potential of trapped

pressure within the systems). When this is the case, raise a separate ICC for the task.

4. Isolations for CSE within the boundary isolation meet the requirements in section 15 of this CoW Procedure and are positively isolated with their own ICC.
5. Leak testing within the boundary isolation meets the requirements of this CoW Procedure.
6. They cross-reference all related permits to work and additional ICCs within the boundary isolation to the boundary ICC.
7. Only remove boundary isolations when all work within the boundary is completed.
8. If work on a piece of plant or equipment within the boundary isolation is to be suspended, a separate specific isolation is applied, and an ICC confirmed and in place before the boundary isolation is removed. Examples of plant and equipment in this situation could be piping, vessels, mechanical or electrical equipment or valves. An example of having to suspend work would be due to waiting for spares to arrive.
9. Verify that any equipment within the boundary isolation is left in a safe condition and isolations in place meet the isolation standard.
10. Include the integrity monitoring and verification checks of isolations in planned visits where a boundary isolation includes:
    a) an NUI, or
    b) remote unattended sites, or
    c) both.
11. The frequency and requirements of the monitoring shall be included within the IDP and risk assessment
12. Assess any additional tasks on systems or equipment that are already part of a boundary isolation to consider any requirements for applying additional isolations and controls.
13. In practice, the geographical area of a boundary isolation may contain live pipework, such as utility systems that feed the adjacent plant. Clearly mark these areas with live pipework and make sure everyone working in the area is aware of it.

d. If a positive boundary isolation is not achieved, the isolations within that system are required to conform to the process isolation standards in Table 26. If isolations do not conform with these standards, follow the non-conformant process.

14.25.1 Boundary isolations with active bleed (e.g. TARs)

a. For TARs only, when using a boundary isolation on a system within the process unit, and when it is not reasonably practicable to use positive isolation, an integrity proven DBB can be used if all the following requirements are met:

1. The bleed is left open to a safe location. In this context, a 'safe location' is one that has minimal potential for back pressure or contamination.

14.25.1(a)1 above intends to minimise the risk of the downstream valve in the DBB arrangement, seeing any pressure rise due to an excursion in the system being used as *a vent location (e.g. use a flare system which is designed to operate at low pressures even when another system is venting into it).*

2. The bleed is periodically closed and monitored to Verify that zero energy is reaching the downstream valve in the DBB arrangement.
3. All other necessary controls are in place to manage hazards associated with the work that is going to take place downstream of the DBB (e.g. full inventory removed, flushed, and purged, atmospheric monitoring, area barriered off, drains covered, fire watcher).
4. Work taking place downstream of the DBB is not CSE, or HWOF.

14.26 Cross-site boundary isolations

On some sites, pipes, cables, drains or communication connections cross the site boundaries (bp or third-party). If an isolation is required on any of these systems, they are classed as cross-site boundary isolations.

a. If a cross-site boundary isolation is required, a formal process for communicating and controlling the isolation shall be used and a cross-site boundary certificate completed. Either party shall request, in writing, the other for cross-site boundary isolation.

b. The isolation shall conform to both parties' CoW procedures. Both sites have previously agreed and documented the details of these, typically in contracts or agreements. Each party will apply a lockout device as specified in their CoW procedure. The isolation will remain in place and be revalidated by both parties until both sites Verify and certify that the required work is complete, in a safe condition and the system may be de-isolated.

c. The cross-site boundary isolation certificate does not authorise work. All work shall be controlled through the site's CoW system.

14.27 Isolating radioactive sources

Radioactive sources are sometimes used within instrumentation on bp facilities.

Sources consist of radioactive samples contained in a shielded box. Typically, the sample itself is a small piece of radioactive substance encased in double-wall stainless steel cladding, resembling a medicinal pill in size and shape. The source may be locked out for testing and maintenance only, by dropping a metal shutter over the "window" of the box.

a. Sites that use radioactive sources shall have the risks associated with the source managed by a competent person, typically known as the radiation protection supervisor (RPS).

b. The IsA Instrument shall design and implement the IDP.

c. The RPS shall:

   1. countersign the IDP to Verify it meets relevant radioactive source legislative requirements
   2. be present when a radioactive source is isolated in the field, to Verify IDP conformance.

14.28 Long-term isolations

Long-term isolations (LTIs) are defined as those isolations that no longer have work performed against them but are required to remain in place.

a. Isolations are moved to LTI if they are in place with no active or scheduled work.

b. Positively isolate any LTI.

c. Where positive isolation is not possible, the LTI is classed as non-conformant and a Level 2 TRA carried out to determine and manage the associated risk.

d. Before moving an isolation to LTI, the AA shall do the following:

   1. Record why the item is being isolated for a long-term period, for example:

      a) waiting on parts or materials

      b) equipment is being taken out of service for a period

      c) the equipment is redundant, abandoned-in-place or awaiting demolition.

   2. Consider the effect of the LTI on preservation of equipment (for example anti-condensation heaters for motors, loss of trace heating in sub-zero conditions, standing alarms, corrosion inhibition, inerting or barring over of rotating equipment).

   3. Consider the risks associated with PBU frequency checks when in LTI. For example:

      a) Was there any evidence of PBU whilst the isolation was ‘live’?

      b) Has there or is there likely to be any significant changes in process conditions while the LTI is in place (e.g. temperature, pressure, flow rates, specific gravity)?

      c) Is the isolation non-conformant?

   4. Record how long the isolation is expected to be in place before it can be de-isolated, or work can re-start on it.

   5. Verify that the permit assigned for the work is closed.

   6. Verify that any positive isolations have a broken joint tag to show joint make-up was torqued and leak tested.

e. The ICC is then moved to LTI in eCow.

f. LTIs shall undergo an engineering review after 180 days using the quality assessment in eCoW.[32] The requirements for further reviews are based on the outcome of the assessment with a minimum of annually. This reviews the effectiveness of isolations in place, considers how risk may change over time and considers if the isolation can be replaced by application of a permanent modification, controlled by an eMoC. The review is led by the Site Engineer, involving relevant discipline engineers, and SA or AA. It is not a field inspection of the isolation but a review of the list of LTIs to review risk and possible engineering solution to remove.

g. The IsA shall complete an LTI field verification every:

   1. 90 days[33] for non-conformant isolations

   2. 365 days[33] for conformant (positive) isolations.

h. The LTI field verification is checking each isolation point and confirming:

   1. the tag is legible and attached

2. the isolation is in the correct state
3. PBU checks detailed in IDP have been completed

   PBU checks are typically not needed when system is positively isolated.

4. The LTI database in eCoW is up-to-date, with verification records correct using signatures tab in IDP.

i. Before moving an isolation from LTI to isolation in place (for example to authorise a permit to work), the AA Verifies:

   1. all isolation points are in place
   2. zero energy by conducting a PBU check
   3. integrity of electrical isolation at point of work as per sections 14.18.4.1 or 14.18.4.2.

   These verifications can be recorded using the countersignature feature within eCoW.

j. LTIs created during commissioning shall be documented as part of the commissioning, energisation and isolation procedure of equipment and plant and then transferred into eCoW before handover to Production.

14.29 De-isolating

The AA specifies an appropriate set of pre-startup checks in accordance with section 20.

a. Before authorising de-isolation, the AA Verifies:

   1. all relevant QC Certification is completed
   2. all permits linked to the IDP are completed
   3. there are no SIMOPS that could introduce significant hazards
   4. a worksite visit has been completed by an AA to confirm that the operating equipment or plant is ready for de-isolation, including:
      a) confirmation of plant integrity before removing isolations
      b) consideration of the effects of removing the isolation and re-starting plant on other isolations and systems
      c) consideration of substances that can build up behind the blank or spade if a valve leak
      d) Checking of vents or drains before the spade or blank is removed. If a leak is detected behind the isolation, shut the vent, or drain and stop work until a safe system for the removal is in place.
   5. there are no other permits linked to the ICC before authorising de-isolation
   6. an Ex or ATEX inspection has been completed for electrical equipment in hazardous areas if any work may have affected an equipment's hazardous area protection integrity.
   7. that de-isolation is carried out in accordance with the IDP.

15 Confined space entry

a. bp policy is to avoid confined space entry (CSE) wherever reasonably practicable. It is the role of those planning the work to minimise the need for CSE and provide alternate means of performing the work.

b. CSE occurs as soon as any part of the entrant's body breaks the plane of an opening into a confined space.

c. A space is classed as confined if it meets all the following three criteria:

   1. is large enough for an individual to enter fully
   2. has a limited or restricted means of entry or exit
   3. is not designed for continuous occupancy by the individual.

   Table 12 has examples of confined spaces.

d. Not every excavation or enclosed space is a confined space. Use the CSE register to check if an enclosed space is a confined space or not. For excavations, the ground disturbance certificate states if the excavation is a confined space or not.

A confined space may also have the following characteristics:

- it has physical and mechanical hazards or internal configurations or obstructions that could cause someone to be trapped or asphyxiated.
- it contains or has the potential to contain a hazardous atmosphere.
- it contains a material that has the potential to engulf a person who enters the space (for example a molecular sieve or a catalyst).
- it has an internal configuration such that the person who enters it could be trapped or asphyxiated by inwardly converging walls or by a floor that slopes downwards and tapers to a smaller cross-section.
- it is not designed for people to enter and work in regularly. For example, a food storeroom would be designed for regular entry, but a boiler or crankcase would not.
- it is designed to store bulk cargo products, enclose materials and processes or transport products or substances. However, employees may need to enter these spaces occasionally for inspection, maintenance, or cleaning.
- it does not have enough natural ventilation for someone to breathe normally.
- before someone can safely work in it, it requires forced mechanical ventilation for general ventilation purposes, or LEV where tasks in the confined space generate contaminants.

15.1 Confined space isolation

a. Positively isolate the confined space by disconnecting, blinding, or spading from any live energy source including all permanently connected utilities, completely protecting against the release of energy and material into the space.

b. Positively isolate all electrical sources of energy to the confined space.

c. Remove or positively isolate any nucleonic devices before allowing a CSE.

d. Consider the isolated position of vents, nozzles and drains as part of the risk assessment. For example, they may need to be left open while a level bridle is drained and removed, but isolated (blanked or blinded) once the bridle is taken away to reduce the risk of any other materials inadvertently entering the space.

e. Any rotating or reciprocating moving equipment inside the confined space shall be electrically isolated and made secure against unplanned movement.

f. For Wells mud pits or tanks, pump pits, sumps, drains, or other utility systems where a positive isolation is not reasonably practicable, conduct a Level 2 TRA and have an IDP identifying all isolation points, including fluid transfer and supply lines or ducts.

g. When valve isolations cannot meet the standards in Table 26 and Table 29, they are classed as non-conformant; monitor them for integrity over a period defined in the isolation plan.

15.2 Risk assessment of a confined space

a. Confined space entry shall have:

   1. a Level 2 TRA for entry to a confined space

   2. a separate TRA for each task to be executed within the confined space; these can be a Level 1 TRA or Level 2 TRA depending on the task

   3. a specific ERRP, see section 18.5.7 for more details

   4. Live-Live link in the eCoW system so that the task permit cannot be issued unless the CSE permit is live.

b. The risk assessment shall:

   1. consider the hazards listed in sections 15.2.1, 15.2.2, 15.2.3 below

   2. in combination with the TBT, be suitable and sufficient for all entrants to understand the hazards and controls associated with working in the confined space.

c. Where sites require specific additional training for entrants, this shall be detailed in the LIP.

15.2.1 Process hazards

Table 31 - Process hazards

	Process
1	Toxic substances in hazardous concentrations (e.g. hydrogen sulphide (H_2S), benzene, hydrocarbons, heavy metals such as mercury, welding fume that remain from the process or enter from outside the confined space).
2	Flammable gases, vapours and liquids from inside the confined space, from outside it, or both. Consider the density of the contaminants that may accumulate in low points.
3	Gas or vapour emitted from scale or sludge, particularly resulting from mechanical disturbance during access or cleaning or due to the heat from welding operations.
4	Gases from fire protection systems such as CO_2 or halon.
5	Naturally occurring radioactivity: A Radiological Protection Supervisor checks any confined space that might normally contain NORM (including systems containing hydrocarbon, produced water and seawater).
6	Pyrophoric scale formed in systems.
7	Residue or sludge removal considering (e.g. biological contaminants, combustible materials, toxic gases or vapours, paints (cadmium), plating (chromium, nickel, copper, and zinc), degreasers, NORM, moulds, refractory ceramic fibre/Silica).
8	Sulphur dioxide gas (SO_2) can be present in tanks or systems containing sodium bisulphite. Risk is increased if ambient temperature is >35^{o}C. Common use of sodium bisulphite offshore includes marine growth protection systems and oxygen scavengers.
9	Hydrogen gas can be generated by electro-chlorinators in marine growth protection systems. Note that infra-red based flammable gas sensors cannot detect hydrogen gas.
10	Highly toxic Chromium 6 residues can be generated on steel alloy based steam turbine components if the temperature is >400^{o}C. Anti-seize compounds can increase the amount of Chromium 6 generated. Calcium containing products such as calcium silicate & rockwool insulation in contact with high temperature steel alloys can also generate Chromium 6.

15.2.2 Worksite hazards

Table 32 - Worksite hazards

	Worksite
1	Mechanical equipment in the space.
2	Ingress of steam, hot water or other liquids that can cause scalding or drowning.
3	Nearby deluge system activating.
4	Noise and communication difficulties.
5	Access and egress for both work and rescue.
6	Vessel boots and sumps containing liquid that anyone could fall into.
7	Temperature.
8	Inadequate visibility: provide lighting to allow anyone wearing full PPE can find his or her way between the worksite and the exit without difficulty.
9	Electric shock or ignition of flammable gases from portable lights, tools, static electricity or associated electrical equipment.

	Worksite
10	Poor access and egress restricting movement for normal work and escape. Individuals will need to be able to enter and leave the CSE opening comfortably while wearing PPE.
11	Fumes entering the space (for example from drain or vent systems).
12	Obstructions and tripping hazards inside vessels and on access or egress routes. Where they cannot be eliminated, mark them and, if possible, shroud them so that the work party, wearing full PPE for the task, will recognise their location and the nature of the hazard.
13	The routing of items such as cables, ducts, hoses within the vessel and does not obstruct access, egress or work at the worksite.
14	Falling objects or excavations collapsing due to inadequate shoring.
15	Exhaust gases drawn into the confined space from prime movers or heating equipment.

15.2.3 Task hazards

Table 33 - Task hazards

	Task
1	Ergonomic hazards associated with awkward working positions.
2	Vibration from hand power tools.
3	The possibility of static electricity build-up.
4	Injury from mechanical equipment such as mixers, conveyors.
5	Noise from ventilation equipment, adjacent processes or the task being undertaken.
6	Introduction of flammable products such as aerosol dye penetrants used in non-destructive testing.
7	Gas, vapour, or fumes produced by operations being carried out in the confined space such as welding and cutting, brush and spray painting and the use of adhesives, penetrants and solvents.
8	Compatibility between worksite hazards and PPE (e.g. use of Self-contained Breathing Apparatus (SCBA) and limited access).

15.2.4 Oxygen hazards

a. Dangerous situations can arise from oxygen-enriched atmospheres. Take precautions to avoid oxygen enrichment. In particular:

1. keep oxygen cylinders outside the confined space where reasonably practicable
2. isolate oxygen supplies outside the confined space during work breaks
3. remove hoses supplying oxygen from the confined space during work breaks
4. never use oxygen to sweeten or enrich the atmosphere of a confined space
5. adequately ventilate the confined space at all times.

The specific dangers of working in oxygen-enriched atmospheres cannot be over-emphasised. Oxygen enrichment can happen by oxygen supplies leaking or by oxygen building up during oxygen-rich flame cutting processes.

Enrichment of only a few percent will make materials that would normally only burn slowly or with difficulty, burn fiercely – with catastrophic results for people in the confined space.

15.3 Preparing the confined space

a. Preparations shall include:

1. emptying the space of its normal contents and then purging it of residue by hot or cold water flushing, nitrogen purging, steaming, or chemical cleaning, or other Approved methods.
2. air-purging the space of potentially harmful gases prior to entry, except for intentionally inert atmospheres.
3. placing 'Danger – Confined Space Do Not Enter' signs and guardrails at entryways and placing air movers in accordance with a ventilation plan.
4. disconnect, blind, isolate or remove any temporary hook-up or purge connection to the confined space (except for intentionally inert atmospheres).
5. atmospheric testing by an AGT1 to CSE entry criteria defined in section 24.
6. keeping access and egress ways unobstructed. Do not use them for objects such as hoses and cables.
7. having an Approved ERRP available at the TRA. Any specialist recovery equipment required is available and ready to use.
8. protecting all electrical supplies, tools and lighting with earth limiting circuit breakers, RCDs or GFCIs.
9. avoiding placing transformers within a confined space as they have significant stored energy.
10. providing the CSEA with an emergency shutdown (ESD) button that is within arm's reach when blasting or jetting equipment is used.

15.4 Lighting the confined space

a. When lighting is required, either provide two independent sources of lighting, or one with a battery backup to allow evacuation of the CSE in the event of power failure.

b. Before a confined space has been declared gas free, use torches that are suitable for the area classification (zone 0 or class 1 zone 0 or class 1 division 1[103]).

c. When the confined space has been certified gas free (<1% LEL[18]) and is being made ready for work either use:

1. Lighting (at voltage <50 V ac or dc, air driven), provided it meets the following criteria:
    a) Certified for zone 1 or class 1 zone 1 or Class 1 Division 1[103].
    b) At least one light has a battery backup, or a certified flashlight provided as a backup.
    c) Cables that are suitable for the duty and mechanically protected.
    d) All supply transformers (or AC to DC power supplies) are placed outside of the confined space.
2. 110 V / 120 V lighting may be used if Approved by the Site Electrical Leader, provided it meets all of the criteria in 15.4c.1plus the following:

a) The cables and light fittings are not installed in entry ways being used for access or egress to the confined space unless suitable protection is provided.

b) Cables, cords, and lights are secured to prevent damage or submerging in liquids.

c) Voltage levels are limited to 120 V ac grounded neutral (US) /110 V ac supplied via a centre tapped earthed transformer.

d) The circuit inside confined space has ground fault circuit interrupter (GFCI) or residual current device (RCD) personnel protection (where voltage levels to earth have been reduced by using a centre taped earthed transformer with double pole protection.

e) Inspect cables and lights before use. Immediately de-energise and remove any damaged equipment.

15.5 Confined space ventilation

General or dilution ventilation can be provided by natural airflow or mechanical airflow pushing air into a confined space. LEV is a system which relies on mechanical extraction airflow.

a. For work inside a confined space, where actual or potential atmospheric hazards exist, a ventilation plan, Approved by the HSE&C team is required.

b. Dilution ventilation can be used for maintaining the oxygen levels, the thermal environment and for non-toxic contaminant dilution.

c. The TRA shall consider LEV to remove hazardous substances at source for any tasks conducted inside the confined space (e.g. welding, cutting, chemical application).

d. When considering the ventilation method, take account of the following:

    1. The layout of the space.

    2. The position of openings.

    3. Air flow restrictions.

    4. Equipment components in the confined space (for example brackets, trays, pipes).

    5. Maintenance or construction materials erected in the confined space (for example tube and clamp scaffolds, scaffold boards).

    6. Obstructions in the make-up air manway (for example the attendant, weather enclosures around manways, local exhaust ducts, welding cables).

    7. Insufficient number of make-up air man-ways. It is best to have at least one makeup air manway for each air-moving device.

    8. Local exhaust ventilation (LEV) and/or respiratory protective equipment (RPE) may be required for certain tasks generating toxic substances in the confined space

e. The effectiveness of the ventilation system is Verified before entry to a confined space, at the start of the task and periodically for the duration of the task. The verification includes:

    1. Airflow checks using an anemometer and calculation that air changes are adequate for general ventilation

2. Capture hood face velocity checks using an anemometer and, where reasonably practicable, system pressure checks, for LEV utilised as a control measure for tasks in the confined space.
3. Measuring the concentration of hazardous substances in the confined space.

f. Once established, maintain ventilation in the confined space throughout the operation, except as required:
   1. for atmospheric testing
   2. by agreed operational requirements such as welding where the airflow from the ventilation may affect the weld quality.

g. Pressurised air or oxygen shall not be used directly to ventilate a confined space.

15.5.1 Mechanical ventilation

Some confined spaces require mechanical ventilation to provide sufficient fresh air to replace the oxygen that is being used up by people working in the space, and to dilute and remove gas, fumes or vapour produced by the work. This can be done by using blowers, fans, ejectors or eductors to provide an adequate supply of fresh air to replace the used air.

a. Draw fresh air from a point where it is not contaminated by used air or other pollutants.

b. Route extract ventilation away from possible sources of re-entry, and to a place that will not create additional risks. In all cases trunking, hoses or ducting are introduced at, or extend to, the bottom of the vessel to help remove heavy gas or vapour and for effective circulation of air.

c. Airline or trunking shall not, where reasonably practicable, hinder access to or egress from the space.

d. Set up ventilation in such a manner that it will not push or pull contaminants into the confined space such as:
   1. gases or vapours circulated from the confined space
   2. exhaust fumes from generators, air compressors and vehicles
   3. atmospheric bleeds
   4. gases and fumes from hot work outside the vessel (e.g. metal fumes, carbon monoxide)
   5. paint and cleaning solvent vapours
   6. silica, or dust from adjacent blasting operations
   7. lead from paint removal work
   8. asbestos or insulation work
   9. nearby process sources.

e. Verify any contaminants remaining in the recirculated makeup air are <10% OEL[104].

f. Airflow should be maintained at 0.5m/s[36] at the location of work in the confined space. LEV may be required to meet this requirement (see 15.5.2).

g. It may not be reasonably practicable to achieve optimal air change rates (identified in the ventilation plan) because of worksite limitations (for example very large size of the confined space) or task considerations (for example interference with welding inert gas). When this is the case, the ventilation plan shall define other controls to provide adequate protection of the workers such as respiratory protection, local exhaust ventilation, continuous gas monitoring and monitoring for hazardous substances and include these in the task risk assessment.

h. Ventilation equipment shall have the appropriate classification for the hazard or hazards of the space and location used.

i. Equipment used in a hazardous atmosphere shall be bonded and grounded (earthed) as necessary to prevent the accumulation of static electricity.

j. For ventilation system design, consider the following:

   1. Keep duct runs as short as possible. Long runs of duct reduce airflow.

   2. Airflow losses can be minimised by using smooth ducting with large radius bends (elbows). However, flexible ducting is more commonly used for temporary ventilation systems. Flexible ducting tends to collapse at sharp bends therefore make this duct run as straight as possible.

   3. Fans are often hung on vessel flanges with wire. The short-circuiting of airflow that results when air passes through the gap between the fan and the flange can be eliminated by tightly securing the fan with a bolted clamp or by sealing the gap with tape.

   4. Where the fan is air powered, it shall be driven by an air supply independent of that used for air-powered tools. If this is not reasonably practicable, Verify the air flow is adequate to operate the tools and the fan.

      Numerous workers using air-powered equipment driven by the same compressor or source can slow down the fan.

      These factors can result in a reduction of air pressure at the air moving devices by as much as 50%. Guidance on measuring the airflow can be found in ***Annex K****.*

k. For complicated spaces where several pockets of gas or vapour might collect, a more complex ventilation system may be needed to provide thorough ventilation. Forced ventilation or ventilation providing a combination of exhaust and supply of fresh air may be more effective.

l. Periodic checks of pressure and airflow are made to Verify the efficiency of the ventilation system.

The following types of areas do not typically require the use of mechanical ventilation:

- Large, open roof tanks.
- On top of floating roof tanks.
- Open top excavations.
- Open top valve/line pits.
- Large exchanger shells.

15.5.2 Local exhaust ventilation

a. Local exhaust ventilation (LEV) may be required for removal of hazardous substances generated at source inside the confined space. Consider LEV where:

   1. air contaminants are hazardous to health

   2. dusts or fumes are generated

   3. emission sources are near the workers' breathing zones

4. there are only a few emission sources.

b. There may not be enough room to have multiple LEVs. If this is the case, then use general ventilation, but the workers will have to wear RPE to remove contaminants from air (e.g. from welding).

c. The LEV design depends on the contaminants and the task being managed and shall consider the following:

1. A hood that captures the contaminant at the source.

Guidance on minimum capture velocities to adequately control various contaminants are provided in HSE HSG258 A guide to local exhaust ventilation.

2. Ducts that transport hazardous substances through the system. The transport velocity is sufficient for the contaminant to be removed.

3. An air cleaning device that removes the contaminant from the moving air in the system.

4. Fans that move the air through the system.

5. An exhaust through which the contaminated air is discharged.

d. Once established, maintain LEV in the confined space throughout the operation, except as required:

1. for atmospheric testing, or

2. by agreed operational requirements such as welding where the airflow from the ventilation may affect the weld quality.

For more information on LEV use, see regulatory guidance (e.g. HSE HSG258 A guide to local exhaust ventilation) or refer to your local Industrial Hygienist.

15.5.3 Hot work in confined spaces

a. As a general guide, 20[37] air changes per hour, or a full air change every 3 minutes, is recommended to control potential build-up of non-hazardous gases, vapours, or other contaminants.

b. For HWOF, 57m^3/min (2,000 ft^3/min)[38] of air from a clean source is recommended for each welder or HWOF worker. Adequate ventilation shall be provided even if welders are using respiratory protective equipment (RPE).

c. While HWOF is being carried out in a confined space, LEV is used to extract fumes and shall have a minimum capture velocity of 0.5m/sec (100 ft/min)[36]. The captor hood is positioned between 1 and 1.5 duct diameter from the hot work to maintain adequate control.

15.5.4 Managing entry to a confined space

a. The AA shall normally act as supervisor for a CSE and Verify conformance to this procedure.

b. Where local regulations require, a supervisor with specific CSE competence would manage the CSE and in this case would not need to be an AA (e.g. OSHA regulations in GOM).

c. Everyone entering a confined space shall do the following:

1. Understand the conditions required by the CSE permit and any associated permit to work.

2. Know and recognise the hazards they may face during entry, including signs or symptoms, and consequences of exposure to any hazard.
3. Inspect, test and properly use equipment and protective devices.
4. Comply with any personal exposure monitoring requirements.
5. Maintain communication with the confined space entry attendant (CSEA) to enable the attendant to monitor the individual's status.
6. Alert the attendant if an unsafe condition exists or when symptoms of exposure appear.
7. Leave the confined space as soon as possible when:
    a) ordered by the CSEA
    b) the individual recognises the warning signs or symptoms of exposure, or
    c) an unsafe condition arises.

d. When a task is complete the AA and PA shall Verify that no tools or equipment associated with that task have been left inside the confined or restricted space.

e. When all tasks associated with a CSE are complete and before completing the CSE permit, the AA shall Verify that no personnel, tools or equipment have been left inside the confined space.

15.6 Confined space entry attendant

a. The AA Verifies that the CSEA understands their duties and is competent to perform them.

b. The AA decides if more than one CSEA is required for additional entry and exit points. In these cases, maintain radio communication to update the active CSE log.

c. The CSEA shall not:
1. Attempt a rescue themselves; they call the emergency response team who will provide the emergency response by executing the emergency response and rescue plan.
2. Enter the confined space.
3. Leave their post whilst anyone is inside the confined space, unless they formally hand over the role to another CSEA. In this case, the incoming CSEA signs the CSE permit.

d. The CSEA shall:
1. Prevent unauthorised personnel from attempting a rescue.
2. Attend the TBT before work starts.
3. Maintain an accurate count of all persons in the space as follows:
    a) Use an active CSE log or tagging system to record and track people who enter or leave the confined space. Use a log or tagging system for each entry and exit point to the confined space.

    Using photo ID cards on a tally board are the preferred option for use in a CSE entry log.

    b) Verify that any person entering the space has been signed on to the CSE permit and CSE entry log.

   c) Display the CSE entry log or tally board near the entry point.

4. Put in place temporary guardrails and signage to prevent unauthorised entry if any entry or exit point is left unattended (see Figure 18).
5. Mark airlines or safety lines, or both, so that each individual inside the tank is clearly identified if a problem arises.
6. Be aware of the hazards that personnel may face when entering the space, including the mode, signs or symptoms, and consequences of exposure to any hazards or fatigue.
7. Monitor conditions and activities inside and outside the space to decide if it is safe for personnel to enter.
8. Where a mechanical ventilation system is specified in the CSE permit, Verify it is working.
9. Keep personnel inside the space under effective surveillance and maintain effective and continuous communication with them during entry by one or more of the following methods:
   a) Line-of-sight (not always possible).
   b) Voice contact (allowing for distance and ambient noise).
   c) Radio with agreed periodic contact.
   d) Pre-arranged signals on devices such as air klaxons or whistles.
   e) Pre-arranged lifeline signals.
   f) A distress signal unit.
10. Immediately order evacuation of the confined space if:
   a) anyone notices anything that is not allowed in or near a confined space
   b) exposure to a hazard affects anyone's behaviour
   c) a situation happens outside the confined space that could endanger those inside
   d) anyone detects an uncontrolled hazard inside the confined space – once the entrants have been evacuated, the CSEA shall also leave the worksite
   e) new hazards arise that are not identified in the permit or if the permit scope or conditions change.
11. Only allow authorised persons to approach or enter a confined space while entry is under way.
12. Be equipped with a device, such as a radio or telephone, to call for help rapidly if anyone inside gets into trouble.
13. Understand the ERRP and their role within it.

Figure 18 - Example temporary guardrail for CSE entry point.

15.7 Precautions for water jetting in confined spaces

a. The following shall be considered:

1. Provide the CSEA with an emergency shutdown (ESD) button, that is within arm’s reach, for the water jetting equipment.
2. Personnel shall not climb through vessel openings used for high-pressure hoses because there is a risk of hypodermic injury from pinhole leaks. Where this cannot be avoided (for example single access vessels), provide suitable protection to reduce the risks associated with leaking hoses.
3. Plan the vessel entry to have points, nozzles or manways of adequate size available for ducts, hoses and cables.
4. The method of draining jetting water and removing debris from the vessel to minimise manual handling risks, or using non-manual means of removal wherever possible.
5. Provide intercom communications between the jet operator, CSEA and pump operator for all work in confined spaces.
6. Use the water jetting checklist before work starts.
7. Limiting water wash temperature to a maximum 60°C (140°F)[39]
8. Risk of ignition caused by static electricity by:
    a) earthing or bonding all equipment to the tank or structure being washed
    b) using conductive and electrically continuous hoses.
9. Respiratory and dermal risk from spray, or atmosphere containing dislodged biological and chemical matter.

15.8 Confined or restricted space register

The confined space register provides consistency in deciding if an area is a confined space or not. It is a list of decisions made by a multi-disciplined team regarding the status of a space. It is helpful when there might be some uncertainty or ambiguity (for example vessel skirts, ceiling voids or culverts).

a. When it is clear that a space is classed as a confined space (for example process vessels or columns), it does not need to be listed individually in the CSE register.

There are three possible types of area that might be worked within:

- Open spaces where access is not a major hazard.
- Confined spaces as per bp definition managed with a CSE permit.
- Restricted space managed with a permit covering the task being executed.

A restricted space has these criteria:

- Is large enough for an individual to enter and perform assigned work.
- Has limited or restricted means of entry or exit.
- Is not designed for continuous occupancy by the employee.
- Has adequate ventilation and does not have significant hazards within it.

Under OSHA, this is termed as a non-permitted confined space if it meets all four of these criteria.

b. In Production a restricted space is managed using a permit for the task but does not require a CSE permit.

It is important to understand that a restricted space may become a confined space managed with CSE permit if there is inadequate ventilation or a significant hazard occurs within it.

Table 34 shows examples of potential restricted spaces and hazards which may make them a confined space.

Table 34 - Potential Restricted Spaces

Potential restricted space	Hazards which may require a CSE permit
A space protected with systems to inhibit the activation of suppressant systems allowing persons to enter for inspection purposes (e.g. a turbine enclosure, generator module, air compressor module).	Known leak or ventilation not operating as designed. SIMOPS creating hazards.
Ceiling and floor voids in an office building or control room.	Known leak of hazardous material, SIMOPS creating hazards.
A vessel or column skirt that has more than one access point and has no joints or valves or other sources of process or utility leaks within the skirted area.	SIMOPS creating hazards.
Fin fans with mesh or wire open caging that offer free flow of air for ventilation. Access is available via an engineered access point or removable panel and provides usable access point. This point is easily accessible from work area and there are no baffles or dividing partitions between work area and access. The access or egress does not compromise the ERRP.	Known leak of hazardous material from tube or header box. Ventilation restricted say by scaffolding. SIMOPS creating hazards.

16 Breaking containment

16.1 Preparing plant for breaking containment

a. Use a permit, IDP or RAP for all plant preparation work covering draining and flushing of vessels, equipment or pipework. Use a marked-up P&ID to clearly communicate the scope.

b. The breaking containment (BC) shall include a contingency plan; see section 14.4.

c. If BC involves cutting piping or equipment, see section 22.4.

d. Where a task includes both breaking containment and spark potential activities (e.g. replacement and testing of an instrument), two choices are available:

   1. Use either a BC permit which includes the hazards and controls for the spark potential activities, or

   2. two permits linked together, one breaking containment and the other, a hot work spark potential permit.

e. The most efficient method would use the single BC permit, as SIMOPS can be adequately managed using the BC permit with the spark potential controls.

16.2 Potential hazards

a. Consider the following potential hazards when planning these activities:

   1. Work on pipework or vessels contaminated or potentially contaminated with pyrophoric scale. Pyrophoric scale can form in systems that can contain H_2S.

      If these systems are subsequently opened and the scale is exposed to currents of air, the scale could ignite. The pyrophoric scale is made safe by constant and thorough wetting until either the scale is removed, or the system is closed.

   2. Residual process hazardous substances (e.g. hydrocarbons, benzene, heavy metals, process chemicals and reaction products).

   3. Chemical reactions between cleaning materials and a tank or its fittings (for example: acidic cleaning fluid attacking a blanking spade installed for isolation).

   4. Leakage or the collapse of a tank or its supports caused by a reaction with cleaning materials, excessive weight of wash solutions or if vacuum conditions are created.

   5. Spillage during draining or flushing that will have an impact on the environment.

   6. The possibility of radiological contamination from LSA scale or NORM (including consideration of hydrocarbon, produced water and seawater containing systems).

   7. Gaskets containing asbestos. Handle and dispose of these in line with the guidance in regional procedures for managing and working with asbestos.

   8. Explosions and fires caused by the sudden mixing of water with hot oil. This can happen during steam cleaning or when hot oil is being put into systems that have just been steamed or flushed with water and have not been thoroughly drained and dried.

   9. Static electricity as an ignition source or electric shock during steam cleaning or high-pressure water jetting if equipment is not earth bonded.

   10. Possible asphyxiation if people are exposed to nitrogen.

11. Accidental spillage and freezing effects of nitrogen.
12. Trapped pressure or vacuum.
13. Position of workers when operating valves or conducting intrusive work, keeping people out of the Line of Fire.

16.3 Breaking containment on hydrocarbon or hazardous utility systems

a. Immediately before BC, the PA shall Verify that the break point is being monitored for any toxic materials identified in the TRA (for example benzene, hydrocarbons, mercury, NORM).

b. Immediately before BC, the IsA and PA both Verify the integrity of the isolation, as follows:

   1. An IsA confirms that the system has been successfully depressurised and proves the integrity of the isolation to the PA before work starts.
   2. The IsA shall be present, with direct communications to the control centre, during the initial BC and any other step of the task that the AA designates as critical.
   3. The PA applies five-part tags described in section 16.9, to all mechanical joints on piping and small bore tubing systems in hydrocarbon or hazardous utilities that are to be disassembled (see Table I.1).

c. Positively isolate open-ended pipework or equipment being left dependent on valve isolation for longer than one shift.

d. Use direct reading instruments to monitor for hazardous substances on breaking containment (e.g. benzene). Use RPE until there are consecutive readings showing levels are below that requiring RPE.

e. Where RPE is used, Verify permit identifies the specific RPE required and its limitations in use (e.g. maximum exposure concentration and time).

16.4 Breaking containment with non-conformant isolations

a. Consider the following questions during the non-conformant risk assessment for the IDP:

   1. Does the valve leak rate affect the worksite or cause additional hazards for personnel or plant?
   2. What controls can be applied to control the risks to plant and personnel from any potential leakage during BC?
   3. Can the leakage rate be monitored and attended during the period of BC?
   4. What controls can be applied to capture any leakage and safely dispose of it from the worksite?
   5. If the leakage rate suddenly increases, is a contingency plan in place to make the equipment safe?

      For example, a contingency plan can include an emergency isolation method or how to shut down a system or plant.

16.5 Depressurising or draining pressurised vessels, pipelines, or pipework

a. Take the following precautions when depressurising or draining pressurised hydrocarbon and chemical containment systems:

1. Isolate the system from fluid pressure and inventory when it is being emptied.
2. Review the appropriate chemical risk assessment and safety data sheet.
3. Safely relieve the pressure and drain the system. Verify the residual pressure within the system as being atmospheric before BC.
4. Depressurise systems containing gas to a closed system or to a vent or flare header that is designed to accept such gas. If possible, venting to flare is preferred.
5. Only depressurise gas systems to the atmosphere under strictly controlled conditions. The AA, or delegate, instructs anyone working downwind of any drainage or venting operation to leave the area.
6. All hot work (HW) shall stop within the potentially affected area.
7. Where required apply F&G overrides only in the immediate area of the BC.
8. If suitable facilities exist, drain liquid residues to a closed system. If this is not possible, estimate the quantity of liquid remaining in the system. Provide catchment facilities that will take at least this quantity. Then, drain the liquid carefully by opening a flange at a low point in the system. Position yourself so as not to be exposed to unexpected pressure or force and take precautions to prevent the spread of any accidental spillage.
9. Consider if it is possible for dead-legs to exist in the system. Flushing such traps with water will remove residual liquids if there are no flanges or connections.
10. Remove oil-contaminated or soaked lagging material from hot equipment, as it is prone to spontaneous ignition.

16.6 Draining or emptying atmospheric tanks and vessels

a. Use the following good practice when emptying atmospheric tanks and vessels being prepared to change contents, inspected, repaired, or modified, or before being dismantled:

1. Before emptying any tank or vessel, refer to the as-built engineering drawings. These drawings show in detail the internals of the tank or vessel. This will help decide how to drain and isolate the tank or vessel.

   For example, it might be assumed from the outside that a bottom off-take of a vessel is flush, but the drawing might show that the off-take is raised internally.

2. Empty storage tanks and vessels by initially using the normal off-take lines, until suction is lost. Transfer the contents to another suitable tank or to a mobile tank, if appropriate.
3. When emptying and draining, take care to avoid pulling a vacuum. This can occur if the atmospheric or vacuum vents are blocked, or by excessive lowering rates through large diameter lines.
4. Once suction is lost through the normal off-take, removal of the residual liquid contents might need to be done with a portable pump operating through an open manhole, using the tank water drain valve or by water-flotation, taking appropriate precautions against spillage.
5. Consider the hazards of using portable pumps in an area likely to be contaminated with flammable vapour. Use appropriately sited, air-powered pumps.

6. Dispose of residual liquids and sludge in the correct manner according to the requirements of pollution-control legislation.

16.7 Cleaning and gas-freeing methods

a. After depressurising and draining, residual hydrocarbon liquids, vapours, and gases are removed before further work can proceed. Various media can be used to do this, but choices are usually limited by what is available at the work location.

b. Direct reading instruments specific to the residual hazardous substances removed from the vessel are used to assess concentrations of hazardous substances in air following remote cleaning and gas freeing, or before the confined space is entered. Additional purging may be required to bring hazardous substance concentrations down to an acceptable level.

16.7.1 Water flooding

Cold water is usually the most readily available way to clean a tank or vessel. It is reasonably effective at displacing hydrocarbons, although it does not easily remove sludge or oils trapped in complex pipework or vessel internal structures.

a. For stainless steel tanks and vessels, monitor the water used for flushing to Verify it contains only low levels of chlorides (less than 50 ppm[40]) to avoid the risk of stress corrosion cracking of the vessel. Promptly drain and clear water after flushing.

b. Before flooding a tank or vessel with water, confirm that its supporting structure can take the weight. Provide adequate run-down and draining facilities as large volumes of water might be needed for these operations.

c. To avoid a static charge building up when using this method, add water via the base of the tank or vessel. If using a hosepipe, keep the velocity low until the end is submerged and earth or ground the nozzle. Flooding with water cannot be relied on to remove all petroleum vapour, liquid, or solid residues.

d. It is possible to carry out HW on the external surface of a water-flooded tank or vessel without further removing internal hydrocarbon residue if the work is:

   1. below the water level, and

   2. managed by a Level 2 risk assessment.

e. Water used for displacing and removing liquid hydrocarbons could be heavily contaminated after use. Dispose of any contaminated water in an environmentally responsible manner.

16.7.2 Inert gas

a. Nitrogen (N_2), Carbon Dioxide (CO_2), or combustion gas (N_2/CO_2 mixture) may be used to displace hydrocarbon gas and vapour, if they are available in sufficient quantity. This method might be useful if it is inappropriate to introduce water into a system in case it damages the tank or vessel. When injecting such mixtures, Verify that localised freezing of, for example, valves or gauges is not induced due to excessive injection rates.

b. Take care with systems that might contain pyrophoric scale from high-sulphur bearing hydrocarbons. If such scale is subsequently exposed to the air, it can rapidly ignite. Water sprays may be used to prevent this, as they will keep the scale constantly wet.

c. There are two options for displacing hydrocarbon gas and vapour with inert gas:

1. Continuously purge with inert gas until the concentration of flammable vapour is less than 50% LEL[41] (2.2% by volume for methane) in the emerging mixture of flammable and inert gas.
2. Purging with inert gas using 'purge cycles' following a pressurise – depressurise – pressurise process until the concentration of flammable vapour is less than 50% LEL[41] (2.2% by volume of methane) in the emerging mixture of flammable and inert gas.

   Purge cycles can be a preferred method if there is no suitable route that will provide efficient continuous purging, or when dead legs are part of the purge

d. When using purge cycles, consulting with a process engineer may help to estimate the volume of inert gas required. Normal flammable vapour monitoring devices will not work accurately in atmospheres that are deficient in oxygen. This means specialised equipment is needed to accurately measure the LEL.

e. The vessel or tank is normally purged again with air to displace the inert gas. This shall be done if there are plans for people to enter the vessel or tank.

16.7.3 Steam

a. At some sites, steam might be available for purging and cleaning vessels, tanks, and pipework. Steam is the most effective of the common media for this purpose. It shall be used at low pressure, not exceeding 1barg(14.5 psig)[42].

b. Open or closed steaming may be used as follows:

1. Use open steaming if the tank or vessel and its associated system is fully open to the atmosphere.
2. Use closed steaming for closed vessels and their associated equipment. During this operation, raise the temperature to allow volatile liquids to vaporise and disperse, along with the bulk of the steam through a condensing system. This allows the heavy constituents to flow freely, and they can be drained off with the condensed steam from the base of the system.

c. For all but the largest vessels and tanks, steam is needed to raise the external surface temperature to at least 95°C (203°F)[43]. Steaming continues until the condensate flowing from the vessel is substantially free of hydrocarbon.

d. Steam may be used for process vessels, small storage tanks, and medium-sized insulated tanks. It is essential that, after closed steaming, adequate provision be made to prevent damage due to a vacuum being drawn by condensation of steam. In large tanks, the rate of condensation of steam is such that adequate purging is not possible.

e. After steaming, cool down the equipment with copious quantities of water. This additional wash helps to remove residual hydrocarbons.

f. If residual material is left on the tank or vessel surface after prolonged steaming, it might still give-off vapour if heat (for example burning or welding) is applied to it. In such cases, cold cutting may be used or keep the internal surface thoroughly wet during the heating operation.

g. All temporary steam hoses being used shall be electrically bonded and earthed.

16.7.4 Air

a. If it is not reasonably practicable to use any of the above methods, air may be used directly to ventilate equipment and remove hydrocarbon vapour.

b. If using air to ventilate equipment, pump out as much oil and sludge as possible before opening the tank or vessel. If reasonably practicable, use forced ventilation so that flammable vapour is cleared in the shortest possible time. During this purging operation, the flammable range will be passed through, presenting an explosion hazard if an ignition source is nearby.

c. Verify all electrical equipment is suitable for use in a Zone 1 hazardous area or it's isolated.

d. Air movers are most effective when fitted at the roof or top manhole to pull air in at low level. Temporary trunking may be needed to achieve high-level disposal. To minimise the amount of gas or vapour escaping when opening the lower manhole door, keep the air movers running to get a slightly negative pressure before opening the lower manhole door.

e. Vapours escaping from any opening in the equipment being purged can create a flammable concentration in bunded or confined areas. Manage this hazard by barriering-off the area and removing any sources of ignition or HWSP devices. The recommended safe practice is to remove the vapour by air movers attached to the roof manhole.

f. When natural draught ventilation is being used during periods of calm weather, be aware that vapour released from tanks can travel considerable distances without dispersing. Therefore, consider the wind direction and the risk to adjacent operations, premises or the public.

g. As pyrophoric scale can be present within tanks or vessels that have contained sour crude or products, continuously wet internal surfaces from one or more water fog nozzles inserted into the roof opening as follows:

   1. Turn on the fog nozzles first and then open the air movers afterwards.
   2. Open a shell manhole after about five minutes of operation, when the internals are thoroughly wet.
   3. With the air movers still in operation, remove the fog nozzles and dislodge loose scale with high-pressure water streams.

h. When using this method, earth the water nozzles.

16.8 Purging into service

Before re-introducing hydrocarbons into a system, it is important to remove oxygen to reduce the likelihood of a flammable atmosphere.

a. When purging into service, add inert gas to the system until the percentage of oxygen is decreased to the point where any mixture would not be flammable. To provide a safety factor, continue purging to a point at least 20[44]% below the flammable limit, See Table 35 below.

Table 35 - Oxygen end points for purging into service

Purge Medium	CO_2	N_2	CO_2	N_2
Combustible	**Percentage below which no mixture is flammable**		**Percentage purging end points with 20% safety factor**	
	% oxygen	**% oxygen**	**% oxygen**	**% oxygen**
Hydrogen	5.9	5.0	4.7	4.0
Carbon Monoxide	5.9	5.6	4.7	4.5
Methane	14.6	12.1	11.7	9.7
Ethane	13.4	11.0	10.7	9.8
Propane	14.3	11.4	11.4	9.1
Butane	14.5	12.1	11.6	9.7
Isobutane	14.8	12.	11.8	9.6
Pentane	14.4	12.1	11.5	9.7
Hexane	14.5	11.9	11.6	9.5
Gasoline	14.4	11.6	11.5	9.3
Ethylene	11.7	10.0	9.4	8.0
Propylene	14.1	11.5	11.3	9.2
Cyclopropane	13.9	11.7	11.1	9.4
Butadiene	13.1	10.4	10.5	8.3
Benzene	13.9	11.2	11.1	9.0

16.9 Broken joint tagging

a. Complete the following for all disturbed joints:

1. The PA uses a five-part tag to identify broken joints and to help Verify that they are reinstated, and their integrity is confirmed once all work is complete.
2. Record the status of all broken joints in an approved certification process, that keeps the traceability between the five part tag numbers and joint numbers (as identified in the engineering drawings). The removed parts of the tags are kept for 1 month to confirm the joint status.
3. Leave the remaining part of the tag to allow the integrity of the reinstated joint to be monitored during startup. This is removed by operations when the plant is back up to its normal operating conditions and the joint has been periodically monitored for a minimum of two days.
4. Consider tagging critical neighbouring joints that have not been broken but that could be affected by the reinstatement activity.
5. Removal and replacement of plugs and caps associated with IDP bleed points may be omitted from the broken joint tagging process provided the hazards,

controls and return to service of these plugs and caps is captured in the isolation/de-isolation plan and cross-checked.

6. Upon return to service of the system, plugs and caps identified in IDPs (in 16.9a.5), are monitored for a minimum of 48 hours to confirm integrity.

b. Production uses a five-part tag (see Figure 30). In Projects and Wells-controlled sites, the local CoW implementation procedure may specify an alternative tag.

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<tr><td></td><td colspan="4">Section or tab completed by…</td></tr>
<tr><td>This is removed by operations when the plant is back up to its normal operating conditions and the joint has been periodically monitored for a minimum of two days.</td><td>The person leak testing (SPA or IsA)</td><td>The person tightening the joint</td><td>The person making the joint</td><td>The person breaking the joint</td></tr>
<tr><td>Detached by operations and returned to either AA, Certification Focal Point or Certification Lead</td><td colspan="2">Returned to either AA, Certification Focal Point or Certification Lead</td><td colspan="2">PA returned to either AA, Certification Focal Point or Certification Lead</td></tr>
</table>

Figure 19 - Five-part tag for broken joint tagging

17 Working at height

Working at height (WAH) means work in any place where, if precautions were not taken, a person could fall a distance liable to cause personal injury. This includes:

- work above ground or floor level
- anywhere a person could fall from an edge, through an opening or fragile surface
- anywhere a person could fall from ground level into an opening in a floor or a hole in the ground
- over-side working, which is work outside the perimeter of fixed handrails or work during which anyone could fall into water.

Work at height does not include:

- a slip or a trip on the level, as a fall from height has to involve a fall from one level to a lower level
- gaining access to or exiting any work location at height when using a staircase or permanent ladder with guard hoops.

a. Avoid work at height as far as is reasonably practicable.

b. If work at height is unavoidable, the AA shall Verify that:

   1. fall restraint or fall arrest equipment is used for working at elevations of ≥2m (6 ft) where there is no fixed access platform, walkway, or an Approved scaffold with regulation guardrails, handrails and standing surface
   2. the work is risk assessed before it starts, in line with Figure 20
   3. all reasonably practicable precautions are taken to prevent anyone from falling from height a distance that can cause injury, including the adoption of a hierarchy of fall protection when considering risk
   4. the equipment used to work at height is appropriate to prevent a person, or equipment falling or injuring anyone.

c. Where the risk of people or objects falling remains, risk assessments shall define controls to minimise the distance and impact (consequences) of such falls.

Collective measures (for example guardrails, nets, mats, inflated devices) are preferred over personal protective measures (for example fall arrest equipment).

d. OSHA requires employees in general industry workplaces on a walking-working surface with an unprotected side or edge that is 1.2 m (4 feet)[45] or more above a lower level is protected from falling by one or more of the following:

   1. guardrail systems
   2. safety net systems, or
   3. personal fall protection systems, such as personal fall arrest, travel restraint, or positioning systems.

Some fall arrest systems require 2m (6ft) to operate. Consider this when selecting a fall protection method.

17.1 Using the hierarchy of fall protection

The following are examples of how the hierarchy of fall protection is applied for WAH:

- Permanent fixed access (e.g. walkways and gantries) is the first level in the hierarchy of fall protection. This is appropriate where people need regular access for routine maintenance. If this measure has been taken to avoid falls, other measures (e.g. example nets) may not be necessary.

a. The PA shall Verify additional controls are in place if a guardrail has been temporarily removed or if the area is being inspected before it is used for the first time. For example, when installing walkways on a NUI, restraint devices or other suitable personal fall protection equipment and additional supervision would be needed.

- Erecting temporary working platforms is the second level in the hierarchy of fall protection. This includes scaffolding (which has its own risk implications in the construction phase), cradles, aerial lifts, and self-powered work platforms or mobile platforms.
- Using work positioning is the third level in the hierarchy of fall protection. If neither of the first two options are reasonably practicable, then personal suspension equipment, work positioning techniques, or work restraints may be used.
- Using fall arrest equipment to catch a falling worker is the fourth level in the hierarchy of fall protection. It is often difficult to accurately predict the level of risk to the worker during the operation. The seriousness of a fall depends on:
    - where they fall
    - any obstructions they hit when they fall, and
    - how easily other workers can rescue them.

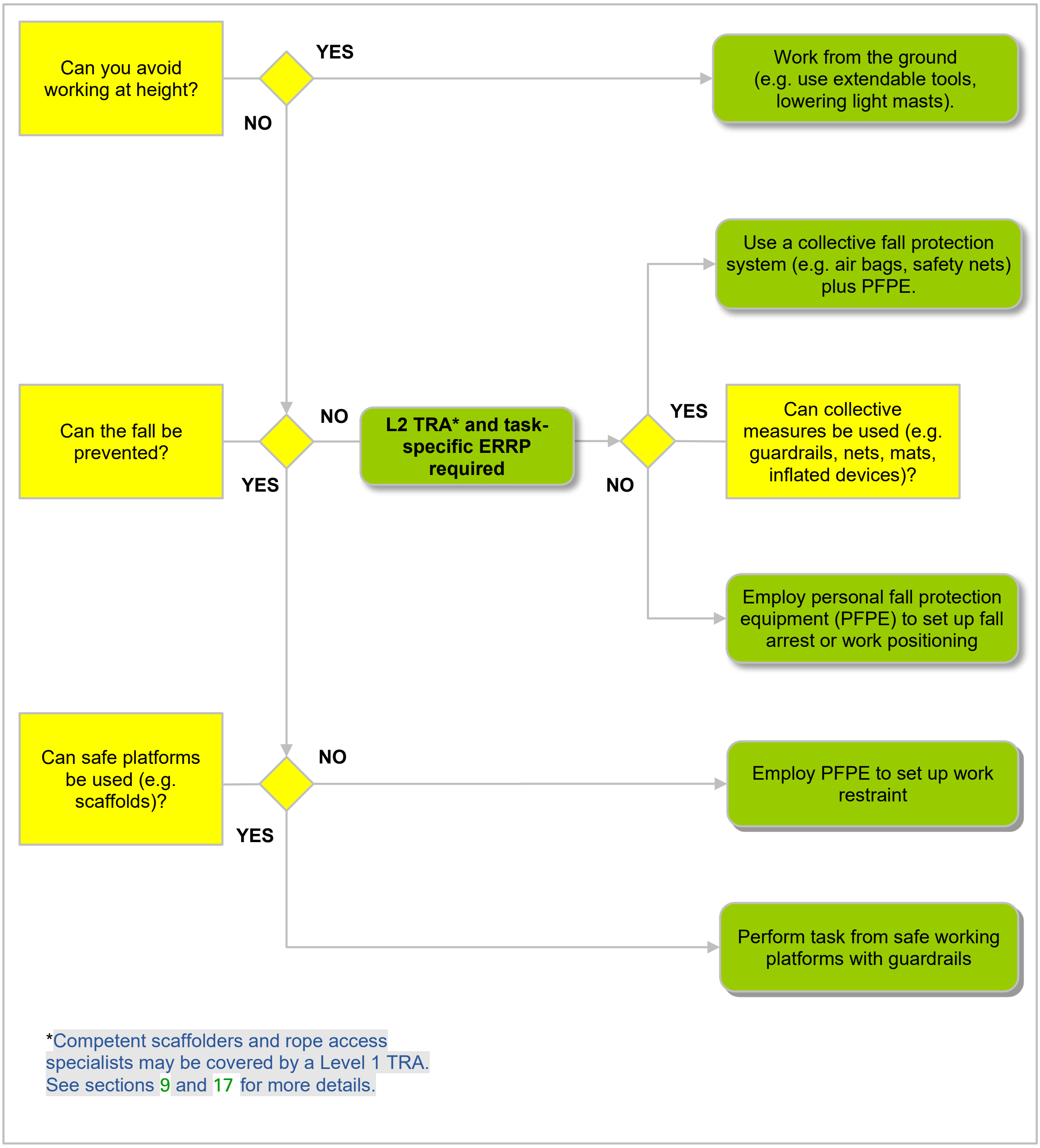


Figure 20 - Working at height flowchart

17.2 Requirements for work at height

a. Before any work at height can proceed, the SA or AA when delegated shall Verify that:

1. Either:

   a) a safe platform with guard or handrails that a competent person has Verified, is in place. This can be a permanent fixed access or a temporary work platform; or

b) a form of personal fall protection is being used including one or more of the following:

1) Work restraint

2) Work position

3) Rope access

4) Fall arrest equipment

2. When using the work restraint, work position, or fall arrest equipment, a competent person has visually inspected the equipment being used.

3. Consideration has been given to whether the PA and work party are medically fit for working at heights (e.g. any known heart disease, vertigo, fear of heights, temporary work restrictions, disabilities, fatigue, injuries), which may put them at risk while working at height.

4. Any damaged or activated equipment (e.g. used fall arrest equipment), has been taken out of service.

5. Fall arrest equipment has:

a) a suitable anchor, preferably mounted overhead

b) full body harness using double lanyard, double latch self-locking snap hooks at each connection

c) synthetic fibre lanyards

d) shock absorber.

6. Fall arrest equipment will limit free fall to 2m (6ft) or less.

7. Personnel are competent to perform the work.

The PA may use the checklist in Table D.9.

17.3 Requirements for a safe platform

a. To determine if a platform for working at height is safe, the PA Verifies that it meets the following criteria:

1. Is stable, strong, and rigid enough for the purpose it is being used or intended for.

2. Is resting on a stable and sufficiently strong surface.

3. Is wide enough for people to walk over, use any necessary equipment or materials, and work safely on.

4. Suitable and sufficient edge protection is in place to prevent risk to others, such as toe-boards, typically a minimum of 0.1m (4in)[46] high.

5. Does not have any openings that people, materials, or objects could fall through and injure someone, or damage equipment.

6. Is constructed, used, inspected, and maintained to prevent, so far as reasonably practicable, anyone slipping or tripping, or being caught between it and any adjacent structure.

7. Is prevented by appropriate devices if it has moving parts, from moving inadvertently during work at height.

8. Is fitted with a suitable guardrail that is high enough to prevent anyone falling and is a minimum of 0.95m (37in)[47] high, with the maximum gap between the guardrails of 0.47m (18in)[48]. As a minimum, it can withstand a load of at least 90kg (200lb)[49] applied in any direction on the top rail.
9. Is in good metallic contact with the structure, or is earthed in order to mitigate the risk of electric shock caused by:
   a) lightning strike
   b) electric tools or lighting that is not reduced low voltage, or RCD/GFCI protected
   c) ignition when carrying out static generating activity.

b. If a platform meets all of the above criteria, work may be carried out from the platform without using work equipment to make it safe.

c. If a platform does not meet all of these criteria, complete a Level 2 TRA to identify any further controls required.

17.4 Using personal fall protection systems

Personal fall protection systems include work restraint, work positioning (including rope access and positioning techniques), fall arrest, or rescue systems.

a. The AA Verifies the following criteria are met before personal fall protection is used:
   1. The hierarchy of fall protection has been applied.
   2. A risk assessment has demonstrated that work can, so far as is reasonably practicable, be performed safely while using the system.
   3. The person who is using the system has been trained in how to use it and enough people in the work area are trained in how to use the equipment, including how to rescue someone if they fall.
   4. The fall protection system is securely anchored.
   5. The various components of the system are strong enough to support all known loads and a competent person has inspected them.
   6. A suitable ERRP is in place.

b. The PA checks the manufacturer’s instructions to decide if the system is compatible with other equipment being used.

c. All equipment that is used in the personal fall protection system is strong enough to withstand any forces placed on it and have an adequate safety margin.

d. The PA Verifies equipment safe working loads (or minimum static strength), working load limits, and maximum or minimum rated loads.

17.4.1 When to use work restraint

Work restraint is a technique that uses personal fall protection equipment to prevent a person from entering an area where a risk of falls from height exists.

It works by tethering the individual by an anchor point and line in such a way that they cannot reach an exposed edge from which they could fall. Work restraint techniques are very effective and often used to prevent personnel from falling when working at height on open decks, roofs, or platforms.

17.4.2 Using work positioning

A work positioning system enables a user to work supported in tension or suspension in such a way that a fall is prevented or restricted. An example would be a bosun's chair.

a. The PA shall only use work positioning systems if it includes a suitable back-up system for preventing or arresting a fall (for example a fall arrest system).

The advantage with work positioning is that people are free to use their hands.

17.4.3 Rope access techniques

Rope access techniques allow access to structures or equipment that are otherwise inaccessible or unsafe to access using conventional techniques.

Rope access comprises a personal fall protection system that specifically uses two static, separately secured sub-systems and can be used for work positioning systems. One of the sub-systems is the means of support. The second is a safety backup for getting to and from the place of work.

Fundamental to this technique is the concept of the static ropes, where the user moves up and down the ropes rather than the rope moving with the user. If the rope moves with the user, it is not rope access but work positioning.

a. Rope access personnel shall be trained and competent to Industrial Rope Access Trade Association (IRATA) or Society of Professional Rope Access Technicians (SPRAT) standards, with at least one of the team competent to Level 3.

b. The PA Verifies that anchor lines do not come into contact with sharp or abrasive edges.

17.4.4 Fall arrest

Fall arrest is the most common form of personal fall protection equipment (PFPE) as it is simple to operate and requires minimal equipment and limited training. Fall arrest is a technique that stops a falling person under safe conditions.

High attachment points are designed into the fall arrest harness, keeping the individual upright in the harness if they fall, even if they are unconscious.

a. The PA shall Verify that a fall arrest system incorporates a suitable shock absorber to limit the force to the wearer's body if they fall. This could be either a shock absorber lanyard or inertia reel, but never both.

b. In many situations, a combined fall arrest and work positioning approach may be required.

For example, a worker might need fall arrest equipment to access the worksite and then convert to work positioning to carry out the task. Alternatively, they could be relying on a work positioning lanyard for primary support, but still have a fall arrest system attached for backup. If they are using work positioning equipment for support, they can rely on the attachment to prevent them losing their balance or falling.

c. In situations where the work method requires employees to detach and re-attach at height, always use a dual lanyard system with at least one connection point maintained.

17.5 Identifying and assessing anchor points

a. The user needs to identify and assess potential anchor points to Verify they are suitable and secure.

b. Use specifically designed and suitable anchor points where they are available (refer to BS EN 795 Personal fall protection equipment. Anchor devices or equivalent standard). When these are unavailable, consider the following when selecting an anchor point.

   1. Anchor points can generally be classed as tested, structural or certified. As a minimum, test these items annually. Structural items are usually capable of performing beyond the requirements of BS EN 795 Personal fall protection equipment. Anchor devices (that is, metallic anchor devices capable of withstanding a shock load of 12kN (2700 lbf) [50] and non-metallic anchor devices capable of withstanding a shock load of 18Kn (4047 lbf).[50]

   2. Process piping may be used for anchors if it meets the following criteria:

      a) Process piping that is ≥ 0.15m (6in)[51] outside diameter with less than a 6.5m (20ft)[51] span between vertical or horizontal supports, with a wall thickness ≥ 6mm (0.25in)[51] may be used for anchors without having to consult an engineer.

      b) An engineer shall Approve process piping that is < 0.15m (6in)[51] outside diameter, or any process piping with < 6mm (0.250in)[51] wall thickness before it can be used as an anchor.

   3. Do not attach anchors to:

      a) any thin wall gas or flare lines

      b) non-metallic lines

      c) instrument or H_2S lines

      d) cable trays or uninspected handrails

      e) insulated lines.

   4. Handrails can only be used for anchoring if they have been checked by a competent inspector and deemed suitable for the proposed task.

   5. Do not anchor to scaffolding unless a competent scaffolding inspector has Approved its use for anchoring.

   6. The PA shall Verify that, where reasonably practicable, anchor points are chosen at or above waist height.

17.6 Over side working

The following shall apply when there is a potential for a fall to water:

a. A life jacket is used for working outside of guardrails.

b. In cases where the life jacket hinders the ability to work safely, conduct a risk assessment before authorisation is given to remove the vest and, as a minimum, requires the person to remain 100% tied off.

c. Maintain communication throughout the duration of the job, including the use of radio communications. Consider using personal locator beacons.

d. When over side working in darkness cannot be avoided, include controls for adequate lighting of the worksite and a rescue strobe light for the worker.

e. Adequate clothing suitable for the possible weather extremes.

f. A task specific ERRP is in place and sufficient personnel trained to use any rescue equipment or techniques relied upon. Consider sea drift in the ERRP.

g. Rescue craft (RC) in the water or available to be deployed where allowed by local regulations or the risk assessment.

h. Standby person positioned with a good line of sight to monitor activity.

i. Notify the standby person and Rescue Craft (RC) of any vessel movements in and around the installation 500m[1] zone, and any activities on or around the installation which could have an impact on the over side work.

j. Consider the following hazards in addition to any task-specific hazards in the risk assessment:

1. Outfalls
2. Vents (e.g. process)
3. Aerials and wireless masts
4. Inlets (e.g. fire pumps)
5. Overboard dumps
6. Exhausts (e.g. lifeboats)
7. Sea and weather conditions
8. Vapours (e.g. produced water treatment)
9. NORM
10. Crane operations
11. Marine vessels
12. Diving operations
13. Process conditions

People planning to work off step ladders close to overboard or over deck handrails can elevate themselves to a level which constitutes a risk of falling over the handrail. This can be controlled by erecting scaffold at the handrail to prevent falls, thus avoiding the need for additional controls (e.g. rescue craft).

17.7 Putting a rescue plan in place

a. The PA shall put a rescue plan in place if people are working at height and it is possible that they might fall and be suspended or fall overboard. This is an integral part of the emergency control procedures.

See section 18.5.8 for detail on ERRP content. For an ERRP certificate see Table C.5.

b. The PA shall do the following:

1. confirm the correct PPE for working at height is in place before any working at height can start.
2. confirm that all the rescue equipment detailed in the rescue plan is ready for immediate use.
3. confirm the emergency rescue team know the location of the work party.
4. stop work if ERRP resources are no longer available, for example:
   a) if the ER team has been called to an incident
   b) manning levels are such that not all tasks can be supported
   c) Emergency Response and Rescue Vessel (ERRV) cannot continue to support overboard work due to sea conditions or other priorities.

17.8 Inspecting and maintaining equipment

a. The SA shall Verify that all work restraint, work positioning, and fall arrest equipment is controlled by a competent person or persons. This competent person is usually called a working at height equipment controller or rigging loft controller and is responsible for:

1. visually inspecting the equipment regularly
2. issuing and controlling lifting equipment
3. inspecting and maintaining all work restraint, work positioning or fall arrest equipment, and
4. maintaining a record of and issuing all work restraint, work positioning or fall arrest equipment to competent personnel.

Harnesses used by painters can become contaminated by paint which might affect the fibres of the harness.

b. Each item of equipment shall also be marked with a unique identification number so that it can be traced back to its point of origin.

c. Test certificates and examination reports shall be available for audit at the site or at a central control point.

d. Working at height equipment controllers or rigging loft controllers, fulfil inspection and maintenance duties for the most frequently used type of equipment (that is, fall arrest). However, competence requirements may specify that specialist equipment such as rope access, require a specialist contractor's competent person to take fulfil these duties.

17.8.1 Pre-use checks (non-recordable)

a. The user of any equipment is responsible for physically checking it before use.

b. Immediately withdraw equipment with any defect from service, and either tag as unusable or destroy it. The following are examples of common defects:

1. Cuts, tears, abrasions, mould, or undue stretching.
2. Alterations or additions.
3. Damage due to deterioration.
4. Contact with fire, acids, or other corrosives.
5. Distorted hooks or faulty hook springs.
6. Tongues unfitted to the shoulder of buckles.
7. Loose or damaged mountings.
8. Non-functioning parts.
9. Wearing or internal deterioration in the ropes.
10. Manufacture's tag missing or illegible.

c. The PA Verifies these checks have been completed and equipment is safe to use.

17.8.2 Inspections (recordable)

a. An appointed competent person shall:

1. inspect harnesses and lanyards every 12 months[52]
2. inspect inertia reels or other specialist working at heights equipment as defined by the manufacturer's or specialist contractor's guidance
3. inspect all equipment before it is returned to storage

4. maintain a record of all inspections.

b. For frequently used lanyards, the suggested inspection frequency is at least every three months. This is particularly important if equipment is used in arduous environments (for example: demolition, steel erection, scaffolding, steel skeletal masts, towers with edges and protrusions).

c. To reduce the risk of damage to lanyards and shock absorbers due to grit blasting operations, keep all lanyards and shock absorbers away from grit blasting work.

17.9 Dropped objects

a. By applying the hierarchy of controls, dropped object risks are minimised.

For example, through design, selection of equipment or tools with restraints, worksite layout and housekeeping.

b. If hazards cannot be eliminated, then before approving the risk assessment, the Approver shall Verify that controls will protect the personnel and equipment below. L4 controls are preferred, as in examples below, instead of relying on L5 and L6 controls.

1. Use tools and equipment Approved for work at height, including the appropriate lanyards and tool bags.
2. Secure all materials stored at height so that any unintended movement does not dislodge them and cause an object to fall.
3. Use mats where there is the potential for small items to fall through grating.
4. Use netting where there is potential for objects to fall outside of guardrails.
5. Install toe-boards where a scaffolding platform is used.

c. To keep people out of the Line of Fire, the PA shall put in place exclusion zones around any area where there is a risk of dropped objects.

The following represents good practice for tool lanyards and attachment points:

1. Tools used at height are attached to a tool bag or the work location via a certified tool lanyard. As such, tooling shall be manufactured and supplied with tested and certified lanyard attachment points.
2. The lanyard attachment point on the tool allows the tool to be used effectively.
3. The length of lanyard wire is appropriate to the unhindered function of the tool.
4. Any retention that is fitted to power tools is not solely secured to the power cable or air hose.
5. The standard use of wrist lanyards is discouraged. However, it is recognised that they may be appropriate to specific tasks (e.g. within confined spaces).

17.10 Fragile surfaces

a. Avoid working on fragile surfaces where reasonably practicable, because some materials (for example, asbestos and various plastics) are particularly brittle and may shatter without warning.

b. When working on, or passing across, fragile roofing materials, use crawling boards that span across joists so that the person’s weight is on the board, never on the fragile roof sheeting. Use at least two crawling boards, one to support the person whilst the other is moved to a new position.

17.11 Use of temporary ladders

The minimum safe working requirements for the use of temporary ladders (e.g. those not affixed permanently to a structure) are described below. This includes scaffold ladders, extension or straight ladders and folding or step ladders. See 500195 bp Practice Use of Temporary Ladders GDP 4.5-0002.

17.11.1 Hierarchy of controls for temporary ladders

a. Apply the following hierarchy of controls when considering mechanisms for accessing and egressing elevated work sites:

   1. Bringing the work to ground level and eliminating the need to access and egress heights.
   2. Using an existing permanent structure.
   3. Engineering controls consisting of temporary equipment to reduce the risk of a fall occurring, in order of preference shown in Table L.1

17.11.2 Use of temporary ladders

a. For installation and use of all temporary ladders follow requirements in Table L.2.

b. When accessing scaffolding follow requirements in Table L.3.

c. The recommendations in Table L 4 should be used when accessing scaffolding.

d. When using extension or straight ladders follow requirements in Table L.5.

e. The recommendations in Table L.6 should be followed when using extension or straight ladders.

f. The recommendations in Table L.7 should be used when performing work from a platform ladder.

g. When performing work from a ladder follow the requirements in Table L.8.

h. Ladders with exposed aluminium, or aluminium alloy with an aluminium content greater than 10%[53] shall not be used in hazardous areas due to ignition risk from frictional or thermite sparking

18 Supplementary certificates

Supplementary certificates are documents that provide additional information on hazards and controls to support a risk assessment and permit to work. They are created and Approved by people who have specialist knowledge and competence in the subject.

Supplementary certificates are developed along with the permit to work during the planning and preparation steps.

a. The AA, or delegate, shall not issue a permit unless all selected certificates are Approved and attached.

b. Table 36 lists who can Approve each type of certificate.

Isolation Confirmation Certificates (ICCs) are linked and not attached because they are created within eCoW.

Table 36 - Certificate approvals

	Certificate	Approver
18.1	Isolation confirmation	AA
18.2	Ground disturbance	Discipline engineers and Facility Support Squad Leader, or delegate
18.3	Lifting plan	Site Lifting Co-ordinator
18.4	Energised electrical work (non-US)	Site Electrical Leader
18.4	Energised electrical work (US)	Site Electrical Leader
18.5	Emergency response and rescue plan (ERRP)	Emergency response leader or local equivalent.
18.6	Abrasive task on live equipment	Facility Support Squad Leader, or delegate
18.7	Mechanical seal plug	VP Production for an isolation (APM when used as vapour or liquid seal)
18.8	Well handover	Well Site Leader and SA
18.9	Pre-startup	SA, or Project Manager or TAR Manager
18.10	Ventilation plan	HSE&C Site Advisor
18.11	Pressurised habitat	Vendor trained habitat inspector, or AA
18.12	Heavy equipment movement	Facility Support Squad Leader
18.13	Cross-site boundary isolation	SA
18.14	Leak testing	Leak testing SPA

18.1 Isolation confirmation certificate

An IDP records the status of all isolations throughout the life cycle of the isolation. It also records the signatures of the IsAs who have confirmed the status of the isolations at any time during the life cycle. Once an isolation is in place, an ICC is created from the IDP by eCoW.

a. Full isolations are managed using an IDP and personal isolations can be detailed on drawings attached to an IDP or permit. See section 14 for details.

b. The ICC, linked to all relevant work permits, is the principal means of control once isolations are in place and performs the following functions:

   1. Identifies the plant concerned and the reasons for isolation.
   2. Records isolation by disciplines.
   3. Records the complete list of isolations including the identification of valve, blinds, blanks, and equipment tag numbers and specific electrical and control information.
   4. Records bleed points for checking valve integrity.

The IsA does not need to amend the ICC when bleed valves are moved to execute PBU monitoring.

   5. Confirming that the isolations are in place.
   6. Authorising any temporary de-isolations and isolations for STT.
   7. Authorising and recording de-isolation when the task is complete.

c. Attach a marked-up P&ID, electrical single-line drawing and electrical schematics or other suitable drawing to the IDP. Attach the Level 2 isolation risk assessment, when required for a non-conformant isolation.

d. For well handover between Production and Wells, control the isolation of the wellhead valves and flowline isolation valves from the piping system or process plant using an ICC. The ICC is used in conjunction with a well handover certificate to manage the handover to and from Wells.

18.2 Ground disturbance certificate

Ground disturbance is a man-made cut, cavity, trench, or depression made in the ground by removing the covering material (for example earth or concrete) that is:

- deeper than 0.3m (12in)[72] if made with hand tools (for example shovels and spades), or
- any depth if made with mechanical equipment, or sharp objects (e.g. picks, spikes, chisels, earthing or ground rods).

a. All ground disturbances shall have a ground disturbance certificate (GDC).

b. Risk assess ground disturbance using a Level 2 TRA unless the GDC verifies there are no hazards from underground services and the excavation is not considered a CSE.

c. The ground disturbance certificate, attached to the permit, identifies the following:

   1. Underground hazards (for example buried services such as process, electrical, and communications) and subsequent isolations of these services.
   2. Controls to prevent collapse or ground movement.
   3. Any requirements for gas testing.
   4. Any requirements for signs, barriers and lighting.
   5. Required inspections and frequencies.
   6. Means of accessing or egressing the excavation.

d. The ground disturbance certificate shall include verification from any relevant discipline engineers (for example electrical, instrument, control or communications).

e. If there are no underground services and the excavation is not a confined space, a Level 1 TRA is acceptable.

18.3 Lifting plan

a. All lifting operations follow the requirements set out in 500229 bp Practice Lifting GDP 4.5-0003. Lifting operations are relevant to:

1. an operation using any type of lifting equipment where a connected load is present
2. lifting and hoisting operations using lifting equipment
3. lifting and hoisting operations using associated transport and handling equipment
4. push and pull operations using lifting equipment.

b. For compliance with legislation and in conformance with bp requirements, key personnel are to understand and apply the relevant requirements of their entity lifting procedure.

18.3.1 Planning a lift

a. Before starting a lift, an Approved lifting plan shall be in place where:

1. Category 1 repetitive lift plans may be valid for up to 6 months[55] with Lifting Engineer endorsement.
2. Category 1, 2 and 3 non-repetitive lift plans are task-specific.

b. Lifting plans:

1. are developed by individuals with a demonstrated competency, and with relevant input from lift team members.
2. document:
   a) the type of equipment, how and where it is to be configured, and include a drawing(s) showing the details
   b) the task specific hazards and controls, including Line of Fire to be captured in the task risk assessment
   c) the required personnel, resources, controls, and action plans/rescue equipment
   d) the deck or ground strength
   e) any potential SIMOPS and proposed controls
   f) the Lifting Person in Charge (LPiC)
   g) exclusion zones
   h) contingencies & factors of safety.

18.3.2 Lift plan verification

a. Before using a lift plan, the AA Verifies the:

1. lift plan details are completed
2. categorisation has been identified

3. approvals, authorisation, and endorsement section include the relevant signatures
4. relevant risk assessments include task specific hazards and controls from the lift plan, including Line of Fire risks and potential SIMOPS conflicts.

18.3.3 Lifting over or in close proximity to live equipment

Lifting over or close to live equipment means any lifting operation that poses a process safety risk to live equipment from any or all of the following:

- the load
- lifting appliances
- lifting accessories

Close means it is within a distance that either the load or lifting equipment (such as a crane boom) could fall on live equipment.

a. Complete a Level 2 TRA for lifting over or close to live equipment, regardless of lift category, and consider the following:
   1. does a reasonably practicable alternative exist
   2. is an operational contingency plan in place
   3. are risks reduced to as low as reasonably practicable.
b. The operational contingency plan shall define the potential worst-case consequences of a dropped object or catastrophic failure of the lifting equipment, and detail:
   1. the controls to be taken before the lift, and
   2. the emergency response actions required.

18.4 Energised electrical work certificate

See section 22.2 for Energised Electrical Work.

The energised electrical work certificate (EEWC) is used to document the specific hazards associated with the electrical energised work aspects of the task (see Table C.3 and C.4). The certificate is Approved by the SEL and can be used as an input to the TRA, to Verify all appropriate hazards have been considered. The TRA will also assess other hazards associated with the task that may not be specific to the electrical energised work. The TRA records all hazards and controls associated with the energised work and the task. It is not acceptable to cross-reference the EEWC instead of recording all the hazards and controls.

18.4.1 Using energised electrical work certificate

a. The HWSP permit to work shall be supplemented by an energised electrical work certificate.
b. This certificate may be re-used for regularly executed tasks, if the task is the same and hazards and controls fully cover the scope and are still applicable.
c. When an EEWC is reused, the PA and AA check that it is appropriate for the proposed work before Verifying and accepting the permit.
d. Annex C shows two energised electrical equipment certificates:
   1. Table C.3 shows an EEWC for non-US sites.

Used in non-US sites, typically where IEC standards are adopted.

2. Table C.4 shows a US EEWC.

   Used in US and any site that uses US standards.

18.5 Emergency response and rescue plan certificate

a. Each site shall have standard or general ERRPs that meet the requirements for response and rescue to most parts of the facility.

b. These shall be available and used for all permitted tasks, but they do not have to be attached to each permit.

c. Any rescue facilities mentioned in the ERRPs shall be available on site (e.g. equipment and competent rescue personnel).

d. If a standard site response plan does not cover the scope or manage the risks of a planned task, then create a task-specific ERRP. Include internal and external drawings or sketches of the confined space, where applicable. If access is restricted, test the ERRP physically to Verify it would work before the work begins.

e. The ERRP shall cover rescuing, recovering, and treating casualties.

f. The ERRP shall be:

   1. reviewed during risk assessment
   2. Approved
   3. in place before work begins
   4. discussed at TBT.

g. The ER team leader, or their equivalent, Approves all ERRPs. In doing this, the team leader confirms that the ERRP meets the needs of the task. The AA may also contribute to developing an ERRP as appropriate and authorise its use.

h. Before issuing a permit with a task-specific ERRP requirement, the AA shall contact the emergency response and rescue team to confirm they are available and agree the emergency communication method.

i. Attach the task-specific ERRP to the permits.

   It is good practice to perform emergency response and rescue drills for each plan or scenario regularly and at least every six months or in line with local regulations, whichever is more stringent. This is to confirm that everyone who is likely to be involved in an emergency response understands his or her roles, responsibilities, and response actions.

18.5.1 Creating an ERRP

a. To create an ERRP, first risk assess the intended task to identify what can potentially go wrong and therefore what contingencies, in the form of controls, are needed in the ERRP.

b. The ERRP needs a title, ERRP number and worksite location to indicate the relevant task and area. It also includes an activity ID and permit number if they are different. Next, the certificate defines the key hazards associated with the task (e.g. hydrocarbon release, fire).

18.5.2 Team members

a. Populate the certificate with the ERRP team roles including any specialist skills or standby requirements. Add a contact method for each of the members.

b. Where relevant, this section of the certificate includes external emergency services if they form part of the ERRP. Include contact details and a person nominated to notify and liaise with them if necessary. Consider notifying emergency services before a task takes place and providing relevant PPE for them.

c. For confined spaces, over side working and unguarded lone working at height, a standby person is required. In other situations, the need for a standby person is determined during the RA. The standby person shall be:

   1. appointed and briefed on responsibilities
   2. physically on site and in visual contact with work party at all times free of other assigned duties
   3. clear about their role in the event of an emergency
   4. capable of stopping the job if there is a communications failure or other unsafe situations.

18.5.3 Communication

a. Include in the ERRP the method of communication between the standby and the workers, in addition to the method between the standby and the ERRP team.

18.5.4 Emergency response and rescue method

a. Complete this section with the step-by-step actions to be taken by the ERRP team (and others) in an emergency, as follows:

   1. What are the response triggers (e.g. plant or site emergency, significant change in the hazardous substances within a confined space or injury where workers cannot exit on their own)?
   2. Who has the responsibility to monitor the task and raise the initial alarm, who will they tell and how (e.g. standby to contact AA or control room)? Define communication methods between all parties and test them before the task begins.
   3. Who will take ownership of that response and make decisions on the next steps? This may be the ERRP team leader but can also be the incident response manager for larger incidents.
   4. What are the potential next steps likely to be? These may include dealing with the problem (e.g. stop leak, put out fire), dealing with its effects (e.g. evacuate employees and visitors, search and rescue, provide first aid) and the order in which they will take place. There may be more than one set of options depending on the impact of the incident. Examples include:

      a) While working in a CSE, a separate full site emergency may require complete evacuation and site muster, whereas an injury within a CSE itself will require the CSE evacuation and muster.

      b) Following an injury within an excavation, if an excavation has partially collapsed, the safety of the ERRP team needs to be considered, before they effect a rescue. However, if the injury is unrelated to the integrity of the excavation, then the team may decide it is safe to effect the rescue or provide first aid.

5. Assign actions to individuals or roles. This will differ for the type of emergency. It may include firstly evacuating the immediate area of other personnel. Then, it may involve Verifying, where reasonably practicable, that any hazards that may have caused the emergency, have been removed or reduced to allow the ERRP team to safely perform their duties. Other examples include:
    a) When rescuing a person suspended by fall arrest equipment, members of the team may need to set-up anchor sling and deploy GOTCHA rescue kit with the intent of reducing suspension trauma.
    b) When rescuing an injured party from a confined space, team members may need to test the atmospheric conditions, or define the injury – or do both of these – before deciding if they can treat the injured party within the space or effect a rescue first. They may also need to decide if external medical assistance is required.
    c) If a lift over live equipment fails, team members may raise the evacuation alarm. Operations may check for musters and consider shutting down the surrounding equipment.
6. Define equipment to be used. The equipment shall be ready and available for use before the task starts.
7. If any of the equipment or members of the ERRP team become unavailable, for any reason, stop the task until the equipment or personnel are available. If the task is in a confined space, suspend all other permits associated with the confined space.

18.5.5 Additional information

a. The additional information section of the certificate allows for any additional information that is not already included. Examples include the following:
    1. diagrams of a CSE identifying where people will be working and including the location of hazards and potential escape routes
    2. diagrams depicting location of people WAH and where rescue equipment may be mounted
    3. diagrams of evacuation routes and muster points (if necessary)
    4. flowcharts to help with decision making during an emergency response
    5. additional information about specialist equipment to be used
    6. checklists specific to the emergency.
b. An area has been provided on the certificate for recognition of any attachments. It may be easier to add as an attachment rather than include it in the additional information section of the form. This could be particularly useful for more complicated tasks that may require detailed information, gathered from a variety of sources.

Examples of additional information and checklists can be found in Annex D.

18.5.6 Approval

a. The ERRP certificate is Approved by the ERRP team leader, or site equivalent role, confirming that:

1. the content is suitable and accurate
2. all personnel are competent and capable
3. any equipment mentioned is available and tested and that all ERRP members understand their duties.

b. The ERRP team leader shall also notify any other relevant parties (for example HSE&C team lead, marine team).

c. The AA authorises use of Approved ERRP.

18.5.7 Emergency response and rescue plans for confined space entry

a. If a standard site response ERRP is not adequate for the risks of a planned CSE task, create a task-specific ERRP and document for the CSE. Include internal and external drawings or sketches of the confined space. If access is restricted, physically test the ERRP to Verify it will work before the work begins.

b. Consider how many other CSE type activities are ongoing and if the ERT can manage all of them.

c. The ERT shall attend the confined space worksite during work activity if the ERRP calls for it.

d. When the emergency response team is not available, the permit shall be suspended and the entry points to the CSE physically blocked off to prevent entry.

e. Where the ERT does not need the emergency response team to assemble at the confined space worksite, they shall be ready to mobilise at short notice if a rescue is required.

18.5.8 Emergency response and rescue plans for working at height

a. If this site standard response is not adequate for working at height, create a task-specific ERRP for recovering personnel working at a height.

b. The ERRP shall cover situations where people cannot descend from fixed or temporary structures or equipment without help and include arrangements to lower or recover them to ground or deck level by other means.

c. The ERRP shall cover rescuing a person left suspended in either fall arrest, work positioning or rope access equipment and consider the risk of suspension trauma and rapid retrieval to minimise it.

After 10 minutes in suspension the risk of irreparable damage increases rapidly.

d. Rescue plans identify the equipment needed. This may include:

1. fall arrestor with retrieval handle
2. specialist rescue equipment such as the GOTCHA system
3. crane and crane basket
4. a mobile elevated work platform
5. man-riding winch and basket
6. forklift with personnel basket
7. scaffolds and ladders.

e. Rescue plans shall identify personnel who will perform the rescue.

18.5.9 Emergency response and rescue plans for over side working

a. If the site standard response ERRP is not adequate for over side working, create a task-specific ERRP.

b. The ERRP shall cover situations where people cannot descend from fixed or temporary structures or equipment without help and where relevant, rescue and recover people from water. Include arrangements to lower them or recover them to deck level by other means, or to rescue them using rescue craft (RC).

c. For tasks where over side working controls include wearing a harness and suspension line (that is, where someone can fall, but remains suspended), the ERRP shall consider the risk of suspension trauma.

d. Rescue plans identify the equipment needed. This may include:

   1. fall arrestor with retrieval handle
   2. specialist rescue equipment such as the GOTCHA system
   3. crane and crane basket
   4. a mobile elevated work platform
   5. man-riding winch and basket
   6. forklift with personnel basket
   7. scaffolds and ladders
   8. rescue craft.

e. When working over water, a rescue craft or ERRV shall be available with close standby cover confirmed.

f. When the work party is not visible to RC, deploy a suitable flag or streamer to indicate the work party's location.

g. When relevant, the rescue plan shall include consideration of:

   1. access for RC below the platform
   2. weather side working
   3. weather conditions and forecasts
   4. how the rescue would be affected if personnel are in the water and do not float free of the jacket, wells, piping, structure or all of these.

18.5.10 Emergency response and rescue considerations for lone working

a. Where work is required at remote sites and lone working is the planned option, a TRA shall determine if a lone worker can do the work safely.

b. The following shall be considered to reduce the risks associated with lone working:

   1. train lone workers on emergency response
   2. establish a clear action plan in the event of an emergency (for example how do they raise the alarm and who do they contact?)
   3. set limits for what is permissible during lone work (some tasks may be deemed too difficult or dangerous to be carried out by a lone worker)
   4. require supervisors to make periodic visits to observe lone workers at the frequency defined in the risk assessment

5. regular contact between lone workers and supervisors via phone or radio
6. use automatic warning devices that alert others if signals are not received periodically from a lone worker
7. Verify that lone workers have returned to fixed base or home after completing a task.

18.6 Abrasive task on live equipment certificate

a. The abrasive task certificate is designed to manage the risks associated with performing abrasive tasks on live equipment.

b. Isolate and depressurise equipment or lines whenever reasonably practicable, for:

1. abrasive blasting, grinding, buffing, needle gunning, power tools with abrasive attachments or other abrasive tasks for non-destructive testing
2. preparing for fabric maintenance
3. executing repairs, maintenance, or modifications
4. retro jetting.

c. Operational and logistical constraints can mean that not all the fabric maintenance can be done during a planned shutdown. If this happens, work may be executed during normal operations, if the following conditions are met:

1. the planned scope has an Approved Abrasive Task Certificate (ATC)
2. the risk assessment for the task execution may be a Level 1 TRA or Level 2 TRA depending on the task. The risk assessment is Approved by the SA as a minimum, and permit authorised for use by SA
3. the ATC is required for every abrasive task activity and is Approved by the Facility Support Squad Leader or their delegate.

The abrasive task certificate records the output and requirements of an engineering-based risk assessment that has determined the risk of integrity failure while executing abrasive work is low enough for the task to continue (see Table C.6).

d. Following abrasive activities (on live or isolated equipment), the SA should Verify that the integrity of the equipment being returned to operation is fit for service if not an ORA is required.

18.7 Mechanical seal plugs certificate

a. Mechanical seal plugs are specialist devices or equipment and shall only be used where there are no other reasonably practicable alternatives. To use as an isolation device, see section 14.14.8 obtain the VP Production approval supported by an engineering review documented in a formal process (for example MoC).

b. Complete a mechanical seal plug certificate whenever a seal plug is used (see Table C.7).

c. Where plugs or balloons are used as a vapour barrier obtain APM approval see section 14.14.8

18.8 Well handover certificate

a. A well handover is the point where the ability to influence or control the state of a well or well equipment moves from one party to another (including between two bp operating entities). Therefore, a formal transfer of accountability shall take place to Verify that the receiving party can continue operations safely and effectively.

b. 100243 BP Procedure Global Operations Organization: Risk Management (GOO-GE-PRO-00001) defines the functional boundary between Production and Wells to be the flange downstream of the wing valve. Isolations executed by Production for a well handover and to isolate plant process from the tree and wellhead are normally applied downstream of this functional boundary. But they could also include the wing valve when applicable (e.g. where Wells has no plans to remove it).

In this case downstream for wing valve is always the outer flange from the well. It does not change due to flow direction (e.g. production or injection).

c. Use the local well handover certificate (WHC) to conform with sections 18.8.1 and 18.8.2.

18.8.1 Well handover from Production to Wells and from Wells to Production

a. For well intervention work, where Production is handing over responsibility for CoW to Wells, the SA and Wells representative shall:

1. define the scope of work covered by the WHC
2. define CoW responsibilities and accountabilities
3. assign an accountable person for the CoW activity.

b. The WHC shall reference, as a minimum:

1. preventive maintenance and valve integrity testing status for all tree and annulus valves, wellhead, annulus pressures and depressurisation details when applicable
2. valve status for wing valves (WV), upper and lower master valves (UMV, LMV), swab valve, downhole or subsurface safety valve (DHSV or SSSV) and further downstream valves if applicable
3. ICC number when plant process has been isolated. This isolation shall follow the requirements in section 14 of this CoW Procedure.

18.8.2 Well handover in Wells, and from Wells to Production

a. GWO follows the requirements in 100023 BP Practice Well Handover to manage either of the following:

1. internal well handovers in Wells (that is, from Drilling to Well Interventions and vice versa)
2. where Wells is handing over responsibility to Production (that is, Drilling to Operations, Well Interventions to Operations).

See 100023 BP Practice Well Handover for more information to be detailed in the WHC.

b. For well equipment (for example the tree and wellhead), the applicable 100222 BP Practice Well Barriers (10-65) and approval process for non-conformant isolations, shall govern all isolations:

1. required for well intervention or breaking containment
2. for piping connected to the well.

For wells isolation on non-bp operated sites, the CoW section in the bridging document details how any gaps between the requirements of GDP 4.5-0001 Control of Work and the contractor's safety management system, are managed.

18.9 Pre-startup certificate

a. Use a pre-startup certificate to Approve the introduction of fluids or energy into a system if its containment envelope has been broken (see Table C.9).

b. The SA may decide a pre-startup certificate is not required when appropriate checks are included within the IDP or permit and scope is limited (e.g. calibrating transmitter, leak testing pig receiver or launcher doors).

c. The SA shall Approve the certificate, but this approval can be delegated to an AA for individual pieces of equipment or small subsections of plant.

18.10 Ventilation plan certificate

a. For work inside a confined space, where actual or potential atmospheric hazards exist, a ventilation plan Approved by the HSE&C team is required. Ventilation has several benefits. It can replace oxygen being consumed by a task (welding) and provide dilution and removal of fumes when a task or worksite is adding potential contaminants to the atmosphere (grinding). It can also help to create a tolerable temperature within the confined space. Ventilation can be provided naturally or mechanically depending on the nature of the space and the work.

The ventilation plan determines the ventilation requirements for the space and tasks taking place and documents the layout of equipment and people. The plan is completed by discipline engineering and is attached to permits as a certificate.

18.11 Pressurised habitat certificate

a. This certificate is required for all Type 3 habitats and has to be completed before a habitat is used. The certificate is Approved by the habitat inspector or the AA.

18.12 Heavy equipment movement certificate

a. Use this certificate when it is planned to move heavy equipment off any permanent roadway or area designed for vehicular movement. Heavy is defined as exceeding the axle loading for the bridges, roadways or areas over which the equipment will travel. The certificate is Approved by the OSTL or delegate.

18.13 Cross site boundary isolation certificate

a. This is required when an isolation is required for pipes, cables, drains or communication connections that cross the site boundaries between bp sites or a bp and a third-party site. This documents the process for controlling and communicating the isolations.

b. The SA Approves a cross site boundary isolations certificate.

18.14 Leak testing certificate

a. This certificate summarises the leak test plan and acceptance criteria. The leak test SPA records the results of the test on the certificate.

b. The certificate is accepted by AA.

19 Purging, leak, and pressure testing

a. Test equipment and piping systems for leaks to confirm integrity following alteration, repair, or joint disturbance.

b. When using temporary equipment for purging, activities shall be managed using the leak test process covered in this section 19.

For more information on the management of temporary equipment, see 100695 BP Procedure Management of Temporary Equipment in GOO (GOO-OP-PRO-00005).

c. This section does not apply to Projects when commissioning new equipment on greenfield or brownfield sites. Requirements for integrity testing of equipment and piping for Projects are defined in a project-specific procedure based on GP 32-20 Site Inspection, Testing, and Commissioning of Plant and GPO-CG-GLN-00009 Tightness Testing Guide.

d. For Wells, this section only applies to wells Maintenance activities on bp owned and operated equipment.

1. Wells is required to follow API 53 Well Control Equipment Systems for drilling for pressure testing surface blow-out preventers and Well Control Equipment during Maintenance Activities.

2. Wells is required to follow 100218 BP Practice Pressure Testing (10-45) for pressure testing in drilling, completions, and interventions operations.

19.1 Purpose of leak testing

Leak testing (as distinct from hydrostatic strength testing or pressure testing) provides a final and complete test of the tightness or integrity of a process or utility system. It uses techniques and materials that allow the entire pressure envelope to be tested in conditions which simulate normal operating conditions.

a. To maximise the value from leak testing, use a test medium which resembles the physical properties of the normal operating fluids. Water is generally used on liquid service equipment and nitrogen on dry gas systems. For two-phase operations, water may be used up to the normal operating level with nitrogen above, to replicate live conditions most closely. This allows function testing of instrumentation in advance of introducing the operating fluids.

19.2 Managing leak and pressure testing

a. The SA shall appoint a leak test single point of accountability (SPA) to design, supervise and manage each leak, purge, or pressure test.

b. When an alteration has been made to the equipment or pipework the design of the test is specified by engineering and covered by an MoC. See section 19.3.

c. Every test, with the exception of in-service testing (19.5), shall have a valid leak test certificate (Table C.14) attached to either the IDP or permit.

d. The SPA shall Verify that any temporary equipment being connected to the facility is either covered by a valid MoC, or its use does not require an MoC.

e. When a test continues over shift:

1. the SA shall Approve a delegate for the leak test SPA who will assume the SPA responsibilities and continue to manage the test.

2. the shift handover shall include the status summary and any monitoring and verification requirements.

f. When a weld or joint is excluded from testing, document the reason for exclusion and Approve as part of reinstatement or system handover process. For example, this can be because a 100% non-destructive test of that weld or joint is the lower risk solution. These are sometimes called a golden weld or witnessed joint.

Choosing the correct method of leak testing is the first step in deciding how to execute leak or pressure testing safely and efficiently.

In bp, and the wider industry, various terms are used to refer to methods of pressure or leak testing. For this CoW Procedure, the following six test methods and terminology have been adopted by bp.

- Pressure testing
- Gross leak testing
- In-service leak testing
- Tightness testing – hydrostatic
- Tightness testing - standard pneumatic
- Tightness testing - high pressure pneumatic

Section 3 (Terms and definitions) and section 19.3 to 19.9 provide guidance on each of these terms.

Three engineering practices cover leak and pressure testing:

- For operational facilities – GP 32-40 In-service pressure testing - common requirements.
- For pipelines – GP 43-46 Guidance on Practice for Pipeline Pre-Commissioning and Line Fill.
- For new construction, commissioning, or TAR - GP 32-20 Site Inspection, Testing, and Commissioning of Plant.

19.3 Pressure testing

A pressure test verifies the integrity of the equipment. Typically, this would be after initial construction and will be at a pressure higher than design and may also be used after repair or alteration.

It is a code mandated pressure test with the test criteria determined through the engineering design of the system.

a. A liquid medium (hydraulic testing) is preferred for pressure testing wherever possible, to minimise the stored energy.

b. The preferred liquid medium is potable water. However, consider the effect of the water and any additives on the process (for example formation of hydrates), and the effect of any residual water or additives on the metallurgy of the pressure envelope. For details, refer to GP 06-29 Corrosion Protection during Hydrotesting.

   1. When testing austenitic stainless-steel systems, use distilled or demineralised water containing <250 ppm[56] of chloride ions.

   2. When testing carbon steel systems using seawater, treat with oxygen scavenger (to reduce oxygen content below 50ppb[57]) coupled with chlorination, or biocide injection – or both of these – to minimise corrosion.

Pneumatic pressure testing takes place above the design pressure. The pressure test is normally performed as the first test after initial construction or after an alteration to the equipment or pipework. The stored energy hazard is significant. If the pressure equipment fails, this can result in a blast wave or fragmentation of the equipment under test. The threat of equipment failure resulting in blast or fragmentation is significantly lower after the first pressure test.

19.4 Gross leak testing

A gross leak test is performed to ensure overall leak tightness of the system or its connections before further testing or process medium is introduced.

a. A gross leak test typically uses dry air or nitrogen up to a maximum of 8 barg (116psig)[58] but not exceeding 90% of the maximum potential system operating pressure, to identify large leaks before doing further service or tightness testing.

b. A gross leak test may be used as a preliminary leak test for new construction, hook-up or following disturbance of a significant number of joints such as in TAR or overhaul.

19.5 In-service leak testing

In-service leak testing, sometimes called service testing, is a tightness test using the process medium or fluid at the normal operating pressure of the system and is performed during startup of the equipment. The risk assessment can be part of the IDP, TRA or SOP depending on which type of document is being used to manage the service test.

a. The following systems are normally service tested:

    1. water (for example seawater, potable water, open drains)

    2. steam

    3. nitrogen generation or systems

    4. air.

b. For hazardous utilities or hydrocarbon, consider a service test where a leak or tightness test:

    1. is not reasonably practicable and

    2. the service test is covered by a risk assessment that considers the potential toxicity, flash point, volume, temperature, and pressure of the fluid.

c. The minimum approval level for service testing with hazardous utilities or hydrocarbons is SA.

d. Where reasonably practicable, perform a gross leak test before a service test on hazardous process fluids and hazardous utilities.

19.6 Tightness testing

A tightness test is performed to ensure overall leak tightness of the system's mechanical connections before the process medium is introduced.

If no alteration has been made, then the (leak) test is a tightness test. There are three methods of tightness testing:

- Hydrostatic
- Standard pneumatic

- High pressure pneumatic

Tightness testing:

- confirms that the plant or system is leak tight
- verifies that production equipment and piping systems are safe for hydrocarbon gases and liquids, and hazardous utilities, to be introduced
- demonstrates integrity of all hydrocarbon production and hazardous utility systems
- allows function testing of instrumentation in advance of introducing operating fluids.

a. Complete a tightness test at the following percent of the design pressure or relief device pressure setting:
   1. Hydrostatic at 90%[59]
   2. Standard pneumatic at 30%[59]
   3. High pressure pneumatic at 90%[59].

19.7 Hydrostatic tightness testing

a. Hydrostatic testing uses a liquid test medium; the preferred liquid medium is demineralised, potable or treated water. However, consider the effect of the water and any additives on the process and metallurgy, including:
   1. the formation of hydrates or corrosion
   2. the impact of water in vacuum systems
   3. the impact of water in cold climates
   4. where the weight of water is more than the system is designed for (this could result in structural failure or rupture).

b. When testing carbon steel systems using seawater, treat with oxygen scavenger (to reduce oxygen content below 50 ppb[57]) coupled with chlorination or biocide injection, or both of these, to minimise corrosion.

c. Use distilled or demineralised water containing <250 ppm[56] of chloride ions when testing austenitic stainless-steel systems.

Further requirements for water quality are in GP 06-29 Corrosion Protection during Hydrotesting.

d. Consider the following if selecting liquids other than water:
   1. the possibility of explosion resulting from the diesel effect
   2. the boiling point relative to the test temperature
   3. the flammability of the liquid: a minimum flash point of 65°C (149°F)[60], and at least 10 degrees above the maximum test temperature.

e. Consider the possibility of brittle fracture when doing a hydrostatic test at metal temperatures near the ductile/brittle transition temperature of the steel. We recommend not using hydrostatic leak testing when the ambient temperature is below 2°C (35°F)[61] on equipment and piping constructed from non-impact tested carbon steel materials (for example, API 5L, A 106, A 105 and A 216) with nominal thickness of < 19mm ($^3/_4$in).

f. For non-impact tested carbon steel materials with nominal thickness > 19mm (¾in), a competent person specifies the minimum metal temperatures for leak testing, based on requirements of GP 42-10 Piping Systems. Sites shall identify any systems containing non-impact tested carbon steel and prepare the appropriate local test procedures.

g. When using hydrocarbon, other flammable materials, or hazardous utilities for hydrostatic testing, conduct an L2TRA with SA as minimum approval.

19.8 Pneumatic tightness testing

Used for pressure testing, gross leak testing, standard and high-pressure tightness tests.

Pneumatic testing is a pressure or tightness test where a gas, generally nitrogen, nitrogen/helium mix or air, is the test medium.

Tightness tests are completed at pressures below the design pressure after successful completion of the pneumatic or hydrostatic pressure test. If the equipment has not been altered, then the pressure test that was completed as part of the initial construction confirms the integrity of the material and welds. Blast and fragmentation hazards are not normally considered significant when risk assessing tightness tests. The more significant threats include local failure of fittings and personnel contact with leaking test medium.

a. Nitrogen can asphyxiate. Manage this hazard when opening vessels that have been nitrogen-purged or when nitrogen is being vented.

b. Air can form explosive mixtures with hydrocarbons and this hazard needs to be managed through the purging and testing process.

Inert gas mixtures (for example nitrogen or a nitrogen/helium mix) may be used for leak testing. This may be the preferred method:

- for gas or flare systems testing
- where using water could harm the process
- where the weight of water is more than the system is designed for (this could result in structural failure or rupture).

c. Nitrogen leak testing generally uses nitrogen quads, site nitrogen equipment or both. Site generated nitrogen is typically 98-99% pure but shall be 95%[62] as a minimum.

Alternatively, a specialist contractor’s nitrogen pumping equipment and bulk tanks might be used. When using a specialised contractor, these tests generally use 99-99.5%[63] nitrogen with a 0.5-1% helium tracer gas.

Helium tracer testing is normally used for large-scale testing of plant or for installing new equipment involving a specialist contractor. Bubble testing is normally for smaller scale testing using nitrogen quads.

d. When nitrogen leak testing vessels containing a catalyst, use catalyst manufacturers’ recommendations for nitrogen purity.

e. If the system cannot be leak tested as a single system, then begin testing with the highest-pressure system to enable decanting to other systems. This will help conserve nitrogen by decanting to pressurise or partially pressurise other systems.

f. To avoid background helium readings and to help detect leaks, tape flanged joints for nitrogen or helium leak tests. Tape other joints and valve stems only as required for identification numbering on as-built drawings and reference back to the testing database. Remove the tape once testing is complete.

g. Gradually introduce pressure into the system, allowing enough time for temperature equalisation. Be aware that the cooling Joule-Thompson effect happens when introducing high-pressure nitrogen or air into the system to be tested.

h. Consider the possibility of brittle fracture when doing a pneumatic test at metal temperatures near the ductile, or brittle transition temperature of the steel – or both of these. Pneumatic testing is not recommended when the ambient temperature is below 2°C[105] on equipment and the piping is constructed from non-impact tested carbon steel materials (for example API 5L, A 106, A 105, A 216) with nominal thickness of <19mm (¾ in).

i. For non-impact tested carbon steel materials with nominal thickness >19mm (¾in), a competent person specifies the minimum metal temperatures for leak testing, based on the requirements in GP 42-10 Piping Systems.

j. Sites shall identify any systems containing non-impact tested carbon steel and prepare the appropriate local test procedures.

k. Introducing nitrogen to a system creates an energy source far greater than the energy stored in an equivalent liquid leak test. To minimise this stored energy, add water to vessels that normally operate with a liquid level before pressurising with nitrogen. However, make sure filling with water will not cause corrosion, scaling, or contamination problems.

19.9 Selecting test method

a. Use the flowchart in Figure 21 to select a test method.

b. A standard pneumatic tightness test (30% of design pressure or up to 90%[59] of pressure relief valve set pressure, whichever is lower) can only be selected if the flanged joints are assembled in accordance with 100577 BP Guide Build it Tight (BIT) Flange Management (GOO-PM-GLN-00011). This includes:

    1. assembly workmanship and integrity of connections
    2. systematic approach to bolted joint assembly
    3. systematic approach to defect elimination
    4. assembler training and competence.

When conducting a pneumatic tightness test, a standard test (taking credit for BIT) is the preferred test method. The standard test reduces the risks associated with the test arrangement (such as test fittings and test equipment) and improves efficiency in terms of time and cost.

Both ASME PCC-2 and HSE GS4 recommend tightness tests are carried out at pressures between 10% and 35% max.

c. The test pressure is selected to maximise the test envelope where adjacent systems require slightly different test pressures. The system tests may be combined by selecting a single test pressure that is within the specified range of both systems.

d. If bursting discs are present within the test boundary with set pressures less than the relief device or design pressure, the leak test pressure shall be 90%[64] of the burst disc set pressure inclusive of rupture tolerance.

e. For compressor and pumps, Verify the seal systems are suitable for the proposed test pressure. If the seal pressure is the first constraint, then typically test to 90% of the seal design pressure. Consult SME to Verify the test plan and pressure are suitable.

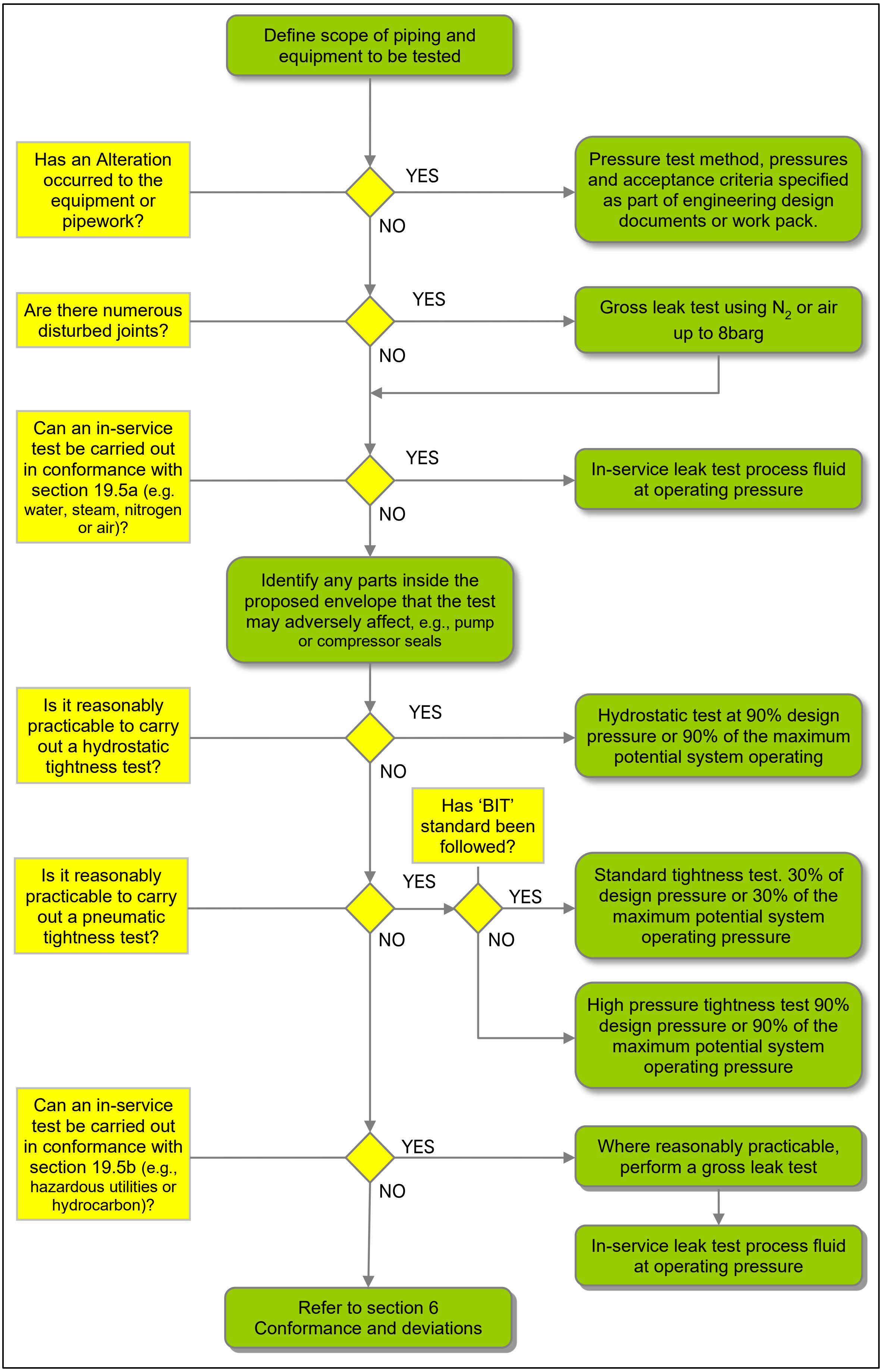


Figure 21 - Selecting test method

19.10 Selecting test medium, pressures, and acceptance criteria

Table 37 - Selecting test medium, pressure, and acceptance criteria

Test method	Pressure	Medium	Acceptance criteria
Pressure test	Engineering design defines test requirements. Typically, 110% to 150%[65] of design pressure	Water Nitrogen or air	Min 30 minute pressure hold (note 1)
Gross leak test	8 barg (116 psig)[58] maximum or 90% pressure relief device setting.	Nitrogen or air	Holding pressure (notes 1 and 2), audible leaks or ultrasonic testing (note 6)
In-service leak test	Operating pressure	Process medium	Visual bubble test – (method 1 or 2 in note 3) or drip test no visible seepage
Hydrostatic tightness test	90%[59] design pressure or 90% pressure relief device setting.	Water	Drip test. No visible seepage
Standard pneumatic tightness test	30%[59] design pressure or up to 90%pressure relief device setting.	Nitrogen or air	Visible bubble test (method 1 or 2 in note 3), or Helium tracer (note 4)
High-pressure pneumatic tightness test	90%[59] design pressure or 90% pressure relief device setting.		Visible bubble test (method 1 or 2 in note 3), or Helium tracer (note 5)

Notes:

1. A test is successful if there is no significant reduction in pressure over the test period and all joints and connections have been visually inspected for leakage. Sometimes it might not be possible to maintain a constant test pressure due to trapped air in the system or passing valves.
2. If the pressure drops more than 2% during the test, the visual inspections are suspended until the pressure can be restored. Joint inspection can be resumed once the system is back at test pressure.

3. Bubble test	**Method 1:** Apply a soap solution to the joint and monitor for surface bubbles.	A bubble test is successful if there is no continuous bubble growth on the surface of the connection under examination.
	Method 2: Tape the joint, insert a 6mm (¼in) diameter tube from the flange into a water bucket, and monitor the number of bubbles released.	Five bubbles per minute. (This approximates to 15scf a year from a 6mm (¼in)[66] tube.)
4. Helium tracer for standard pressure (30%)[67]	Duty Oil Gas <50 barg (725 psig) Gas >50 barg (725 psig)	scf/yr maximum 133 20 10
5. Helium tracer for high pressure (90%)[67]	Duty Oil Gas <50 barg (725 psig) Gas >50 barg (725 psig)	scf/yr maximum 400 200 100
6. Ultrasonic leak testing.	To be carried out by a trained and competent person following an Approved procedure which includes test method and acceptance criteria.	

19.11 Designing the test

a. The leak test SPA shall:

1. create testing envelopes that resemble operating envelopes as far as reasonably practicable and include all connections and periphery equipment that make up a system.

b. The leak test SPA shall consider the following in the design:

1. The test envelope has a PSV with sufficient capacity and a set pressure to stop the test or design pressure being exceeded. It is acceptable to use either existing plant PSVs or temporary PSVs for leak testing.
2. However, if full flow pressure relief is not available, complete a Level 2 risk assessment to determine if controls can effectively manage the HP/LP interface.
3. Where pressure at PSV location cannot be monitored from the pressure injection location, then a communication protocol is needed to Verify the PSV is at system pressure and providing the expected protection.
4. All HP/LP interfaces are clearly identified and adequately protected.
5. The pressure envelope under test is minimised to reduce the level of stored energy in the envelope.
6. Testing takes place as close as reasonably practicable to the start-up date.
7. If simultaneously leak testing two independent and non-connected envelopes that are adjacent to each other, the effects that failure in one pressure envelope might have on the other.
8. The effect on any adjacent system if the pressure in the leak test envelope were to migrate into that adjacent system.
9. Any interfaces with lower pressure systems or equipment (use positive or double block and bleed isolation and consider locking open a vent path to prevent over pressurisation).
10. The location and condition of screwed fittings within the test envelope.
11. Any parts inside the proposed envelope that the test pressure may adversely affect (for example the maximum static pressure on a balanced pump seal, balanced heat exchangers requiring pressure on both sides of the unit).
12. The ability to control the rate of pressurisation and depressurisation within the design limits of the system (including the full depressurisation route).
13. Connected high-pressure equipment (for example accumulators or pulsation dampeners).
14. The suitability of components (for example expansion joints, pipe supports and spring hangers).
15. The need for additional temporary piping support (and removing it after reinstatement).
16. The need to restrain or protect any pipe supports, spring hangers or expansion joints.
17. The implications of non-return valves or other devices or system configuration with the possibility to trap pressure (e.g. fail closed valves).

18. Providing an emergency depressurisation route for large-volume tests. This will ideally be a remote operated blowdown valve, which is an integral part of the leak test envelope and will operate automatically on an installation trip and blowdown event. If this is not possible, identify a manual blowdown route. Both the IsA and the leak test contractor are aware of its location.
19. If the test envelope extends beyond one site (for example pipelines), establish effective communication, including formal procedures, between each site.
20. Set a minimum safe distance for barrier far enough from the equipment to be tested considering the volume, pressure and type of test medium.

19.12 Documenting the test

a. The SPA shall record the test requirements and results in the leak test certificate.

b. The testing shall be part of the IDP or permit. To minimise the number of documents used and hence human error, include the leak test within the IDP where reasonably practicable.

c. When an SOP is used to detail the leak test, include its reference number in the IDP or permit.

d. The IDP, or procedure shall include the following:

1. For preparing for the test – the isolation and isolation state changes required.
2. For conducting the test:
    a) the test method
    b) procedural steps
    c) pressurisation and venting rates
    d) drawings (P&IDs) with details (for example isolation points, fill and vent points, and valve status)
    e) Monitoring requirements
    f) acceptance criteria
    g) depressurisation
    h) de-isolation and reinstatement.

19.13 Preparation for a leak test

a. The leak test SPA shall Verify the following:

1. Pressure indicating, sensing, and relief devices are secure and online, calibrated, and set to the appropriate pressure as necessary.
2. The area is cordoned off with barriers at the distance set in the test procedure or plan.
3. Warning signs are posted at access ways, other strategic positions, and on the equipment to be tested or on the door of test workshops or other designated test areas.
4. Blanking devices (for example spades, blinds, and screwed plugs) conform to the equipment specification.
5. A suitably calibrated pressure-indicating device, or devices, is located where the person controlling the pressure can clearly see the device, or devices.

6. Pressurising equipment has suitably calibrated pressure control or regulator devices.
7. The equipment to be tested is free from any obvious flaws.
8. All attachments that are not rated for the planned pressure have been removed or are effectively isolated.
9. Any temporary restraints needed are in place and will restrain movement if the system fails.
10. Vent and drain valves are in the correct position.

19.14 Checking hardware

Deterioration in the leading threads of connectors can reduce the remaining thread contact area sufficiently for it to fail under pressure with a sudden energy release. Typically, this takes place in test fittings and blanks (as these tend to be frequently tightened and released during pressure testing operations).

All test connectors are subject to cyclic loading, both from the pressure test application and from tightening torque loadings. Some signs of fatigue are clearly visible and measurable (deformed threads), and some are not. If there is any doubt, have the fitting inspected by a competent discipline engineer.

a. The leak test SPA shall Verify the following:
   1. The pressuring equipment and all associated fittings and connections have been inspected, are secure, in sound condition and free from contaminants such as diesel oil.
   2. Fatigue has been considered when test connectors are being inspected and assessed before the test and for continued use.
   3. Hoses and connectors are suitable for their testing purpose (i.e. they are rated for the test pressures and test medium).
   4. Flexible hoses are suitably restrained or shielded to restrict whiplash hazard from failure.

19.15 Executing and monitoring the test

a. The leak test SPA shall supervise the test and Verify the following:
   1. Before the test, a sweep of the test area is completed to check that no one is inside the barrier. Communicate that a pressure test is imminent.
   2. Access is prohibited to everyone during pressurisation periods. Following pressurisation, continue to prohibit access to the test area until the pressure has stabilised. Restrict access for leak detection to essential personnel (a minimum of 2), or as specified on the work permit.
   3. Boundaries of the test area are monitored throughout the test to stop unauthorised personnel entering the area.
   4. During pressurisation and depressurisation, access to the test area is minimised.
   5. Pressure is added to any system slowly and in a controlled manner. Stop initially at 4-5 barg (60-75 psig)[68] or 25% of the final test pressure if the final test pressure is less than 20 barg (290 psig). Confirm the entire leak test envelope is pressurised before continuing.

6. Pressure is increased in stages equivalent to 25% of the final test pressure. Pressurisation is stopped at these intervals (that is, 25%, 50%, and 75%) to allow the system to stabilise.
7. The minimum monitoring time for test is 30[69] minutes (time required for pressure stabilisation in the system). When the leak test volume is small (≤0.3m^3 (10ft^3)) the time may be reduced to 10 minutes. Typical examples include single instruments, small pumps, and short lengths of pipe between isolation valve and pressure relief valves.
8. Joints and flanges are checked for visible or audible leakage at each step change in pressure. Pressure drop time assessments are performed at each stage to satisfy the AA of leak test envelope integrity. Verify adjacent systems are not building pressure at hold points.
9. When test pressure is reached, the pressurising equipment is isolated from the pressure envelope.
10. In an extended test, the possibility of a pressure increase due to thermal expansion is considered.
11. Pressure monitoring shall include any adjacent systems and depressurisation routes that are not positively isolated. Alarms on adjacent systems and depressurisation routes are used to monitor for pressure build-up.
12. The equipment being tested is not subjected to any form of shock loading.
13. The test results recorded in the leak test certificate or attached prints or charts from a recording device meet the acceptance criteria.

19.16 Managing identified leaks

a. If any leakage from a joint is detected during pressuring a system, the PA shall stop pressurisation and inform the leak test SPA and do one or more of the following:
    1. Depressurise the system using the Approved venting point and repair leak.
    2. Isolate the leak from the test so the rest of the system can be pressurised as planned to find additional leaks at higher pressures.
    3. Isolate the section that has the leak, depressurise that section and repair.
    4. Use an Approved procedure or method to repair leak at an agreed criteria (e.g. pressure, temperature).
b. Depressurise systems under test before bolt re-tightening, tensioning or other remedial action to reduce leaks. Valve glands may be adjusted but not re-packed while the system is still pressurised.
c. Additional information concerning flanged joint repair is given in 100577 BP Guide Build it Tight (BIT) Flange Management (GOO-PM-GLN-00011) and GP 42-32 Flanged Joints - Repair.

19.17 Depressurising

a. The leak test SPA shall Verify the following:
    1. When the test is complete, the pressure is reduced gradually and under controlled conditions following the depressurisation rate in the leak test certificate until the system reaches atmospheric or the desired operational pressure.

2. Vents at high points are opened before draining liquids, to prevent a vacuum being drawn.
3. Where reasonably practicable, inert gases are vented to the installation flare and vent system. If this is not reasonably practicable, they are vented to a safe area where they will not affect personnel. Sometimes pressuring fluid can be decanted into another test envelope to conserve pressuring media. If venting large volumes to atmosphere, a risk assessment of this activity is conducted and a procedure detailing how personnel will be protected during depressurisation developed.
4. When venting a high-pressure system through a lower pressure system, the flow rate does not result in a pressure that exceeds the pressure rating of the lower pressure system.
5. Liquefied hydrocarbons such as LNG or LPG are routed to a flare via fixed or suitable temporary facilities and not be released to atmosphere.
6. Clamps or bolts are not loosened while the system is still under pressure. Only competent personnel who have been trained in the appropriate procedures can remove clamps.
7. There is no trapped residual pressure in any part of the envelope (for example behind non-return valves or check valves).

19.18 Pipeline pig trap leak testing

a. Test pig trap doors before a pig trap is left unattended. This requirement can be met by either of the following:
    1. a tightness test using water or nitrogen
    2. a low-pressure seal test with nitrogen or water followed by a service test.

b. Manage either through an Approved procedure (SOP) or by approving a risk assessment within a permit.

19.19 Vessels with engineered closure

Engineered closures are typically designed to be opened regularly and are found on vessels such as filters and coalescers. They can be managed in the same way as pig traps provided the closures meet the design requirements of GP 43-50 Pigging, Pig Launchers, and Receivers.

19.20 Using high pressure gas

The following requirements are in addition to those covered in section 19.

In the context of this section only, ‘using high pressure gas’ refers to use of a gas supply that has the potential to produce more than a system’s design pressure (e.g. nitrogen cylinders, quads and/or pumps).

Plant nitrogen, with a pressure of approximately 8 barg, would not typically be considered high pressure, unless the system design pressure is less than this.

a. Use a Level 2 TRA to manage leak testing or purging when using;
    1. temporary equipment
    2. gas cylinders, quads or pumps, or
    3. a specialist contractor.

Fatalities in the industry have resulted from temporary equipment or fittings failing during leak testing. Industry estimates suggest 95% of incidents can be avoided if people are sufficiently separated from equipment under pressure.

b. The leak test SPA shall Verify that engineering has confirmed the following:

1. Gas injection is supplied through hoses rated for maximum discharge pressure of the source.
2. The velocity of the medium shall not exceed criteria specified in EP-GP-28-01 Flexible Hose Assemblies This can be achieved by either;
   a) selecting a suitable size hose, or
   b) limiting the flowrate.
3. Where the velocity criteria cannot be met, engineering approval is required and documented in the leak test certificate. Engineering review will consider as a minimum, the effects of high pressure drop and high velocity on all associated equipment.

   Most hose failures are due to high velocities, or incorrect use (e.g. wrong bend angle, lateral offsets). For more information on hose velocity limits, see: EP-GP-28-01 Flexible Hose Assemblies.
4. The injection point is suitable for the planned flowrates within acceptable velocities and pressure drops. High velocities and pressure drops can damage hardware, seals, and instruments. False pressure readings can also occur impacting Over Pressure Protection Devices (OPPD) performance or pressure recording equipment.
5. A suitable PSV (either permanent or temporary) is installed to provide over pressure protection from gas supply equipment, being able to handle the maximum rated discharge pressure and flow of supply equipment as per equipment datasheets:
   a) at the injection point (using a different tie-in to any OPPD) and
   b) within the system being purged or tested (using a different tie-in to any OPPD).

   Recent history in the oil and gas industry has recorded over pressure events (during leak testing) due to PSVs and OPPDs having blocked tappings. Separate tappings help to reduce this risk.
6. Where a single PSV may be used to protect the system being purged or tested.
7. OPPDs are installed to prevent safe design limit excursion and shut off pressurisation equipment when a set pressure is reached. When designing the leak test decide on the number and location of OPPDs required. In making this decision consider:
   a) Is an OPPD required?
   b) the number and location of OPPDs
   c) OPPD response time to stop gas injection.
   d) differential between the source and leak test pressures.
   e) location and number of sensing elements with respect to the size and layout of the test envelope.

8. In deciding the number and location of injection points, PSVs and OPPDs the overall risk from the number of disturbed joints and resulting witness joints has been considered.
9. OPPDs do not automatically re-start the gas injection if the system pressure reduces below the OPPD set-point.

c. The requirements in 19.20b can be delivered for regularly used equipment on a site by having list of equipment recorded in the LIP, that has been assessed by engineering as suitable and conformant.

d. The leak test SPA shall Verify the following:

1. If temporary PSVs are used, consideration has been given to where these PSVs would vent to if they lift. The location has been agreed with the AA.
2. All valves between the injection point and the PSVs and, or OPPDs are secured and tagged in the open position (using yellow pro-locks).
3. OPPDs are tested before the task commences and the test requirement is included in the leak test certificate.
4. OPPDs and PSV use separate tie-in points.
5. In case of OPPD activation during the task, all activity is suspended, and the AA is informed for further investigation before injection can re-commence.
6. Where fitted, test the low temperature trip prior to use.
7. During purging or leak testing operations, all valves that are used to create the leak test envelope, are either; managed by an IDP, or secured and clearly tagged (e.g. Do not operate, purge / leak test in progress)
8. A communication protocol is in place for conducting the leak test.

e. Before pressurisation, the AA or delegate and leak test SPA shall walk through the system to be tested with the marked-up P&IDs and Verify the following are as per the leak test certificate and supporting documents:

1. test envelope limits
2. valve positions
3. injection points
4. over pressurisation protection and monitoring positions and settings
5. method to safely depressurise the system
6. the test area is adequately barriered off
7. all relief valves are online, and settings are as specified

f. When a leak test goes over a shift, the shift handover shall include the status summary and any monitoring and verification requirements.

g. Figure 22 shows an example layout for purging and leak testing using temporary equipment.

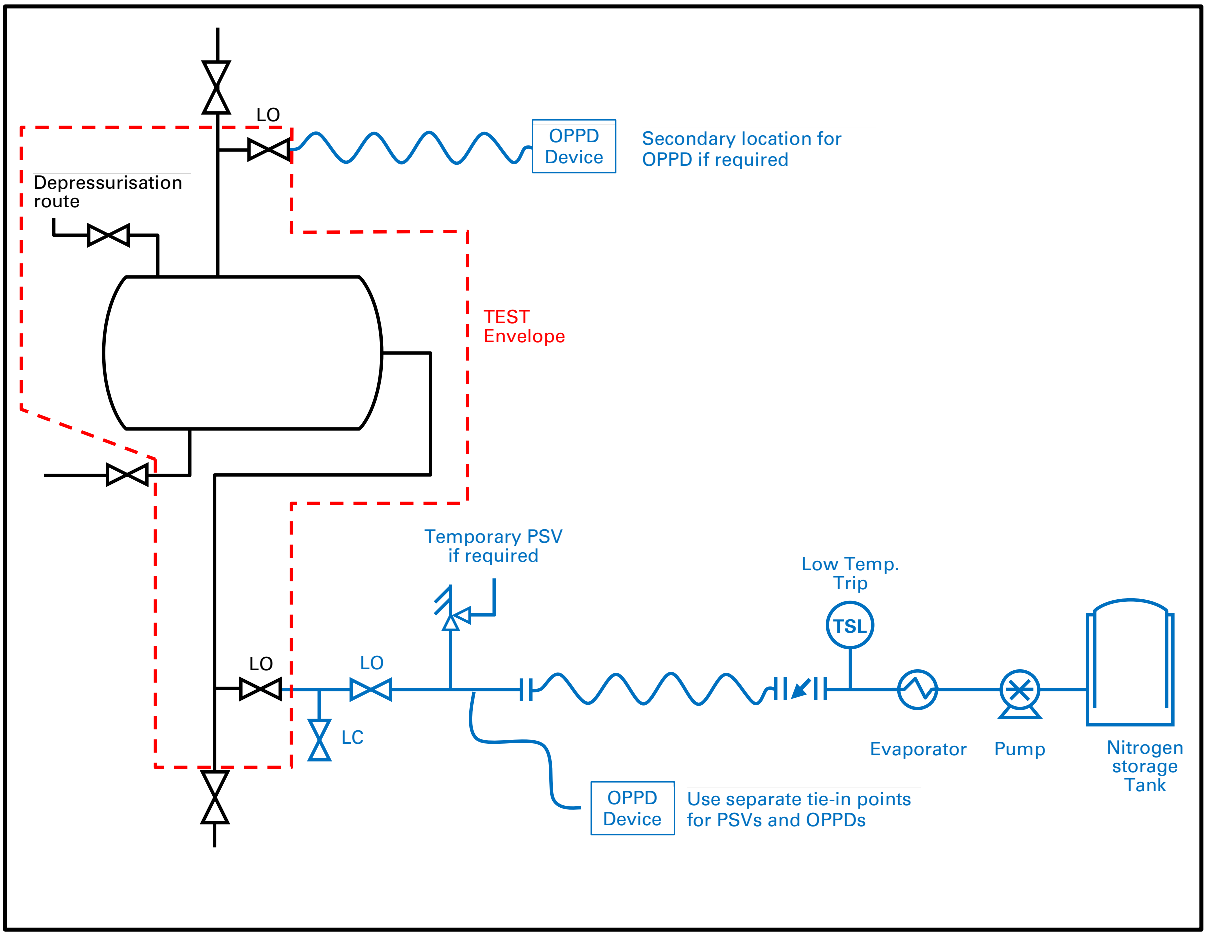


Figure 22 - Example layout for purging and leak testing using temporary equipment

19.21 Leak testing positive isolations

a. All positive isolations shall conform to section 14.14.3 of this procedure, be fully rated and appropriately torqued.

b. Positive isolations that are likely to see material and/or pressure shall be leak tested before use.

For example: Dropping a spool to have an air gap and installing a blank on the process side of the positive isolation.

c. When assessing whether a positive isolation is likely to see material and/or pressure consider the following:

1. known or historical integrity risks with valve isolation integrity
2. the risks from integrity or process event issues
3. human error associated with the duration of the isolation and management of PBUs
4. potential for trapped fluid and/or pressure
5. effects of thermal expansion
6. potential for blank/spade and joint corrosion
7. how to safely remove the positive isolation (e.g. use vented blank, vented spade, or temporary system shutdown to remove any pressure).

d. LTI positive isolations shall conform to section 14.27 of this CoW Procedure.

e. LTI positive isolations shall be leak tested as soon as reasonably practicable.

f. Positive isolations that are not likely to see material and/or pressure, do not require a leak test.

For example:

1. *Dropping a spool to have an air gap and installing a blank on a confined space side of the positive isolation.*
2. *Inserting a spade into a flange connection with a proven valve isolation on the process side of the positive isolation including ongoing verification of integrity via PBU*

g. All leak testing shall be conducted in line with this leak testing section 19.

19.22 Leak testing relief valve flanges

a. When relief valves (RV) are removed for overhaul or replacement, the flanged joints upstream and downstream of the RV shall, where reasonably practicable (e.g. where suitable isolation and vents are available), be leak, or tightness tested in line with Figure 21.

b. When leak testing the downstream flange, leak test to the maximum allowable back pressure of the RV, or 90%[70] of the downstream line design pressure, whichever is lower.

The downstream line design pressure can be limited in three ways:

- *the downstream line (spool) can be fully rated to the same design pressure as the upstream line*
- *the downstream line (spool) can be rated to the same design pressure as the flare header*
- *the downstream flange of the RV can be connected directly to the isolation valve.*

The maximum allowable back pressure can be found on the PSV data sheet.

c. If leak testing of the downstream flange is not reasonably practicable (e.g. relief valve to flare with no block valve), use the process in Figure 21 to determine if it is safe to perform a service test.

Note: when assessing the risk of using a service test on the downstream flange, consider that, in many cases there is negligible pressure in the flare system until a system on the plant is relieving.

20 Plant reinstatement

Reinstating plant requires as much attention to planning and detail as the initial isolation. In the context of this section, reinstatement of plant is defined as the activities to achieve system readiness including the reintroduction of process medium and/or electrical energy ready for plant start-up. Plant start-up is typically managed by SOPs.

a. For Wells, this plant reinstatement section only applies to Wells maintenance activities on bp owned and operated equipment. Wells is required to follow 100218 BP Practice Pressure Testing (10-45) for pressure testing in drilling, completions, and interventions operations.

b. The SA shall:

 1. Follow the regional certification procedure when reinstating plant
 2. Verify that a plan is developed and implemented to safely isolate, test, and reinstate plant during the work scope planning process
 3. Approve reinstatement of plant for larger scale jobs.

Figure 23 identifies two typical processes that can be followed when reinstating plant.

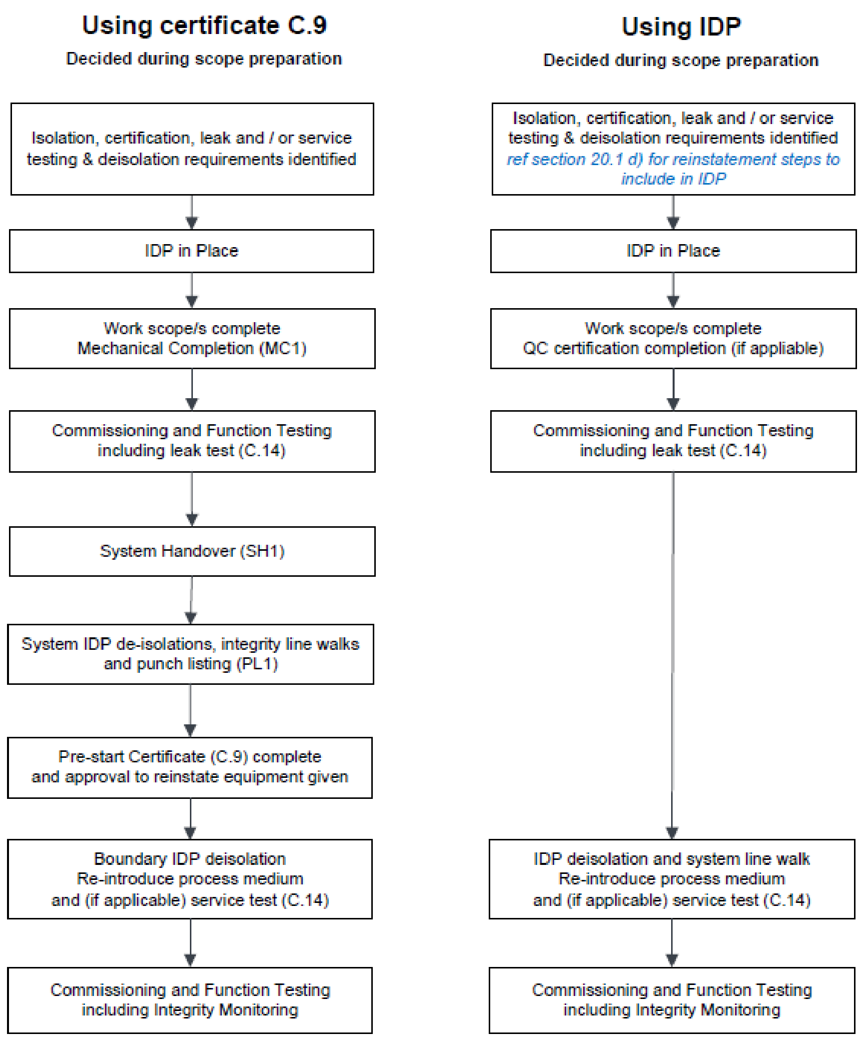


Figure 23 - Overview of typical reinstatement processes

20.1 Reinstatement of plant

a. Pre-startup certificate Table C.9 is used for plant startups following work. The SA may decide not to make this a requirement when the scope is minimal (e.g. maintenance routines or replacing a single instrument) or where there has been minimum intrusive work (e.g. following a trip).

b. The integrity verification required will depend on the extent of the work that has been carried out. It ranges from leak testing process systems to function testing logic systems or shutdown systems. In all cases, these tests and their results are recorded using QC Certification. Only after these tests have been successful can the SA, or AA if delegated, give permission to deisolate the plant. In all cases, a level of pre-start verification and line-walking shall be done to Verify the plant or system's full integrity.

> *The line-walking checklist and pre-startup certificate are to Verify the integrity of the system to prevent a loss of primary containment (LOPC). They are not designed to line up the whole system ready for startup.*

c. For TARs and extended system outages, consider drawing up a specific TAR and planned intervention pre-startup certificate Table C.9, informed by the template Table D.8. This is part of the overall verification process that the SA uses to approve the introduction of hydrocarbons and plant restart.

d. The reinstatement plan includes pre-start verification checks to confirm the plant is ready for start-up. When the pre-start certificate Table C.9 is not required, consider the following as a minimum to deal with the risks involved in reinstatement:

1. intrusive work is complete
2. broken joint integrity is reinstated
3. QC Certification including Mechanical Completion Certificate (MC1), C.14 and/or SH1 (dependant on scale of work) has been completed and approved
4. any materials introduced during the outage have been removed (e.g. oxygen, water, or leak test fluids)
5. dead-legs are identified and managed
6. integrity line walking to Verify:
    a) equipment (e.g. fittings, hoses and electrical equipment that were attached during the testing) has been removed
    b) check that any plugs, caps, blanks, covers have been replaced to original specification after any fittings and hoses have been removed
    c) valves have been reinstated to normal operating status
    d) LO/LC valves are secure, and in their normal position.
7. critical equipment (e.g. relief valves, F&G, and ESD systems) are de-isolated and available
8. competent personnel are available
9. service testing requirements (see section 19)
10. rate of increase of energy (e.g. temperature, pressure, electrical) during reinstatement and start-up
11. energy reintroduction authorisation.

e. Do not reinstate a system until the section where containment was broken has been leak tested (see section 19). If joints are not to be leak tested, they shall be captured as witnessed joint and/or included in a system service test.

f. Lagging and cladding may be left off and scaffolding left in place to conduct this verification. Where this is not desirable (for example LNG), a tell-tale may need to be fitted to the cladding.

g. Following successful leak testing, if no leak is detected, then the leak test portion of the tag is torn off and the applicable QC Certification section(s) updated and signed.

h. For plant outages that have involved intrusive work and where line-walking is required:

   1. the AA Verifies that competent personnel who are familiar with the process system perform the line-walking

   2. P&IDs for line-walking are assigned to individuals for marking up to record a system has been checked. The line walker signs and dates each drawing used capturing any actions required on a punch list.

   The line-walking checklist in Table D.8 can be used to help mitigate human error.

i. After hydrocarbons or hazardous utilities are introduced, visually check joint integrity of all broken joints and other joints on the same system that might have been affected by disturbance of the system. Repeat checks typically every 12 hours[71] until the plant has reached its normal operating pressure and temperature. These checks are done for a minimum of two days.

j. If no leak is detected after this period, then the monitoring portion of the tag is torn off and the applicable QC Certification section(s) updated and signed.

20.2 Witnessed joints

a. Typically, connections that are dismantled after a leak test, left deliberately untested, or are not part of the leak test boundary, are treated as an untested joint and use the witness joint process to manage the risks associated with them.

b. A witnessed joint is:

   1. independently witnessed

   2. quality assured by following an Approved jointing procedure

   3. recorded on a joint register that contains joint identification number, system ID, operating fluid, temperature, and operating pressure

   4. monitored as agreed in the risk assessment, for any leaks as part of a service leak test.

c. The SA shall Verify that a competent mechanical person witnesses the making of the joint. As a minimum, they are to Verify that:

   1. the surface is clean

   2. the correct gasket or seal ring is used

   3. no scoring on surface or gasket is present

   4. the correct sequence and value of torque is applied

   5. the leak test section of the five-part joint tag is used to indicate the flange is a witnessed joint: write witnessed by and, or a large ‘W’ on the tag.

d. In some circumstances, it may not be reasonably practicable to independently witness every joint and record on a joint register. In these cases, all other requirements in this section apply.

Below are some examples of where it may or may not be considered reasonably practicable to apply the full witnessed joint process to an untested joint. In all cases, the higher standard is the preferred choice:

- Example 1: Casing drains with blank flanges on the bottom of a compressor that will operate with hydrogen at 30 barg. In this case, the result of these blank flanges leaking, once the compressor is running, could be catastrophic. Therefore, based on reasonable practicability, these blank flanges would be treated as witnessed joints.
- Example 2: A plug on a 3 barg cooling water circuit where the valve upstream of the plugs was part of the leak test envelope. In this situation, you may decide that this joint does not need to be witnessed and would just be subject to the verification process described in 20.2c.
- Example 3: a vent/bleed point within the isolation boundary used to introduce the test medium. One option would be to extend the test envelope to include the point, another would be to treat as a witness joint.
- Example 4: DBB isolation that is not de-isolated for the leak test and that leaves the bleed valve and the plug untested. Options as example 3.

21 Ground disturbance

a. Ground disturbance is a man-made cut, cavity, trench, or depression made in the ground by removing the covering material (for example earth or concrete) that is:

   1. deeper than 0.3m (12in)[72] if made with hand tools (for example shovels and spades), or

   2. any depth if made with mechanical equipment (including piles and boring systems), or sharp objects (e.g. picks, spikes, chisels, posts, earthing or grounding rods).

b. All ground disturbances shall have a ground disturbance certificate (GDC).

c. All underground services shall be positively identified by physically exposing using safe excavation methods

d. Excavations >1.2m (4ft)[73] deep shall have:

   1. atmospheric testing in a hazardous area and, if there is potential for hazardous atmospheres, in non-hazardous areas

   2. shoring or grading as detailed in section 21.2. Consider shoring or grading for shallower excavations depending on soil

   3. access and egress points every 6.7m (25ft)[74] (for example in trenches or large excavations).

See Figure 24 for an overview of the ground disturbance process.

21.1 Ground disturbance preparation and site surveying

a. The Facility Support Squad Leader or delegate shall Verify the following:

   1. The procedures used for site survey services are consistent with applicable sections of ICE/BSI document PAS 128-2014 Specification for underground utility detection, verification, and location.

      Further guidance and input on survey, positioning, and mapping support from the region survey & geospatial resource, can be found in RD001-SP-GLN-800 Ground Disturbance Survey Guideline (RD001-SP-GLN-800-00003951).

   2. A suitable data search is conducted internally and with relevant third-parties, to identify all applicable site drawings and plans to be used for site survey planning and execution. The search includes interface with the region geospatial team to review OneMap and other relevant sources.

   3. The region survey and positioning team have Verified the survey procedures, survey calibrations, operations, as-found results (existing services) and as-built results (new services).

   4. The person using the detection and mapping equipment is competent and qualified, with evidence either attached or referenced on the ground disturbance certificate.

      Further guidance on competency can be provided by the local survey and positioning team.

   5. The person performing the underground services detection and mapping use:

      a) suitable cable/pipe locating equipment (CATSCAN, Ground Penetrating Radar, Electro-Magnetic Locator, or equivalent devices).

b) acoustic (tone) or other active signal systems where reasonably practicable, to improve the detection and location of service lines.

6. The person conducting the survey shall:

a) mark the location of all underground services, and the results recorded in the GDC

b) mark lines at 5m (15ft)[82] intervals or less, as applicable, to clearly define the location of services with colours in line with Table 38

c) pin flags or markers that do not infringe on the marking conventions or colours within Table 38, to instruct personnel to hydrovac or manually excavate.

A regulation at US sites, including a recommended practice, is to place pin flags or equivalent markers that show the location of underground services.

7. The HSE&C Site advisor has Verified a site survey for environmental health hazards is carried out and has advised on the need for a pre-excavation contamination assessment.

Industrial land can be contaminated with environmental health hazards such as heavy metals including lead and cadmium, oils and tars, solvents, and asbestos.

Table 38 - Designated pin flag or marker colours

Colour	Colour name	Item
	Red	Electric
	Yellow	Gas, oil, steam or chemical
	Orange	Communications, cable
	Blue	Potable water
	Green	Sewer or storm drain
	Purple	Reclaimed water, irrigation
	Pink	Temporary survey
	Grey	Search zone
	White	Proposed excavation

21.2 Excavation design

a. The Facility Support Squad Leader shall Verify that the design of temporary bridges installed at crossing points to protect pipelines or equipment are either, part of an approved engineering workpack, or covered by an MoC.

b. For excavations of 1.2m (4ft)[73] or deeper the following shall apply:

1. Include an excavation-specific drawing as part of the ground disturbance certificate.

2. Shield (trench box), bench or slope all excavations unless they are in stable rock.

3. Table 39 below identifies the maximum slope for different soil types.

4. Determine soil type using visual and manual testing. If this is not reasonably practicable, assume the soil type is type C with 1½ to 1 slope, see Table 39.
5. For some activities, materials, or ground conditions (or a combination of all of these), danger might arise from excavations less than 1.2m (4ft)[73] deep and shoring or sloping may be required.

Table 39 - Excavation slope requirements

Soil type	Description	Maximum slope[78] (horizontal to vertical)
Solid rock	Not applicable	Vertical (90º)
A	Hard and dense soils, compressive strength greater than 144kPa, clay, hardpan, caliche.	¾ to 1 (53º)
B	Medium soils, 144kPa > strength > 48kPa (angular gravels, silty soils, Type A soil that has been disturbed, subjected to vibration, or is fissured.	1 to 1 (45º)
C	Weak soils, strength ≤ 48kPa, gravel, sand, wet (seeping or submerged) soil.	1½ to1 (34º)

21.3 Risk assessment

a. Risk assess ground disturbance using a Level 2 risk assessment unless the GDC verifies there are no hazards from underground services. If there are no hazards from underground services, a Level 1 risk assessment may be used.
b. To determine if the excavation is to be treated as a confined space, consider the following:
    1. does the excavation meet the criteria for a confined space in section 15c?
    2. is there is a risk of atmospheric hazards either from the surrounding area or from the task being performed?
    3. does the excavation require any form of isolation before entry?
    4. is there a risk of engulfment from entry of solids or liquids?
    5. is there restricted means of access and exit for the work party?
    6. are access and exits restricted if anyone needs to be rescued?
c. If the answer to any of the above is yes, a confined space permit is required.
d. Consider the following during the risk assessment:
    1. if it is reasonably practicable to isolate services, including electric cables before excavation
    2. identify overhead power lines, structures, or pipework and isolate if reasonably practicable. If isolation is not reasonably practicable limit the maximum height of any machinery to 0.75 x the minimum safe operating clearance. Erect non-conductive or earthed goalpost type height warnings or signage both sides of overhead power lines. Follow the requirements of section 22.6.
    3. the level of supervision required
    4. the quality and completeness of documents and the complexity of the location with respect to quantity and depth of underground services

5. the need for signs and the type of barriers. Barriers and warning signs are used when the ground disturbance is large enough to enter.
6. when classed as a CSE, control access to the excavation following the CSE process
7. the need to provide lighting
8. the need to segregate and transport excavated materials
9. testing required before work starting and during the excavation
10. the need for any standby personnel
11. any required ground penetrations for the task
12. controls to prevent injury from ejected soil and other material when using air digging or jetting
13. the use of jetting tools around old and fragile cables that could be more easily damaged by this method
14. the need to notify site emergency services if the work will restrict access to facilities or area
15. provision for diverting traffic or for over-plating roads or footpaths.

21.4 Performing excavations

a. The PA shall use the following safe excavation practices:

1. Assume all services (for example electricity, pressure, and hazardous substances) are live.
2. Immediately stop work if an unexploded ordinance (UXO) or unidentified object is uncovered. The PA shall tell the AA who will initiate the incident management process. Clear the area and put barriers in place to keep people at least 100 metres away from the area.
3. Use service plans or drawings and suitable location devices (CATSCAN, ground penetrating radar, electro-magnetic locator) to find or confirm suspected locations of underground services.
4. Positively identify all underground services using trial holes by using safe excavation methods (hand digging, hydro excavation and suction, or air blow) to confirm location and depth. A number of trial holes may be needed to accurately identify; the size, number, direction, and depth of the services (e.g. for a 100m long excavation, the risk assessment may require a trial hole every 10 meters). Consider that services do not always run in straight lines.
5. When closer than 0.5m (18in)[75] to any service, use hand digging, air jetting or suction and hydro excavation to excavate. Do not use power tools or mechanical excavators.
6. When hand digging, use plastic spades and shovels with curved edges rather than other tools that are likely to damage services.
7. Make frequent use of scanning during the excavation (scan and scrape). Service location and depth is likely to become more accurate as material is removed.
8. Where reasonably practicable excavate alongside the service rather than directly above it.

9. Do not throw or spike spades or shovels into the ground but ease them in with gentle foot pressure.
10. Do not use picks in soft clay or other soft soils near to buried services. If they are included in the risk assessment, they may be used with care to free lumps of stone and break up hard layers of chalk or sandstone.
11. Position the machinery and vehicles so they cannot affect the security of the excavation walls.
12. Do not allow vehicles and machinery within 2m (6ft 6in)[76] of a trench or excavation. Place vehicle stoppers to prevent vehicles reversing into and near excavation.
13. Stop work and seek advice from the AA if any previously unidentified pipes, cables, cable ties, or cable identification tape are exposed.
14. Support and protect exposed services such as pipelines or cables.
15. Do not use exposed services as handholds or footholds.
16. If an underground service is damaged during excavation, stop work, make the worksite safe, and inform the AA. Keep people away from the area until it has been made safe.
17. Disposal of any excavation materials shall conform to local materials or waste management procedures.
18. Clearly signpost or mark any temporary crossing or bridge. Consider the need for temporary lighting.
19. Fence or erect guardrails for crossing lanes on both sides along the edge of the pipe crossing to restrict access. Assess the extent of fencing or guarding based on local conditions.

b. In addition to the requirements in 21.4(a), when an excavation includes breaking hard surfaces, follow the requirements below:
    1. Assume the service is embedded within the hard surface until exposed.
    2. Handheld power tools may be used 0.5m (18in)[75] or more away from the indicated line of a service buried in or below a hard surface.
    3. Once hard surface is broken, careful hand digging from the side under the hard surface to positively locate the service.
    4. Avoid using hand-held power tools over the service unless:
        a) the service has already been exposed by digging under the surface to be broken out and it is at a safe depth (at least 300mm[77]) below the bottom of the hard surface material; or
        b) physical precautions have been taken to prevent the tool striking the service.
    5. Mechanical excavators and power tools can be used to break-up hard surfaces where the survey has proved that there are no services, or the services are deep enough so as not to be damaged by such tools.

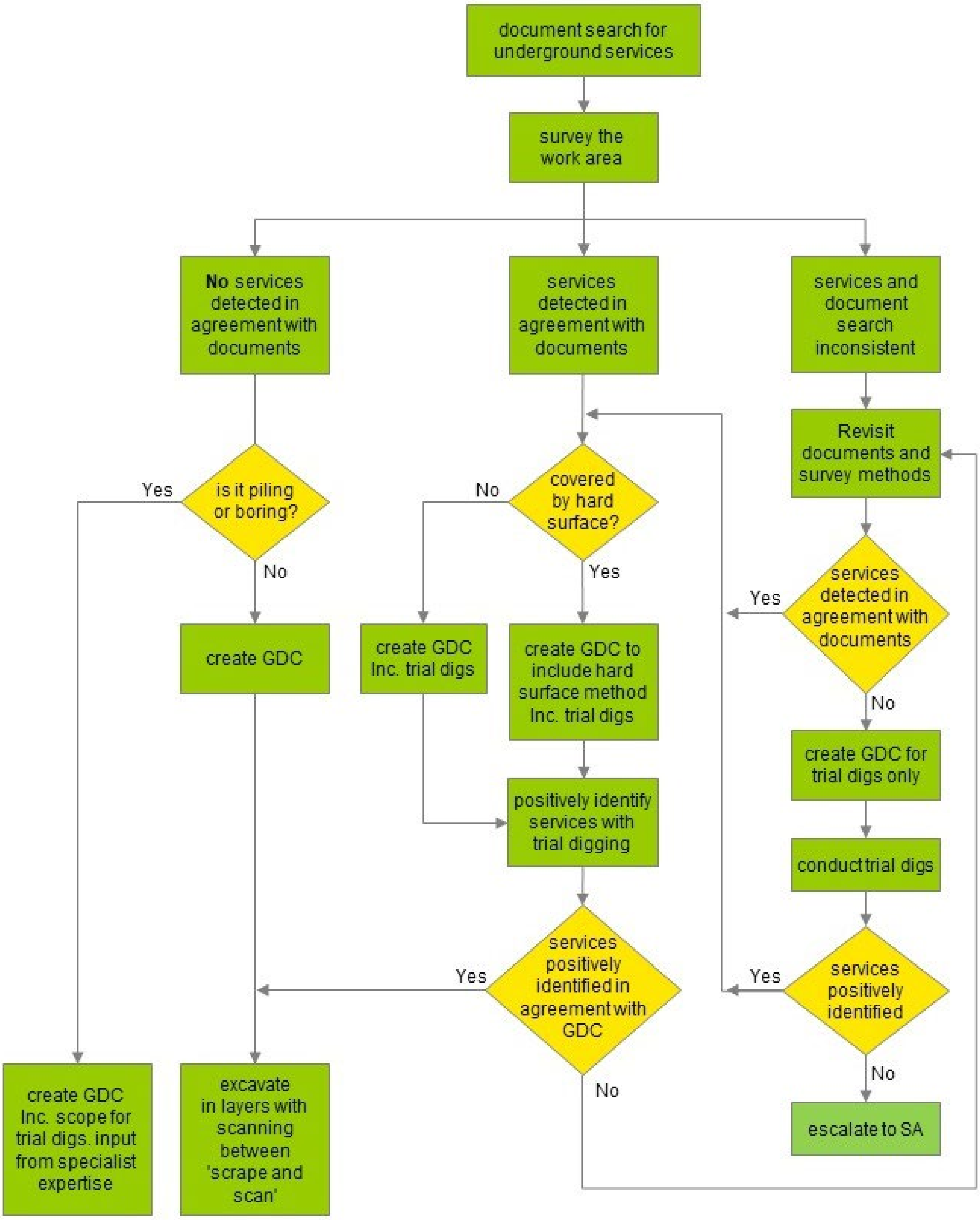


Figure 24 - Ground Disturbance overview

21.5 Inspecting and tagging excavations

a. The SA shall appoint a suitable person to inspect and tag the excavation:

1. When excavation works are completed.
2. At the start of every shift, before any work can begin on or within the excavation to identify potential hazards and review ground conditions.
3. After any event likely to have affected the strength or stability of the excavation or the shoring, such as water encroachment from weather, ground conditions, fall of rock, earth, or other material.

4. Carry out periodic monitoring for factors that could affect the disturbed ground (for example adverse weather, water encroachment, or uncovering hazardous substances such as asbestos). This might involve 24-hour monitoring in high-risk areas.

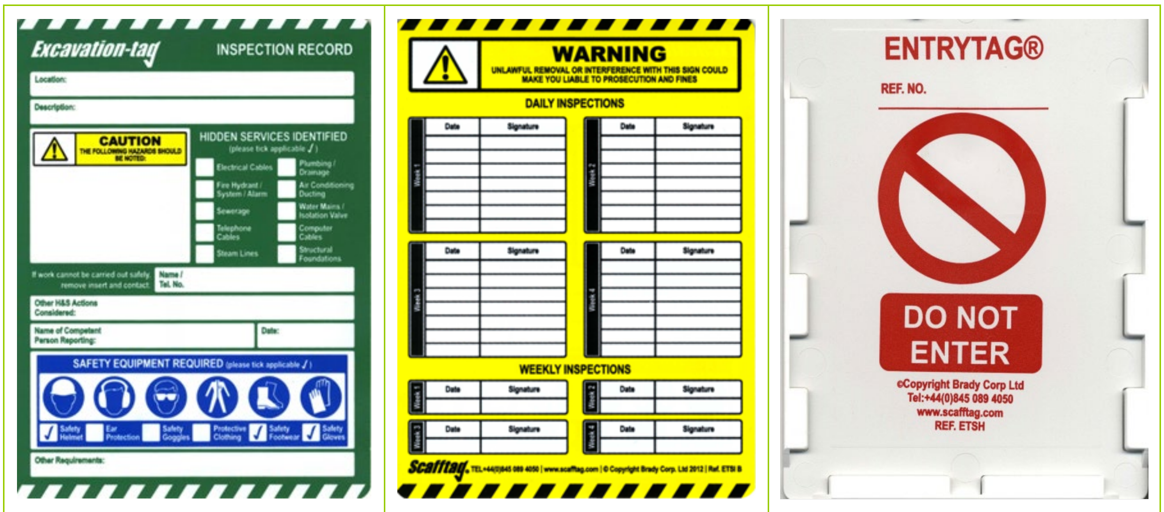
5. Weekly. Sign and date the excavation tag on the reverse and replace it in the holder.

b. If the inspection of the excavation does not meet the required standards, the excavation tag shall be removed and reported to the AA.

21.6 Excavation tags

a. The PA attaches a tag holder and tag (see Figure 25) to barriers as soon as they are erected. The tag displays the relevant details for the work scope, including contact details.

b. At the end of each shift and whenever the worksite is left unattended, remove the excavation tag to reveal 'Do Not Enter' on the tag holder.



A Excavation tag insert (front) | B Excavation tag insert (reverse) | C Excavation tag holder (empty)

Figure 25 - Excavation tags and tag holder

21.7 Entry to a completed excavation

a. Before entry into the excavation, check the excavation tag is current and signed DO NOT ENTER if the inspection tag is out of date.

21.8 Reinstating an excavation

a. The PA shall Verify the following actions:

1. Reinstatement is carried out in line with the reinstatement plan included in the excavation's method statement, procedure, or ground disturbance certificate.

2. Underground services are adequately protected during backfilling.

3. Most of the water is removed from the trench before backfilling commences.

4. Pipelines and services are evenly bedded on the trench padding throughout their length.

5. Access controls, warning signs, or barriers are not removed until:

a) backfilling is complete

b) all plant, equipment and materials have been cleared from the site

c) the area has been restored to original or better conditions.

6. The compaction techniques in the Approved work plan are followed, to avoid damage to services when compacting of the backfill is needed.

b. The Facility Support Squad Leader or delegate shall Verify:

1. all changes to underground services are recorded on the relevant drawings following local MoC procedure.

2. copies of updated drawings are provided to region survey and positioning team so that relevant region drawings, GIS and OneMap system can be updated accordingly.

22 Special conditions and techniques

22.1 Guardrails and barriers

Guardrails provide physical protection and are constructed from rigid materials (for example scaffold or fencing). Guardrails prevent falls, guard created openings, or make a work platform or other place of work safe.

Guardrails can also be called barricades.

Barriers provide a warning of a hazard and may be constructed of non-rigid materials (for example synthetic rope, plastic chain, yellow caution, or red danger tape).

During normal rig floor operations drilling red zone management is enforced and is used instead of a barrier.

a. Erect guardrails or barriers around any area that is considered unsafe to enter. See Table 40 for guidance on when to use a guardrail or barrier.

b. Consult a competent person (for example an SA, AA, H&S site lead, or engineer) if there is any uncertainty around defining an unsafe area.

22.1.1 Using guardrails and barriers

a. Guardrails and barriers shall:

    1. have a sign or signs clearly showing, as a minimum, the name of the owner with contact information and the hazard it is protecting or reason for it being there

    2. not restrict access to emergency equipment or exits, or affect operation of instruments such as fire and gas detectors

    3. be in place for the minimum period of time necessary to manage the hazard and be removed promptly after the work is completed

    4. not be crossed without permission from the owner, AA, or SA

    5. be securely tied-off to avoid being inadvertently dislodged but not tied-off on any process or instrument equipment.

b. Consider weather and potential deflection of dropped objects when defining the protected area radius. The radius of the protected area will increase with the height of the potential dropped object.

c. Use a barrier whenever there is hazard or danger area that has restricted access but for which a guardrail is not required.

22.1.2 Additional guardrail requirements

a. Guardrails shall meet the following additional conditions:

    1. Placed to prevent, so far as is reasonably practicable, anyone falling or any material or object from any place of work falling.

    2. The minimum height for the top rail of all new permanent guardrails is 1.07m (42in)[79] above the surface from which a person could fall.

    3. The minimum height for the top rail of any guardrails already installed or being used in construction is 0.95m (37in)[47] above the surface from which a person could fall.

4. Toe-boards are suitable and sufficient to prevent a person falling, or any material or object from any place of work falling.
5. Positioned so that any gap between any horizontal guardrails and other means of protection does not exceed 0.47m[80] (18.5in).
6. Suitable and of sufficient size, strength, and rigidity for their purpose and to withstand accidental entry into the guarded area.

Sufficient guardrail strength is the capability to withstand a load of at least 90kg (200lb)[49] applied in any direction at any point on the top rail. This meets the OSHA requirement.

7. Are placed, secured, and used so far as is reasonably practicable, so that they are not accidentally displaced.
8. Do not have a lateral opening except for a point of access to a ladder or stairway if an opening is necessary.

b. Guardrails, fencing or other means of protection may need to be removed to perform a task, causing created openings for short periods (less than one shift). In these circumstances the PA shall Verify that:
    1. the area is adequately barriered to prevent accidental entry into the danger area
    2. the guardrails are removed or altered for the minimum time needed to complete the task
    3. a standby person is there to manage and control access until the means of protection is replaced
    4. if a method of personal fall protection is required, it is securely anchored as detailed in section 17.
c. Consider gates, preferably self-closing, for all scaffolds. Minimise the gap for protection at all times and immediately close the gates after the operation has finished.

22.1.3 When guardrails and barriers are required

Table 40 - Guardrails and barriers

<table>
<tr><th>Hazard</th><th>Barriers</th><th>Guardrails</th></tr>
<tr><td>Unattended open holes in decks or walkways that are greater than 0.3m (12in)[54] square.</td><td rowspan="4">Not permitted</td><td rowspan="4">Minimum required</td></tr>
<tr><td>Deteriorated or unsafe gratings that pose the risk of a fall to a lower level.</td></tr>
<tr><td>Deteriorated or missing handrails that poses the risk of a fall.</td></tr>
<tr><td>Unattended and exposed excavation, trenches, vessels or tanks.</td></tr>
<tr><td>Hot work areas.</td><td rowspan="13">Minimum required</td><td rowspan="13">As appropriate</td></tr>
<tr><td>Unattended confined space work areas.</td></tr>
<tr><td>Attended work areas with exposed or energised electrical equipment.</td></tr>
<tr><td>Attended open holes in decks or walkways where the opening is one square foot or more.</td></tr>
<tr><td>Slip, trip and same-level fall hazards.</td></tr>
<tr><td>Pressure or leak testing.</td></tr>
<tr><td>Overhead work areas where there is potential for falling objects.</td></tr>
<tr><td>Lifting operations.</td></tr>
<tr><td>Work areas that pose a health risk, (for example NORM, X-ray, asbestos, lead, and benzene).</td></tr>
<tr><td>Injury or incident scenes that have not been investigated or where potentially infectious material might be present.</td></tr>
<tr><td>Radiation work areas identified by radiation tape, as applicable.</td></tr>
<tr><td>Asbestos work areas identified by red danger tape, as applicable.</td></tr>
<tr><td>Areas where dangerous goods or cargo are being stored.</td></tr>
</table>

22.1.4 Created openings and holes

A created opening is any opening where:

- gratings, handrails, stair treads or kicker plates have been removed from structures or
- damaged structures create a potential risk of falls or dropped objects, or both.

This includes equipment removal, hatches, trap doors, manholes, access ways and voids larger than 0.3m (12in)[54] square.

22.1.5 Planning for a created opening

a. When planning a job, eliminate created openings where reasonably practicable (for example carrying out work from below using a suitable access such as scaffold or a man lift). If the need for an opening cannot be eliminated, a TRA is required to establish whether the associated risks can be sufficiently controlled.

22.1.6 Choosing the level of TRA

a. To determine the appropriate level of risk assessment, consider the following:

1. Does the space limit the provision of suitable access and egress?
2. Does a working at height hazard exist?
3. Is the floor space unstable?
4. Does the floor space contain any hazardous fluids or residues?
5. Is there any potential for ingress of materials, liquids, or gases?

b. If the answer to any of the above questions is yes, a Level 2 TRA and ERRP is required.

For created openings, falling a distance that could cause injury refers to falling into the opening and could happen when working within the guarded area, but outside of the opening itself. When working within the created opening, consider if there is a risk of falling within that space.

c. If no significant risk exists, then a Level 2 TRA may not be required.

22.1.7 Risk assessment considerations for working at height near openings

a. Where there is a risk of falling a distance that could cause injury, the risk assessment shall consider the following:

1. **Clear accountability** by identifying a worksite owner to monitor and secure the created opening. This includes any periods of worksite inactivity or interruption and continues until the opening is removed by replacing the cover or by installing an adequate temporary covering.
2. **Minimising risk exposure** by minimising the amount of time the created opening is present. Replace the grating, manhole or handrail or install an adequate temporary covering at the end of the shift, or during periods of inactivity such as breaks or shift handovers. For tank or vessel entries where manholes need to stay open for ventilation consider fitting mesh covers capable of withstanding a $366 kg/m^2$ ($75 lb/ft^2$)[81] load.
3. **The use of guardrails, barricades, or load bearing covers** to protect against the hazard. Place adequate signage with the name of worksite owner, their contact details and the hazard or risk within the barriered or guarded area.
4. **Fall protection:** everyone within the barriered or guarded area at risk of falling through created openings shall wear suitably secured, personal fall protection equipment.

See section 17 for more information on working at height.

b. Use an entry attendant to:

1. prevent unauthorised access to the work area
2. control the number of persons within the guarded area
3. Verify that fall protection is being used within the guarded area
4. replace the cover or install an adequate temporary covering before they (the entry attendant) leave.

22.2 Energised electrical work

Energised electrical work is work or testing that meets either of the following criteria:

- On or in close proximity to exposed energised conductors (≥50 V ac or dc[82]).
- Involves interaction with equipment where an increased likelihood of injury from an exposure to an Arc Flash hazard exists.

Close proximity is defined as being within the distance shown in Table 41 and Table 42. In US, this distance is known as the limited approach boundary.

Exposed (in this context) is defined as – an electrical conductor or circuit part that is not suitably guarded, isolated, or insulated, to prevent it being inadvertently touched. Examples that would be deemed as 'suitably guarded' include Ingress Protection standard IP2X (and higher) (IEC 60529), and Type 1 (and higher) NEMA enclosures (NEMA 250).

Normal operation of properly installed, maintained, and secured equipment with no evidence of impending failure is not considered work and hence is not Energised Electrical Work.

No evidence of impending failure means that there is no evidence such as arcing, overheating, loose parts, visible damage, or deterioration.

Normal operation of a circuit breaker includes opening and closing but not insertion or removal (i.e. racking).

22.2.1 Control of energised electrical work

a. All work on electrical equipment shall take place when the equipment is isolated in accordance with section 14.18. However, there are situations where this is not reasonably practicable. These situations are limited to when:

   1. the risk of isolating the circuit is greater than the risk of doing the energised work. For example:

      a) Interrupting emergency response equipment such as fire and gas systems, fire water supplies.

      b) De-activating emergency alarm systems.

      c) Shutting down hazardous area ventilation equipment.

   2. it is not practicable to do the work in a de-energised state (e.g. work on batteries, live-line phasing, fault finding).

   3. the equipment is being isolated or energised (e.g. racking in/out, proving dead)

b. All energised electrical work shall be risk assessed per section 22.2.2.

c. Energised electrical work requires an energised electrical work certificate (see section 18.4) other than the following exceptions.

   1. Racking equipment on or off live busbars.

   2. Testing for absence of voltage as part of an isolation.

   3. Applying earths/grounds as part of an isolation.

   4. Visual inspections completed from outside the restricted approach boundary distance (see Table 41 and Table 42).

22.2.2 Risk assessment for energised electrical work

a. In all cases of energised electrical work, a risk assessment shall assess the risk of:
   1. electric shock
   2. Arc Flash injury
b. At a minimum, an electric shock risk assessment shall determine the following:
   1. potential for an electric shock to occur
   2. location and voltage of exposed conductors
   3. safeguards necessary to mitigate the risk of shock.
c. At a minimum, an Arc Flash risk assessment shall determine the following:
   1. potential for an Arc Flash to occur
   2. severity of the Arc Flash hazard to which personnel will be exposed
   3. safeguards necessary to mitigate the risk of Arc Flash.
d. Controls to reduce risk from electric shock and Arc Flash may include the following:
   1. Installing temporary insulation, protective enclosures, or screens to prevent contact with live conductors.
   2. Using temporary barriers and warning notices to keep unauthorised people away from the work area.
   3. Ensuring that adequate clearances are established and maintained when working near to energised equipment.
   4. Providing a good working environment (e.g. dry, non-dusty, quiet, low vibration, with adequate lighting, access, and space for working).
   5. Using insulated or insulating tools.
   6. Using test instruments with shrouded leads, current limiting fuses, secure connections, and appropriate voltage rating.
   7. Having an accompanying person to monitor the work and provide emergency support.
   8. Reducing the arc-flash energy, for example by:
      a) changing the network configuration to reduce the fault current at the work location
      b) increasing the work distance
      c) reducing protection device trip times.
   9. Use of rated and maintained PPE to reduce the risk of contact with energised parts, or the effect of arc-flash (e.g. insulating gloves, insulating matting, arc-flash PPE) and removing metallic jewellery and removing conductive tools from pockets.

22.2.3 Approach boundaries

Table 41 - Approach boundaries (AC systems)

<table>
<tr><th rowspan="2">Nominal system voltage range (phase-to-phase) (ac systems)</th><th colspan="2">Close proximity or limited approach boundary[83]</th><th rowspan="2">Restricted approach boundary</th></tr>
<tr><th>Exposed movable conductor*</th><th>Exposed fixed circuit part</th></tr>
<tr><td><50 V</td><td>Not specified</td><td>Not specified</td><td>Not specified</td></tr>
<tr><td>50 V – 150 V</td><td rowspan="6">3.0m (10ft)</td><td rowspan="2">1.0m (3ft 6 in)</td><td>Avoid contact</td></tr>
<tr><td>151 V – 750 V</td><td>0.3m (1ft 0in)</td></tr>
<tr><td>751 V – 15 kV</td><td>1.5m (5ft)</td><td>0.7m (2ft 2in)</td></tr>
<tr><td>15.1 kV – 36 kV</td><td>1.8m (6ft)</td><td rowspan="2">0.8m (2ft 7in)</td></tr>
<tr><td>36.1 kV – 46 kV</td><td rowspan="3">2.5m (8ft)</td></tr>
<tr><td>46.1 kV – 72.5 kV</td><td rowspan="2">1.0m (3ft 3in)</td></tr>
<tr><td>72.6 kV – 121 kV</td><td>3.3m (10ft 8in)</td></tr>
<tr><td>138 kV – 145 kV</td><td>3.4m (11ft)</td><td>3.0m (10ft)</td><td>1.17m (3ft 10in)</td></tr>
</table>

Table 42 - Approach boundaries (DC systems)

<table>
<tr><th rowspan="2">Nominal potential difference (DC systems)</th><th colspan="2">Close proximity or limited approach boundary[84]</th><th rowspan="2">Restricted approach boundary</th></tr>
<tr><th>Exposed movable conductor*</th><th>Exposed fixed circuit part</th></tr>
<tr><td>≤ 50 V</td><td>Not specified</td><td>Not specified</td><td>Not specified</td></tr>
<tr><td>51 V – 100 V</td><td rowspan="8">3.0m (10ft)</td><td rowspan="3">1.0m (3ft 6 in)</td><td>Avoid contact</td></tr>
<tr><td>100 V – 300 V</td><td>Avoid contact</td></tr>
<tr><td>301 V – 1 kV</td><td>0.3m (1ft 0in)</td></tr>
<tr><td>1.1 kV – 5 kV</td><td rowspan="2">1.5m (5ft)</td><td>0.5m (1ft 5in)</td></tr>
<tr><td>5 kV – 15 kV</td><td>0.7m (2ft 2in)</td></tr>
<tr><td>15.1 kV – 45 kV</td><td rowspan="2">2.5m (8ft)</td><td>0.8m (2ft 9in)</td></tr>
<tr><td>45.1 kV – 75 kV</td><td>1.0m (3ft 2in)</td></tr>
<tr><td>75.1 kV – 150 kV</td><td>3.3m (10ft 8in)</td><td>3.0m (10ft)</td><td>1.2m (4ft)</td></tr>
<tr><td>150.1 kV– 250 kV</td><td>3.6m (11ft 8 in)</td><td>3.6m (11ft 8 in)</td><td>1.6m (5ft 3in)</td></tr>
</table>

**Exposed movable conductor describes a condition in which the distance between the conductor and a person is not under the control of the person. The term is normally applied to overhead line conductors supported by poles.*

22.3 Battery systems

A battery cell is a source of electrical energy that is always live (even when isolated from its charger and load). It contains corrosive electrolyte and can produce explosive gases during charging and discharging.
Cells may be linked together, to form battery-bank systems with a significant stored energy capacity.

a. Only use proprietary battery tools or tools suitable for live working (that is, ASTM F1505-10 in US and IEC 60900 elsewhere) for work on battery systems. Use separate equipment for alkaline and lead acid cells, to prevent cross-contamination of electrolyte and damage to cells.

b. When risk assessing work on battery systems, consider the following hazards:

   1. Batteries remain live even when isolated from their charger and load. As such, if the battery work gives rise to the risk of contact with electrical conductors, ≥50 V, the work requires an energised electrical work certificate, as described in section 22.2.

   2. Do not wear jewellery or other conductive materials that can fall across the battery terminals.

   3. Shrouding terminals, using appropriate tools, and removing inter-cell connections may reduce the risk of electric shock.

   4. Batteries can produce explosive gases during charging and discharging and the risk of explosion may be reduced by:

      a) isolating batteries (from a remote location) to prevent charging or discharging

      b) providing ventilation while work is in progress

      c) using gas testers calibrated to detect hydrogen and positioned so that the effects of ventilation and the fact that hydrogen is lighter than air are captured

      d) eliminating or controlling both worksite and task ignition sources.

      Gassing can be seen as bubbles in the battery electrolyte and can smell of strong acid.

   5. Manual handling.

   6. Chemical hazards.

c. The risk assessment shall identify task-specific PPE appropriate for the hazards associated with working on battery systems. This can include rubber apron, rubber gloves and any other clothing required by the safety data sheet. Suitable insulating gloves may be worn if the required manual dexterity is not impaired.

d. The PA shall Verify that a supply of eyewash solution is available at the worksite while work on batteries is in progress. (This is also valid when working on sealed batteries.)

   Isolation of the battery from the charger or load is not required for checking cell voltages, adjusting electrolyte levels, or measuring electrolyte concentration.

22.3.1 Battery discharge testing

a. Discharge testing of batteries shall only be done using a bp Approved procedure, by vendor specialists or by those who have been assessed competent and authorised.

b. Where battery banks have to be re-linked or have temporary leads fitted for testing, the work may require an EEWC.

22.4 Cutting pipework

a. General work location tags might not reliably identify cut locations. Mark cut locations on pipes or cables using bands of coloured tape (see Figure 26).

On austenitic stainless-steel systems (for example 316 SS), take care to use tape containing low chloride levels to avoid stress corrosion cracking occurring beneath the tape.

b. When a piping system is physically cut or drilled to repair, modify, decommission, or demolish it, include the following steps in the CoW preparation and risk assessment process:

1. The PA uniquely identifies all planned cut points in the system within the work scope.
2. When preparing the job, the PA physically marks planned cut points by taping on either side of each cut point.

   During the fitting of this marking tape, make a 360 degree check around the cut points to confirm the cut path is clear of any other lines and cables etc.
3. The PA and AA individually mark all planned cut points on pipework or cable using different colours of tape.
4. The PA removes insulation before taping the line.
5. The AA clearly marks process lines near the planned cut as ‘Live Pipe’ or ‘Dead Pipe’.
6. Each cut point mark references the permit number and is uniquely identified in line with the work scope.
7. The AA Verifies that cut points are correctly marked before work starts.
8. The IsA Verifies that the system has been depressurised or deenergised, and proves the integrity of the isolation and zero energy to the PA.
9. An AGT tests to confirm the line is gas-free before cutting, using a drilled pilot hole, if necessary.
10. The risk assessment considers hazardous substances and activities associated with the cutting process (pipe material, pipe coating, cutting method).
11. The IsA witnesses the first cut in any isolation envelope or system.
12. The PA removes all tapes when the work is complete.

c. Where it is impossible to mark a line (for example working subsea), use another method to Verify that the correct line or equipment has been identified.

d. The AA shall have enough knowledge of and information about the work scope to correctly mark cut points (for example Approved work pack and marked-up P&IDs, isometrics, or wiring diagrams with each cut point clearly marked and numbered).

e. Where necessary, the AA consults an engineer or operations technician who can Verify the position of the cut location tape.

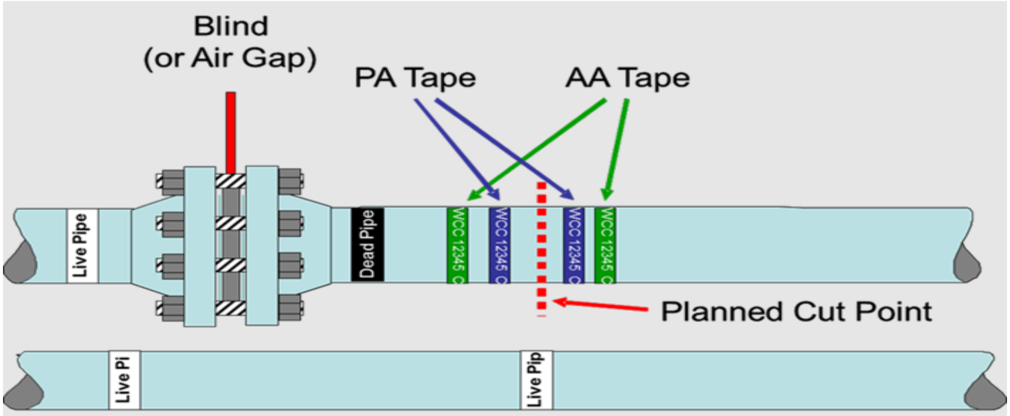


Figure 26 - Marking lines or cable for cutting

22.5 Cutting electrical cables

a. Consider all electrical cables to be energised until proven dead. The only exception is cables that are being installed and have not been connected to a point of supply, provided they can be positively identified.

b. Before cutting an electrical cable, the following steps are required:

   1. Isolate, prove dead, and earth (see section 14.18.5 for more information on when earthing is required).

   2. Positive identification.

   3. Prove dead at the point of work.

c. A Level 2 TRA is used when:

   1. cutting cables that cannot be positively identified as per section 22.5.1.

   2. where the cable has a known fault.

d. The Site Electrical Leader is part of the Level 2 TRA team for work involving cutting cables.

22.5.1 Positive identification

a. Use cable records, drawings, and cable markers to identify the cable and any adjacent cables that may be present.

b. The cable shall then be positively identified using either of the following methods:

   1. A rope securely tied with a loop around the cable, and slid along the cable from the point of work to an isolated point where the cable can be identified by a cable number and proven dead.

   2. A cable tracer to identify the cable and spiking the cable. An electromagnetic tone may be injected onto the cable and appropriate detection equipment used to identify the cable at the location where it is to be cut. The cable is then proved dead by cable spiking. Cable identification by electromagnetic tone is completed by a person competent in cable tracing techniques and trained in using the specific detection equipment employed.

c. Following positive identification, the PA shall apply identification tape to the cable at the point where it is to be cut.

22.5.2 Proving dead at point of work

a. Prove the cable is dead at the point of work by:

   1. proving the cable is dead at a convenient point and tracing the cable from that point to the point of work by tying a rope loop around the cable and sliding the loop along its length, or

   2. spiking the cable.

b. If the point of work coincides with the location of a break in cable continuity (e.g. a cable and, or cable joint fault) then both sides of the fault or break are proven dead. This can be done by repeating 22.5.2a at points 1 or 2 at both sides of the point of work.

22.5.3 Proving dead by cable spiking

The purpose of cable spiking is to prove that the cable is dead. In the case of misidentification, cable spiking may cause the supply protection to trip.

a. Treat cable spiking as energised electrical work (see section 22.2) and hot work (see section 12). Use HWOF when explosive charge is used and HWSP if using a hydraulic spiker.

b. The cable spiking equipment shall be designed for the purpose of cable spiking and remotely operated (typically by lanyard or hydraulic hose).

c. A person competent in cable spiking and familiar with operating the type of equipment being used shall complete cable spiking.

d. Use the following method when cable spiking:

   1. Install barriers around the cable to be spiked, to keep all personnel at a safe distance from the spiking equipment.

   2. Before spiking the cable, test the insulation resistance of the cable between line conductors and between line conductors and earth. Record the impedance values. This requires earths (if applied) to be removed and conductors to be proven dead before testing.

   3. After spiking, re-test the cable insulation to confirm that all conductors have been shorted to earth.

If the test values have not changed from the pre-spike test, then use caution as this may mean the incorrect cable has been spiked, or that the spike has not penetrated the cores of the cable. Review the results and check other possible circuits.

e. For further confirmation that the correct cable has been spiked, re-apply the cable tracer after spiking. This may be necessary, for example, where a cable has a low insulation resistance (cable fault), and the cable testing steps above are ineffective. The tracer signal should not be present past the point of spiking.

f. Re-apply the earths (where required in section 14.18.5) before the spiking device is removed from the cable.

22.5.4 Cable cutting

a. The cable may be cut after isolation, proving dead and earthing (where required as per section 14.18.5), positive identification, marking, and proving dead at the point of work.

b. bp recommends using remote hydraulic cutters to cut cables.

c. Use of cutting equipment is considered hot work spark potential.

d. For small diameter LV cables, use suitable insulated hand tools at the discretion of the Site Electrical Leader. In this case, consider the Arc Flash hazards and use appropriate PPE, which may include insulating gloves, full-face screen, and Arc Flash suit.

e. Once the cable is cut, drain earths shall be applied if there is a risk of induced voltages from adjacent current carrying cables.

f. Temporary drain earths shall be used after pressure tests or insulation resistance testing to discharge the cables.

22.6 Working close to overhead power lines

If work has to take place close to an overhead power line and the overhead line cannot be diverted or isolated, follow the requirements in 100610 bp Procedure Production Electrical Safety Rules (GOO-OP-PRO-00004).

22.7 Engineered scaffolding

a. During the planning process, if scaffolds are outside the scope of a generally recognised standard configuration, then the scaffold design shall be:

   1. engineered by a competent person, and

   2. assessed by calculation to have adequate strength, rigidity, and stability while it is erected, used, and dismantled.

Examples of this type of scaffold are:

- load bearing
- temporary pipe supports
- cantilever or jib support scaffolds
- hanging scaffolds
- suspended scaffolds.

Consider the weight of what might be placed on the scaffold (e.g. heat exchanger cradles, intelligent pigs, catalysts, and pipe spools) as they can be heavier than they look and beyond the capacity of a standard scaffold.

b. Produce drawings, supplemented with specific instructions on how to use the scaffold safely, and make available to all scaffold users.

c. If engineered scaffolds need to be modified, the design calculation shall be reassessed.

22.8 Hot tapping

Hot tapping is the penetration of the pipe using a hot tap machine to either drill or cut a coupon out of an in-service pipe with specialised equipment.

Stoppling is placing pipe plugs through a hot tap to plug the line with a stoppling tool. On-line or in-service welding is the welding of specialised fittings or sleeves to an in-service on-line pipe for both pressure and non-pressure sleeves.

a. Hot tapping and stoppling shall only be executed once an eMoC has been Approved.

b. When Approved, the task of hot tapping shall follow the normal CoW planning and execution processes described in this CoW Procedure.

For more information on hot tapping refer to GIS 18-023 In-Service Welding and Material Specification for Hot Tap Fittings.

22.9 Controlling access to restricted areas

a. Clearly mark padlocks so that it is easy to identify ownership. This can be by colour, stencilling or accompanied by a tag.

b. A site may use locks or padlocks for restricting access to equipment not associated with energy isolation.

c. Padlocks or locks used to restrict access shall not be the same as padlocks used for isolations or locked valve management.

d. The SA can authorise removal in an emergency where the owner of a padlock used solely for restricted access cannot be located.

e. Rooms containing any electrical, telecoms, control and automation equipment and systems are normally locked and access to them is restricted.

22.10 Re-classifying hazardous areas as non-hazardous

A classified hazardous area is a location where fire or explosion hazards might exist due to the presence of flammable gases or vapours, flammable liquids, combustible dust, or ignitable fibres.

a. Classified hazardous areas are shown on hazardous area drawings which shall be available to the AA to help assess risk when planning work in hazardous areas.

The reason for re-classifying an area as non-hazardous is to allow the use of potential ignition sources safely by eliminating potential sources of combustible gases, vapours, or dusts.

b. To temporarily re-classify an area from hazardous to non-hazardous, personnel shall apply the relevant local MoC process:

   1. The MoC process specifies the validation period. The Engineering Discipline Manager defines this in consultation with the SA and with the ODM's approval.

   2. The process plant is positively isolated.

   3. The process plant is shut down, depressurised, evacuated, tested, and confirmed free from hydrocarbons.

b. Red-lined drawings may be used to re-classify a hazardous area in the short term (that is less than six months).

22.11 Entry into machinery enclosures

a. Machinery enclosures, including gas turbine, emergency generators, nitrogen generation cabinets, are designed for entry. However, these spaces are considered as restricted spaces and entry needs to be controlled. This can be managed using a procedure or permit and the risk assessment shall cover hazards from the following:

   1. Release of debris from a major failure of the machine, most likely during startup, load changes or failure of the starter motor. The hazards associated with diesel engines are less than gas turbines, but the same precautions will apply.

   2. Gas release within a machinery enclosure where gas is the fuel or part of the process; ignition could result in fire and explosion.

3. Asphyxiation from fixed water mist fire suppression systems which use stored pressure nitrogen (N_2) as a propellant and where the water produces steam that displaces oxygen in the event of a fire.
4. Asphyxiation from CO_2 or halon fire suppression systems.
5. Leaks from nitrogen generation.

b. Personnel shall not enter the enclosure during:

1. machinery startup
2. planned major load changes (for example plant startup)
3. manual adjustment of load settings
4. fuel changes.

22.12 Digital security on automation systems

a. Cyber-attacks on automation systems (such as DCS, PAS, BPCS, PLC, SIS and ESD), can create a process safety hazard. To protect against these attacks, bp has defined a set of automation system cyber security requirements. A number of these measures shall be addressed when performing risk assessments on automation systems work activities.

b. Do not use removable media (e.g. memory sticks and external hard disks) to transfer data to and from any automation system for any other purpose and scan them for malware (e.g. viruses) before using them.

c. Scan PCs and laptops for malware (e.g. viruses) before connecting them to automation systems.

This requirement is particularly important when vendors and contractors provide their own PC or laptop to perform work, as normal bp IT&S digital security policies and procedures have not been applied and bp has no knowledge of what the equipment has previously been used for.

d. Prior to connection to automation systems, PCs and laptops shall have wireless network connectivity disabled (e.g. Wi-Fi and Bluetooth).

This requirement is important to prevent a direct connection (bypassing the firewall) between the automation systems and the bp corporate network.

22.13 Temporarily supported or suspended loads

Working with temporarily supported or suspended loads is potentially a high-risk task. The loads can move while suspended, leading to serious injury, fatality, or damage to equipment.

a. Loads shall not be suspended over or near people when this can be avoided. When this cannot be avoided the risks to people shall be minimised using appropriate controls.

b. Where loads are suspended, consider the area below them as a danger zone and restrict access to avoid Line of Fire hazards.

c. Complete a Level 2 TRA, with appropriate engineering input, for work involving temporarily supported or suspended loads when:

1. a fatality is a credible consequence if the load were to move or if the support failed whilst the load was suspended or supported

2. the potential exists for energy to develop, including axial and lateral loads due to thermal energy, whilst the load is supported or suspended.

22.14 Draining operations

Draining water from equipment that also includes hazardous materials can lead to the release of hazardous materials if the draining operation is not stopped before the hazardous materials begin to discharge from the drain. Equipment failure can cause these releases, but human error is a more common cause. Various conditions may increase the potential for human errors leading to an LOPC during routine draining activities, including the following:

- inefficient, trivial, or repetitive actions
- unclear signage on equipment
- change in status is not easily perceived
- drain outlet piping not visible to operator
- no written procedure or checklist to cover this task
- difficult working environment (weather, ease of access, noise)
- potential for interruptions or distractions
- reduced operator alertness or fatigue
- inadequate verification that the steps in the procedure are followed
- line-up to sewer is not correct.

a. Before draining fluids, the AA shall Verify the following:

1. Where a task requires draining of any system containing hazardous material the operator shall not leave the draining activity without closing the drain valve.
2. The appropriate chemical risk assessment safety data sheet and has been reviewed.
3. Direct reading instruments are used to monitor for expected hazardous substances when draining (e.g. benzene).
4. The use of suitable RPE and specific PPE until there are consecutive readings showing levels are below that requiring RPE or specific PPE.
5. Where required F&G overrides are applied only in the immediate area of the draining.

22.15 Pyrophoric scale

Pyrophoric scale is a form of iron sulphide that combusts on exposure to oxygen. It may be present where hydrogen sulphide can react with carbon steel.

a. Manage the use of equipment or work on systems containing pyrophoric scale using one of the following methods:

1. use a BC permit for work on small pipework systems, strainers, filters, and valves where water flooding can be an effective control measure
2. use a HWOF permit for large pipework systems, heat exchangers or vessels contaminated with pyrophoric scale.

22.16 Abandoned in place (AIP)

As installations age, or alterations are made, some systems or items of equipment are no longer required for operation. Plant or equipment that is no longer operational needs to be formally assessed, and if appropriate, decommissioned, or 'abandoned in place' (AIP) in a timely manner.

The inherently safer method would be to remove the equipment completely if it is unlikely to be used in the future, as abandoned equipment no matter how well prepared, represents a risk. Typically, removal would be the first choice.

a. When equipment, or pipelines are to be decommissioned/abandoned in place (AIP), a technical eMoC is required with relevant engineering SMEs to:
    1. determine how the equipment will be prepared for the decommissioned state
    2. assess the ongoing hazards related to abandonment (e.g. appropriate external inspections to make sure that deterioration of insulation, vessel supports, and other aspects do not deteriorate to the point where they become a hazard to people)
    3. Identify relevant process change requirements (e.g. document and maintenance system updates).
b. Preparation for abandonment includes cleaning, (e.g. flushing, purging, or inerting, treating, cleaning, draining etc). Considerations for this preparation will include:
    1. consideration of equipment type (e.g. vessels, tanks, pipes, motors, pumps, valves, electrical) and relevant hazards associated with each
    2. age of equipment
    3. integrity (including internal/external corrosion)
    4. nature and physical characteristics of material that has been inside the equipment
    5. potential of H_2S residuals in equipment and pipelines
    6. potential presence of NORM
    7. geography of equipment/pipeline (e.g. harsh corrosive conditions, under-road pipework, possible collapse)
    8. plans for future removal and timeline
    9. proximity to other equipment/people/activities
    10. potential for dead legs
    11. electrical equipment involved (motors, feeders, earthing)
    12. instrumentation loops (feeders and outputs)
    13. risk based inspection plans; the RBI planning exercise should consider deterioration modes while the equipment is out of service to avoid structural collapse of equipment, objects falling from the structures, or other out-of-service failures with adverse consequences.
c. Once the equipment has been prepared, it shall, so far as is reasonably practicable, be air-gapped from existing/remaining equipment.
d. When it is not reasonably practicable to air-gap the equipment, then it shall be positively isolated from existing /remaining equipment.

e. Once air-gapped, or positively isolated, blanks/blinds/plugs/gaps shall be installed to prevent any material escaping from or entering the decommissioned, or AIP equipment.

22.17 Working on tank roofs

a. Avoid working on floating or fixed roof tanks where reasonably practicable.

22.17.1 Floating roof

a. Due to the infrequent nature of work on floating roof tanks, an expert shall be included in the risk assessment team when personnel are required to access the roof.

b. The risk assessment shall consider the following guidance as a minimum:

1. Use a confined space permit to manage work on top of a floating roof tank when it contains hydrocarbons and take the tank offline.
2. Raise the tank roof to a high level (0.5m[102] below the high-high level trip) to provide the best ventilation while keeping the HHL trip active.
3. Tank relief vents should be in the normal closed position and not actively relieving pressure.
4. Evaluate tank roof condition before access (no cracks or signs of hydrocarbons leaks, and the roof should be relatively level).
5. Tank roof drains should be open and operational.
6. While on the roof the roof position should be marked at the boundary (minimum of four equidistant points) and a member of the team assigned to warn of any issue of roof instability.
7. Any people and equipment loaded on to the tank roof should first have a weight assessment – and if required mitigation measures taken.
8. Weather should be good with no threat of storms or lightning.
9. Anti -static PPE to be worn.
10. Materials to be evaluated for the zone, specifically aluminium and other materials as identified in IEC60079-0.
11. Tools to be suitable for the hazardous are zone (note that open hatches and vents create zone 0 risks based on duration).
12. Continuous gas testing while personnel are working on tank roof (see section 24), note that depending on the tank contents other emissions may need to be monitored and have other limits for safe working (e.g. benzene, H_2S, PCAH).

22.17.2 Fixed roof

a. Due to the infrequent nature of working on fixed roof tanks, an expert shall be included in the risk assessment team when personnel are required to access the roof outside of the engineered access ways.

b. The risk assessment shall consider the following guidance as a minimum:

1. Evaluate tank roof condition before access.
2. Suitable access provision (e.g. scaffold with engineering approval).
3. Open hatches or vents.

4. Weather should be good with no threat of storms or lightning.
5. Any people and equipment loaded on to the tank roof should first have a weight assessment – and if required measures taken.
6. Tools to be suitable for the zone (note open hatches and vents create zone 0 risks based on duration).
7. Continuous gas testing.

22.18 Retro-jetting

Retro-jetting, also known as high-pressure jetting, involves using a lance or wand to locally direct high-pressure water into a plugged pipe to clear a blockage or restriction. Jetting pressures of the water can be high (several thousand psig), therefore localized internal pressures can be very high on piping systems, depending on the nature of the blockage or restriction in the pressure piping. Pipe internal blockages often occur on drains systems, which are subject to internal corrosion risks and may have localized areas of thin wall.

LOPCs have occurred within bp through high-pressure jetting into equipment with internal corrosion.

High pressure jetting can create electrostatic discharge and therefore can be an ignition risk in Hazardous Areas.

a. Prior to high-pressure jetting into any equipment, the condition of the equipment to be jetted shall be Verified using an abrasive task certificate.

b. The use of abrasive task certificate is not required where the equipment has been positively isolated and hazardous materials removed. For example, cleaning of tube bundles using a specialist contractor with an approved methodology.

23 Managing locked valves

Valves are either locked open or locked closed (LO/LC) to prevent harm to people, plant, or the environment.

Sometimes valves are labelled CSO/CSC on P&IDs and other documents. In this CoW Procedure, LO/LC requirements apply to CSO/CSC valves.

bp follows a locked valve management process to Verify the following:

- the correct valves are locked
- valves are secured and tagged
- valve position changes are authorised
- status and any changes are recorded in the locked valve register (LVR)
- conformance through operational inspections and self-verification.

This locked valve management process reduces the risk associated with the following:

- loss of primary containment
- process flow deviations caused by valve movement (e.g. equipment overpressure, overfilling or operation outside of its design parameters)
- HP/LP interfaces
- equipment damage
- unplanned equipment trips
- loss of availability or functionality of:
    - fire and gas detection
    - emergency response systems (e.g. fire pumps, foam, or halon)
    - overpressure protection
    - metering systems
    - depressurisation systems.

23.1 Types of locked valves

a. There are two types of locked valves:

1. Type 1 – valves preventing high consequence safety or environmental events.
2. Type 2 – valves preventing lower consequence safety or environmental events, or preventing availability impact, or production impact.

b. Examples of Type 1 and 2 valves are listed in section 23.1.1 and 23.1.2 below. The lists are mandatory, but not exhaustive.

c. When a valve is not covered in either of the lists below the Engineering Discipline Manager decides if the valve is a Type 1 or a Type 2.

The type of device used affects the likelihood of a locked valve being in the incorrect position as a result of human error. This in turn can influence the way in which activities such as a layer of protection analysis (LOPA) treat this valve as a protection layer.

23.1.1 Type 1 locked Valves

a. Instrument isolation valves in safety instrumented functions ≥IL2.

b. Isolation valves around pressure relieving devices (excluding thermal relief duty).

c. Isolation valves around pressurisation valves.

d. Isolation valves around depressurisation and blowdown valves.

e. Isolation valves around vacuum relief devices.

f. Isolation valves on cargo vents.

g. Valves in flare headers.

h. Valves on high pressure and low pressure (HP/LP) interfaces where overpressure of equipment or pipework could otherwise occur.

i. Bypass valves where it is possible to overpressure downstream equipment, or where opening in normal operating conditions could result in flow induced vibration failure.

j. Instrument isolation valves to instruments managing compressor control systems.

k. Hydraulic lines, including returns, on systems rated as ≥IL2.

l. Isolation valves on fuel gas or inert gas systems providing purge gases for integrity or safety (e.g. in cargo and storage tanks, or motor purges).

m. Valves that the HAZOP (or equivalent) has identified, whose incorrect position is an initiating cause that could lead to a level D (or higher) safety or environmental impact. Where information is not available, the Engineering Discipline Manager decides if the valve is a Type1 or Type 2.

23.1.2 Type 2 locked valves

a. Valves on active fire protection systems such as firewater, foam, or CO_2.

b. Instrument isolation valves on highly managed alarms and IL1 safety instrumented functions.

c. Chemical injection into potable water systems.

d. Valves on fiscal metering systems.

e. Valves to change operating mode.

f. Isolations around thermal relief valves.

g. Valves that the HAZOP (or equivalent) has identified, whose incorrect position is an initiating cause that could lead to a level E (or lower) safety or environmental impact. Where information is not available, the Engineering Discipline Manager decides if the valve is a Type1 or Type 2.

h. Utility provision to support critical equipment e.g. diesel to firewater pump.

Typically valves on main headers that could disable large sections of plant would be Type 1.

23.2 Securing locked valves

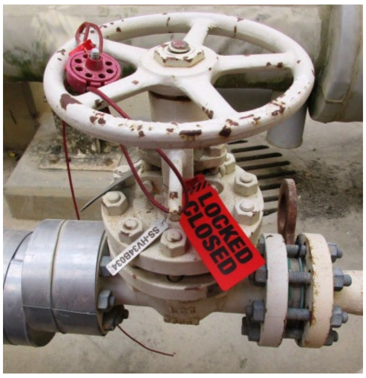
a. Valves shall be secured as per Table 43.

b. When securing the valves, consider the following:

1. use installed securing points or fit the manufacturer's recommended adapter plates to secure the valve stem to the valve body and prevent rotation.
2. if you cannot use or fit the manufacturer's recommended adapter plates, do not lock valve handles together. Independently secure them to the piping to prevent rotation.

Table 43 - Managing locked valves

Type	**Type 1**	**Type 2**
Description	Valves preventing high consequence safety or environmental events.	Valves preventing lower consequence safety or environmental events or preventing availability or production impact.
Operational inspections	Every year[85].	Every 2 years[85].
Control of movement	IDP, operational movement. Using personal isolation see 23.4.3	IDP or operational movement Using personal isolation if within shift.
Securing method	Engineered interlocks, or colour-coded Pro-lock, or similar product, with integrated securing device. There is no requirement for additional padlocks or seals. Colour coded as follows: • Green for open. • Red for closed.	Plastic breakable car seal. Colour coded as follows: • Green for open. • Red for closed.
Securing method when Isolated or out of position	• IDP – yellow pro lock and eCoW isolation label • Personal isolation – yellow pro lock and personal isolation label • Operational movement – yellow pro lock and out of position label	

Pictures of devices		
Pictures of devices		

23.3 Tagging locked valves

a. Tag locked valves according to their normal design position of either 'Locked Open' (green tag) or 'Locked Closed' (red tag).

b. Attach the tags to the valve independently of the locking device so that they remain in position when the locking device has been removed. The tag shall be manufactured from a durable material for example, prism polypropylene, traffolite, brass or stainless steel.

Figure 27 - Tags for locked valves

c. When moving valves from their designated or normal position, tag them with one of the following, whichever applies:
    1. Isolation tag.
    2. 'Altered valve' or 'out of position' tag or operations flagging tape to designate valves out of position.
    3. Personal isolation tag (type 2 only).

23.4 Locked valve movement

a. The AA authorises movements of locked valves to control the position and security:
    1. Type 1 valves may only be moved using an IDP or operational movement function in eCoW. All type 1 movements are cross-checked.
    2. Type 2 valves can be moved using:
        a) an IDP (which updates the LVR).
        b) an operational movement (which updates the LVR) supported by a permit or SOP.
        c) a personal isolation for less than one shift supported by a permit (LVR is not updated).
    3. Type 2 valves are typically cross checked, but this may be de-selected with AA agreement.

b. If the movement of a safety valve defeats a safety system, the AA shall follow the temporary override process in section 10.

c. When designing an isolation, avoid using locked valves as PBU points where reasonably practicable. If there is no other option, you may use locked valves that are controlled as an isolation point without updating the locked valve register each time the valve is moved for PBU checking.

23.4.1 Using an IDP

a. If a Type 1 or Type 2 locked valve forms part of an isolation, identify it in the IDP.

23.4.2 Using operational movement function with eCoW

a. Only move a locked valve out of, or back into, its designated position for operational requirements if the move is covered by a permit or an SOP.

b. The AA may authorise the locked valve movement when they have Verified that the permit or SOP is available and approved.

c. If a safety system is defeated by a locked valve movement, then an override is required.

23.4.3 Using personal isolation

a. Personal isolations may be used for moving type 1 locked valves for maintenance or for PSVs, that are tested in situ and where, by design, there is no 100% spare, if the following conditions are met:
    1. the isolation is compliant with section 14.13 personal isolation
    2. is not an LRP

3. the TRA considers and manages the risks associated with incorrect isolation and de-isolation (including cross checking), and
4. the SA has authorised the permit.

b. Type 2 locked valves may be moved using a personal isolation for less than one shift when specifically identified in the permit or SOP.

23.5 Maintaining a locked valve register

a. Use a legible copy of the master P&IDs to identify all locked valves to support use of the LVR.

b. Include the locked valve category listed in Table 44 in the LVR.

The valve categories are shown in Table H.1 with descriptions and layout diagrams.

The LVR is available within eCoW and has 21 attributes in columns as listed in Table 45 .

c. The AA informs the Site Engineer and SA if valves are identified that:

1. need to be moved repeatedly
2. might need to be locked but are not on the register
3. are on the register but might not need to be locked.

Table 44 - Locked valve categories

Locked open valves	Locked closed valves
LO-1 SIL1 or greater rated process trip system	LC-1 Closed or hazardous drains
LO-2 Compressor anti-surge systems	LC-2 HP or LP flare vent valve
LO-3 Pressure or vacuum relief system	LC-3 Fiscal metering
LO-4 Overpressure protection blowdown	LC-4 Bypass valve
LO-5 Continuous flow path to drains	LC-5 Fire protection systems drain valves
LO-6 Flow path to HP/LP flare	LC-6 Wellhead control panel
LO-7 Continuous vents to atmosphere	LC-7 HP/LP interface protection
LO-8 HP/LP interface protection	LC-8 Environmentally critical valve
LO-9 System functionality critical valves	LC-9 System functionality critical valves
LO-10 Isolation valves in drain headers	LC-10 Pressure or vacuum relief system
LO-11 Minimum flow protection	
LO-12 Fire protection systems delivery valves	
LO-13 Safety critical valves	

Table 45 - Locked valve register

No.	LVR column	Entry *Shaded lines are automatically updated using IDPs, operational movements, or inspections*
1	Site	Name of the site.
2	Area or Location	A description of the location of the valve on the facility.
3	P&ID	P&ID reference number where the valve is located.
4	Line	The line number of the line containing the valve.
5	Valve tag	The unique valve tag number.
6	Valve description	Description of what the valve does.
7	Spare	For future use
8	Lock number	If numbered locks are used, enter the lock number in this cell.
9	Key number	Number of key used.
10	Type and Device	Type 1 locked (pro-lock), Type 1 interlocked, Type 2 locked (breakable car seal) or Type 2 interlocked.
11	Category	This is the locked valve category LO1 to LO12 or LC1 through to LC8. These categories summarise the design intent or reason for the valve being managed as LO/LC.
12	Normal position	The position the valve is designated to be in.
13	Current position	The position the valve is presently in eCoW. Out of position is when this position is different from the normal or design position.
14	Comments	A free text box to add further details on why the valve is out of position or any other helpful comments.
15	ICC or movement	The ICC or movement number or numbers are entered here.
16	Last Moved	The date the valve was last moved. This is generated by the eCoW system based on the last signed valve movement entry in the register.
17	Operational Inspection Group	The valves in the register are split into groups that can be allocated to different shifts or teams for completing operational inspections.
18	Last Inspection	The date the last inspection was entered into the system.
19	Service Description	Process duty of the line or equipment (for example crude oil, water, or steam).
20	Purpose or Hazard	A free text box to describe why the valve is locked in the open or closed position (i.e. its purpose for being there or the hazard it is mitigating).
21	Inspection Notes	Any comments or notes from operational inspection.

23.6 Operational inspections

a. Complete and record operational inspections within eCoW as follows:

   1. Every 365 days[86] for Type 1 locked valves.
   2. Every 730 days[86] for Type 2 locked valves.
   3. Before startup of equipment or systems containing locked valves that were shut down for maintenance or modifications.

b. Where operational inspections or self-verifications identify non-conformance with process, the above frequencies would typically be reduced.

c. For LO/LC valves that have been replaced because of maintenance or installed as a result of a new project, Verify the flow direction and the valve position before fluids are introduced.

d. Confirm the following during operational inspections:

   1. Valves are in the position recorded in the locked valve register.
   2. Securing devices are in good condition (i.e. they are in place and not corroded or broken) and secured to make locked valves inoperable.
   3. Tags are fitted separately from the securing device.

      When the securing device is removed and the valve is moved during maintenance, the tag remains in place to signify the valve's correct position for isolation reinstatement.

   4. Valves found in the wrong position are recorded in the inspection comments and reported to the SA, who takes appropriate action.
   5. The locked valve register is correct and up-to-date.
   6. The most recent revision of the controlled P&ID is available showing the normal position of locked valves.
   7. Any defective tags or securing devices are replaced or a maintenance work order is raised where appropriate.

e. The AA Verifies that there are no overdue operational inspections.

   Conformance with locked valve process is managed through a combination of operational inspection, self-verification, and assurance.

23.7 Interlocked valves and keys

Valves are interlocked to ensure they are operated in a particular sequence because doing otherwise could result in an unsafe condition, harm to the environment, or damage to equipment. When a valve is fully opened or closed, another key is released. To return the valve to its original position the key is returned.

Interlocks are used in a variety of circumstances and each interlock system is individually designed based on a functional specification.

a. When the interlocked valve is a type 1 or 2 locked valve, use an IDP or operational movement and record the trapped interlock key number in the locked valve register 'key number' field.

b. Interlocked valves for operational sequencing are recorded in a locally managed interlock register.

c. Use a local site process to control the management of interlock keys. This local site process shall include and record the following:

1. device tag or number associated with the interlocked valve
2. key number
3. the reason for key issue or key return
4. who the key was issued to, when, who the key was returned by and when
5. approval from the SA or the delegated role to issue the key to change the valve position
6. approval dates
7. verification that interlock keys are securely stored and controlled by the SA or their delegate
8. spare or master interlock keys.

d. If a master interlock key is used to operate valves out of sequence, complete a Level 2 risk assessment as part of the CoW document that is being used to move the interlocked valve, (IDP, SORA, ORA, permit, RAP or SOP).

e. A Level 2 risk assessment needs to identify the hazards associated with overriding the interlock and the controls required to manage risk.

f. Complete an ORA if there is a prolonged hold part-way through a sequence due to an abnormal condition.

23.8 Maintenance of locked valves

a. The equipment maintenance strategy shall include the managed valve maintenance requirements.

b. Keep a record of all maintenance on locked valve in the site's CMMS.

23.9 Modifying a locked valve register

a. The Engineering Discipline Manager, or delegate shall:

1. add, or remove valves, or manage updates to the locked valve register 'Type', 'Category' or 'Normal position' (Table 45 no. 10, 11 or 12) using eMoC. All other changes to the register may be made without an eMoC.
2. Verify the accuracy of all updates.

24 Gas testing

Gas testing involves testing for toxic and flammable gases using portable detection equipment and, where such gases may be present, is an integral part of the CoW process.

Gas tests are done to confirm that:

- the working environment is safe from flammable or toxic gas hazards
- oxygen is present to support life.

Sites have many intrinsic hazards, including the presence of flammable and toxic gas. Therefore, gas testing is carried out by competent personnel to either confirm that worksites are free from toxic or flammable gases, or to allow the use of appropriate controls. This is a key control in managing the risks of fire, explosion, poisoning or asphyxiation.

a. Authorised gas testers (AGTs) are responsible for carrying out gas tests in compliance with this CoW Procedure. Every AGT shall have completed the appropriate training and been assessed as competent.

b. There are three levels of AGT, with Level 1 the highest level of competence:

   1. Level 1 – gas test for all tasks, including hot work and CSE.
   2. Level 2 – gas test for all tasks, except CSE initial testing.
   3. Level 3 – use and interpret results from both portable and personal continuous gas monitoring. This level of gas tester is not authorised to complete the initial gas test prior to permit issue.

      It is expected that the AGT level 1 is a senior role with extensive experience of confined spaces and knowledge of all substances that need managing within them. They will understand nitrogen and oxygen enrichment, be able to determine what materials we might need to test for (e.g. benzene, VOCs, mercury, H_2S, NORM) and they provide coaching and verification for AGT2 and AGT3.

c. For a task that requires continuous gas monitoring, an AGT shall be present. The PA or a member of the work crew if trained and competent may fulfil this role.

d. The PA for a CSE task shall not also be the initial gas tester (AGT1) for that task.

e. An AGT1 gas tests:

   1. before entry into a confined space
   2. to establish continuous monitoring and Verify an AGT2 or AGT3 is able to manage the continuous gas monitoring and any alarms where delegated.

f. An AGT1 or AGT2 gas tests:

   1. before hot work open flame of any type where heat is used or generated (for example welding, flame cutting or grinding in a hazardous area)
   2. when the risk assessment requires it for work located in a non-hazardous area or within 11m (35ft)[2] of live plant
   3. during work that might cause an uncontrolled release of hydrocarbons or other flammable or toxic materials
   4. when investigating activation of fixed gas detection systems
   5. when monitoring purging operations.

g. Maintain and check that gas detectors are serviceable before use.

h. AGTs shall use active monitors where reasonably practicable.

i. To help collect a representative sample for conducting a gas test, consider location, obstructions, wind direction, and contaminants (for example dust or steam).

j. Continuous gas monitoring using a personal detector is the preferred method for HWSP activities. If this method is not used, then a gas test is required before work that might generate sparks or other sources of ignition where there is any potential for flammable atmosphere.

k. For CSE, active monitors shall be set up and placed by the AGT1 and used at all times. Individual entrants to the CSE may wear passive monitors.

Active monitors are those that use a pumped system to provide the sample to the sensor. Passive monitors rely on the sample passing over the sensor by natural air movement. Modern gas detectors can have both a passive mode (for body worn applications, conserving battery life) and active mode (allows an internal pump to be activated and a hose to be attached for checking confined spaces). Other models are provided with an intrinsically safe pump that fits externally, offering the same benefits.

24.1 What checks to do before an AGT uses a gas detector

a. The AGT shall Verify the following before using a gas detector:

1. the gas detector is correct for the task. The user is competent to use it
2. the detector is within its calibration date. If not, replace the detector and restart the pre-use checks
3. the gas detector is in a good state of repair and the casing is not damaged. If it is in poor repair or damaged, replace the detector and restart the pre-use checks
4. the battery is fully charged. Recharge or replace the battery, if necessary
5. the sensor head and membranes are clean. Clean or replace if necessary
6. the detector ‘zeroes’ in a clean air environment and the readings are as follows[87]:
   a) % LEL = 0% ppm
   b) Hydrogen sulphide (H_2S) = 0 ppm
   c) Carbon monoxide (CO) = 0 ppm
   d) Percentage oxygen = 20.9%
7. if using an aspirator, Verify that the aspirator is in a serviceable condition and is leak-free. If not, replace the aspirator
8. Bump test the detector with sample gas(es) of known concentration
9. only use sample line types, sample line lengths or sensors recommended by the manufacturer.

24.2 How to maintain a gas detector

a. The SA nominates a person or people to be responsible for maintaining and calibrating gas detection equipment to deliver consistent standards.

b. Follow the manufacturer's instructions for servicing portable gas detection equipment. If the equipment is used frequently or in a dirty environment, additional servicing may be needed.

24.3 Limitations of portable gas detectors

When detecting flammable, asphyxiant and toxic gases at the worksite, know the limitations of gas detectors, cross-sensitivities and be aware of alternative gas detecting equipment.

24.3.1 General limitations

a. Some substances (for example solvents or silicones) could adversely affect portable gas detectors. If contamination is suspected, return the detector so it can be rectified, recalibrated, or both.

b. Flammable gas detectors are not sensitive to low levels of hydrocarbon vapours below the Lower Explosive Limit (LEL) range. If concerned about the presence of hydrocarbon vapours in the ppm range, use a photo-ionisation detector or colorimetric detector tubes.

c. The presence of very low concentrations of flammable gas could produce indications that can be mistaken for 'zero drift'. In such circumstances, remove the equipment to a clean air environment and recalibrate.

d. Dust, mist, or saturated steam could block the flame arresters of certain types of gas detection equipment. This would make them stop working or give wrong readings. Take care to keep detection equipment clean.

e. Off-scale indications, in either direction, could indicate the presence of a potentially explosive atmosphere. It will then be necessary to flush the detection equipment with clean air and cross-check for the presence of gas by taking the reading again, or by using another type of gas detection equipment. Under such circumstances, assume the presence of a potentially explosive atmosphere until proven otherwise.

f. Catalytic bead %LEL sensor detectors rely on the presence of oxygen to detect hydrocarbons in the air. Do not use them for detecting hydrocarbons in an inert or oxygen-deficient atmosphere unless using a dilution tube in accordance with the manufacturer specifications. When testing for hydrocarbons in an inert or oxygen-deficient atmosphere, use a meter specifically designed for this purpose.

Standard 4-gas meters have traditionally been fitted with catalytic bead %LEL sensors. Be aware that modern 4-gas meters may be fitted with an infra-red %LEL sensor - these cannot detect hydrogen gas.

g. Meters used to test for hydrocarbons in an inert or oxygen-deficient atmosphere are often referred to as tank scopes. They usually read in percentage hydrocarbon by volume and by %LEL. Be careful not to confuse the two. To detect flammable gas in the absence of oxygen, these meters use infra-red sensors. Be aware infra-red sensors do not detect hydrogen gas.

24.3.2 Aspirated detector tubes

a. Aspirated detector tubes (also known as colorimetric tubes) may be used to measure a wide range of toxic gases and vapours that %LEL gas detection equipment are not able to detect.

b. Aspirated detector tubes consist of either a manual or a battery-operated suction pump, with the inlet fixed to a reactive chemical tube.

c. Different tubes are used in different ways, follow the manufacturer's instructions when using.

24.3.3 Photo-ionisation detectors

a. Photo-ionisation detectors (PID) measure volatile organic compounds (VOC), including hydrocarbon vapours at the ppm level, typically in the range 0.1 ppm to 2000 ppm.

b. PIDs are available as both sentry and personal monitors. They can be set to alarm and to log exposure levels, if applicable.

PIDs with a benzene-specific option are available to purchase.

c. Do not use PIDs to measure LEL as they do not respond to methane.

d. Consider the PPE required to protect against breathing in VOCs when sampling because the levels are unknown.

24.4 Gas alarm limits

a. To provide safe limits and avoid spurious alarms set portable or personal gas monitors to alarm as follows:

1. LEL = 10% (0.44% by volume methane)[87]
2. H_2S = 10 ppm
3. Oxygen = 19.0% (low) and 23% (high)
4. Total hydrocarbons (for PIDs) = 100 ppm
5. CO = 30 ppm (low) and 200 ppm (high)

For OSHA sites the low oxygen alarm set point is 19.5% and high is 23%.

b. As a minimum, personal H_2S monitors shall have one alarm set at 10 ppm. If personal H_2S monitors have the functionality for two alarm settings, apply best practice of alarms at 5 ppm and 10 ppm.

1. At 5 ppm[88] the accuracy of the personal gas detector shall be Verified, source of H_2S in the area investigated, and exposure risk based on H_2S LTEL of 5 ppm evaluated.
2. At 10 ppm[88] immediately evacuate the area and investigate the alarm. Consult an Industrial Hygienist (IH) to confirm the area is safe for re-entry.

Detailed guidance on appropriate action on alarm and safe to return instructions following H_2S personal alarm activations can be found in BP Technical Note TN 3.4-0050 Hydrogen sulfide personal gas monitors.

c. For personal CO alarms:

1. If the alarm is Low – leave the area straight away and investigate further with a different monitor before entering the area again.
2. If the alarm is High – evacuate the area and initiate emergency response.

24.5 Gas testing when purging and investigating leaks

a. Before returning hydrocarbon plant to service it is important to displace oxygen to reduce the likelihood of a flammable atmosphere. This can be done by purging with an inert gas (for example nitrogen), or by displacing all gases with water. See section 16.8

b. When investigating a known leak or when breaching a hydrocarbon envelope, use a portable monitor to test the breathable atmosphere (not the atmosphere around the leak itself). Continue this throughout the tests.

c. If a hydrocarbon leak is observed, do not intervene unless a gas monitor is available to test the atmosphere. If necessary, evacuate the site and return with a gas monitor or monitors.

d. In any situation, evacuate to a safe area and reassess if:

   1. levels of hydrocarbons in the atmosphere reach 10% LEL or 19%[89] oxygen

   2. more than one local fixed gas detector goes into low alarm.

e. When investigating a leak, approach from upwind. If a suspect leak contains H_2S, the AGT shall stop and put on breathing apparatus before resuming the investigation. Use a buddy system whenever using breathing apparatus.

Further detailed information can be found BP Technical Note TN 3.4-0050 Hydrogen sulfide personal gas monitors.

24.6 Carbon monoxide

Carbon monoxide (CO) can cause death or loss of consciousness, so understanding the danger from CO and the safe operating limit (SOL) is important. CO inhibits the blood's ability to absorb oxygen. It exists where there are combustion products (e.g. turbine exhausts). The US OSHA(CAL) short-term exposure limit (15min) for CO is 200 ppm[90]. For UK & EU sites, the CO STEL is 100 ppm[106].

a. Where sites deploy CO monitors in temporary refuges, their ERRPs shall include guidance on the action to take if the CO level exceeds 60 ppm. This may involve moving personnel to a less affected part of the temporary refuges or in extreme cases considering the temporary refuges to be impaired.

24.7 Nitrogen

Nitrogen (N_2) can cause death or loss of consciousness, so understanding the danger is important. N_2 is present in air at 78% and frequently used to purge vessels, tanks, and process plant.

Gas detectors cannot detect the increased presence of nitrogen and show only a reduced presence of oxygen. The hazards from inhaling nitrogen are often underestimated. Remember, two breaths of pure nitrogen can make a person unconscious.

24.8 Explosive or flammable limits

The region between the LEL and the UEL is known as the flammable or explosive range.

The LEL refers to the lowest concentration of a gas in the atmosphere that gives a flammable mixture. For example, the LEL of methane is 4.4%[91] by volume. This means that, if there is less than 4.4% by volume of methane in air, the mixture is too lean (weak) to support combustion.

a. Some regions specify the LEL for methane as 5%. Where this is the case, regions shall recalibrate atmospheric monitors to the 4.4% standard.

The UEL refers to the highest concentration of a gas in the atmosphere that results in a flammable mixture. For example, the UEL of methane is 16.5%[92] by volume. This means that, if there is more than 16.5% by volume of methane in air, the mixture is too rich (concentrated) to support combustion.

A rich gas mixture would typically occur in a confined area (for example, an oil storage tank), where the methane cannot disperse.

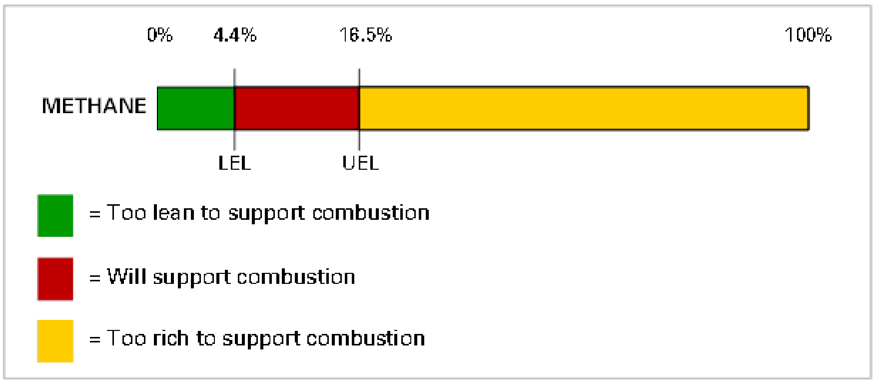


Figure 28 – Methane lower explosive limit (LEL) and upper explosive limit (UEL)

Figure 28 shows that concentrations of methane in air between 4.4% and 16.5% are flammable.

24.9 Lower explosive limit and upper explosive limit of common gases

a. The LEL and UEL of some common gases found in the oil and gas industry are shown in Figure 29.

b. For most gas testing purposes, it is the LEL that is significant. The AGT is responsible for recording the percentage of LEL for the specific flammable gas they are testing.

c. When calibrating portable gas monitors, always use the manufacturer's correction factors for the respective calibration gas being used.

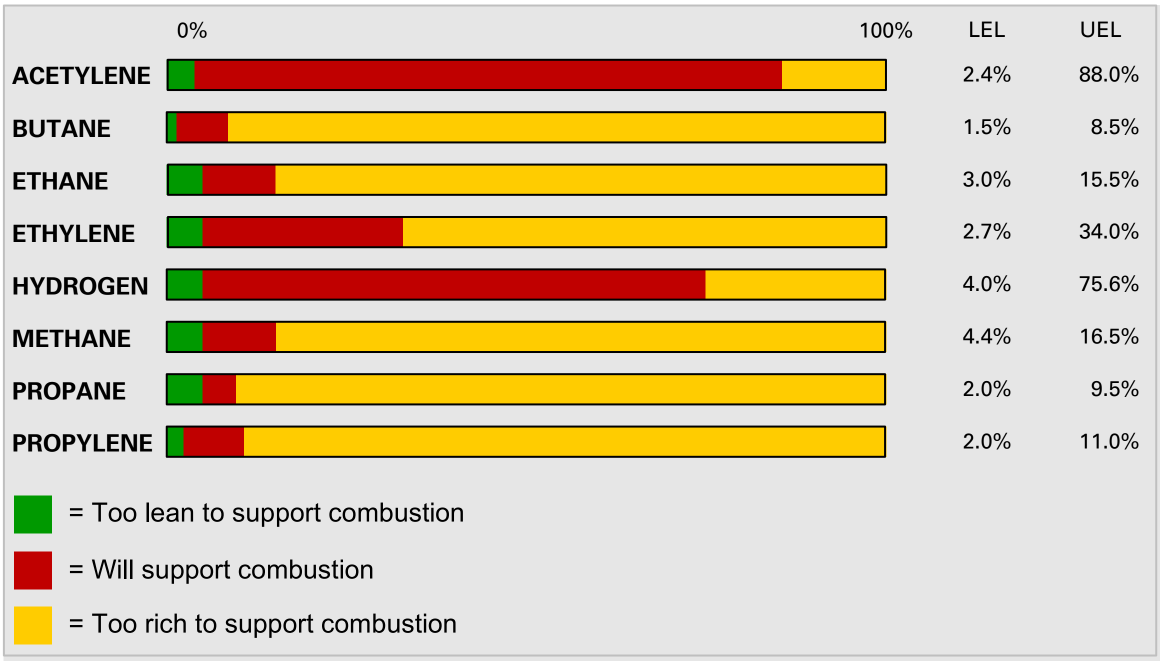


Figure 29 – Lower explosive limit (LEL) and upper explosive limit (UEL) for common gases

24.10 The flashpoint for a liquid

The flashpoint for a liquid is the lowest temperature at which it produces enough vapour to form an ignitable mixture with air. This means that the concentration of flammable vapour above the liquid is close to the LEL.

24.11 The narcotic effects of hydrocarbon vapours

Inhaling volatile hydrocarbon vapours, such as those from condensates, can cause narcotic effects (for example drowsiness, dizziness, confusion, and inability to make rational decisions). Such effects could be apparent after three to four breaths, depending on concentration. Equally, recovery after three to four breaths of uncontaminated air is expected.

Figure 30 shows the physical effects of breathing a hydrocarbon vapour at different concentration levels.

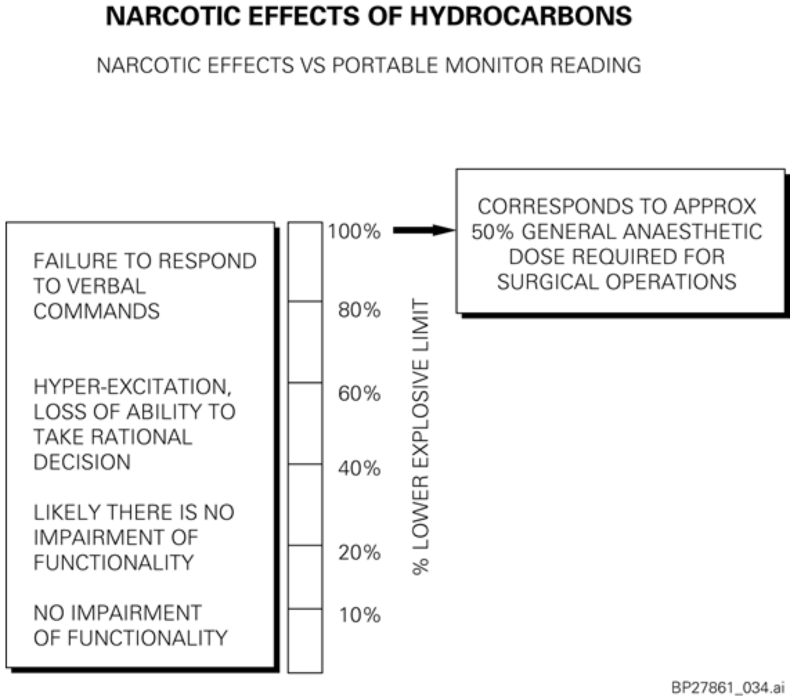


Figure 30 – Narcotic effects of hydrocarbon vapours

The concentration levels are expressed as a percentage of the LEL of the vapour, not the concentration by percentage volume. One hundred percent LEL is about 4.4% methane in air by volume. The calibration against LEL enables personnel with portable hydrocarbon gas monitors to be aware of the presence of a potential narcotic atmosphere quickly enough and to take appropriate action to evacuate to a safe place.

24.12 Toxic gases, vapours and asphyxiants

Gases such as nitrogen, hydrogen and methane all act by simply displacing oxygen in air. These gases are known as simple asphyxiants.

Substances that affect the body’s assimilation of inspired oxygen, such as carbon monoxide, prevent the uptake of oxygen in the blood. These gases are known as chemical asphyxiants.

More toxic asphyxiants, such as hydrogen sulphide (H_2S), directly affect the respiratory centre of the brain, causing breathing to stop.

For details of occupational exposure limits (OELs), refer to sources such as UK HSE, US OSHA, US ACGIH.

24.13 Hydrogen in analyser houses and systems

a. Hydrogen is often used as a fuel and carrier gas in gas chromatographs and analysers. Consider hazards associated with the use and potential leak of hydrogen in analyser houses, shelters and cabinets when performing risk assessments for activities associated with such systems.

b. All analyser house, shelter and cabinet gas detection alarms shall be healthy before work commences.

c. All persons entering an analyser house, shelter or cabinet that contains hydrogen shall have a personal gas detector, which detects H_2 and CO.

CO is generated by inefficient combustion of hydrogen.

d. Locate portable gas detectors measuring hydrogen at the vent of the purged enclosure of gas chromatographs and analysers that use hydrogen as a fuel and/ or carrier gas during work activities.

Gas detectors at these vents will activate if there has been a leak of hydrogen within a purged analyser enclosure.

24.14 Atmospheric testing for confined spaces

a. An AGT1 using calibrated gas testing equipment shall perform initial gas testing prior to permit issue. Continuous monitoring can be performed by any AGT. The gas testing results are recorded on the CSE permit.

b. Continuous monitors shall be placed at air intakes and within the CSE.

c. For a CSE the PA and AGT1 shall be different people.

d. Initial gas testing includes testing for oxygen, %LEL, CO and H_2S. If the confined space previously contained hydrocarbons, test for benzene. Additional site specific gas tests may be required such as mercury vapour, mercaptans, sulphur dioxide and total VOCs, as identified in the risk assessment. The types of additional gas testing required is based on the historical content of the confined space. The test results are used by the AA to decide:

   1. if the space is safe for entry
   2. if additional vessel purging will be needed
   3. which PPE is required for entry
   4. any time limitations for entry into the space
   5. any other additional controls.

e. The AGT1 shall initially test for gas from outside the confined space before anyone enters and as close as possible to the time work starts. An extension hose may be required to test the full depth of the tank. As some gases are lighter than air and others heavier, therefore check all tank depths.

f. Always test and Verify the oxygen content before measuring the LEL readings of flammable gases and concentrations of toxic gases are measured.

If oxygen is deficient, the catalytic bead %LEL cell may not work properly, giving a false (low) response.

g. Following the atmospheric testing of a confined space evaluate the results to Verify that conditions are acceptable for manned entry (i.e. within the limits set out in Table 46). Where there is any uncertainty, contact an industrial hygienist or HSE&C Site Advisor to help interpret the results.

h. Oxygen and explosive levels are measured using standard instruments. The AGT1 doing the testing shall validate these before and after each test or series of tests.

   The software in eCoW does not allow the permit to be issued unless these readings are in place.

i. A CSE permit may be issued for entry without respiratory protection (for example BA) when:

   1. the AGT1 is able to collect fully representative samples from all areas of the confined space from outside the confined space
   2. this representative testing meets the acceptable criteria for entry summarised in Table 46
   3. there is no sludge, residue, or contamination that could generate a hazard when disturbed.
   4. there is no risk of a hazardous atmosphere created by work within the space (e.g. welding, grinding, or coating repairs).
   5. In addition, temperatures within the confined space should be risk assessed for entry which include ambient parameters (air temp, radiant heat, humidity, air flow) as well as clothing / PPE, personal risk factors and duration of entry.

Typically, hydrocarbon vapours (including benzene) will be present where there is residual hydrocarbon and, or hydrocarbon sludge.

j. Where abrasive blasting or other activities have created a dust-filled atmosphere, clear the confined space of dust before allowing re-entry.

k. If subsequent activities conducted inside the confined space after entry generate hazardous substances (e.g. welding, cutting) risk assessment should determine appropriate controls which may include general or local exhaust ventilation and RPE.

l. Before issuing a permit for activity within the confined space, the AA reviews any other permits and considers the potential impact of the generation of hazardous substances on other tasks within the space (SIMOPS). The AA consults with relevant SME support (e.g. Industrial Hygienist) when those potential impacts are not known or understood.

Figure 31 provides an overview of the steps to take when initially testing the atmosphere of a confined space. The provided flow assumes the space has been suitably isolated, emptied, purged, and flushed, and is not kept intentionally inert.

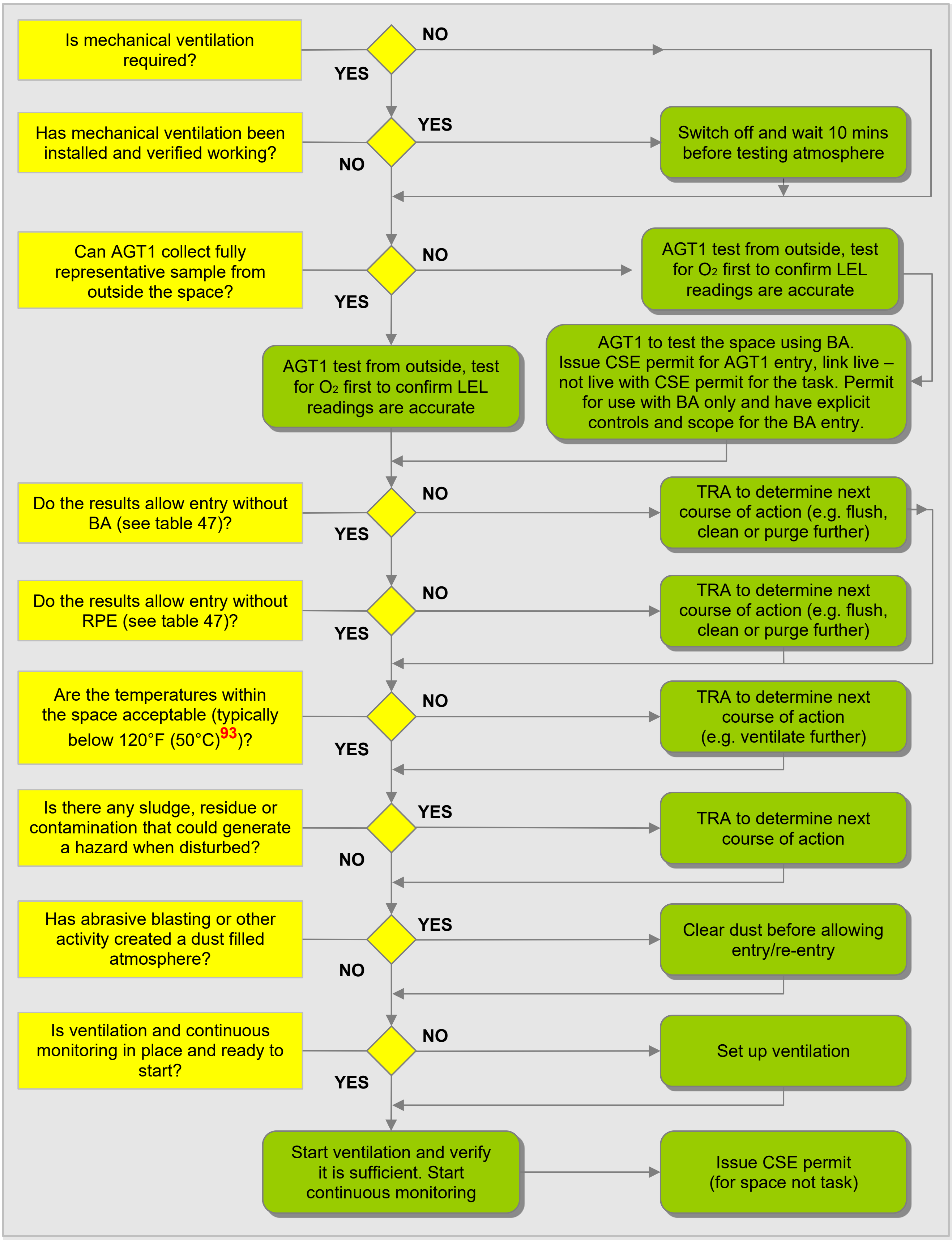


Figure 31 – Atmospheric testing a confined space

24.15 Entry to a confined space with breathing apparatus for testing

a. For larger confined spaces where it is not possible to test all areas of the space from the outside, take additional measurements from inside the confined space.

b. Once the initial test from outside the confined space is within the range shown in Table 46, the AGT1, wearing PPE that includes a supplied-air BA, may go inside the confined space to do further testing. A CSE permit shall be issued for the AGT's entry.

c. The CSE permit for entry using BA shall be separate to the CSE permit for entry without BA and linked live-not live.

d. For confined spaces with complex internal layouts, extra work (for example installing access and removing access hatches) may have to be carried out to allow full testing and to confirm the environment is safe (for example no sludge present that may contain hazards). This may be done on the CSE permit, if the permit scope is specific and AGT1 trained personnel are conducting or helping with the process.

e. Carefully manage the CSE, as the BA can make access and egress awkward. Consider in the planning how the gas detectors are to be carried into the confined space, possibly down vertical ladders whilst in BA.

f. Entry with BA may exist for an extended period and requires precise controls with clear signage and barriers at the CSE. The permit shall be explicit in scope, controls, and ERRP requirements. The SA Verifies and authorises the initial entry to a confined space.

g. When gas testing larger spaces (for example tanks), where a ventilation system is used to maintain a continuous airflow, the AGT shall shutdown the ventilation for at least 10 minutes[94] before performing the gas test to get a representative sample. If the AGT needs to enter the confined space to conduct the test they do this using BA. Once they have a representative sample, the ventilation system can go back into service.

h. Do not stop the ventilation system while anyone is inside the confined space without BA.

Table 46 – Confined Space Entry (CSE) criteria[95]

Oxygen % in atmosphere	**Flammability % lower explosive limit (LEL)**	**Action[95]**
19.5 to 21	<1	No action
21 to 23		TRA to investigate oxygen enrichment and assess risks associated with it (notes 6, 8 & 11).
16.1 to 19.5	1-10	BA required due to oxygen levels (notes 9 & 11).
<16.1		No entry allowed. Classed as inert entry (note 10).
>23.5	> 10	No entry allowed. Classed as oxygen enriched atmosphere (or LEL too high), risk of spontaneous ignition exists.

Toxic gas	Concentration	Action
H_2S	< 5 ppm	No RPE required. The bp internal OEL for H_2S is 5 ppm, 8-hour
	5 ppm to 10 ppm	RPE is required. Due to severe acute effects, SCBA is recommended (notes 6 & 7)
	> 10 ppm	Due to severe acute effects, SCBA shall be worn (notes 6 & 7).
Carbon monoxide	30ppm	Different OEL values exist globally for CO. Consult local Industrial Hygienist for applicable concentrations and actions.
Benzene	Control exposure to carcinogens, mutagens & repro-toxins (CMRs) to a level as low as reasonably practicable below local OELs.	Consult local Industrial Hygienist for applicable concentrations and actions.
Mercury vapour		
Other toxic gases (Note 5)		

Notes:
1. When gas testing larger vessels (such as tanks), where a ventilation system is used to maintain a continuous air flow, the AGT shall shutdown the ventilation for at least 10 minutes before performing the gas test to get a representative sample.
2. If the AGT needs to enter the confined space to conduct the test, it is done using breathing apparatus. Once a representative sample has been collected, the ventilation system goes back into service.
3. Never stop the ventilation system while anyone is inside the confined space.
4. Perform continuous gas monitoring throughout the period that anyone is in the confined space.
5. OELs can be found on SDS. However, they are subject to change, therefore consult a primary source of OELs from the relevant national body (for example UK HSE (EH40), US OSHA (PELs), US NIOSH, US ACGIH).
6. Risk assessment includes a specialist, (for example industrial hygienist) to determine appropriate controls (including ventilation and respiratory requirements) based on measured concentrations of gases or dusts and the work to be carried in the confined space.
7. Some chemicals do not have Approved filters or cartridges for APRs and can require BA if determined by the risk assessment.
8. Where the O_2 content is found to be above 21, investigate the area as oxygen is being produced and conduct a risk assessment to determine the appropriate controls. Oxygen enrichment can lead to spontaneous ignition and fire.
9. Oxygen concentrations below 19.5% are considered oxygen-deficient and IDLH in the US unless the employer can demonstrate that O_2 levels cannot fall below 16.0%. Only use self-contained breathing apparatus (SCBA) or supplied-air respirators with an auxiliary air supply in IDLH.
10. For the purposes of CSE, treat any atmosphere with less than 16.1% oxygen as inert. A competent specialist contractor with VP approval performs inert entry.
11.Evaluate any toxicity risk to determine if controls are adequate.

For ease of use and clarity, it is recommended that each business entity has a quick look-up table or tables that specifies the applicable CSE entry limits, the personal gas alarm limits and maximum safe gas concentrations for the RPE options available on site.

25 Leaks and seeps management

The effective management of leaks and seeps (L&S) helps to reduce both process and personnel risks caused by the uncontrolled release of material. Such incidents may result in injury, environmental impact, property damage and deferral of production.

The environmental impact of leaks and seeps includes the associated methane emissions to the atmosphere. Although global carbon dioxide emissions are significantly greater than methane emissions by volume, methane has a more potent short-term effect on global warming and is increasingly recognised as being a significant contributor to climate change, with every tonne of methane emitted having the same impact as 25 tonnes of carbon dioxide (the most common greenhouse gas). Thus, effectively managing leaks and seeps not only reduces process safety risks, but also reduces bp GHG emissions.

Design and engineering controls supported by a searching and monitoring regime both on plant startup and during normal operation help to reduce the likelihood of L&S.

a. The frequency of L&S searches shall be risk based, specific to the facility, and consider processes, age, and condition of plant.
b. Conduct more frequent searches on high-pressure process gas systems.
c. Consider additional searches following TARs, planned and unplanned shutdowns, and in support of plant restart, taking into account warm-up and pressure increase.

The following are examples of common sources of leaks:

- Joints, including flanged, threaded and compression fittings.
- Piping, instruments, and impulse lines including small bore connections, inside instrument housings, external corrosion, damaged insulation, vibration, and inadequate support arrangements.
- Valves: body, joints, plugs and stem seals.
- Hoses: support arrangements, condition of end fittings and connections, and for cuts, kinks, bulges, signs of abrasion, corrosion, and over-bending.
- Pumps and compressors: casings, fittings, mechanical seals, and small-bore lines.
- Incorrectly fitted or missing caps, plugs and blanks.

Where equipment is designed to have a degree of material release (e.g. mechanical seal flush) and the release is within design conditions, formal recording is not required.

This section is not intended to cover the management of Subsea L&S. Subsea use an anomaly management workflow with regional assessment and reporting requirements, which includes recording within their equipment IM plan.

25.1 Identifying leaks and seeps

Leaks and seeps can usually be identified:

- visually through wetting or discolouration, frost or freezing
- by sound, or smell
- using portable gas detectors or aspirational detector tubes
- using forward looking infrared (FLIR) camera.

The FLIR camera is used to proactively identify new hydrocarbon L&S and to monitor existing emissions. Additionally, the camera can be used following major interventions such as turnarounds to monitor integrity following the re-introduction of hydrocarbons. See section 25.7 for guidance on using an FLIR.

a. The SA shall implement a structured L&S search and monitor programme. Frequency is risk based but search the whole plant at least annually.

b. The programme should include a regular FLIR camera search on plants' gas systems, during normal operations to identify leaks and seeps invisible to the human eye. Any identified leaks and seeps are added to the L&S database in eCoW, risk assessed and managed according to risk. The frequency of the FLIR search is typically quarterly but is informed by the integrity performance of the asset.

25.2 Managing leaks and seeps

There are four steps in the process to manage leaks and seeps (L&S):

- Classify the leak or seep (C1-C4 as per Table 47 and Table 48) and decide whether continued operation is acceptable.
- Prove the leak or seep is stable.
- Tag the leak or seep and create a record in eCoW. Always record the leak or seep, even if repair is immediate, as the record provides valuable information regarding leaks and seeps risk on the site.
- Monitor the leak or seep.

a. Leaks and seeps that are isolated are recorded in eCoW.

b. The SA uses the operations dashboard in eCoW to manage leaks and seeps and set suitable self-verification frequency.

25.3 Classifying leaks and seeps

Table 47 – Leaks and seeps

Type	**Description**	**Measure**[96]	**Monitoring frequency**
Fugitive emissions	Methane or other uncombusted hydrocarbons emitting from equipment.	As per HSE guidance on emission factor.	Typically an annual survey.
Seep	Leakage at a rate less than that defined as a leak.	A liquid release of < 4 drips per minute. For gas < 20%LEL at 10 cm downwind of source.	Not more than 14 days apart or conduct a risk assessment to set monitoring frequency if required.
Leak	Occasional observable or measureable releases of hydrocarbons, chemicals or hazardous utilities – are observed from a pump seal, or valve packing, or flange to a containment area (**i.e. not directly to land or water).** The condition does not require immediate action to mitigate risk.	A liquid release is dripping at a rate of ≥ 4 drops per minute. For gas ≥ 20% LEL 10 cm downwind of source.	C1: as per risk assessment C3: Not more than 14 days apart, or conduct a risk assessment to set monitoring frequency if required. If stability is in doubt conduct a risk assessment

a. If the leak is C1, see Table 48, or if its stability is in doubt conduct a risk assessment to establish monitoring frequency and identify if any additional controls are required. Consider actions in the event of escalation (for example, upper limit of leakage rate).

b. Use task monitoring within eCoW to track and review the monitoring frequency and controls if the condition deteriorates.

c. When a leak or seep is covered by an ORA it is still tracked in eCoW but does not require a separate risk assessment.

d. The decision to repair a leak or seep is risk based and a timely repair is always the preferred choice. Balance the risk of delaying repair against disruption to planned work if carried out immediately.

Table 48 – Leak classification

Category	Medium (Annex I)	Release type
1	Hydrocarbon or hazardous utility	Leak
2	Hydrocarbon or hazardous utility	Seep
3	Non-hazardous utility	Leak
4	Non-hazardous utility	Seep

25.4 Prove the leak or seep is stable.

a. When anyone identifies a leak or seep the AA or delegate shall evaluate its class and whether it is stable.

1. L&S from glands, joints, plugs, nipples, or screwed fittings may be assessed as stable if the leak or seep rate has not deteriorated at a second evaluation within two days of it being identified.
2. If the leak or seep is from an integrity breach such as corrosion, then do not assume it is stable.
3. Consider factors such as location, materials, escalation potential and area occupancy during the evaluation.
4. Once the leak or seep is proven stable, it may be appropriate to review the risk assessment and reduce the monitoring frequency or required controls.

25.5 Tagging and recording leaks and seeps

a. Tag all leaks and seeps in the field to identify the location.

b. Record leak or seep in eCoW and CMMS.

c. The tag shall be easily visible and contain the following information as a minimum:

1. description of duty, including unique leaks and seeps eCoW number
2. date reported
3. who placed the tag
4. CMMS number

Figure 32 – An example leaks and seeps tag

25.6 Monitoring and closing leaks or seeps

a. When a gas leak or seep has been detected, record and date a baseline of the leak either by description, gas detector measurement, using a digital camera or FLIR camera.

b. Establish a regular re-evaluation of the leak to evaluate for deterioration and possible intervention. The frequency of the re-evaluation depends on the leak location, size, and material type.

1. For category C2-C4, either:

    a) have a monitoring frequency no more than 14 days apart [97] without the need for a risk assessment, or

    b) conduct a risk assessment to set a leak or seep specific monitoring interval or determine if further monitoring is required.

2. For C1, conduct a risk assessment to establish monitoring frequency and identify whether any additional controls are required.

c. A leak or seep record can be closed in the following circumstances:

1. The defect has been repaired.
2. The leak or seep is no longer present, a review by site engineer determines the leak or seep is unlikely to re-occur and SA agrees closure.
3. The equipment is classified as abandoned in place (see section 22.16).

25.7 Using a FLIR camera

a. FLIR cameras shall be calibrated and maintained as per manufacturer's recommendations and used by trained personnel.

b. The AA shall consider the camera's effect on other infra-red devices such as fire and gas detectors before issuing a permit or giving permission for NPW.

25.8 Surveys for methane fugitive emissions

a. As part of bp's goal to reduce GHG emissions, it is important to identify fugitive methane emissions. These can occur from sources such as compressor seals and valve stem seals. The FLIR camera is used to survey sites in a structured manner to identify sources of fugitive emissions.

25.9 Re-commissioning gas hydrocarbon systems

a. Following a major overhaul, turnaround or project involving gas systems, the FLIR camera may be used to confirm the integrity of identified joints, blind flanges, valves, and valve glands on gas systems. Any identified L&S are added to the L&S database in eCoW, risk assessed and managed according to risk.

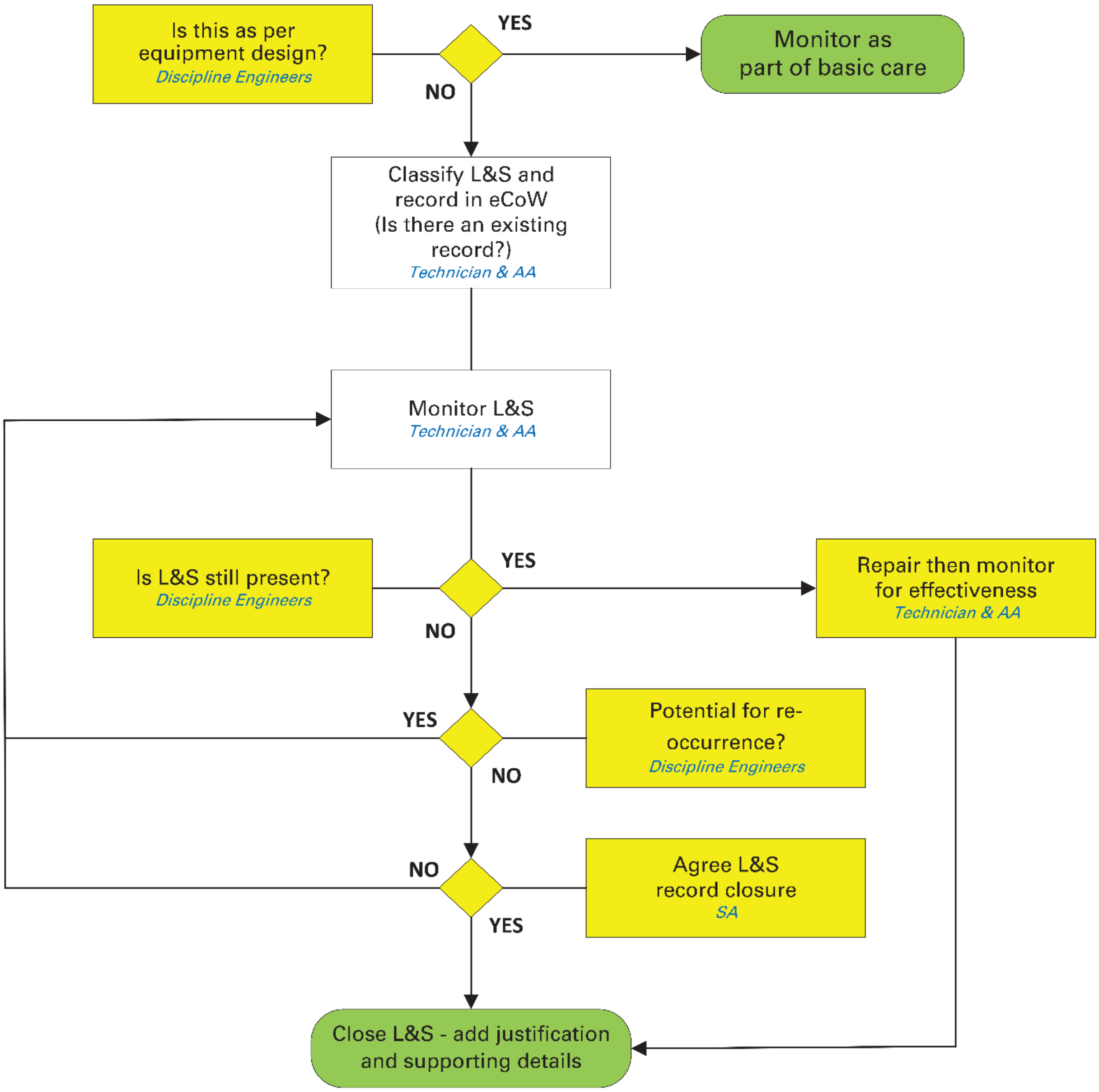


Figure 33 – Overview of L&S process

26 Self-verification, assurance, and audit

bp aims to Verify consistent application of the CoW process. Therefore, having a programme of regular self-verification (SV) in place is key. Assurance and audit, in line with S&OR and Group Audit programmes also helps assess how the CoW process is being managed at the site and identifies any areas where an improvement or correction might be needed.

Table 49 – Self-verification, assurance, and audit summary

	Type	Scope	SPA	Tool	Frequency
1	Self-verification	Site	SA	eCoW	Risk based, but typically daily.
2	Assurance	Site, regional and functional	S&OR Regional OA	Assurance insights and recommendations are recorded in the assurance database.	As stated in assurance plan, typically quarterly.
3	bp Group Audit	Site, regional and functional	Group Audit	Group Audit protocols.	Determined by Group Audit.

26.1 Line personnel carry out self-verification

Using the SV protocols, review the CoW system against all aspects and requirements of this CoW Procedure.

a. The ODM shall Verify conformance with this CoW Procedure and the review of SV results are a key part of this verification.

b. Task-level self-verification protocols have been developed and shall be used within eCoW. These protocols include a list of questions to ask, and they suggest some areas to test. The CoW SV protocols are as follows:

1. permits
2. isolations
3. overrides and inhibits
4. procedures
5. operational risk assessments
6. lifting
7. shift handovers
8. locked valves
9. leaks and seeps
10. alarm management
11. TRA quality assessment
12. IDP quality assessment
13. TBT quality assessment
14. LTI engineering assessment.

c. The SA participates in the process and appoints additional people to do these reviews (for example team leaders, H&S leaders). Asking supervisors and technicians to be part of the verifications is a good coaching opportunity and brings a broader perspective to the verification.

d. The SA shall take a risk-based approach to decide how often each site performs SV checks, and the sample size in each of the 14 areas that is appropriate for the site.

e. Consider when to do an SV, for example: conducting isolation verification during execution of the isolation or de-isolation.

f. This risk-based approach shall include consideration of:

   1. type, complexity, risk level, application of LSR, and amount of work activity in the schedule
   2. CoW incidents, near misses, HIPOs, and self-verification findings for similar work
   3. routine work that is infrequently checked
   4. individual or team knowledge and experience and familiarity with the work and the site or work location.

g. Focus the site's efforts based on feedback received from the reviews and risks being managed and do not follow a pre-set schedule.

h. The SA shall review the effectiveness of self-verifications by considering:

   1. the effectiveness of self-verification checks in identifying gaps in conformance
   2. the effectiveness of actions to close gaps in conformance
   3. the number and types of checks based on planned activities
   4. the status and target dates for all actions.

i. The mix and number of SVs completed may vary over time. The SA shall Verify all 14 protocols are covered at a suitable frequency based on risk and findings.

j. If SV checks identify observations that require corrective action, record those actions with the relevant observation.

k. eCoW provides reports to help the SA manage the completion of self-verification actions in a timely manner.

26.2 Reviewing self-verification

a. Discuss the findings from each self-verification review at the daily CoW meetings. ODMs also review the summary of findings at one of their regular meetings.

b. Verify and record observations and actions to close gaps or to cover proposed improvements in the following areas:

   1. CoW organisation and roles, including contractors filling CoW roles
   2. training and competency of bp and contractor personnel in CoW roles
   3. the CoW planning and scheduling process
   4. permits to work and supplementary certificates.
   5. risk assessments (TRA, SORA, ORA, and isolation)
   6. risk assessed procedures
   7. self-verification protocols and process.

26.3 OMS conformance levels

Conformance with OMS 4.5 is delivered through the relevant sections of this CoW Procedure. Boundaries and technical scope are defined in the CoW Procedure.

OMS conformance is assessed using the Group conformance level definitions. To assist practitioners, the framework in Table 50 below, with examples, has been developed. This framework (listed as 'recommended evidence') does not seek to redefine the OMS conformance levels but is used to guide, inform, and support the determination of OMS conformance levels.

Table 50 – OMS conformance summary

Conformance level	Evidence to support a conformance level assessment
Level 3 **Group Definition** Evidence demonstrating conformance with the Group Essential.	**CoW Procedure and eCoW deployed** 3.1 All sites live with the CoW Procedure and eCoW in use.
Level 4 **Group definition:** Level 3 plus documented processes that are practiced and well understood with clear accountabilities and defined competencies.	**eCoW** 4.1: Full functionality of 'mandated' eCoW elements, or equivalent tool, are in place. 4.2: Any residual CoW data not transferred at 'go live' is migrated to eCoW. 4.3: All isolations (including LTIs), ORAs and SORAs are being managed in eCoW. 4.4: Process being applied with minimal overdues in eCoW. **CoW Procedure** 4.5: CoW Procedure is fully adopted with clear evidence that '8 steps of the CoW process' are operational. 4.6: Any deviations are Approved and documented in eCoW or the LIP. 4.7: Any updates to the CoW Procedure have been communicated, implemented and users trained. **Competence** 4.8: All CoW roles are in place as per CoW Procedure. 4.9: All training completed with knowledge assessment records available in My Talent & Learning. 4.10: All bp CoW roles have been assessed using the competence process and records and certificates are available in RMS database. 4.11: Any existing site CoW training or competence assessment profiles, processes and tools are retired. **Self-verification (SV)** 4.12: All SV protocols are in use in eCoW as per CoW Procedure. 4.13: Full functionality of eCoW is in place for task SV, or an equivalent process, using performance management KPI measures identified in the procedure. 4.14: Task SV is being used and the SV programme is being updated based on findings and site-specific risks. 4.15: The daily site CoW meeting uses the eCoW dashboard (suite of measures) to Verify the CoW process is being followed and key risks are being managed.

Conformance level	Evidence to support a conformance level assessment
	4.16: System SV of the CoW process is being performed using reports and dashboards.
Level 5 **Group definition:** Level 4 plus verification and monitoring processes to confirm that conformance is maintained.	**Self-verification** 5.1: Self-verification is driving corrective actions & CI. **Monitoring** 5.2: Reports generated from eCoW confirm that CoW performance remains within acceptability bands (in comparison to other sites) defined by Production Operations. 5.3: The analysis of performance measures required within the procedure is consistently used to identify and address conformance gaps with visible leadership engagement in monitoring outputs.

27 Performance management

There are two tools available to help the site manage and improve its control of work performance. There are:

- dashboards within eCoW
- web based reports

27.1 Dashboards

Dashboards provide real time information of current control of work documents and status. They also include measures and KPIs to support day-to-day management of the system and process.

27.2 Web based reports

The reports provide a time and site-based trending and visualisation of useful information including dashboard and KPI trending. These should be used for continuous improvement and system optimisation.

28 Training and competence

The training and competency process confirms that everyone in a CoW role has:

- the right training to perform their role
- demonstrated their knowledge of the training they have received, and
- had their competencies assessed and any identified gaps closed to Verify they can correctly apply the CoW process and systems.

a. The competency assessment covers practical demonstration and knowledge testing. The individual being assessed shall be trained and practised. For example, an IsA would be expected to:

1. complete online and virtual/instructor-led training
2. build portfolio of isolations under full supervision in training version of eCoW (utilities, SV, DBB)
3. be competency assessed in the field, and
4. have post-assessment work Verified using quality indicator self-verifications to demonstrate the role is being executed to the required standard.

b. To retain competency and skills an individual shall be actively executing the role.

28.1 Training

There is a comprehensive range of CoW training products that includes all aspects of the CoW policies, standards, and procedures. The requirements for training are in a training matrix available in the Production library.

Link to master version of CoW training matrix

This training may be used for refresher and revalidation. bp recommends assessing personnel to identify competency gaps and what revalidation or refresher training is required to fill these gaps.

All training is accessed via the My Talent & Learning system which retains all training records and expiry dates.

a. The SA shall Verify that the site induction, or any new-start training, includes:

1. an overview of this CoW process
2. what individuals are expected to do including specifically ‘anyone has the authority and obligation to stop unsafe work or report unsafe conditions’.

28.2 Competence Assessment

This CoW Procedure has a defined set of role-based competency assessments to achieve consistency.

a. Before being assessed, candidates for CoW roles require training, time working at the site, practise within the training system and to deliver some of their expected responsibilities under supervision.

b. When an individual has completed their training, the line manager may also carry out on-the-job informal assessments before the formal competency assessment.

c. Contractors who hold roles in the bp CoW system are required to meet the competency requirements in line with the CoW role they are filling.

d. Individuals can hold multiple CoW roles, provided they have been assessed as competent in each of the roles. Each assessment shall be done individually. Multiple candidates cannot be assessed as a group for a specific role.

e. Assessments include practical demonstration in addition to assessing basic knowledge. For some CoW roles, both technical knowledge and leadership behaviours are assessed. Certain roles require completion of an online test based on this CoW Procedure.

A summary of competence assessment structure and timings can be found in the CoW SharePoint site.

f. The candidate's line manager works with the candidate to develop an action plan to close any identified gaps. All assessment gaps shall be closed prior to appointment into role by the SA.

g. SAs at hydrocarbon operating sites shall complete the SOR Critical Role assessment and have all gaps closed in order to be appointed to the SA role. Only SAs at non-hydrocarbon operating sites, e.g. buildings, shops, roads/pads etc. can be assessed for the SA role using the stand-alone SA Assessment in this section.

h. Site Authorities subject to the SOR Critical Role assessment shall:

1. be re-assessed before the expiry date.

2. close any gaps on re-assessment within six weeks of the re-assessment date.

3. be either: removed from role if their re-assessment gaps are not closed within the gap closure due date, or a risk assessment and approved deviation obtained per section 6 of this CoW Procedure to continue in role.

i. The stand-alone SA assessment will not be valid for a hydrocarbon site. Therefore, an SA that moves from non-hydrocarbon sites, shall follow the safety critical role appointment procedure 100466 bp Procedure GOO Site Safety Critical Role Appointment (GOO-OP-PRO-00003).

j. A re-assessment is required to extend the competency validity period. The re-assessment process can either be:

1. an evidence-based portfolio where the candidate has been actively fulfilling the role, or

2. a full reassessment.

k. CoW roles are assessed using qualified assessors. An Approved list of assessors is maintained within RMS.

l. The assessment process is managed, and records are retained within RMS.

28.3 Competence Assessors

a. The assessor requirements for CoW roles are listed in Table 51. Suitable practitioners may be appointed as exceptions to this table by agreement between SA and Central team (e.g. new deployments, organisational structure, projects).

b. Assessors shall complete the relevant competency assessor training for their role.

c. Assessors shall not assess anyone they have coached and developed in preparation for the role.

d. The number of assessors per site will be limited to maintain consistency and quality. Assessors are nominated by SA and approved by the CoW Central team prior to appointment.

Table 51 – CoW assessor requirements[98]

Role being assessed	Experience / Requirements
FA	• SOR Critical role assessor, or • Held OIM / OSM / ODM roles with >5 years' experience of CoW
SA	• SOR Critical role assessor
SA Standalone	• SOR Critical role assessor, or • Held OIM / OSM / ODM / OA with >5 years' experience of
AA & IA	• SA in role >1 year, or • Those qualified to assess FA or SA.
IA	• AA in role >1 year and • Only by agreement between SA and Central team (e.g. new deployments, organisational changes, projects)
TRA Facilitator	• Nominated by SA after demonstrating suitable behaviours to deliver 'professional distance' and is an experienced TRA facilitator • facilitated a minimum of 3 TRAs with a quality assessment >80% score in eCoW. Score is Verified by central team, or • AA assessors
IsA & Isolator	• Nominated by SA after demonstrating suitable behaviours to deliver "professional distance" and is an experienced IsA in the same discipline. • Approved a minimum of 3 IDPs with a quality assessment >80% score in eCoW. Score is Verified by central team. • IsA HV can assess IsA LV 2 or isolator electrical but IsA LV2 cannot assess IsA HV.
PA	• AA in role >1 year and have completed a minimum 3 TBT quality assessments with improvement opportunities recorded.
AGT1 & 2	• AGT1 nominated by SA after demonstrating suitable behaviours to deliver "professional distance". • Have been active in the AGT1 role for one year
AGT3	• AGT1 or 2, HSE&C Site Advisor, ER Team
Leak Testing SPA	• AA assessors, or • PTL, MTL, Site Engineers.
CSE Attendant	• AA, IA, HSE&C Site Advisor, ER Team
Firewatcher	• AA, IA, HSE&C Site Advisor, ER Team

28.4 Appointing individuals to Control of Work roles

a. The SA shall only appoint someone to a CoW role when they have been trained and assessed competent for the role. An individual may hold more than one CoW role provided they have been assessed as competent in each of those roles.

~~b.~~ The SA Verifies that individuals are inducted, have completed any required local training and are familiar with the site before authorising roles in RMS.

1. For example, a PA on platform A has been working there for six months. They then move to platform B but do not have to repeat any of the training courses for CoW and their competency is still valid. However, before they are assigned platform B in eCoW the SA authorises that they have been inducted and familiar enough with the site to be a PA. Once on site it is expected that self-

verification is used to check on any new user to Verify their work meets the competency standard.

c. The SA shall use self-verification to test, through sampling, that those holding CoW roles can clearly demonstrate they understand their CoW roles and responsibilities.

d. The SA, or AA when delegated, shall inform any contractor employees who hold CoW roles in the bp CoW system of the role's responsibilities. They complete any necessary bp training and are Verified that they meet the competency requirements in line with the CoW role they are filling.

The CoW system is a global consistent system and therefore the roles in it apply globally. A competent PA or IsA, for example, retain their CoW role competence which can be applied anywhere bp uses this CoW system.

e. The time they need to be on a site to be deemed familiar will vary depending on the role and the complexity of the site. This is an SA decision, and they consider the following when deciding:

1. If user training is complete, consider a refresher training programme.
2. Practice permits, shadowed by an AA with the individual playing an active and supervised role.
3. Practice IDPs, shadowed by an IsA with the individual playing an active and supervised role.
4. Re-assess competency.
5. Assignment of roles shall follow the criteria in Table 52 below.

Table 52 – Role assignment criteria[99]

eCoW Role	Role assignment criteria
All roles	• The number of roles should be consistent with workload to make sure skills can be maintained. Verified using minimum usage report. • Where criteria below cannot be met, exceptions shall be agreed with Central CoW team and recorded in RMS.
Permit Vision User	• View access. • Ability to draft documents. • Able to conduct self-verifications. • Not required if user has another role in eCoW for same site. • Should not be used to train PAs, use the training system for this. • RMS automatically revokes when another role is assigned.
Site Authority	• Nominated by the functional authority. • Site or facility manager (e.g. OIM/OSM) typically holds this role.
Area Authority	• Does not need an IA role for the same site. • RMS automatically revokes IA role when AA role is assigned.
Issuing Authority	• Experienced production technician, or supervisor who are very familiar with the process and the facility. • Experience of participating in risk assessments.
Performing Authority	• Not normally held by AA, SA, or FA
Isolating Authority Process	• Production technician or Wells equivalent who has been an active Isolator process for min 1 year. • RMS automatically revokes Isolator role after IsA is assigned
Isolating Authority Instrument	• Technician who has been an active instrument Isolator for min 1 year. • RMS automatically revokes Isolator role after IsA is assigned
Isolating Authority Electrical LV 1	• Limited to on/off switches that do not require access to the internals of any equipment or the use of tools. • Not intended for those who hold Isolator electrical Low Voltage or Isolating Authority LV2 or HV roles.
Isolating Authority Electrical LV 2	• Electrical Technicians who have been an active isolator LV for min 1 year • RMS automatically revokes Isolator and LV1 roles after this role is assigned.
Isolating Authority Electrical High Voltage	• Electrical technicians authorised to work on High Voltage Electrical systems. • RMS automatically revokes LV2, LV1 And Isolator after IsA HV role is assigned.
Isolator Process	• Production technicians who are competent to work unsupervised at the relevant facility. • Maintenance technicians who also operate equipment, e.g. GWO rig personnel, or who have extensive experience and knowledge of both the process and the facility. • Not required by those who hold an IsA role.
Isolator Instrument	• Instrument technicians who are competent to work unsupervised at the relevant facility. • May be held by specialist disciplines with suitable experience and knowledge (e.g. HVAC) • Not required by those who hold an IsA role.
Isolator Electrical Low Voltage	• Electrician Technicians competent to work unsupervised at the relevant facility. • May be held by specialist disciplines (e.g. HVAC, or telecoms) • Not required by those who hold an IsA role.
TRA Facilitator	• Have been a team member of at least 5 level 2 TRAs • Can demonstrate suitable behaviours to be objective and sufficiently impartial to the task and work crew. • Ability to facilitate a group discussion.

eCoW Role	Role assignment criteria
Functional Authority	• Held by senior leadership.
Authorised Gas Tester 1 (AGT1)	• Conduct gas test for HWOF and CSE tasks. • Production technicians, HSE&C Site advisors, or ER team who are very familiar with the process and the facility. • Is an experienced AGT2. • Extensive experience of confined spaces with knowledge of all substances that need managing within them (e.g. benzene, VOCs, mercury, H_2S, NORM, oxygen enrichment, N_2). • Have the behaviours to train and provide quality assurance for AGT2 and AGT3.
Authorised Gas Tester 2 (AGT2)	• Conduct gas test for HWOF, and monitor CSE tasks after equipment has been placed and set up by AGT1. • Production Technician, ER team, HSE&C, contractors familiar with the operating site.
Authorised Gas Tester 3 (AGT3)	• Personnel that will be required to continuously monitor for gas using a personal monitor, or portable gas monitor, if set up and placed by an AGT1 or AGT2 (depending on the task).
Control Room Technician (CRT)	• Responsible for recording and implementing all overrides in eCoW. • Responsible for managing active overrides through shift handover.
Leak Test SPA	• Has sufficient experience and knowledge to create test envelopes and be able to consult with engineers and specialist contractors on leak test methods and requirements.
Site Electrical Leader	• Can demonstrate suitable technical skills and behaviours to hold overall electrical accountability on-site.
Site Lifting Co-ordinator	• Is normally held by the SA but may be delegated to a suitably competent person if approved by the ODM.
LOLC Data Manager	• Normally delegated to the Process and Process Safety Engineering Team Leader, unless otherwise recorded in the LIP. • Accountable for technical content of the static fields within the LVR. • May nominate additional users for LOLC Data Manager role within eCoW to assist with updates to LVR static fields. • Additional users limited to 2 per site, unless otherwise agreed by Central CoW team.
LOLC Mover	• Held by production technicians who move locked valves using an operating procedure.
LOLC Operational Inspection	• Held by production technicians who conduct periodic field inspections on locked valves.
Fire Watcher	• Have ability to communicate clearly and courage to stop the job.
Confined Space Entry Attendant	• Have ability to communicate clearly and courage to stop the job.

28.5 Revoking roles

a. When an individual has low, or no use of the role, the SA shall either:

1. revoke the role via the role management system (RMS), or
2. following a familiarisation and coaching plan, Verify that they meet the expectations of minimum use.

b. When an individual is no longer working at the site, the SA shall revoke the role via RMS.

c. RMS will auto-revoke following configured business rules (e.g. Permit Vision User when user has another role on same site, hierarchy of roles, inactive IT account combined with no recent access).

Annex A
Roles and responsibilities

This annex sets out in detail the roles and responsibilities for the following CoW roles:

Site Authority (SA)

Area Authority (AA)

Issuing Authority (IA)

Performing Authority (PA)

Isolating Authority (IsA)

Authorised Gas Tester (AGT)

Fire Watcher (FW)

TRA Facilitator

Site Electrical Leader

Confined Space Entry Attendant (CSEA)

Isolator

Site Lifting Co-ordinator

Leak Test SPA

LOLC Roles

CRT

CoW Certificate Approver

A.1 Site Authority (SA)

Table A.1 – R&R Site Authority

Site Authority (SA)			
The SA is accountable for safely executing work on bp-operated sites. The site or facility manager (e.g. OIM, OSM, WOM, project, construction, or commissioning manager) normally holds this role. They Verify that the site's CoW systems, processes, and organisational structure are in place to implement and conform to this procedure. For the GOM Region, the SA is always the OIM and the designated Ultimate Work Authority in accordance with Safety and Environmental Management Systems (SEMS, 30 CFR) requirements.			
	The SA:	**Section**	**How to demonstrate**
1	Is accountable for implementing this CoW Procedure.	7.1	Job description.
2	Defines the AA's areas of responsibilities and the physical limits for each area on a plan or map.	6.2	Plan or map in LIP.
3	Is accountable for site lifting co-ordination either by holding the role of SLC or Verifying delivery when the SLC role is delegated.	5.3	Self-verification.
	The SA does the following:		
4	Chairs the daily CoW meeting to manage cumulative residual risk, SIMOPS and CoW performance for the site.	8.4.2	Records of meetings.
5	Submits HWOF to the relevant VP (i.e. Production, Projects, or Wells) if they are not employing any of the five primary controls.	12.2	Functional sign off in eCoW.
6	Authorises RA II, HWOF (in Haz area) and CSE permits	8.4.5	eCoW records.
7	Attends first TBT for CSE RA II and HWOF RA II.	8.5.4	eCoW records.
8	May delegate TBT to AA for all RA II permits (other than CSE, or HWOF) and for RA I HWOF/CSE.	8.5.4	eCoW records.
9	Conducts and manages site CoW self-verification.	26	Self-verification.
10	Reviews requests for deviations to this CoW Procedure as described in section 6.5. Accountable for implementing any conditions in agreed deviations.	6.5	LIP/ eCoW Records
11	Formally delegates responsibility to suitably competent delegate when required (e.g. for night shifts and weekends).	5.3	Handover log or email.
12	Documents regularly performed delegations in the LIP.	5.3	LIP.
13	Communicates that everyone has the authority to stop unsafe work. Does this throughout the process (e.g. when talking to leaders during CoW self-verifications, at site inductions).	8.5.4	On permits. Site inductions.
14	Appoints ORA leaders. Authorises ORA use and reviews ORA status, including remedial plans, weekly.	11, 11.8 & 11.9	eCoW records.
15	Conducts and records crew and shift change where applicable.	8.7.8	Handover log.
16	Appoints a leak test SPA to supervise and manage a leak test	19.2	
	The SA Verifies the following:		
17	Non-conformant isolations are managed as per this CoW Procedure.	14.5	Self-verification.
18	Quality of CoW documents before moving to verified state. Most of these documents are Verified by AA or IA.	**Table 4** 8.3.15	eCoW records.
19	Adequate equipment and competent resources for every designated site CoW role are in place.	7.1	Self-verification.

Site Authority (SA)			
20	Everyone involved in CoW on their site conforms to this CoW Procedure.	7.1	Self-verification.
21	The site induction, or any new-start training, includes an overview of this CoW process and what individuals are expected to do.	28.3	Self-verification.
22	CoW Incidents are investigated and recorded.	8.5.6	IRIS.
23	Shift handovers involving CoW are in line with this CoW Procedure.	8.7.7	Self-verification.
24	Through sampling, that those holding CoW roles can demonstrate they understand their CoW roles and responsibilities.	28.1	Self-verification.
25	CoW self-verification detailed in section **26** is being delivered.	26	Self-verification.
26	CoW training and competency detailed in section **28** is being delivered.	28	Competency assessments.
	The SA decides, Approves or authorises the following:		
27	Tasks on integrated activity schedules that meet the applicable execution readiness criteria in **Table 1.** SA advises Site Manager when SA is not the Site Manager.	**Table 1** & 8.1.6 Dashboards	Records of Approved schedules.
28	Appoints people to CoW roles.	28.1	RMS
29	The approval of the following risk assessments in line with the risk matrix approval levels for TRA, SORA and ORA.	**Table 2**, **Table 3**, 11.8 & 11.7	eCoW records.
30	Authorises emergent work that is raised.	8.1.4	Break in KPI.
31	Authorises work to proceed as scheduled or amends schedule as part of daily CoW meeting.	8.4.3	eCoW records.
32	Authorises HWOF permits in hazardous areas.	**Table 2**, **Table 3**,	Permit signatures.
33	Authorises permits in line with the risk matrix approval table and re-authorises permits and templates for permits, LRP IDP and SORA.	7.3 & 8.7.3 & 8.3.5 & 8.3.11	eCoW records.
34	Authorises the use of Approved bridging documents that affect the site CoW (e.g. projects, diving vessels, rigs, and vessels working within a platform 500m zone).	5.5	Sign bridging documents.
35	The readiness for plant reinstatement for large-scale jobs or restarts of the whole facility.	**20.1**	Pre-start certificate
36	Approves service testing hydrocarbons and hazardous utilities (up to risk Area II).	19.5	eCoW records.
37	Approves certificates listed in table 37.	**Table 36**	eCoW records.
38	Authorises removal of locks in an emergency.	22.9	eCoW records.
39	Authorises use of master or spare keys for interlocked systems.	23.7	eCoW records.
40	Authorises use of Approved Level 2 SORAs and ORAs.	10.6 & 11.4	eCoW records.
41	Delegates authority, with Projects representatives at a brownfield site, to project personnel.	5.5	Bridging document or MoC.
42	Approves a leak test SPA delegate to supervise and manage a leak test after shift change	19.2	eCoW records

A.2 Area Authority (AA)

Table A.2 – R&R Area Authority

Area Authority (AA)			
The AA manages and controls the CoW process in their area. AAs are accountable for task, process, and worksite hazard identification and risk controls associated with work performed in their area of responsibility. The AA can delegate some of their CoW responsibilities to the IA but cannot delegate responsibilities listed in point 1 below. Accountability for the work always remains with the AA. If planned activities in one area affect activities in another area, refer to the other AA as the AAA. Substations and electrical buildings can be classed as areas. These can have their own AA with electrical skills as well as the skills they need to take on the AA role.			
	The AA is:	**Section**	**How to demonstrate**
1	Not allowed to delegate AA accountability but may delegate responsibility to a competent AA or IA the activities as detailed in **Table J.1**.	5.3 & **Table J.1**	Handover log.
	The AA does the following:		
2	Monitors the worksite at minimum frequency defined in the TRA and permit.	7.2.5 & 8.6.1	eCoW records.
3	Visits the worksite with PA to prepare for a TRA.	8.2.2 & 9.2	Signed TRA.
4	Closes a permit by signing to confirm that the work is complete, and the worksite was left in a safe and tidy condition. The worksite visit can be delegated to an IA.	**Table 4** & 8.7.4	eCoW records.
5	May assist the planner to determine the individual CoW tasks needed during the planning of the job.	8.1.1	Self-verification
6	Conducts a detailed handover about ongoing tasks at a shift change with the oncoming AA and documents this conversation.	8.7.8	Handover logs.
7	Communicates with other AAs affected by work that affects their area of responsibility (e.g. HW or BC).	8.1.3	AAA signatures.
8	Authorises permits with residual risk in Area I and may issue them to the PA.	**Table 2**, **Table 4** & 8.4.5	Records of authorised permits.
9	Conducts a joint worksite visit (with the PA), on the first issue of a permit, or may delegate to an IA if in residual risk Area I.	8.5.4 & **Figure 6**	Self-verification
10	Controls SIMOPS in their area of responsibility.	7.5	TBT records.
11	Develops the permit and any applicable CoW supplementary certificates with the PA during the task planning stage.	8.3	eCoW records.
12	Manages the scheduled work list for their area of responsibility.	8.1.3	Integrated schedules.
13	Works with the planners and schedulers to provide guidance on and prioritise planned and unplanned work requests.	8.1.1 & 8.1.3	Integrated schedules.
14	Participates in TRA for any HWOF, CSE, or where initial risk is in Area III or above.	**Table 18**	Signatures on TRA.
15	Inspects worksite with the PA for HWOF, pressurised habitats and auxiliary equipment before allowing work to start, and weekly checks whilst the habitat is in place.	**Figure 6** & 8.5.1	Signature verifies CoW documents.
16	Agrees with the PA which competent person is assigned to fire watcher (FW), authorised gas tester (AGT) or confined space entry attendant (CSEA).	8.5.1	Self-verification.

Area Authority (AA)			
17	Delegates responsibility to a competent person.	5.3 & **Table J.1**	Handover log or email.
18	Captures any lessons learned from the CoW process within eCoW.	8.8	eCoW.
19	Completes, before executing de-isolation, work site visit and all associated pre-start verification checks.	8.7.5 & 20	Pre-start certificates.
20	Manages LTIs.	14.28	SV in eCoW.
21	Authorises all movements of locked valve.	23.4	eCoW records.
22	Cross-checks isolations and de-isolations.	14.6	eCoW records.
	The AA Verifies the following:		
23	The original documents for closed permits and supplementary certificates are retained for at least one month.	8.7.9	Paper copies of documents.
24	The permit specifies how often the worksite will be inspected and monitored, as agreed in the Approved TRA.	8.6.1	eCoW records.
25	The quality of CoW documentation during the planning stage by checking both the content is accurate and supplementary certificates are Approved and attached.	**Table 4**	eCoW records.
26	It is safe to restart work in an area after a work suspension.	8.5.6	eCoW records.
27	Level 2 TRAs are planned.	8.1.3	Integrated schedule.
28	Pre-requisite TRA controls are in place and fully effective before issuing permits.	8.5.1	Rule in eCoW.
29	Isolations are in place and meet the requirements of this CoW Procedure. The AA can delegate this verification to an IsA.	8.5.1	IDP.
30	There are no overdue locked valve operational inspections in eCoW.	23.6	eCoW records
	The AA decides or Approves the following:		
31	IDPs and confirms energy isolation integrity before issuing permit to work.	14	Approved IDPs.
32	Any STT associated with work.	14.7	Rule in eCoW.
33	Risk assessments where residual risk is in Area I of the risk matrix.	**Table B.5** & 8.2.2	eCoW records.
34	Approves pressurised habitat certificate.	18.11	Certificates.

A.3 Issuing Authority (IA)

Table A.3 – R&R Issuing Authority

Issuing Authority (IA)			
The IA role, which can exist at sites, is a CoW role that is an assistant to the AA.			
	The IA is:	**Section**	**How to demonstrate**
1	Not the same person as the PA for a specific task.	8.5.1	eCoW rule.
	The IA does the following:		
2	Carries out worksite visits for risk assessment, work start, monitoring or completion.	**Table 2**, 8.5.1 & **Figure 6**	Signature on permit.
3	Conducts a detailed handover about ongoing tasks at a shift change with the oncoming AA or IA and documents this conversation.	8.7.8	Permit records.
4	Stops any work that does not conform to the permit to work.	8.6	Permit records.
5	Issues permits to the PA when delegated by AA.	**7.1**, **Table 2**, **Table 4** & 8.5.1	Signature on permit.
6	When delegated by AA and for residual risk Area I permits only, may conduct a joint worksite visit with the PA following issue of the permit to work	8.5.4 & **Figure 6**	Self-verification.
7	When delegated may participate in Level 2 TRA in place of the AA for tasks in risk Area I.	**Table 18**	Signature on TRA.
	The IA Verifies the following:		
8	The quality of CoW documentation during the planning stage by checking both the content is accurate and supplementary certificates are Approved and attached.	8.1.3 & **Table 4**	eCoW records.
9	Worksite is safe before work can restart after a work interruption.	8.5.6	Signature on permit.
10	Everyone on the work party understands the work scope, the hazards associated with it, and the controls in place for the task.	8.6.1	Signed off permits.
11	The worksite monitoring has been completed in line with the risk assessment.	8.6.1	Permit.
12	Pre-requisite TRA controls are in place and fully effective before issuing permits, particularly fire watch, gas testing, and monitoring for hot work.	8.5.1	Signed.
	The IA Approves or decides the following:		
13	Risk assessments with residual risk in Area I, when delegated by AA.	**Table B.5**	Signed TRA.
14	Where delegated, activities listed in **Table J.1**	**Table J.1**	Self-verification.

A.4 Performing Authority (PA)

Table A.4 – R&R Performing Authority

Performing Authority (PA)			
The PA is the person in charge of the task described in the permit to work.			
	The PA does the following:	**Section**	**How to demonstrate**
1	Performs the task or supervises the work party performing the task.	7.1	Self-verification.
2	Can be responsible for more than one task at a time, provided they can safely manage tasks, provide adequate supervision and effective monitoring.	7.1	Self-verification.
3	Delegates to another PA with the equivalent competency if they cannot be present for CoW related activities (e.g. developing a permit to work or taking part in a TRA).	5.3	Self-verification.
4	Visits the worksite with the AA or IA to identify and record the hazards and controls for the task being planned before completing a Level 1 TRA.	9.2 & **Figure 5**	eCoW records.
5	Participates in the Level 2 TRA or, if unavailable, nominates a competent PA as delegate.	**9.5 & Table 18**	eCoW records.
6	Reviews that the permit to work sufficiently describes the task, location, start time, duration, and any known risks and limitations.	8.3	eCoW records.
7	Conducts a pre-job toolbox talk with the work party to: • communicate the requirements in the permit, RAP and TRA • Verify that the work party understands the requirements • post a copy of permit in an accessible area close to the worksite.	8.5.4	Signed TBT records.
8	Keeps the worksite in a clean and safe condition and work within the scope covered by the permit.	8.5.3	eCoW records on PA feedback.
9	Informs the AA or IA when the task is completed or suspended or if worksite conditions change.	**Table 4** & 8.5.6 & 8.7	eCoW records on PA feedback.
10	Conducts a detailed handover about ongoing tasks at a shift change with the oncoming PA and documents this conversation.	8.7.7	Handover log.
11	Stops any unsafe work and reports to the AA or IA.	8.6	eCoW records.
12	Records any feedback from the task on the permit to work. Informs the AA or IA so they know what action has been taken.	**Table 4** & 8.7	eCoW records.
13	Confirms, if safe to do so, that when a task is interrupted, the worksite is left in a safe and orderly condition and any equipment being used is shut down or isolated.	8.5.6.1, 8.5.6.3 &8.5.6.4	PA feedback in eCoW.
14	Assesses the worksite following an interruption to check it is safe to resume work.	8.5.6.4	eCoW records.
15	Communicates contingency plan from IDP to TBT discussion	8.5.4	Self-verification.
	The PA Verifies the following:		
16	The PA, or their delegate (e.g. FW), stays on site for 30 minutes after HWOF has been completed to monitor for potential ignition sources.	12.5	Self-verification.
17	The equipment, including task-specific PPE being used is correct for the task, meets site safety standards and is in safe condition.	17.4 & 17.4.4 & 17.7 & 17.8.1	Self-verification.
18	The controls specified on the permit are followed.	8.5.3	Self-verification.
19	The work party members who have been selected for the task are competent to carry out the tasks, use the equipment and PPE as detailed in the permit to work.	**Table 13**	Self-verification.
20	The schedule includes all assigned and required tasks (e.g. scaffolding, insulation and, isolation).	8.1.1	Self-verification.

Performing Authority (PA)			
21	An IsA has demonstrated the integrity of any isolation before work starts.	8.3.8, 14.1 & 16.3	Self-verification.
22	An IsA is in attendance before carrying out BC work.	8.3.8 & 16.3	Self-verification.
	The PA decides the following:		
23	Following a discussion with the AA, accepts the permit to work by signing, electronically or on the form.	7.1 & **Table 4** & 8.5.1	eCoW records.
24	To escalate to a Level 2 TRA when a Level 1 TRA is not adequate for the task, along with the AA.	8.2.1	Self-verification.
25	With the AA or IA, assigns FW for HWOF tasks, and an AGT for gas testing.	8.5.1	Self-verification.

A.5 Isolating Authority (IsA)

Table A.5 – R&R Isolating Authority

Isolating Authority (IsA)

There are five types of IsAs based on discipline:

1. IsA-Electrical LV1 (low voltage)
2. IsA-Electrical LV2 (low voltage)
3. IsA-Electrical HV (high voltage)
4. IsA-Instrument
5. IsA-Process.

The IsA Electrical LV1 is a role designed to improve efficiency of simple, low voltage electrical isolations that are for non-electrical work only. These isolations can only use points that do not require access to the internals of any equipment or the use of tools.

	What we require:	Section	How to demonstrate
	The IsA does the following:		
1	Designs energy isolations in line with this procedure and drafts an IDP	7.1 & 14.1	IDPs & ICCs.
2	Cross-checks isolations and de-isolations	14.6	ICC records.
3	Secures isolations in accordance with this procedure	14.10	Self-verification
4	Signs off each completed step on the IDP	14.3 & 14.9	ICC records.
5	Demonstrates isolation integrity or proves dead at the initial stage and then continues to monitor (e.g. PBU verification and isolation security) throughout the duration of the isolation.	8.3.8, 14.1 & 14.13	eCoW records on PBU
6	Attends breaking containment associated with the energy isolation to demonstrate isolation integrity and zero energy state.	8.3.8, 14.1 & 16.3	Control on permit.
7	Performs STT as instructed by the AA and updates the IDP.	14.7	ICC records.
	The IsA Verifies the following:		
8	Energy isolation integrity is in place to safely conduct the task. This includes the cross-check for each isolation point with the IDP being countersigned for each one as required.	8.3.8 & 14.1 & 14.6	ICC records.
9	When delegated by the AA, Verifies Isolations are in place and meet the requirements of this CoW Procedure		
	The IsA Approves or decides the following:		
10	With the PA, requirements for any STT at the early stages of planning any isolations.	14.7	ICC records.

A.6 Authorised Gas Tester (AGT)

Table A.6 – R&R Authorised Gas Testers

Authorised Gas Tester (AGT)

There are three levels of AGTs, as follows:

1. AGT1 authorised for all gas testing and monitoring and is the only level that can perform initial test for CSE.
2. AGT2 as AGT1 except CSE initial testing.
3. AGT3 authorised to provide monitoring using atmospheric gas detectors. These detectors can be in the form of personal or portable monitors. When portable monitors are used, be it active or passive, these monitors shall first be checked, calibrated and positioned by an AGT1 or AGT2 (depending on the task).

	What we require:	Section	How to demonstrate
1	The PA for the CSE task shall not be the AGT Level 1 for CSE.	24	eCoW records.
	The AGT1 does the following:		
2	Conducts initial test for CSE and records results on CSE permit.	8.3.12, 15.3, 24 & 24.14	eCoW records.
3	Checks, calibrates and places the equipment to be used for continuous monitoring by any level AGT.	24.14	Calibration records
4	All tasks within AGT2 scope		
	The AGT2 does the following:		
5	Tests for the presence of flammable gases, vapours, toxic gases, or vapours and oxygen content for all types and levels of testing.	24	eCoW records.
6	Conducts the required initial testing for HWOF tasks.	24	eCoW records.
7	Operates and confirms the gas testing equipment is calibrated and suitable for use.	24.1	Calibration records.
8	Conducts worksite gas tests before a permit to work is issued.	24	eCoW records.
9	Monitors, in line with prescribed controls, for the presence of flammable gases and vapours, particularly for HWOF and CSE tasks.	24	eCoW records.
	The AGT3 does the following:		
10	Uses or wears a device for continuous monitoring for any tasks assigned to them.	24	Self-verification.
11	Performs the role of monitoring the continuous gas detectors and stopping the job if the detector alarms.	24	Self-verification

A.7 Fire Watcher (FW)

Table A.7 – R&R Fire Watcher

Fire Watcher			
Fire Watchers shall be present and have no other duties but monitoring a worksite during any hot work open flame (HWOF) task and for 30 minutes after the work has stopped. In complex multi-deck layouts, more than one Fire Watcher may be required. A fire watcher shall have AGT3 competence			
	The Fire Watcher does the following:	**Section**	**How to demonstrate**
1	Raises the alarm if there is a fire, incident or hydrocarbon release.	12.5.1	Self-verification.
2	Monitors the worksite to Verify that safe conditions are maintained during hot work operations.	12.5.1	Self-verification.
3	Reads, understands and adheres to the TRA and permit requirements.	12.5.1	Self-verification.
4	Understands and agrees with the AA and PA how to communicate and what site protocol to use at the start of an HWOF task, during breaks and when the task is completed.	12.5.1	Self-verification.
5	Demonstrates understanding of their emergency duties.	12.5.1	Self-verification.
6	Knows what levels activate the continuous monitor alarm, and the action to take should an alarm activate.	12.5.1	Self-verification.
	The Fire Watcher Verifies the following:		
7	Suitable firefighting equipment is available, certified and ready to use.	12.5.1	Self-verification.
8	Flammable materials have been cleared away from the worksite.	12.5.1	Self-verification.
9	Drains remain covered and sealed while the task is being carried out.	12.5.1	Self-verification.
10	Sparks and weld spatter are contained within the habitat.	12.5.1	Self-verification.
11	That they know where the following are: • The nearest manual alarm call point. • The emergency shutdown button. • The emergency shutdown for portable engine-driven equipment such as generators and compressors.	12.5.1	Self-verification.
12	That continuous gas monitoring is completed as defined in the permit.	12.5.1	Self-verification.
	The Fire Watcher Approves or decides the following:		
13	Stop hot work operations if unsafe conditions develop.	12.5.1	TBT records.

A.8 TRA Facilitator

Table A.8 – R&R TRA Facilitator

TRA facilitator			
The facilitator is a role, not a position. It may be filled by anyone who has completed the facilitator training and met the required CoW competencies for the role. The facilitator leads a Level 2 TRA process from its research phase through to the field visit, meeting and documentation phases. This is a team process, but the facilitator is responsible for the quality of the team's product. They shall use the team members' knowledge of the task being risk assessed to record the hazards and the agreed controls.			
	What we require:	**Section**	**How to demonstrate**
1	For tasks identified with an initial risk in risk Area IV or above, the TRA facilitator shall be independent of the AA's area and the discipline performing the task that requires the Level 2 TRA.	9.5	eCoW records.
	The TRA facilitator does the following:		
2	Leads the team through the task risk assessment process.	**Table 18**	Self-verification.
3	Researches and gathers relevant data and supporting documents such as previous TRAs, incidents and safety data sheets before the meeting to help in the task risk assessment process.	**Table 18**	Documents attached to TRA.
4	Tells the team what they can expect on the worksite visit and who will be involved in the TRA meeting.	**Table 18**	eCoW records.
5	Gets the group consensus and records the TRA initial and residual risk and approval level required.	**Table 18**	eCoW records.
	The TRA facilitator Verifies the following:		
6	The team uses the HITRA energy sources to identify the worksite process, and task hazards.	9.1	Hazards in TRA.
7	The team considers and identifies SIMOPS.	**Table 18**	Self-verification.
8	The team considers emergency response requirements beyond basic emergency procedures.	**Table 18**	Self-verification.
9	The correct people attend the TRA (e.g. the AA, PA, any additional specialists).	**Table 18**	eCoW records.
10	The team has agreed the consequences for each identified hazard.	**Table 18**	eCoW records.
11	The team has agreed the controls for each identified hazard.	**Table 18**	eCoW records.
	The TRA facilitator Approves or decides the following:		
12	Determines the approval level based on minimum approval requirements in section 8.3.	**Section 8.3**	eCoW records.

A.9 Site Electrical Leader

Table A.9 – R&R Site Electrical Leader

Site Electrical Leader			
Electrical competent person with accountability to Verify and Approve electrical CoW activities where defined by this procedure. Typical roles used are Responsible Electrical Person (REP), Electrical Lead Engineer or Electrical Team Leader.			
	The Site Electrical Leader does the following:	Section	How to demonstrate
1	Approves electrical energised work certificates.	**Table 36**	Self-verification.
2	Approves 110 V / 120 V lighting for use in CSE.	18.2	Self-verification.
3	Is part of the TRA team for cable cutting scope.	22.5	eCoW records.
4	Is part the TRA team, or delegates to a competent electrical person, for electrical scope.	9	eCoW records.
	The Site Electrical Leader decides the following:		
5	Tasks cannot be done by a safer alternative method when working on energised electrical equipment.	18.4	Self-verification.

A.10 Confined Space Entry Attendant (CSEA)

Table A.10 – R&R Confined Space Entry Attendant

Confined Space Entry Attendant (CSEA)			
The CSEA shall be present and have no other duties when managing confined space entry and exit. More than one entry attendant may be required where there is more than one entry or exit point.			
	The CSE Attendant does the following:	**Section**	**How to demonstrate**
1	Not enter the confined space or leave their post whilst anyone is inside the confined space.	15.7	Self-verification.
2	Not attempt a rescue and prevent unauthorised personnel from attempting a rescue.	15.7	Self-verification.
3	Attends the TBT before work starts.	15.7	Self-verification.
4	Raises the alarm to call emergency response team if there is an incident.	15.7	Self-verification.
5	Monitors the worksite to Verify that safe conditions are maintained during CSE activities.	15.7	Self-verification.
6	Reads, understands, and adheres to the TRA and permit to work requirements.	15.7	Self-verification.
7	Understands and agrees with the AA and PA how to communicate and what site protocol to use at the start of a CSE operation, during breaks and when the task is completed.	15.7	Self-verification.
8	Maintains a tagging system or log for each entry and exit point of CSE. It is good practice to use photo ID passes on a display board to do this.	15.7	Self-verification.
9	Puts in place guardrails and signs to prevent unauthorised entry when the CSE is left unattended.	15.7	Self-verification.
	The CSE Attendant Verifies the following:		
10	The number of people in CSE at the same time is not more than the number specified in the risk assessments.	15.7	Self-verification.
11	Gas testing is completed and recorded on the CSE permit at the required frequency.	15.7	Self-verification.
12	Suitable rescue equipment is available and ready for immediate use.	15.7	Self-verification.
13	They know where the following are: • The nearest manual alarm call point. • The ESD button. • The ESD for portable engine-driven equipment such as generators and compressors.	15.7	Self-verification.
	The CSE Attendant decides the following:		
14	When to stop work if potentially unsafe conditions develop.	15.7	Self-verification.

A.11 Functional Authorities

Table A.11 – R&R Functional Authorities

Functional Authorities			
	All Functional Authorities	**Section**	**How to demonstrate**
1	Reviews the status of the SORAs and ORAs every 90[16] days.	11.9	eCoW records.
2	Approves TRAs, SORA and ORA for their functions in accordance with the HITRA approval table.	11.8, **Table B.5**	eCoW records.
3	Approves TRAs in accordance with Table 4 which defines minimum approval levels for specific tasks.	**Table 3**,12.2	eCoW records.

A.12 Isolator

Table A.12 – R&R Isolator

Isolator			
An Isolator implements isolations and de-isolations in the appointed discipline (process, electrical low voltage, and instrument).			
	The Isolator does the following:	**Section**	**How to demonstrate**
1	Install or remove isolations (limited to low voltage for electrical isolations) specific to their discipline	14.1	IDP.
2	Design and implement personal isolations.	14.13	Self-verification.
3	Cross-check isolations and de-isolations. May only cross-check isolations and de-isolations made by a discipline specific IsA.	14.6	

A.13 Site Lifting Co-ordinator

Table A.13 – R&R Site Lifting Co-ordinator

Site lifting coordinator (SLC)
The SLC provides verification but does not create lifting plans, supervise, or execute lifting operations. The SLC shall be independent from the work group executing the lifting operation (i.e. not influenced or controlled in any way by the company or organisation executing or responsible for the task). For SLC Roles and Responsibilities, see Entity Lifting Procedure. For example, 100572 bp Procedure Management of Lifting Operations and Lifting Equipment

A.14 Leak Test SPA

Table A.14 – Leak Test SPA

Leak Test SPA			
The leak test SPA is appointed by the SA to supervise and manage the test. The SPA is responsible for designing a test, managing the test area, recording of the results and verification that all requirements in this procedure are followed. The SPA may handover to a delegate if the test goes beyond a shift, but the delegate requires SA approval, and the SPA retains accountability for the test.			
	The Leak Test SPA does the following:	**Section**	**How to demonstrate**
1	Designs a leak test.	19.11	Self – verification
2	Supervises and manages a leak test.	19.15	Self – verification
3	When using high pressure gas in a leak test, and before pressurisation, walks through the system with the AA or delegate to Verify all requirements have been completed.	19.20	Self – verification
4	Records the results of a leak test on the leak test certificate.	19.15	eCoW records
5	Hands over leak test responsibilities to a delegate if a test continues past the shift.	19.2	eCoW records
	The Leak Test SPA Verifies the following:		
6	Leak test preparations have been completed.	19.13	Self – verification
7	When witness joints have been used, the leak test certificate specifies the frequency and type of leak test monitoring, and that post leak test monitoring is completed and recorded.	20.2	eCoW records

A.15 LOLC Roles

Table A.15 – LOLC Roles

LOLC Roles			
The LOLC roles manage the movement and recording of locked open and locked closed valves			
	The LOLC Mover does the following:	**Section**	**How to demonstrate**
1	Moves locked valves out of, or into position after authorization from the AA	23.4	eCoW records
	The LOLC Data Manager does the following:		
1	Own the technical content of the static field of the LVR.	23.9	eCoW records
2	Make amendments to the master document held in eCoW following MoC.	23.9	eCoW records
3	Verifies accuracy of LVR content.	23.9	eCoW records
	The LOLC Operational Inspection role Verifies the following:		
1	Valves in the field have been physically checked. Annually for type 1 and every 2 years for type 2. The position in the LVR and the field are aligned, and the following field checks are confirmed:	23.6	eCoW records
2	Valves are in the position recorded in the locked valve register.	23.6	eCoW records
3	Securing devices are in good condition (i.e. they are in place and not corroded or broken) and secured to make locked valves inoperable.	23.6	eCoW records & SV
4	Tags are fitted separately from the securing device.	23.6	eCoW records & SV
5	Valves found in the wrong position are recorded in the inspection comments and reported to the SA, who takes appropriate action.	23.6	eCoW records
6	The locked valve register is correct and up to date.	23.6	eCoW records
7	The most recent revision of the controlled P&ID is available showing the normal position of locked valves.	23.6	Self - Verification
8	Any defective tags or securing devices are replaced or a maintenance work order is raised where appropriate	23.6	Self – Verification & CMMS

A.16 CRT

Table A.16 - CRT

Control Room Technician			
	The CRT does the following:	**Section**	**How to demonstrate**
1	Provides input to SORA risk assessments when required	10.5	eCoW records
2	Record all overrides in the override register	10.3.2	eCoW records
3	Authorize and record implementation of an override with an active SORA	10.3.2, 10.3.3	eCoW records
4	Verifies that any live overrides are recorded in the shift handover	10.3.4	Shift log

A.17 CoW Certificate Approver and non-eCoW roles

Table A.17 - CoW Certificate Approver and non-eCoW roles

CoW Certificate Approver and non-eCoW roles			
The CoW Certificate Approvers Verify that CoW certificates are accurate and fit for purpose. The approval of these certificates is required before a permit can be issued			
	The Facility Support Squad Leader does the following:	**Section**	**How to demonstrate**
1	Approves or delegates approval of Heavy equipment movement	**Table 36** & **Table C.12**	eCoW records.
2	Approves or delegates approval of ground disturbance certificate	**Table 36**	eCoW records.
3	Approves or delegates approval of Abrasive task on live equipment	**Table 36** & **Table C.6**	eCoW records.
	The Site Engineer does the following:		
1	Completes, with the AA, the engineering review of LTI after 180 days and then risk based with a minimum of annually.	14.28	eCoW records.
	The Project Manager or TAR Manager does the following:		
1	Use a pre-startup certificate to Approve the introduction of fluids or energy into a system if its containment envelope has been broken	18.9	eCoW records
	HSE&C representative does the following:		
1	Approves a ventilation plan for confined spaces to identify the ventilation requirements and the layout of equipment and people.	18.10	eCoW records
	Emergency Response Leader does the following:		
1	Approves the ERRP to confirm: • the content is suitable and accurate • all personnel are competent and capable • any equipment mentioned is available and tested and that all ERRP members understand their duties.	18.5	eCoW records
	The Habitat Inspector does the following:		
1	Approves a pressurized habitat certificate for all type 3 habitats.	18.11	eCoW records
	The Engineering Discipline Manager does the following:		
1	Accountable for the content of the locked valve register.	23.9	LVR
	The ODM does:		
1	Approves delegation of SLC from SA	5.3	LIP
2	Verifies that regional requirements to notify regulators about SORA and ORA application is completed within the required time frame.	10.3.2 & 11.1	Regional document
3	Approves temporary changes to hazardous area classification	22.10b	MoC
4	Verifies conformance with CoW Procedure.	26.1 & 26.2	Self-verification
5	ODM approves delegation of SA role	28.2	eMoC
	The VP Production does:		
1	Approves delegation of SLC role to outside of Production	5.3	LIP
2	Approves use of mechanical plugs as primary isolation	18.7	Certificate
	The Radiation Protection Supervisor (RPS) does:		
1	When isolating radioactive sources, countersigns the IDP to Verify it meets relevant radioactive source legislative requirements.	14.27	eCoW records

Annex B
HITRA tables

B.1 HSE impacts levels

Table B.1 - HITRA HSE impacts levels

<table>
<tr><th colspan="2">Level</th><th>Health and Safety</th><th>Environmental[1]</th></tr>
<tr><td>A</td><td rowspan="3">Levels A-C maintain the visibility of risks with the potential for catastrophic impact even if their probability of occurrence is extremely low. The upper level of this framework is defined by the most severe level of impact ever seen in industry.</td><td>Comparable to the most catastrophic health/safety incidents ever seen in industry.
100 or more fatalities or life changing injuries.</td><td>• Future impact, e.g. unintended release, with widespread damage to any environment and which remains in an "unsatisfactory" state for a period > 5 years.
• Future impact with widespread damage to an environmentally sensitive area and which can only be restored to a "satisfactory"/agreed state in a period of more than 1 and up to 5 years.</td></tr>
<tr><td>B</td><td>Catastrophic health/safety incident causing very widespread fatalities within or outside a facility.
50 or more fatalities or life changing injuries.</td><td>• Future impact with extensive damage to a non-environmentally sensitive area and which remains in an "unsatisfactory" state for a period > 5 years.
• Future impact with extensive damage to an environmentally sensitive area and which can only be restored to a "satisfactory"/agreed state in a period of more than 1 and up to 5 years.
• Future impact with widespread damage to a non-environmentally sensitive area and which can only be restored to a "satisfactory"/agreed state in a period of more than 1 and up to 5 years.
• Future impact with widespread damage to an environmentally sensitive area and which can be restored to a “satisfactory”/agreed state in a period of around 1 year.</td></tr>
<tr><td>C</td><td>Catastrophic health/safety incident causing widespread fatalities within or outside a facility.
10 or more fatalities or life changing injuries.</td><td>• Future impact with extensive damage to a non-environmentally sensitive area and which can only be restored to a "satisfactory"/agreed state in a period of more than 1 and up to 5 years.
• Future impact with widespread damage to a non-environmentally sensitive area and which can be restored to a “satisfactory”/agreed state in a period of around 1 year.
• Future impact with extensive damage to an environmentally sensitive area and which can be restored to a “satisfactory”/agreed state in a period of around 1 year.
• Future impact with widespread damage to an environmentally sensitive area and which can be restored to a “satisfactory”/agreed state in a period of months.</td></tr>
<tr><td colspan="4">bp's commitment to health, safety and the environment is paramount; this is reflected in bp’s HSE goal of "No Accidents, No Harm to People, and No Damage to the Environment". No accident, injury, or loss of containment causing damage to the environment is ever “acceptable” to bp. bp is using this framework (equivalents of which are used throughout industry) to support the consistent prioritization of actions to eliminate or mitigate HSE risk and as part of bp's Performance Improvement Cycle to deliver continuous risk reduction.</td></tr>
<tr><td colspan="2">D</td><td>Very major health/safety incident.
3 or more fatalities or life changing injuries.
30 or more recordable injuries or illnesses[2].</td><td>• Future impact with extensive damage to a non-environmentally sensitive area and which can be restored to a “satisfactory”/agreed state in a period of around 1 year.
• Future impact with localized damage to an environmentally sensitive area and which can be restored to a “satisfactory”/agreed state in a period of around 1 year.
• Future impact with widespread damage to a non-environmentally sensitive area and which can be restored to a “satisfactory”/agreed state in a period of months.
• Future impact with extensive damage to an environmentally sensitive area and which can be restored to a “satisfactory”/agreed state in a period of months.</td></tr>
</table>

Level	Health and Safety	Environmental[1]
E	Major health/safety incident. 1 or 2 fatality(ies) or life changing injuries. 10 or more recordable injuries or illnesses[2].	• Future impact with localized damage to a non-environmentally sensitive area and which can be restored to a "satisfactory"/agreed state in a period of around 1 year. • Future impact with extensive damage to a non-environmentally sensitive area and which can be restored to a "satisfactory"/agreed state in a period of months. • Future impact with localized damage to an environmentally sensitive area and which can be restored to a "satisfactory"/agreed state in a period of months. • Future impact with extensive damage to an environmentally sensitive area and which can be restored to a "satisfactory"/agreed state in a period of days or weeks.
F	High impact health/safety incident. 3 or more recordable injuries or illnesses[2]. Days Away From Work Case (DAFWC).	• Future impact with localized damage to a non-environmentally sensitive area and which can be restored to a "satisfactory"/agreed state in a period of months. • Future impact with immediate area damage to an environmentally sensitive area and which can be restored to a "satisfactory"/agreed state in a period of months. • Future impact with extensive damage to a non-environmentally sensitive area and which can be restored to a "satisfactory"/agreed state in a period of days or weeks. • Future impact with localized damage to an environmentally sensitive area and which can be restored to a "satisfactory"/agreed state in a period of days or weeks.
G	Medium impact health/safety incident. 1 or 2 recordable injury(ies) or illness(es) [2].	• Future impact with immediate area damage to a non-environmentally sensitive area and which can be restored to a "satisfactory"/agreed state in a period of months. • Future impact with localized damage to a non-environmentally sensitive area and which can be restored to a "satisfactory"/agreed state in a period of days or weeks. • Future impact with immediate area damage to an environmentally sensitive area and which can be restored to a "satisfactory"/agreed state in a period of days or weeks.
H	Low impact health/safety incident. First aid. Single or multiple exposure(s) with non-permanent adverse health effects.	• Future impact with immediate area damage to a non-environmentally sensitive area and which can be restored to a "satisfactory"/agreed state in a period of days or weeks.

B.2 Business impact levels

Table B.2 - HITRA Business impacts levels

Level	Financial	Non-Financial				
		Accounting and control	**Media/public reaction**	**License to operate**	**Government/key stakeholder reaction**	**Management time**
A	>$20 billion	External auditors issue an adverse opinion on the accounts.	Public or investor outrage on a global scale.	Threat of global loss of licence to operate.	Major intervention from major government – US, UK, EU, Russia. Irrevocable damage to relationships with key stakeholders of benefit to the Group.	Long-term diversion of Board and Executive management time to manage issue/event.
B	$5 billion - $20 billion	External auditors qualify accounts.	Public or investor outrage in major western markets – US, EU.	Loss of licence to operate a major asset in a major market – US, EU, Russia.	Intervention from major government – US, UK, EU, Russia. Damage to relationships with key stakeholders of benefit to the Group.	Long-term diversion of Executive management time to manage issue/event.
C	$1 billion - $5 billion	Material error in published financial statements and restatement required. Material Weakness (actual or potential error) externally reported.	Public or investor outrage in other material market where we have presence or aspiration.	Loss of licence to operate other material asset, or severe enforcement action against a major asset in a major market.	Intervention from other major government.	Mid-term diversion of executive management time to manage issue/event.
D	$100m - $1 billion	Error in published accounts, and restatement not required. Tier 1 Significant Deficiency (actual or potential error) reported to the MBAC.	Public or investor outrage in a non-major market, or localised or limited 'interest-group' outrage in a major market. Prolonged adverse national or international media attention. Widespread adverse social impact.	Severe enforcement action against a material asset in a non-major market, or against other assets in a major market.	Interventions from non-major governments. Damage to relationships with key stakeholders of benefit to the Segment.	Short-term diversion of Executive management time to manage issue/event.
E	$5m - $100m	Tier 2 Deficiency (actual or potential error) reported internally.	Limited 'interest-group' outrage in non-major market. Short-term adverse national or international media coverage.	Other adverse enforcement action by regulators.	Damage to relationships with key stakeholders of benefit to the SPU.	Mid-term diversion of Senior management time to manage issue/event.
F	$500k- $5m	Tier 3 Deficiency (actual or potential error) reported internally.	Prolonged local media coverage. Local adverse social impact.	Regulatory compliance issue which does not lead to regulatory or other higher impact level consequence.	Damage to relationships with key stakeholders of benefit to the Performance Unit (PU).	Short-term diversion of Senior management time to manage issue/event.
G	$50k - $500k	Tier 4 Deficiency (actual or potential error).	Short-term local media coverage.	Non-compliance with industry standards but no regulatory action taken.	Some disruption to local operations (e.g. loss of single road access less than 24 hours).	Mid-term diversion of Local management time to manage issue/event.
H	<$50k	Minor error or control deficiency.	Isolated and short-term complaints from neighbours (e.g. about a specific noise episode).	Non-compliance with standards that exceed industry norms.	Minimal damage to relationships with local stakeholders or neighbours.	Short-term diversion of Local management time to manage issue/event.

B.3 Energy sources

Table B.3 - HITRA Energy sources

Energy source	Description and guidance
Biological	Many sources of energy in life forms, including wildlife and viruses or bacteria (e.g. as found in sewage systems, drain lines and cooling towers).
Body mechanics	Human strength and agility applied to a task involving lifting, pushing, pulling, climbing, or positioning.
Electrical	Types and voltages of electricity including high-voltage power systems (i.e. AC, battery systems, DC) and static. Electrical work involves considering whether the task: • requires equipment related to the task or in the area of the task to be isolated • involves electrically-powered equipment • is in an area where there is vulnerable electrical equipment (e.g. insulated cabling, uninsulated overheads, and power lines) • involves transferring fluids, power or friction between non-conducting materials that could generate static electrical charges • involves systems and equipment that are adequately grounded, or bonded, or both.
Gravity	Causes tools, equipment, or people to fall or move. This affects lifting tasks, work at height, and objects that might fall.
Hazardous process material	Reactive, combustible, flammable, or explosive gases, liquids, or solids (e.g. hydrocarbons or process chemicals that have the potential to cause fires or explosions).
Human Factors	People and their interactions with other people as well as: • how people interact with the plant and processes • characteristics of individuals (e.g. Height, fatigue, physical capability).
Mechanical	This includes mobile equipment, moving parts on stationary equipment, and rotating equipment. Even though items are non-powered, their momentum as they are moved can crush or cut people or vulnerable equipment. Also includes sharp edges of tools and equipment.
Noise	A form of pressure energy that has the potential to result in noise induced hearing loss. Work that can generate noise involves considering whether: • the task is in a high-noise area • the task involves using noisy tools or equipment • noise could cause communication problems, including in an emergency.
Pressure	Air, water, pneumatics, springs, and gases are possible sources of significant pressure energy. Work that involves pressure involves considering the following: • Non-return valves where material can be trapped between the valve and an isolation point. • Equipment in which trapped or undrained material can remain. • General equipment or line conditions (e.g. and area of corrosion, where a pressured leak is foreseeable).

Energy source	Description and guidance
	• Reaction forces from a pressure leak, which can move an unrestrained item (e.g. hose, cylinder, pipe segment).
Radiation 	This can be in the form of • Ionising radiation (i.e., radioactivity) for example from level transmitters, logging devices and NORM. Hazards to health and activation of process control or protection • Sunlight - Hazards to health, temperature changes to equipment and its contents • Radio waves, - Interference with wells, communication, or protection systems.
SIMOPS 	These are possible interactions between tasks occurring at the same time. Tasks are reviewed to prevent the following from happening at the same time: • Actions within the task itself. • Unrelated work taking place nearby. • Work in restricted access area that calls for close co-ordination.
Thermal 	Energy associated with hot or cold surfaces and fluids, undesired chemical reactions, and ambient temperatures.
Toxic substances 	Substances that are hazardous to health which may be present in the form of gases, vapours, dusts, aerosols, fumes, liquids, or solids (e.g. hydrocarbon, nitrogen, welding fumes, paints, process chemicals, benzene, toluene, ethylbenzene, xylenes, H_2S, asbestos, lead, mercury).
Weather 	A source of potential harm related to environmental conditions (e.g. rain, wind, snow, sleet, hail, heat, cold, fog). These create conditions that can potentially impact an employee’s ability to perform a task safely.

B.4 Risk matrix (Group 8x8)

When positioning a risk event on the matrix, it is not usually possible to determine the likelihood and impact of an event precisely in advance of the risk event happening. Reflecting this uncertainty, the position on the matrix is, therefore, only approximate.

Normally for a TRA, use the risk matrix levels A to H and likelihood descriptors 1-8 to determine the risk figure. Use the additional numerical information on probability when additional data exists to support a further quantitative estimate of a probability value.

Table B.4 - Risk matrix (Group 8x8)

		Likelihood of risk event								
		1	2	3	4	5	6	7	8	
		A similar event has not yet occurred in our industry and would only be a remote possibility.	A similar event has not yet occurred in our industry.	A similar event has occurred somewhere in our industry outside of bp.	A similar event has occurred somewhere within bp	A similar event has occurred, or is likely to occur, within 30 years of the facility, businesses or functions.	Likely to occur once or twice within 30 years of the facility business or function.	Event likely to occur several times within 30 years of the facility, business, or function	Common occurrence (at least annually) at the facility business or function	
Probability		Less than 1 in a million	Less than 1 in 100,000	Less than 1 in 10,000	Less than 1 in 1,000	Less than 1 in 100	Less than 1 in 10	Greater than 1 in 10	1	
Impact (severity) level	A	8	9	10	11	12	13	14	15	Area V
	B	7	8	9	10	11	12	13	14	
	C	6	7	8	9	10	11	12	13	
	D	5	6	7	8	9	10	11	12	
	E	4	5	6	7	8	9	10	11	Area IV
	F	3	4	5	6	7	8	9	10	Area III
	G	2	3	4	5	6	7	8	9	Area II
	H	1	2	3	4	5	6	7	8	Area I

B.5 HITRA approval table

Table B.5 - Approval table

Risk area	Approval authority		
	Wells	**Production**	**Projects**
V	Risks in these areas shall not be managed through the CoW procedure. Follow the requirements of the entity risk management procedure to manage these risks.		
IV (C+)			
IV (D/E)	Region VP Wells *	Region VP operations *	VP Projects *
III	Wells Operations Manager	Area Production Manager	Projects Manager
II	Wells Superintendent	Site Authority	Construction and, or Commissioning Manager
I	Area or Issuing Authority **	Area or Issuing Authority**	Area or Issuing Authority**
*Some Blue D/E risks may require additional notification and endorsement through the entity risk management procedure before they are Approved via CoW. See entity risk management procedures for details. ** When delegated by Area Authority			

Annex C
CoW certificates

CoW certificates are used to Verify that a worksite or job is prepared safely and in conformance with this CoW Procedure. They identify task specific conditions and controls that are to be used when planning, during the risk assessment and as part of work execution. CoW certificates capture technical approval, and their use is mandated by bp. See below:

Link to Isolation

Link to Ground disturbance

Link to Lift Plan

Links to Energised electrical work certificate

Link to Emergency response and rescue plan (ERRP)

Link to Abrasive task on live equipment

Link to Mechanical seal plug

Link to Pre-startup

Link to Ventilation plan

Link to Pressurised habitat

Link to Heavy equipment movement

Link to Cross-site boundary isolation

Link to Leak test

C.1 Link to Isolation confirmation certificate

Table C.1 - Isolation confirmation certificate

Created by eCoW software.

C.2 Link to Ground disturbance certificate

Table C.2 - Ground disturbance certificate

C.3 Link to Lift Plan

Use the local Lift Plan to conform to section 18.3.

C.4 Links to Energised electrical work certificate

Non-US:

Table C.3 - Energised electrical work certificate (Non-US)

US:

Table C.4 - Energised electrical work certificate (US)

C.5 Link to Emergency response and rescue plan (ERRP) certificate

Table C.5 - Emergency response and rescue plan certificate

C.6 Link to Abrasive task on live equipment certificate

Table C.6 - Abrasive task on live equipment certificate

C.7 Link to Mechanical seal plug certificate

Table C.7 - Mechanical seal plug certificate

C.8 Link to Well handover certificate

Table C.8 - Well handover certificate

Use the local well handover certificate to conform to sections 18.8.1 and 18.8.2.

C.9 Link to Pre-startup certificate

Table C.9 - Pre-startup certificate

C.10 Link to Ventilation plan certificate

Table C.10 - Ventilation plan certificate

C.11 Link to Pressurised habitat certificate

Table C.11 - Pressurised habitat certificate

C.12 Link to Heavy equipment movement certificate

Table C.12 - Heavy equipment movement certificate

C.13 Link to Cross-site boundary isolation certificate

Table C.13 - Cross-site boundary certificate

C.14 Link to Leak test certificate

Table C.14 - Leak test certificate

Annex D
Checklists

CoW checklists provide guidance for the user to aid checking the key issues and hazards when planning, during the risk assessment or as part of work execution. bp recommends these are used but they do not need to be signed and attached to the CoW documents.

Link to Breaking containment

Link to Confined space entry

Link to Confined space entry for water jetting

Link to Ground disturbance

Link to Hot work open flame

Link to Leak testing

Link to TRA

Link to Line walking

Link to Working at height

Link to Over side working

Link to Isolation

Link to LTI – Engineering review checklist

D.1 Link to Breaking containment checklist

Table D.1 - **Breaking containment checklist**

D.2 Link to Confined space entry checklist

Table D.2 - **Confined space entry checklist**

D.3 Link to Confined space entry for water jetting checklist

Table D.3 - **Confined space entry checklist for water jetting**

D.4 Link to Ground disturbance checklist

Table D.4 - **Ground disturbance checklist**

D.5 Link to Hot work open flame checklist

Table D.5 - **Hot work open flame checklist**

D.6 Link to Leak testing checklist

Table D.6 - **Leak testing checklist**

D.7 Link to TRA checklist

Table D.7 - **TRA checklist**

D.8 Link to Line walking checklist

Table D.8 - **Line walking checklist**

D.9 Link to Working at height checklist

Table D.9 - **Working at heights checklist**

D.10 Link to Over side working checklist

Table D.10 - **Over side working checklist**

D.11 Link to Isolation checklist

Table D.11 - **Isolation checklist**

D.12 Link to LTI – Engineering review checklist

Table D.12 - **LTI – Engineering review Isolation checklist**

Annex E
Paper Backup

E.1 Paper backup

a. If a server fails or if, for any reason the electronic CoW system is not available, a limited paper backup system is provided. The paper backup system cannot deliver the rigour inherent in the design of the electronic CoW system and as such the paper system shall only be used for essential work when the electronic system is not available.

b. Each site is required to have a backup paper system ready to use in the event of a system outage at the normal place of permit issue.

c. There is an expectation that the paper backup system will only be used for a limited period of a few shifts at most. If the paper backup system is used, certain safeguards provided by the electronic system will be lost. Examples include permit dependencies, permit and certificate linking, automatic updates to associated registers, approval levels and visual SIMOP indicators. To reduce the risk associated with using this system, as far as is reasonably practicable, minimise or defer all non-essential work including:

    1. movement of locked valves
    2. use of ORA and SORA
    3. isolation movement
    4. HWOF and CSE work.

d. The workflow follows the same steps to generate, Verify, and authorise all permits, ORAs and IDPs as with the electronic system. Level 1 and Level 2 risk assessment forms and the risk assessment process in section 8 and section 9 of this CoW Procedure are applied. The work party signs the declaration form in accordance with the normal process.

e. When a permit is used in conjunction with a risk assessment, the paper copies are cross-referenced against each other by adding the risk assessment number to the permit and the copies of the paperwork collated together to take to the worksite. As each pre-printed form has a second copy, these are retained for a minimum of one month in the control room, permit office or a central place on the site where CoW is managed.

f. If existing paper copies of an eCoW permit or isolation are available from the previous shift, then it is acceptable to use these permits and re-issue using wet ink signatures as long as conditions have not changed, and the risk assessment is still valid.

g. When the eCoW system becomes available after an outage it is acceptable to continue to work under the paper backup system certificates for the remainder of the shift. Transfer all paper backup permits and isolations to eCoW at the earliest opportunity to maintain a single point of control.

E.2 Temporary overrides

a. When eCoW is not available an ORA shall be used in all situations that would normally require a SORA.

E.3 Permit register

a. During permit issue, the AA needs visibility of the interactions between current ongoing works. This and the permit register provide a log of all live permits and their location. The AA refers to this log before issuing a permit to confirm that there are no SIMOP clashes or conflicts with any isolation. The AA completes all the required fields in the register during permit issue. When the permit is completed or suspended, then the AA records this in the relevant field.

E.4 Isolation register

a. A register is provided to log all isolations that are put in place during the period where eCoW might not be available. The AA completes all the data required in the register when an isolation is moved to in place. When an isolation is removed, then the AA enters the time and date in the relevant section to signify that the isolation is now complete. The AA also cross-references any work permits linked to the isolation so that the status of the permits can be checked prior to giving permission to remove an isolation.

E.5 Locked valve register

a. During isolations and de-isolations, it is understood that locked valves will change position when the isolation points are applied and removed. During a period when the eCoW system is not available, a register is provided to log all locked valve movements so that the LVR can be updated or checked, or both, when the eCoW system becomes available. When valves are moved under isolation, de-isolation, or both of these, then the AA updates this register with the relevant details.

Annex F
Site CSE Register

Table F.1 is a site CSE register. Some examples are provided, but the register is completed by the site.

Table F.1 - Site confined space entry (CSE) register

Site A - CSE and Restricted Space Register					
Equipment	**Location**	**CSE/ Restricted Space Level/Gas Test**	**Rescue Plan**	**Minimum No. of Persons Entering Space**	**Min No. of Standby Man**
Turret Head and Transverse bulkheads 1/2/3	Turret	CSE L2RA/Gas Testing Required	Yes	1	1
TSS Void Spaces – All levels, including forepeak tank	TSS	CSE L2RA/Gas Testing Required	Yes	1	1
All process separation vessels, including oil/water/gas plant. (SRP cartridge filters – see below)	Topsides Process Deck and Marine Deck	CSE L2RA/Gas Testing Required	Yes	1	1
SRP cartridge filters	Module 15	Restricted workspace L2RA/Gas Testing	Yes	1	1
All Process Chemical Tanks	Module 16	CSE L2RA/Gas Testing Required	Tank Dependent	1	1
All Hull Tanks, including but not limited to Cargo Tanks/Ballast Tanks /Void Spaces	Main Deck	CSE L2RA/Gas Testing Required	Yes	2	1
All Fresh Water Tanks	Engine Room	CSE L2RA/Gas Testing Required	Yes	1	1
All Diesel Fuel Tanks	Engine Room	CSE L2RA/Gas Testing Required	Yes	2	1
All vessel skirts	Topsides process modules and Engine Room	CSE L2RA/Gas Testing Required	Yes	1	1
Crane Pedestals	Module 13 Starboard and Module 14 Port	CSE L2RA/Gas Testing Required	Yes	1	1
Gas Turbine enclosure – Enclosure area around Engine / PT / Exhaust	Modules 5&6	Restricted workspace L2RA (hazards different for online / offline entry)	No	Offline: 1 Online: 1	Offline: Not Required Online: 2 (1 at access door, 1 at water mist cabinet)
Gas Turbine exhaust volute (exhaust collector)	Modules 5&6	CSE L2RA/Gas Testing Required	Yes	1	1
VSAT "Raydomes"	Bridge	Restricted workspace L2RA	Yes	1	1
All accommodation /engine room lift shafts	Accommodation and Engine Room	Restricted workspace L2RA	Yes	1	1

Annex G
Applicability guidance for Projects activities

Table G.1 - Applicability guidance for projects activities

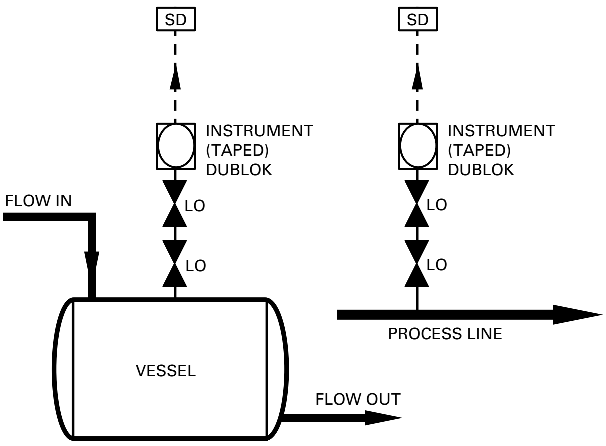
Activity	At bp Site	
	Greenfield	Brownfield
Contractor construction vessel activities at bp offshore site (not including interface activity).	Contractor SMS	
Contractor camp activities at bp onshore site.	Contractor SMS	
Hook- up or Tie-in activities at bp site.	Contractor SMS	CoW
Commissioning by contractor at bp site.	Contractor SMS	CoW
Construction activities at bp site.	Contractor SMS	CoW
Commissioning by Projects at bp site.	Contractor SMS	CoW
Decommissioning facilities at bp site.		CoW
Decommissioning or demolishing entire bp plant.		Contractor SMS
Subsea activities from contractor vessel at bp site.	Contractor SMS	
Onshore pipeline construction.	Contractor SMS	CoW
Onshore pipeline commissioning by contractor.	Contractor SMS	CoW

Activity	At Contractor Site	
Fabrication at contractor site.	Contractor SMS	
Commissioning by Projects at contractor site.	Contractor SMS	
Utilities operation by Projects at contractor site.	Contractor SMS	CoW

Annex H
Locked valve categories

Table H.1 - Locked valve categories

<table>
<tr><td>LO-1 SIL1 or greater rated process trip system:
Instrument isolation valves when the instrument forms part of any process trip system.</td><td>LO-2 Compressor anti-surge systems:
Isolation valves to instruments managing compressor anti-surge systems.</td></tr>
<tr><td>



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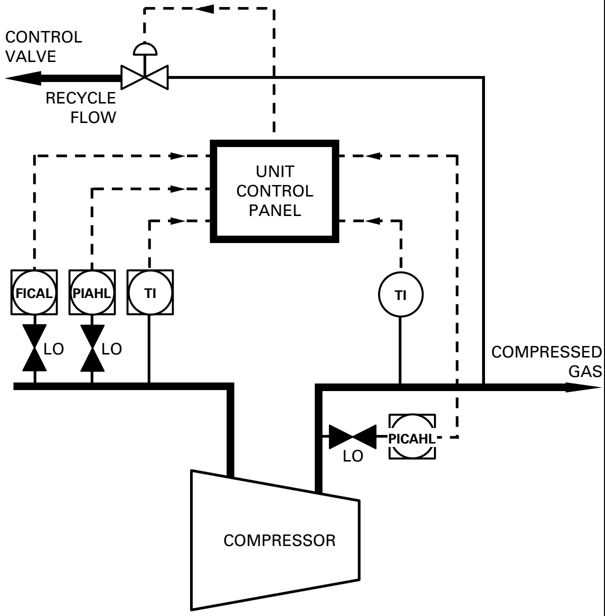
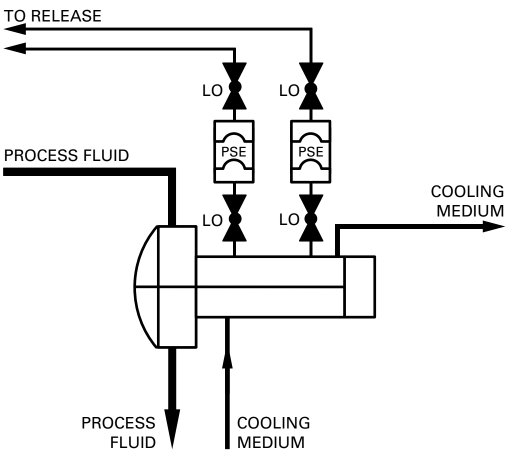


</td></tr>
<tr><td>LO-3 Pressure or vacuum relief system:
Valves in a pressure or vacuum relief system, including a valve in the inlet and outlet of the relief lines. This includes dual PSV systems.</td><td>LO-4 Overpressure protection blowdown:
Valves upstream or downstream of an ESDV (XXV), which opens to blow down the system.</td></tr>
<tr><td>



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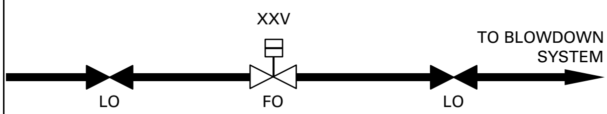
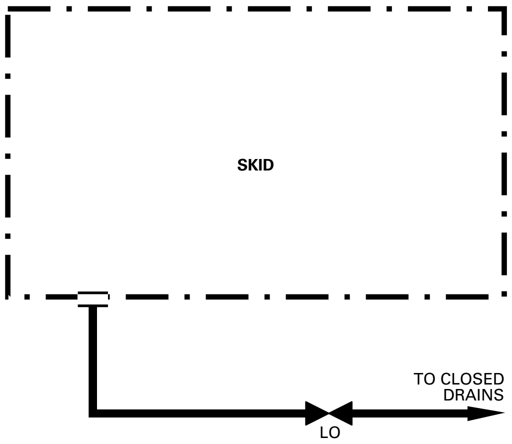
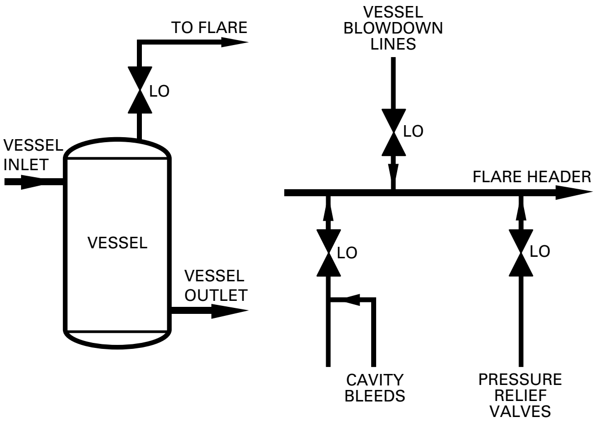
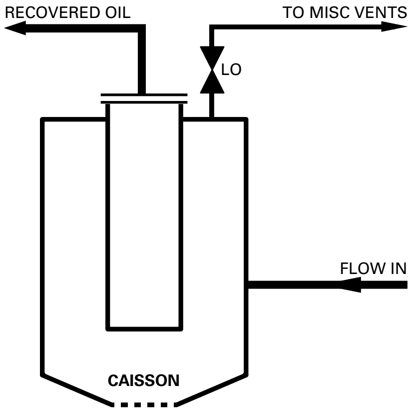
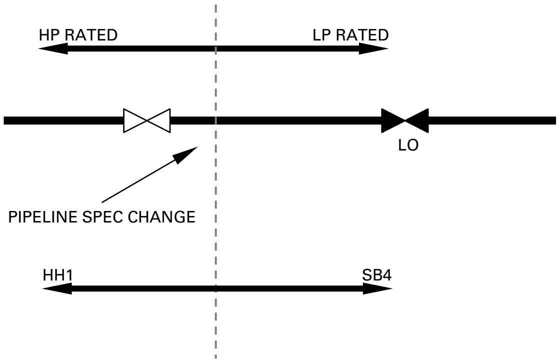
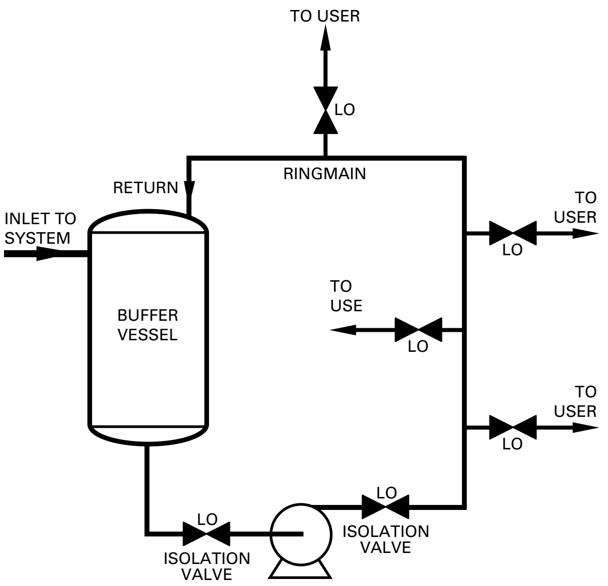


</td></tr>
</table>

LO-5 Continuous flow path to drains: Valves providing continuous access to drains from vessels or systems (for example vendor skids) where it is critical that the flow of excess fluids is controlled.	LO-6 Flow path to HP/LP flare: Isolation valves on vents to HP / LP flares, for example: • to prevent vessels overpressurising • to provide a controlled route of gas disposal from cavity bleeds • isolation valves on the flare header.
	
LO-7 Continuous vents to atmosphere Isolation valves to vents systems that provide a controlled route for the continuous removal of gases.	LO-8 HP/LP interface protection: Valves on a HP/LP interface that are LO to prevent a section of line overpressurising.
	

<table>
<tr>
<td>LO-9 System functionality critical valves:
Isolation valves in systems that shall be LO to maintain the function of the system, typically focused on systems essential to maintain operation of SCEs valves in for example:
Fuel gas - Diesel - Nitrogen - Chemical injection.
Water injection - Seawater - Heating medium.
Potable and service water - Instrument air.
Breathing air - Firewater.</td>
<td>LO-10 Isolation valves in drain headers:
Manual valves in drain headers are LO to avoid backflowing from one vessel to another if they are being drained simultaneously.</td>
</tr>
<tr>
<td>
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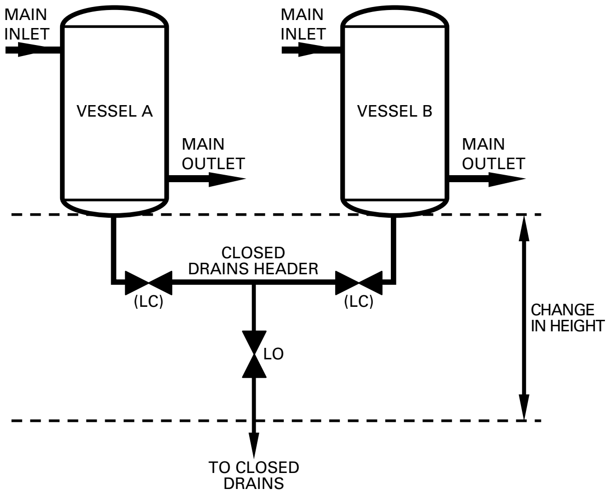
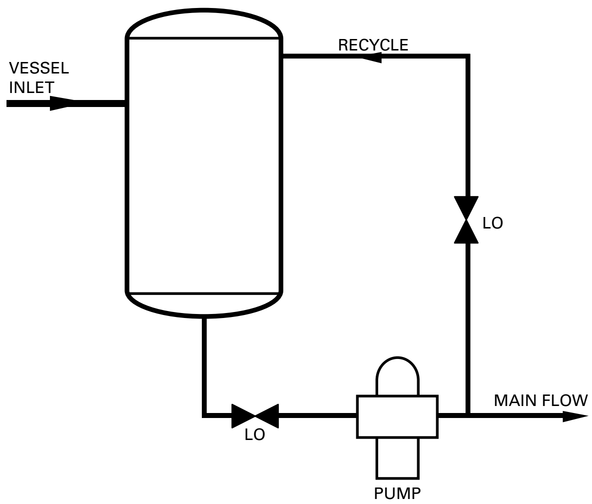
<td>
</td>
</tr>
<tr>
<td>LO-11 Minimum flow protection:
LO valves in a minimum flow recycle loop around a pump to prevent causing damage to the pump.</td>
<td>LO -12 Fire protection system delivery valves</td>
</tr>
<tr>
<td>
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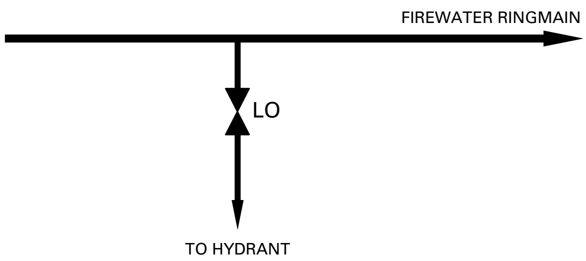
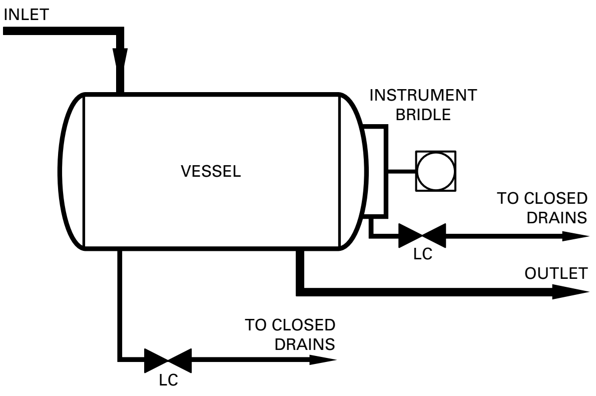
<td>
</td>
</tr>
</table>

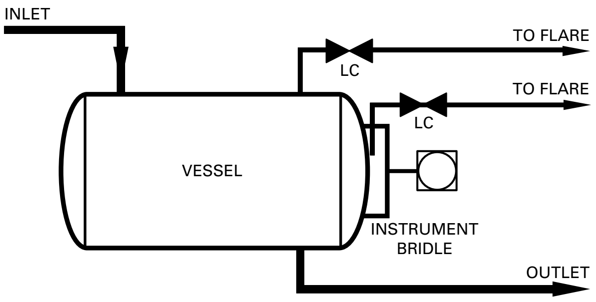
LC-1 Closed or hazardous drains:

Valves to closed/hazardous drains, which are opened when it is required to drain a vessel or process line once it has been isolated.



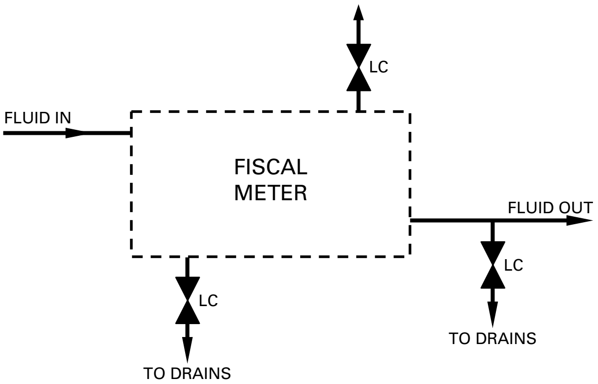
LC-2 HP or LP flare vent valve:

Valves to the flare, which are required to vent off gases contained within a vessel or a process flowline once it has been isolated.



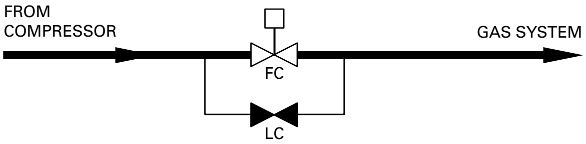
LC-3 Fiscal metering:

Vents and drains on and downstream of the fiscal meter that cannot be opened for fiscal reasons.



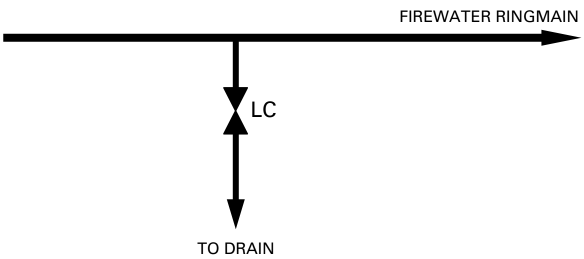
LC-4 Bypass valve:

Bypass valves required for pressure equalisation before opening at startup (e.g. valves around the pig launcher). Control valve bypasses that have the potential to overpressure downstream plant shall be LC. If included in the plant HP/LP Interface list, they may also have a restriction orifice fitted, limiting the potential to overpressure downstream plant.



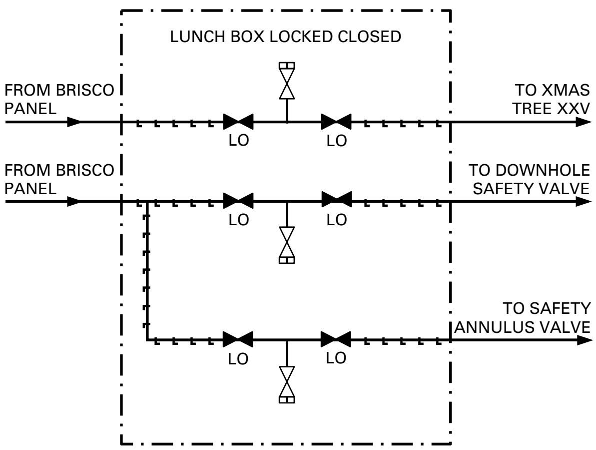
LC-5 Fire protection systems:

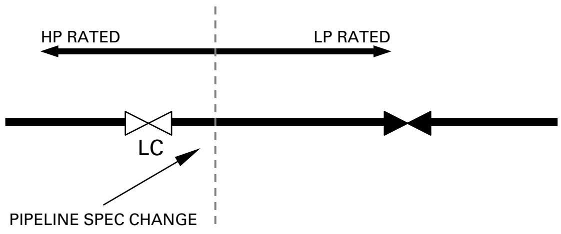
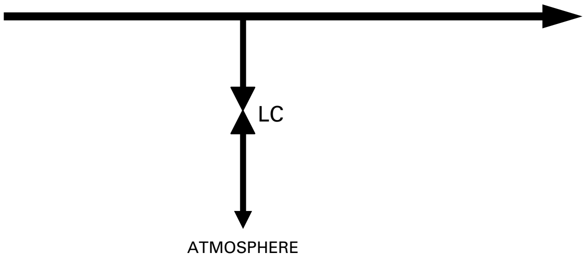
Drain valves on the firewater ring main, deluge, and sprinkler skids.



LC-6 Wellhead control panel:

Valve in which the position is controlled by containing it within either a locked lunch box valve cabinet or a locked Brisco panel.



LC-7 HP / LP Interface: Valves on a HP/LP interface that are LC to prevent a section of line overpressurising.	LC-8 Environmentally critical valve:
	

Annex I
Hazardous and non-hazardous process fluids and utilities

Table I.1 - Hazardous and non-hazardous process fluids and utilities

Hazardous process fluids and hazardous utilities[100]	
All hydrocarbon systems, including:	
Wellheads, flowlines, and risers	Closed drains
Separation	Fuel gas
Crude metering	Diesel
HP compression	Hydraulic oil
Gas dehydration	Methanol
LP compression	Oil-based drilling mud
Relief, flare, and vent	Lube oil and Seal oil
Non-hydrocarbon systems, including:	
Produced water	Hazardous open drains
Water injection (HP, > 50 barg (725 psig) design pressure)	Inert gas (asphyxiation hazard)
Cooling medium (containing toxics)	Nitrogen (asphyxiation hazard)
Heating medium (containing toxics)	Chemical injection
Chlorination (until diluted)	Steam
Water (≥60°C (100°F)	Water based mud and brine
Non-hazardous process fluids and non-hazardous utilities:	
Seawater used for ballast or cooling	Firewater
Water injection (LP, ≤ 50 barg (725 psig design pressure)	Bilge water
Fresh service water and potable water	Sewage and grey water
Compressed air ≤ 14 barg (200 psig)	
This table identifies hazardous materials for consideration when designing an isolation (e.g. DBB, SVI). It is not exhaustive or intended to be used when assessing personal safety risk. In such cases that a material is not classified in this table or when in doubt, consult HSE&C for advice.	

Annex J
Tasks that an AA can delegate

Table J.1 - Tasks that an AA can delegate

Tasks that an AA can delegate	
AA can delegate to another AA	**AA can delegate to an IA**
Verification of permits	Issue permits
Pre de-isolation verification	Level 1 TRA site visit
Pre-startup checks	Worksite visit for work start, monitoring or permit close out
Isolation integrity checks	Verify permit suspension during emergencies
Verifications before work restart after suspension	Rescue plan review before permit authorisation
Worksite visit and TBT attendance, providing it is not the first visit for CSE or HWOF	Approval of risk Area I risk assessment
Verify permit suspension during emergencies	Verify working at height TRA, conditions, equipment (see section 17)
Monitoring of witness joints when delegated by SA	Retain permits and certificates for one month
Rescue plan review before permit authorisation	Verification of permits
Follow hierarchy of controls to confirm HWOF	Habitat inspections
Habitat inspections	Agree with PA for FW competency
Verify working at height TRA, conditions, equipment	On closing a permit Verify the personal isolation has been removed and the plant line-up is correct
Retain permits and certificates for one month	Verifications before work restarts after suspension
Agree with PA for FW competency	
Worksite visit for permit close out	
Verify Life Saving Rules breaches are recorded in IRIS	
Review TRAs include lessons learned from incidents, near misses	
Capture knowledge within eCoW	
Change of permit to work conditions (e.g. monitoring frequency)	

Annex K
Measuring airflow through a vessel

a. Field measurement requires a pocket calculator, measuring tape and air velocity instrument. Calculations are made using the following formula:

1. Q = VA

In this:

2. Velocity (V) is in feet per minute (fpm).
3. Area (A) is in square feet (sq.ft.) For circular openings, the formula to derive A is A = πr2.
4. Air flow (Q) in cubic feet per minute (cfm) is the quantity of air passing through a manway.

b. Measure the average makeup air velocity (in fpm) entering the vessel through each opening. Makeup air entering the vessel is measured because the air moving devices, when used to pull air through the vessel, usually make the exhaust air too turbulent for effective measurement.

When identifying and selecting intake air openings for airflow measurement, consider the possible effects of short-circuiting which may be present. If short-circuiting is suspected, it may be prudent to test the air flow pattern using smoke tubes to confirm that the 2,000 cfm per welder criterion is appropriate for the situation under investigation. If short-circuiting is suspected but cannot be excluded, use of local exhaust ventilation is likely the better choice.

c. Measure the largest openings first. Since most of the air will pass through the larger openings, they will account for the majority of the makeup air entering the vessel. If the confined space is supplied with pressurised makeup air (from portable air conditioners or heaters), pierce the flexible ducting to measure the air flow velocity and repair the hole with duct tape.

d. Multiply the average airflow velocity for each opening by the cross-sectional area (in sq.ft.) of the opening to obtain the quantity of makeup air (in cfm) entering the confined space. Finally, add the makeup air quantities for each opening in the vessel.

The ACGIH Industrial Ventilation, A Manual of Recommended Practice recommends up to 20 measurements along two 10-point transects at 90° to each other. This document provides the details of accurate air velocity measurements which provide spacing for circular openings which will provide equal areas. For rectangular openings, 16 measurements are recommended. The average velocity can be calculated by averaging the measurements for a given opening.

Example #1: A single fan is mounted on a manway near the top of a vessel, and makeup air is entering through a manway (40’ diameter) near the bottom of the vessel at an average velocity of 370 fpm. Determine the amount of make-up air.

1. Determine the cross-sectional area (A).
2. Use the formula: $A = \pi r2$
3. Radius = ½ diameter = 20’ = 1.67'
4. A = (3.1416) (1.67) ² = 8.76 ft²
5. Calculate the air flow (Q) in cfm:

a) Use the formula: Q = VA

b) Q = 370 fpm x 8.76 sq.ft. = 3,242 cfm

In this example, 3,242 cfm dilution ventilation is supplied to the vessel. Remembering that one active welder is allowed for each 2,000 cfm dilution ventilation entering the confined space, only one welder may work in this space.

Example #2: For the same space, if there is still one fan on the upper manway, but there are now two 40’ manways available for makeup air. What is the amount of makeup air if the average velocity is 280 fpm through one manway and 310 fpm through the other?

The cross-sectional area for the two 40’ manways is 8.76 sq.ft. (See Example #1)

6. The air flow in cfm:

   a) 280 fpm x 8.76 sq.ft. = 2,453 cfm

   b) Plus

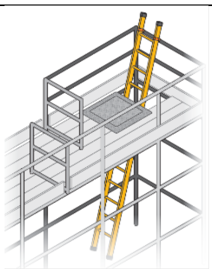
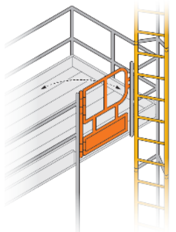
   c) 310 fpm x 8.76 sq.ft. = 2,716 cfm

   d) Total: 5,169 cfm

In this example, 5,169 cfm dilution ventilation is supplied to the vessel and two welders may work simultaneously in this space.

Annex L
Temporary Ladders

Table L.1 - Temporary equipment examples[101]

Item no.	Description	Picture of item
a	Scissor lifts or mobile elevated work platforms	
b	Mobile platform stairs or ladders (with rear bar or chain).	
c	Scaffolding: 1. With a lift. 2. With stairs.	
d	Scaffolding with internal inclined scaffold ladder with protection (i.e., ladder trap hatch or handrails)	
e	Scaffolding with external scaffold ladders accesses using a safety gate or swing arm system or onto platform with guardrails.	

Item no.	Description	Picture of item
f	Ladders	

Table L.2 - Additional requirements for all temporary ladders[101]

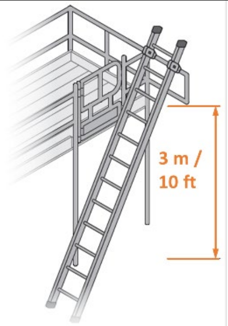
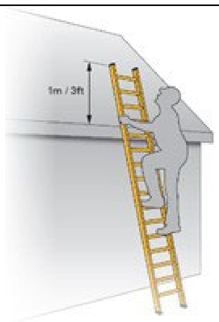
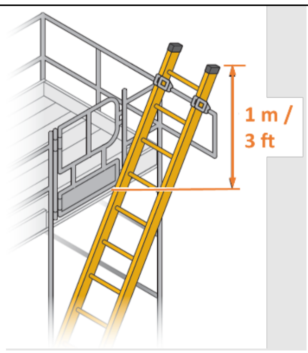
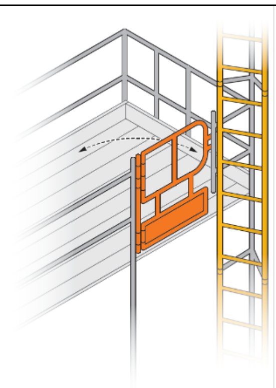
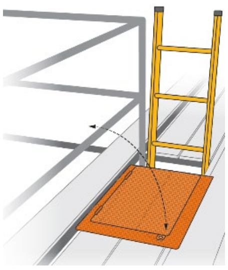
Item no.	Requirement	Picture for reference
a	Personal fall protection is used on temporary ladders where the height of climb exceeds 3 m (10 ft). Due to already existing proprietary scaffold systems and adjustments that might be required to achieve a proper platform level for work to be performed, a variance of up to 5% (15 cm or 6 in) above the 3 m or 10 ft requirement is allowed between scaffold decks and is considered as meeting this requirement. This variance includes the use of internal ladders for access after the first scaffold deck and is only applicable to the distance between scaffold decks.	
b	Where a ladder of greater than 3 m (10 ft) has been risk assessed to be the safest method of access, and personal fall protection equipment is yet to be installed, the first climb activity is to secure personal fall protection, for the individual and any subsequent climbers prior to any work being performed.	
c	While ascending and descending the ladder, the employee faces the ladder with both hands available to climb.	
d	Ladders are secured or stabilized to prevent accidental displacement.	

Table L.3 - Additional requirements for accessing scaffold[101]

Item no.	Requirement	Picture for reference
1	Ladders, rails or grab bars extend at least 1 m (3 ft) over or into any landing or scaffold platform to maintain balance for transition to platform.	
2	Scaffold ladders at the point of access or egress have a step-across distance of not more than 30 cm (12 in) as measured from the centreline of the steps or rungs to the nearest edge of the landing area.	
3	Self-closing swing gates that open inward or an equivalent barrier are used at all entry points for scaffold ladders.	
4	Internal scaffold ladder access protection around the opening, such as a protected ladder trap with self-closing mechanism, guard rail or an equivalent barrier.	Ladder trap door is designed with guard rails on both sides 

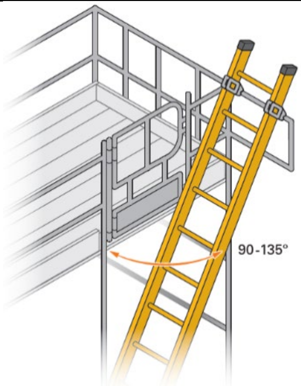
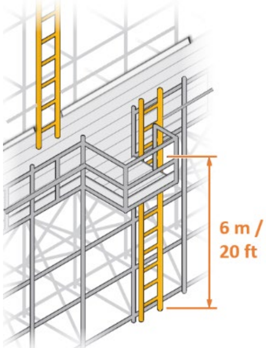
Item no.	Requirement	Picture for reference
5	When installed externally, scaffold ladders are installed at between 90 and 135 degrees to the platform deck being accessed.	
6	If the length of any section of a scaffold ladder exceeds 6 m (20 ft), a rest platform (deck) is required The requirement (a) in Table L. 2 for fall protection where Height of Climb exceeds 3 m (10 ft) still applies.	

Table L 4 - Additional recommendations for accessing scaffold [101]

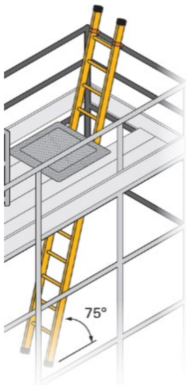
Item no	Additional recommendation	Picture for reference
1	Access and egress are accomplished using stairs or internal ladders.	
2	Where stairs cannot be used, inclined ladders at a maximum 75-degree (4:1) angle are used.	

Table L.5 - Additional requirements for using extension or straight ladders[101]

Item no	Additional recommendation	Picture for reference
1	Extension ladders have rung-locks fully engaged while in use.	
2	When the use of an extension ladder is the only means of access to complete the work, the extension ladders are limited to 9 m (30 ft). *The requirement (a) in Table L. 2 for fall protection where Height of Climb exceeds 3 m (10 ft) still applies.*	

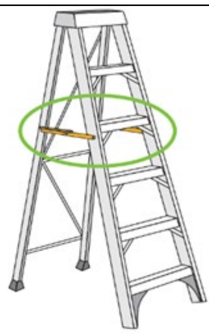
Table L.6 - Additional recommendations for using extension or straight ladders[101]

Item no.	Additional recommendations	Picture for reference
1	If an extension or straight ladder is being used as part of normal operations, an engineering solution is implemented.	
2	Extension or straight ladders are used at a maximum 75-degree angles (4:1), so that the distance from ladder base to the base of the support is one quarter of the working length of the ladder.	

Table L.7 - Additional recommendations for performing work from a platform ladder[101]

Item no.	Additional recommendations	Picture for reference
1	Platform ladders are used in place of extension or straight ladders to perform work. *Platform ladders are preferred over folding ladders and extension ladders.*	
2	Platform ladders are: a) Used on level ground with support for all four sides of its base. b) Not moved while someone is on it. c) Not used on ice, snow, or slippery surfaces unless suitable means to prevent slipping is employed.	

Table L.8 - Additional requirements for performing work from a ladder[101]

Item no.	Additional requirements	Picture for reference
1	If the ladder does not have an inbuilt platform or safety rail, Fall Protection is required when working from a ladder above 2 m (6 ft). *Note: Working from a ladder is working at height. However, the use of a ladder for access and egress is not working at height.*	 
2	Do not stand on the top two rungs of the ladder.	
3	Step ladders are: a) Equipped with a metal spreader or locking braces that securely holds the front and back sections in an open position while the ladder is in use, b) Not used for accessing an elevated work area unless designed by the manufacturer for this use.	

Annex M
References

Table M.1 - References

No.	Value	Section	Source
1	500m	5.5 & 8.4.3	500102 BP Practice Control of Work Integrated Practice, US GOV 33 CFR 147.10 Establishment of safety zones, IMO IA910M 100657 bp Procedure Production Asset 500 Meter Zone (GOO-LI-PRO-00001)
2	11m or 35ft	Table 19 & 12.2, 24 & Table 4	US government: Safety & Environmental Enforcement, Interior § 250.113 OSHA 1910.252(a)(2)(iii)
3	24 hr.	8.7.4 & Table 3	CoW defined
4	14 days	8.3.4, 8.4.5 & 8.7.3	CoW defined
5	4 hours	8.3.4, 8.5.1 & 14.13	CoW defined based on working time directive
6	3 years	8.3.5 & 10.6	CoW defined
7	10 barg (US 150 psig).	9.4 & Table 7	CoW defined based on limit for single valve isolation limit
8	392°C (738°F)	Table 11	API RP 2216. In this case we have used the auto ignition temperature for diesel, (210°C) which is a credible fluid that could come into contact with hot surfaces in operations with a low auto ignition temperature. We then applied the 182°C as defined in API RP 2216 to give a minimum hot surface ignition temperature of 392°C. Where a site has materials with a lower auto ignition temperature then this figure is revised.
9	1.2m (4 ft)	Table 12	UK HSE. Consider if this space meets the criteria for CSE
10	10%	8.6.2	CoW defined
11	5 Years	8.7.9	bp document retention policy
12	MTTR (7 days, whichever is the lower figure) specified.	Table 20	CoW defined based on advice and support of instrument and control TA S&ORA + I&C engineering discipline leader.
13	7 days	Table 20	Decision made after consultation with ICE SMEs
14	Review every 90 days	Table 20	Decision made after consultation with ICE SMEs
15	12 hours	Table 20	US CFR Title 30 CFR 250 Subpart H
16	90 days	11.4 & 11.9, A11	500102 BP Practice Control of Work Integrated Practice
17	72 hours	11.7	CoW defined
18	<1% LEL	12.5, 12.6 & 15.4	CoW defined based on industry practice.
19	30 minutes	12.5	NFPA® 51B Standard for Fire Prevention During Welding, Cutting, and Other Hot Work
20	20 air changes	13.2	Industry guidance - SafeHouse
21	1.5m (5ft)	Table 22	CoW defined based on industry custom and practice
22	25-50 Pa or 0.1-0.2in	Table 22	Industry guidance - SafeHouse

No.	Value	Section	Source
23	25Pa	Table 23	Industry guidance - SafeHouse
24	240Vac or 120Vdc.	Table 24 & Table 29	CoW defined with GOO central senior electrical engineer approval
25	19mm (3/4in) max valve <50 barg for BC and Non-BC>50barg	Table 24	CoW defined. Decision taken with UEC based on a practical approach
26	<10 barg (US 150 psig).	14.6, 14.14.10, 14.22 & Table 26	CoW defined. 150 psi reflects the fact that many regions use 150psi spec pipework. Limitations or standards that require 10bar, this can include a 150psi rating.
27	25kg (50lb)	14.10	OSHA 1910.147
28	10 minutes	Figures 15,16 & 17	bp Custom and practice based on Code B31.3
29	<50V ac or dc	14.18.2, 14.19	GOO central senior electrical engineer defined
30	≤ 20mm, ¾in	14.19	CoW defined
31	<50 barg	14.22	CoW defined
32	180 days	14.28	500102 BP Practice Control of Work Integrated Practice
33	90 and 365 days	14.28	CoW defined
34	Multiple voltages	Table 28	GOO central senior electrical engineer defined based on: IEC 60038 and NEMA C84.1
35	Multiple voltages	Table 29	GOO central senior electrical engineer defined based on: IEC 60038 and NEMA C84.1
36	0.5m/sec (100 ft/min)	15.5.1, 15.5.3	OSHA 1910.252(c)(2)(ii)
37	8 and 20 ACH	15.5.3	2001 American Industrial Hygienist Association Confined Space Entry Protocol Guide
38	57m^3/min (2,000 ft^3 /min)	15.5.3	OSHA 1910.252(c)(2)(ii)
39	60°C (140°F)	15.7	CoW defined based on HSE guidance on scalding or burning hazards.
40	50 ppm	16.7.1 & 6.4.3	API 660
41	50%LEL	16.7.2	GP 60-20
42	1barg (14.5 psig).	16.7.3	CoW defined based on industry practice
43	95°C (203°F)	16.7.3	CoW defined based on industry practice
44	20% safety factor	16.8	In consultation with process engineering with consideration of American gas associated purging manual. Fourth edition
45	4 feet (1.2 m)	17	OSHA 1910.28(b)(2)(i)
46	0.1m (4in) high.	17.3	OSHA 29 CFR 1910.23(e)(4)
47	0.95m (37in) high	17.3 & 22.1.2	US OC 200/31 - The work at height regulations
48	0.47m (18in).	17.3	OSHA 1926.451(g)(1)(vii) BS EN 12811
49	90 kg (200lb)	17.3	OSHA 1926.502(b)(3)
50	12kN (2700 lbf) and 18kN (4047 lbf)	17.5	EN 795:2012 European standard relating to the testing of personal fall protection equipment – Anchor Devices

No.	Value	Section	Source
51	Multiple values	17.5	CoW defined based on calculations from Alaska engineering team
52	12 months	17.8.2	BS EN 365:2004 Personal protective equipment against falls from a height. General requirements for instructions for use, maintenance, periodic examination, repair, marking and packaging
53	10%	17.11.2	Sourced from HSE & IEC guidance
54	0.3m (12in)	18.2 & 22.1.3, 22.1.4 Table 40	OSHA Walking-Working Surfaces Regulation 29 CFR 1910.21-30
55	6 months	18.3.1	100572 bp Procedure Management of Lifting Operations and Lifting Equipment
56	<250 ppm	19.3 & 19.7	UEC mechanical seta interpretation of GP 06-29
57	50ppb	19.3 & 19.7	GP 06-29
58	8 barg (116psig)	19.4 & Table 37	GP 32-40
59	90%, 30%, 90%	19.6, 19.9, Figure 21 & Table 37	GP 32-40
60	65°C (149°F)	19.7	CoW defined
61	2°C (35°F)	19.	Custom and practice based on ASME design codes
62	95%	19.8	CoW defined based on normal industry practice. UEC Approved
63	99-99.5%	19.8	UEC supplied catalyst manufacturer recommendations to avoid exotherms
64	90%	19.9	UEC supplied industry design practice
65	110% to 150%	Table 37	UEC supplied industry design practice
66	15scf a year from a 6mm (¼in) tube.)	Table 37	GP 32-40
67	Multiple values based on helium tracer	Table 37	GP 32-40
68	4-5 barg (60-75 psig) or 25%	19.15	CoW defined based on GP 32-40
69	30 minutes	19.15	30 Mins from GP32-20 and GP 32-40. 10 minutes for low volumes (volume defined by CoW based on UEC input) based on process piping codes B31.1
70	90%	19.22	CoW defined based on UEC guidance
71	12 hours	20.1	CoW defined based on bp custom and practice
72	0.3m (12in)	21	CoW defined based on industry practice
73	>1.2m (4ft)	21	OSHA 1926.651(g)(1)(i)
74	6.7m (25ft)	21	OSHA 29 CFR 1926.651 and 1926.652 21
75	0.5m (18in)	21.4	UK. HSE: HSG47 (Third edition), Avoiding danger from underground services
76	2m (6ft 6in)	21.4	Cow Defined based on APWA guidance
77	300mm	21.4	UK. HSE: HSG47 (Third edition), Avoiding danger from underground services
78	Multiple values	Table 39	OSHA Technical manual: Excavations: Hazard Recognition in Trenching and Shoring
79	1.07m (42in)	22.1.2	OSHA 1926.502 & HSE WAH regs 2005
80	0.47m (18.5in	22.1.2	BS EN 12811

No.	Value	Section	Source
81	366kg/m^2 (75lb/ft^2)	22.1.7	Cow Defined based on equivalent load limit to scaffolding board
82	≥50 V ac or dc	22.2	GOO central senior electrical engineer guidance based on the principle that live equipment is hazardous above 50 V as referenced in NFPA70E and UK HSE HSG85
83	Multiple values	Table 41	NFPA70E
84	Multiple values	Table 42	NFPA70E
85	1 year & 2 years	Table 43	CoW defined based on Oil industry practice
86	365 days for Type 1 locked valves. 730 days for Type 2 locked valves	23.6	CoW defined based on Oil industry practice
87	Multiple gas alarm limits	24.1, 24.4	Based on international regulations and guidance and Approved by S&OR IH Director
88	5ppm & 10ppm	24.4	bp S&OR Senior Industrial Hygiene Director guidance
89	10% LEL or 19% oxygen	24.5	IH community guidance
90	200 ppm	24.6	ACGIH, NIOSH, OSHA and EH40
91	4.4%	24.8	GP 60-20
92	16.5%	24.8	GP 60-20
93	120°F (50°C)	Figure 31	CoW defined based on industry practice
94	10 minutes	24.15	IACS & ICS industry practice
95	Multiple values	Table 46	CoW defined based on international legislation and guidance. Approved by S&OR IH Director
96	Multiple values	Table 47	Cow defined based on bp custom and practice
97	No more than 14 days apart	25.6	CoW defined
98	Multiple values	Table 51	CoW defined
99	Multiple values	Table 52	CoW defined
100	All	Table I1	CoW defined, guided by GP 44-40 Design for Isolation of Equipment for Maintenance and Emergency
101	Multiple values	Table L1-L8	500195 bp Practice Use of Temporary Ladders GDP 4.5-0002
102	0.5m below HH trip	22.17.1	CoW defined based on discussions with regions
103	zone 0 or class 1 zone 0 or class 1 division 1	15.4	Provided by Upstream S&OR and based on U.K. HSE Confined Space regulations
104	<10% OEL	15.5.1	UK HSE Guidance Document EH40 or US National Institute for Occupational Safety and Health (NIOSH) guide to chemical hazards)
All sources marked as 'CoW defined' have been Approved by the CoW Governance Board which consists of GOO, GPO, GWO and S&OR.			