INERT ENTRY OPERATIONS PROCEDURE

V:2024.1.2

Industrial Performance Services ★ Industrial Tubular Catalyst Services

Inert Entry Operations Procedure

May 2024

PURPOSE

It is the fundamental rule of our company to take every precaution to protect the health and well-being of personnel entering confined spaces or other areas in which hazardous atmospheres may be present.

This procedure defines the minimum requirements that must be in place at each IPS★ITCS jobsite to protect IPS★ITCS employees, the Client, and other contract personnel from the hazards associated with entering and / or working near vessels purged with nitrogen or other inert gases (e.g., argon, carbon dioxide, etc.).

This procedure sets out the rules and principles that must be followed to:

- safeguard personnel working in hazardous atmospheres.
- guard against any unauthorized people intending to enter dangerous areas.
- outline inert entry and rescue procedures all procedures will be followed

SCOPE

This procedure applies only to work performed under inert atmospheric conditions.

Confined Space Work performed in non-inert atmospheric conditions is covered under the Confined Space Procedures found in Section 25.0 of the IPS★ITCS Safety Procedures Manual.

Compliance

The main components of the inert entry system must be designed and constructed to meet the following standards:

• Grade “D” Compressed Breathing Air	29 CFR 1910.134 ANSI/CGA G-7.1 NIOSH 202-100

• Egress Cylinder Assembly	29 CFR 1910.134 ANSI/CGA G-7.1 API 2217A – 2217 NIOSH 202-100 Blackbox Technologies
• Regulators, Gauges and Manifolds	29 CFR 1910.134 ANSI/CGA G-7.1 API 2217A – 2017 NIOSH 200-000 Blackbox Technologies
• High-Pressure Air Hose Manifolds	29 CFR 1910.134 ANSI/CGA G-7.1 API 2217a – 2017 Blackbox Technologies
• Low-Pressure Air Hose Umbilicals	29 CFR 1910.134 API 2217A – 2017 NIOSH 201-043 NIOSH 200-053 NIOSH 203-003 Blackbox Technologies
• Fall Protection and Retrieval	29 CFR 1926.503 29 CFR 1910.146 NFPA 1983 – 2017 NIOSH 201-045 Blackbox Technologies
• Safety Harness	29 CFR 1926.503 29 CFR 1910.146 NFPA 1983 – 1997 API 2217A – 2017 NIOSH 202-008-1 NIOSH 202-008-2 Blackbox Technologies
• Helmet	29 CFR 1910.134 API 2217A – 2017 NIOSH 13F-0800 NIOSH 200-000 Blackbox Technologies

NOTE: *See **HSE.PRO.Edelhoff-Blackbox Commander Helmet Procedure** for additional information*

OBJECTIVES

Employees will be trained prior to entry into an Inert Space and the training will be certified by IPS★ITCS. IPS★ITCS provides training for all employees whose duties include working in or around Inert Space. IPS★ITCS certifies that the required training has been accomplished. The certification includes employee name, trainer signature / initials, and dates of training. Certification is available to employees & their authorized representative.

Each Customer's Site Inert Entry Safety Guidelines and / or Operating and Maintenance Procedures will be compared for a gap analysis and the more stringent policy will be followed.

Personnel working inside the vessel will be required to exit the confined space after working continuously for 4-hours based on the API 2217A "Guidelines for Safe Work in Inert Confined Spaces in the Petroleum & Petrochemical Industries", and re-entry will not be allowed until a time period of 30-minutes have elapsed. No person will be required to remain inside the vessel longer than he or she feels comfortable. As necessary, when personnel are working in multiple bed reactors, variations / deviations to the 4-hour maximum time limit might be necessary and will be discussed with IPS★ITCS senior management and client contact.

DEFINITIONS

1. **ALS** – Advanced life support, i.e., EMT, Paramedic, Doctor
2. **Confined Space** – A space that: a) is large enough and so configured that an employee can bodily enter and perform assigned work; b) has limited or restricted means for entry or exit (e.g., tanks, vessels, reactors, silos, storage bins, hoppers, vaults, and pits are spaces that may have limited means of entry); and c) is not designed for continuous employee occupancy.
3. **Module Operator (MO)** – An employee who has completed the IPS★ITCS MO certification class which is provided by the company and is responsible for the safe operation of the Blackbox Technologies Life Support System. The MO is also responsible for maintaining the required documentation for the inert entry which is listed in this procedure.

4. **EES** – Emergency Egress System. Consists of at least a two (2) bottle system of 300 ft^3 breathing air cylinders filled with compressed certified and tested breathing air. Bottles are pigtailed together, a regulator attached with a splitter and yellow EEL (Emergency Egress Lines) attached to the splitter. This is a complete and independent system which is not included nor connected to the Primary and/or Secondary Life Support System. An EEL line must be provided and attached to this system for each of the helmets. The line must be always within reach of the entrant unless this line will cause an entanglement hazard for the entrants.
5. **EEL** – Emergency Egress Line is a yellow breathing airline which is connected to the EES (Emergency Egress System).
6. **Entry Supervisor** – The person responsible for determining if acceptable entry conditions are present at a confined space where entry is planned, for authorizing entry, overseeing entry operations, for terminating entry. The duties of entry supervisor may be passed from one individual to another during an entry operation. These responsibilities also may be transferred between the owner and contractors.
7. **Fit Testing** – The process of evaluating a respirator's sealing characteristics for a specific user and the respirator's performance for the user-controlled conditions. For inert entry, fit testing of respiratory protection equipment shall include the specific equipment which will be used for entry.
8. **Hazard** – A situation or inherent chemical or physical property with the potential to do harm (flammability, oxygen deficiency, toxicity, corrosive, stored chemical or mechanical energy).
9. **Hazardous Atmosphere** – An atmosphere that may expose employees to the risk of death, incapacitation, impairment of ability to self-rescue, injury, or acute illness from oxygen deficiency or enrichment; flammability or explosion potential; or toxicity (as set forth in OSHA Regulation 1910.146[b]).
10. **Hot Zone** – The area around the entrance to the inerted confined space most likely to be affected by effluent gases; sometimes called the "restricted area" and/or "exclusion zone".
11. **IDLH** - (Immediately Dangerous to life and health). The traditional NIOSH definition for published IDLH values is the maximum concentration of an air contaminant from which one could escape within 30-minutes without a respirator and without experiencing any escape-impairing or irreversible health effects. Total loss of respiratory protection in an inert atmosphere can cause virtually immediate impairment and result in rapid asphyxiation. While inert atmospheres are indeed IDLH by NIOSH criteria, the hazard is much more immediate and severe.

12. **Inert Confined Space** – A confined space where the existing atmosphere is intentionally displaced with a non-flammable gas, such as nitrogen, creating an inert atmosphere in the confined space. As used in this procedure, an inert atmosphere is oxygen deficient (typically below 4% O_2) and is an immediate asphyxiation hazard.
13. **Inert Entry** – Entry into a confined space with an inert atmosphere starts as soon as any part of the entrant's body breaks the plane of an opening into the space. "Entry" includes all subsequent activities in the inert confined space.
14. **Inerting** – The process of eliminating the potential for a flammable atmosphere by using an inert gas such as nitrogen or carbon dioxide to displace oxygen required for ignition.
15. **Lower Flammable Limit (LFL)** - The minimum concentration of a vapor in air (or other oxidant) below which propagation of flame does not occur on contact with an ignition source. The Lower Flammable Limit is usually expressed as a volume percentage of the vapor in air. Sometimes called Lower Explosive Limit (LEL).
16. **Safety Data Sheets (SDS)** – Written or printed material concerning a hazardous chemical and prepared in accordance with OSHA's Hazard Communication Standard, ANZI Z 400.1, or comparable international standard. A SDS provides data on physical properties, safety, fire, and health hazards for a particular chemical, mixture or substance.
17. **Oxygen-Deficient Atmosphere –** An atmosphere in which the oxygen content is below that needed for normal human function without impairment. For inert entry, the typical oxygen content (below 4% in inert entry situations) is very much less than the oxygen-deficient definition often used (e.g., by OSHA) of "atmosphere containing less than 19.5% oxygen by volume." Inert entry requires much lower oxygen concentration percentages to provide a working environment, minimizing fire hazards by maintaining the oxygen level low enough to prevent combustion.
18. **Parts Per Million (PPM)** - 10,000 ppm in one percent.
19. **Permit** – An entry permit means a written or printed document provided by the employer or authorizing entity to allow and control entry into a permit space which contains the information specified in OSHA 1910.146 paragraph [f] or equivalent.
20. **Pyrophoric** - A material (e.g., iron Sulfide or certain carbonaceous materials) that, when exposed to air, can spontaneously oxidize and heat, providing a source of ignition if a flammable vapor/air mixture is present.
21. **Risk** – The probability and consequences of exposure to a hazard, hazardous environment or situation which could result in harm.

22. **Risk Assessment** – The identification and analysis, either qualitative or quantitative, of the likelihood and outcome of specific hazard exposure events or scenarios with judgments of probability and consequences.
23. **Risk Based Analysis** – A review of potential needs based on a risk assessment.
24. **Upper Flammable Limit (UFL)** – The maximum concentration of a flammable vapor in air (or other oxidant) above which propagation of flame does not occur on contact with an ignition source. The Upper Flammable Limit is usually expressed as a volume percentage of the vapor in air (sometimes called the Upper Explosive Limit [UEL]). In popular terms, a mixture containing a percentage of flammable vapors above the UFL is too “rich” to burn and one below the LFL is too “lean” to burn.

ROLES AND RESPONSIBILITIES

IPS★ITCS Team Protocols

1. The supervisor has the overall responsibility for the job with regards to safety, progress, records and contact with client's representatives etc.

2. One individual will be responsible for the operation of the Breathing Air Cylinders at any one time during an entry under inert conditions.

3. One individual (to enter the vessel) will be fully equipped to meet all the dangers inside the vessel.

4. One individual (suited up) will be outside the vessel entry/exit point to watch and assist the individual inside the vessel.

a. **Project Supervisor**

- Requirements:
  - Leadership, supervision, and client liaison skills
  - Certified inert entry technician
  - Knowledge of site and reactor
  - Familiar with job scope and all equipment
  - Commitment to safety

- Responsibilities:
  - Establish channel of communication with plant supervisors
  - Obtain permits to work
  - Ensure all equipment is set out correctly
  - Brief all employees of the safety requirements and job scope
  - Ensure that signage is placed at appropriate sites to warn of N2 presence
  - Ensure all equipment is within test date
  - Establish an order in which personnel will enter
  - Check reactor atmosphere for suitability to enter
  - Monitor activities inside the reactor
  - Report to client as soon as possible the need for spare parts General liaison with client
  - Complete all QA/QC documentation and have signed off
  - Prepare a job report
  - Oversee of the clean-up of pyrophoric/hazardous materials
  - Control of equipment on site
    - Report defect equipment, by use of tag out system.
    - Security of equipment
    - Third party equipment

b. **Module Operator ***

- Requirements:
  - Certified inert entry technician
  - Project experience Commitment to safety

- Responsibilities:
  - Ensure all air lines are securely connected
  - Test alarms
  - Ensure communications panel is charged and working
  - Ensure that all air Cylinders are connected (as per Inert Entry Requirements)
  - Monitor all pressure gauges on the panel
  - Control the operation of the panel during an inert entry
  - Communicate to ground support to change Cylinders when necessary (low pressure - before alarm sounds)
  - Communicate with and relay messages from person inside Liaise with project supervisor
  - Fill out inert entry checklist
  - Fill out the Inert Entry Module Operator Log
  - Ensure acceptable inert entry conditions; Is responsible in the first instance to control emergency

c. **Inert Entry Technician** *

- Requirements:
  - Certified inert entry technician
  - Commitment to safety

- Responsibilities:
  - Check all equipment about to be used and make sure that it is clean and fit for purpose
  - Ensure all correct PPE is worn
  - Check integrity of all hose connections to the harness
  - Check egress Cylinder is full
  - Ensure communications are functioning correctly
  - Check reactor atmosphere
  - Enter the reactor in an orderly and safe manner
  - Work safely and efficiently while inside
  - Continually inform the top-hole personnel of the status of work
  - Clean-up of pyrophoric/hazardous materials
  - Check all lines and hoses are free from obstruction before exit
  - Change coveralls after exiting vessel and wash as soon as possible
  - Brief next entry person on status of work

d. **Stand-by Person** *

- Requirements:
  - Certified inert entry technician
  - Commitment to safety

- Responsibilities:
  - Primary responsibility is to ensure that the technician entering the vessel is appropriately dressed for entry under inert conditions
  - Check all equipment about to be used and make sure that it is clean and fit for purpose
  - Ensure all correct PPE is worn
  - Check integrity of all hose connections to the harness
  - Check egress Cylinder is full
  - Ready all lights and tools necessary for the work
  - Ensure trip hazard is minimized on reactor top
  - Connect fall arrester to entry operator
  - Assist entry operator to enter and inform of any hazards
  - Lower equipment and tools as required
  - Check reactor atmosphere
  - Assist entry operator to exit the reactor
  - Cover the reactor manway and make safe (manway Locking device)
  - Brief next entry person on status of work

e. **Second Stand-by/Assistant * Top Supervisor**

- Requirements:
  - Certified inert entry technician
  - Commitment to safety

- Responsibilities:
  - Assist top hole stand-by
  - Tidy the area Assist panel watch
  - Direct crane if being used
  - Assist entry operator to enter and inform of any hazards
  - Lower equipment and tools as required
  - Check reactor atmosphere
  - Assist entry operator to exit the reactor
  - Cover the reactor manway and make safe (manway Locking device)
  - Assist with QA documentation

f. **Ground Support Personnel**

- Requirements:
  - Ability to run all ground activities
  - Knowledge of inert entry activities
  - Commitment to safety

- Responsibilities:
  - Ensure all equipment is set out in an orderly manner
  - Brief all ground support personnel on their duties
  - Ensure all personnel wear correct PPE
  - Direct forklifts
  - Maintain regulated area and keep non-authorized personnel out
  - Ensure drums are lined and labelled correctly
  - Monitor catalyst flow and temperature
  - Monitor nitrogen flow and supply
  - Monitor air supply (e.g., Cylinder connections and changeovers)
  - Clean-up of pyrophoric or hazardous materials
  - Ensure liners are tied and lids are sealed
  - Ensure the drums are stored in an appropriate location
  - Liaise with Project Supervisor
  - Assist with control of QA/QC
  - Know what is always happening on top and inside the vessel
  - Control project area

NOTE: *Trades marked with "*" should be skilled in all duties to allow for rotation of people.*

PROJECT PROCEDURES FOR INERT ENTRY

Pre-Contract Meeting

- Prior to commencing any inert entry work, a pre-contract meeting between the client and IPS★ITCS must be held.

- Personnel required to attend the meeting would normally include:
  - Client mechanical, maintenance, engineering and process and operations personnel
  - Client and IPS★ITCS safety personnel
  - IPS★ITCS Project Manager and/or Supervisor

- The meeting should address the following issues:
  - Site/Plant rules
  - Designation of working areas
  - Positioning of barricading
  - Information on the vessel/job/blinding
  - Loading diagrams and requirements
  - Catalyst storage locations and requirements
  - Catalyst disposal
  - Location of the IPS★ITCS equipment (i.e., screeners, vacuum units etc)
  - Location of the nitrogen bullet (if used in the process)
  - Induction/Training of personnel involved in the activity
  - Interaction of mechanical personnel with inert entry work (i.e., maintenance of blinding, elbow removal and replacement etc)
  - Screening requirements of the catalyst
  - Safety procedures (including review of the JSEA's)
  - Compatibility of IPS★ITCS equipment with site facilities (i.e., hose connections, electricity supply, etc)
  - Site security
  - Rescue procedures
  - Preparation at Work Site
  - Equipment layout plan in order to place materials in an orderly, functional manner
  - The clean-up of pyrophoric/hazardous materials
  - Utilities supplied by the client for proper use by the contractor

- Safety facilities such as showers, eye wash, medical center, safe areas etc.
- Placement of barricading and signs to restrict the area to prohibit all personnel not directly involved with the inert entry from entering a potentially dangerous area
- Contacts with client's representative/s.

Life Support Equipment

Life support equipment is to be inspected according to the Inert Entry Checklist to confirm that all components are functioning properly. Visual checks must be made before any and every entry is made.

Other Equipment and Facilities

Other equipment and facilities either supplied by the client and/or IPS★ITCS such as:

- Vacuum unit
- Screening machine
- Recirculation unit
- Dust collection equipment
- Drums/palets/lids/clamps/trash cans, etc.
- Hoisting/transport equipment
- Safety equipment
- Utilities etc,

- Must be inspected prior to the project commencing (and regularly throughout the duration of the project) to ensure that the equipment is operational and fit for use.

- The rescue equipment is to be positioned as close as possible to the manway at which the inert entry is being performed.

Project Kick-Off Meeting

At the commencement of the inert entry project, the Project Supervisor must hold a project kick off meeting with all personnel involved in the project.

- The kickoff meeting should cover the following:
  - expected condition of the vessel into which the entry is to be made (i.e.: temperature, atmospheric conditions, location and condition of internals, the types and quantities of catalyst, balls, baskets, grids, plates etc).
  - a review of the JSEA relevant to the work to be done.
  - allocate specific tasks to members of the crew.
  - review inert entry requirements for the vessel being worked on; and
  - review rescue procedures
  - QA/QC requirements
  - Permit system/requirements

- A comparison can be made with similar previous jobs to determine the most practical and safest approach.

- Pre-planning every aspect of the job is required to complete the job successfully. Refer to the following listed forms:
  - Job Hazard & Environmental Analysis
  - Project Planning Form
  - Blind(s) Acceptance List
  - Rescue Pre-Plan
  - Rescue & Fall Protection Equipment
  - Pre-Job Meeting Form
  - Crew List & Crew Training Records
  - Nitrogen Awareness & Handling Policy
  - Blackbox Technologies Operation Manual 2022
  - Inert Entry Checklist

- IPS★ITCS employees will be involved in the operation to provide the contractor with the proper knowledge, task expectations and accountability to complete the job safely. Site documents shall incorporate thorough preplanning procedures to include:
    1. IPS★ITCS's Operations and HSEQT representatives will review the customer's written site safety and emergency/rescue plan prior to arrival or start of work in an effort to identify any gaps between procedures. If gaps are identified issues will be resolved prior to the start of work and the most stringent procedure will be followed.

2. Prior to inert entry, IPS★ITCS will coordinate a meeting to discuss the written plan for performing work under inert conditions and their emergency procedures. Meeting attendees shall include:
    - Project Manager
    - Superintendents
    - Supervisors
    - Site Safety Coordinator
    - Module Operator
    - Leads
    - Technicians
    - Customer Site Contact
3. Results of this meeting shall be documented, and action items must be completed prior to start of the inert entry job.
4. IPS★ITCS will provide the Customer with written documentation prior to commencement of work supporting qualifications for working in an inert environment. The minimum documentation required shall include:
    - Employee service and current training records for all crew members
    - Certification of emergency/rescue training
    - Documentation of Confined Space Entry training
    - A written procedure for performing work, including:
        a. Job Safety & Environmental Analyses (JSEA)
        b. Rescue Plan for work as defined below.
5. IPS★ITCS will perform, prepare, and conduct a written Job Hazard Analysis (JHA) and/or a Job Safety & Environmental Analysis (JSEA) prior to entry of the vessel, specific to the vessel being entered and the work being undertaken. The supervisor will communicate the Job Hazard Analysis (JHA) and Job Safety & Environmental Analysis (JSEA) to all involved personnel. The Job Hazard Analysis (JHA) and Job Safety & Environmental Analysis (JSEA) needs to address all the risks associated with the work such as:
    - Setting up the inert entry and catalyst handling equipment at the work site
    - Access and egress to the equipment
    - Provision for adequate lighting
    - Restricted Zone / Exclusion Zone
    - Control of employee access
    - Control of access around the work site and around any open manways where nitrogen is being vented

- Lifting and rigging activities
- Manual handling activities
- Catalyst handling
- Removal of vessel internals (scale traps, internal manways, trays)
- Installation and operation of catalyst dump valve
- Catalyst loading
- Installation of warning signs utilizing international caution / danger symbols.
- Air supply to EEL will be provided to ensure air supply (such as a 2-bottle cart)

Vessel Conditions for Inert Entry Activities (All other Sub-Sections)

- Prior to entry being made into an inert vessel, the inert entry crew is to check:
  - all blinding
  - connection of the utilities to, or in, the vessel for leakage and correct supply etc
  - check that either a regulator, flow meter/indicator and pressure gauge is present on the inlet of nitrogen supply to the vessel to ensure that a pressure build-up cannot take place (Grubs Manifold)
  - the inert entry limits are satisfied (see Table 1)

Table 1
Inert Entry Limits

Criteria	Limit
Benzene	<1ppm
Furfural	<2ppm
Hydrogen sulphide	<10ppm
Lower Explosion Level	<5% (for initial entry)
Nickel Carbonyl	<0.05ppm
Arsenic	<0.05mg/m^3
Oxygen	<3% volume maximum
Temperature	<100^{O}F

NOTE: *If Benzene, Furfural, Nickel Carbonyl or Hydrogen Sulphide levels exceed those specified above, consideration should be given to further purging of the vessel and/or upgrading the protective clothing to work by the technicians entering the vessel/space.*

- In the event the entry criteria cannot be achieved and/or cannot be maintained, entry into the space/vessel must be suspended and the work activities (including the level of personal protective equipment utilised) and environment reviewed.

Benzene Considerations

- Vessels containing concentrations of benzene above 1ppm should not be entered without respiratory protection. Because catalyst work is generally performed under a nitrogen blanket, the risk of inhalation of Benzene is eliminated because technicians are wearing supplied air respiratory protection. As such, the next most hazardous route of exposure will be skin absorption – an acknowledged low level exposure route.

- It is acknowledged that attaining 1ppm Benzene concentrations inside reactor vessels may not always be possible. In this case, the following personal protective equipment guidelines should be adopted by personnel when entering vessels with Benzene concentrations:

Table 2
PPE Requirements for Personnel Entering Benzene Contaminated Vessel/Space

Concentration	Clothing
0 < 1ppm	Standard overalls
> 1ppm < 100ppm	Standard overalls with covering Tyvek protective overalls
> 100ppm < 1200ppm	Gas suit
> 1200ppm	Evacuate reactor and ascertain reason for LEL environment

NOTE: *Due to presence of Nitrogen, supplied air respiratory protection required as mandatory equipment for all persons entering that space*

- Due to the action of a nitrogen purge on a vessel, personnel working at the open manway can potentially be exposed to Benzene. If Benzene concentrations in the area surrounding the manway are high, consider adopting other control actions:
  - Tarp over manway (to deflect vapours away from the technicians)
  - Relocate the panel and other operations to a location upwind of the vapor plume
  - Supply of personal protective equipment as outlined below (see Table 3) (for concentrations monitored in the technicians personal breathing space).

Table 3
PPE Requirements for Working in Benzene Areas
(Outside the Vessel/Space)

Concentration	Respiratory	Clothing
0 < 1ppm	No respiratory protection required	Standard overalls
> 1ppm < 25ppm	Air purifying respiratory protection (half face with organic vapour filters)	Standard overalls
> 25ppm	Supplied air respiratory protection	Standard overalls with Tyvek overalls

NOTE: *Personnel working outside the vessel will not be exposed to excessive Benzene concentrations for excessive periods of time and as such the wearing of a gas suit has not been deemed necessary.*

Nickel Carbonyl Considerations

Table 4
PPE Requirements for Entering Nickel Carbonyl Contaminated Vessel/Space

Concentration	Clothing
0 < 0.025ppm	Standard overalls
> 0.025ppm < 50ppm	Standard overalls with covering Tyvek protective overalls
> 50ppm < 250ppm	Gas suit
> 250ppm	Evacuate reactor and ascertain reason for high Nickel Carbonyl concentration

NOTE: *Due to presence of Nitrogen, supplied air respiratory protection required is mandatory equipment for all persons entering that space.*

- Due to the action of a nitrogen purge on a vessel, personnel working at the open manway can potentially be exposed to Nickel Carbonyl. If Nickel Carbonyl concentrations in the area surrounding the manway are high, consider adopting other control actions:
  - Tarp over manway (to deflect vapors away from the technicians)
  - Relocate the panel and other operations to a location upwind of the vapor plume
  - Supply of personal protective equipment as outlined below (see Table 5) (for concentrations monitored in the technicians personal breathing space).

Table 5
PPE Requirements for Working in Nickel Carbonyl Contaminated Areas (Outside the Vessel/Space)

Concentration	Respiratory	Clothing
0 < 0.025ppm	No respiratory protection required	Standard overalls
> 0.025ppm < 2ppm	Air purifying respiratory protection (full face)	Standard overalls (including gloves)
> 2ppm < 50ppm	Supplied air respiratory protection	Standard overalls with Tyvek overalls

NOTE: *Personnel working outside the vessel will not be exposed to excessive Nickel Carbonyl concentrations for excessive periods of time and as such the wearing of a gas suit has not been deemed necessary*

Furfural Considerations

Table 6
PPE Requirements for Personnel Entering Furfural Contaminated Vessel/Space

Concentration	Respiratory Protection	Clothing
0 < 1ppm	No respiratory protection required	Standard overalls
> 1ppm < 50ppm	Air purifying respirator (full face)	Standard overalls with covering Tyvek protective overalls
> 50ppm	Supplied air respiratory protection	Gas suit

NOTE: *Due to presence of Nitrogen, supplied air respiratory protection required is mandatory equipment for all persons entering that space.*

- Due to the action of a nitrogen purge on a vessel, personnel working at the open manway can potentially be exposed to Furfural. If Furfural concentrations in the area surrounding the manway are high, consider adopting other control actions:
  - Tarp over manway (to deflect vapors away from the technicians)
  - Relocate the panel and other operations to a location upwind of the vapor plume
  - Supply of personal protective equipment as outlined below (see Table 7) (for concentrations monitored in the technicians personal breathing space).

Table 7
PPE Requirements for Personnel in Furfural Contaminated Areas (Outside the Vessel/Space)

Concentration	Respiratory	Clothing
0 < 1ppm	No respiratory protection required	Standard overalls
> 1ppm < 50ppm	Air purifying respiratory protection (full face)	Standard overalls with covering Tyvek protective overalls
> 50ppm	Supplied air respiratory protection	Standard overalls with covering Tyvek protective overalls

NOTE: *Personnel working outside the vessel will not be exposed to excessive. Furfural concentrations for excessive periods of time and as such the wearing of a gas suit has not been deemed necessary.*

Temperature Considerations

- In some circumstances the reduction in temperature to this level is not possible.
- The following are general recommendations to be considered and implemented when and where possible to reduce the impact of heat stress on individuals entering and working inside vessels:

- The use of cool suits/vortex type systems and/or reflective thermal suits. This will usually assist the person carrying out the work to maintain a stable body temperature.

NOTE: *In some reactors it may not be practicable to wear this additional protective equipment as it either restricts the wearer (already wearing full BA Equipment) or allows too much oxygen to enter the atmosphere you are working in and puts the person at greater risk from other sources.*

- Where the use of specialized heat minimization clothing and/or equipment is to be considered, please refer to the HSE Manager for guidance on the development of a project specific safety management plan.

- If work is to take place in temperatures above 100^0F (40^0C) and they are not using a cooling system, then the worker must be closely monitored (eg, personal heat stress monitoring etc.) and strict safety management guidelines adopted and adhered to. The team must ensure that a suitable work/rest schedule and rotation system is adopted to ensure that no individual is exposed to excessive heat stress conditions.

- A documented heat stress plan will be available on-site at all times. This plan will outline the IPS★ITCS ***HSE.PRO.Heat Stress Management Procedure.2023*** for managing heat stress incidents effectively. It will include guidance on recognizing heat stress symptoms, first aid procedures, a work/rest regimen based on the ACGIH Threshold Limit Values, escalation protocols, and other relevant information.

- IPS★ITCS does not encourage working in hot environments and believe that when the vessel can be cooled to <100^0F (<40^0C), then this is the preferred method. The client must understand that when temperatures are increased, productivity will be reduced through both the impact of the heat on the workers and the additional weight needed to be carried by the worker as personal protective equipment.
- All work is to be undertaken using the complete IPS★ITCS life support system, including communications equipment. This enables suitable monitoring of inert entry personnel and a continuous log of heat exposure as a preventative measure. In addition, this equipment facilitates immediate communication and ensures timely response and assistance in case of heat stress incident.

Client Issues Related to Vessel Entry

Work Permits

- The work permit system will vary from client to client.
- Prior to the commencement of the work, valid permits are required in which all arrangements and special conditions are recorded. This should be approved and signed by all the necessary parties.

- In some circumstances it is usual to have in place two or more permits, i.e.
  - Vessel entry permit
  - Hot work permit
  - Cold work
  - Vehicle entry

- In all cases, there will have to be checks of blinds list of equipment etc., prior to issue.

- Usually, the permit will be issued by the operations department or the contract engineer and be countersigned by the members of the inert entry crew undertaking the work. The required tests or inspections described have to be performed before the issue of the permits and at the stated intervals, thereafter, should the need arise.

- After any long breaks in the work schedule, the permits should be renewed.

- If the first test has proved acceptable for entry, it is probably not necessary to stop the work in anticipation of the results of the following tests.
- All test results should be noted on the permits.

- Should any conditions in the vessel or area change, then all parties involved in the issue of the permits should be notified and conditions checked.

Access

- Access to the platform or barricaded area should be restricted to IPS★ITCS personnel only. No other authorized personnel are permitted unless agreed by the IPS★ITCS Manager/Supervisor.
  - External area hazards should be considered to determine the perimeter of this regulated area.
  - There will be a minimum of 4-feet from the vessel opening or manway for the protection of the employees.

- Barricade the work area and post “Vacuum Operation” signs in accordance with the Vacuum Operations procedure.
  - Signs should state the following:

- Post “Danger – Nitrogen” Signs in specified locations.
  - Signs should state the following:

Weather

- It is also important to check the weather forecast prior to work commencement as weather conditions can play an active role when accidents occur. For example:
  - High ambient temperature
  - Low wind speed from variable directions
  - High or low humidity

- It is always important when working in close vicinity to the entry/exit points of the vessel to keep to the windward side.

Entry

- When all conditions have been met, the technician will enter the vessel and/or atmosphere. Their entry will be assisted by the second technician (stand-by person) suited up outside the vessel. Stand-by personnel cannot leave their post until they are relieved. At all times, people not wearing life support equipment must be upwind from the vessel or atmosphere. An air purifying respirator may be necessary for some support crew activities.

- Entry is usually accomplished using fixed rigid ladders.

- When ladders are used, fall arrest equipment must be used by the individual ascending/descending the ladder. Where possible, a mechanical hoist to assist in emergency use should be available at the work site.

- During descent or ascent, all slack must be kept out of the umbilical. Care must always be taken to ensure that there are no twists or that the umbilicals are not twisted around other obstacles inside the vessel as this will restrict movement and disrupt an emergency attempt.

Identification of Hoses and Manifolds

- All hoses and manifolds to be identifiable (either labelled or color coded) to enable technicians to easily identify the function of individual hoses and to verify that the hose to manifold connections are correct.

Work Area

- When the technician reaches the work area, he will inform the personnel on the entry/exit point, his location, and conditions.

Dangerous Locations

- During inert entries and/or dumping, contact with dangerous chemical substances is possible at several locations:
  - the platform of a vessel
  - the inside of the vessel
  - the surroundings of a dump nozzle during dumping or screening
  - the inside of a vessel after ventilation
  - the roped off area around the workplace.

- It is essential to monitor, at regular intervals, the atmosphere at the various locations, for which proper devices like Combustible Gas Indicators (capable of monitoring Oxygen, Hydrogen Sulfide and Carbon Monoxide concentrations and LEL percentages) and PIDs (when monitoring for specific substances is required) will be available as a part of our inert entry equipment.

Suspending Work

There are factors beyond our control that on some occasions may force us to stop work entirely or adapt to the new circumstances. For example, if the top of a catalyst bed is badly blocked, the possibility exists that dangerous substances may be trapped beneath this layer which can cause vapors to escape creating a threat to the life support team.

- On such occasions, the team leader and/or client's representative will stop the job.

- Other factors on which work would stop are:
  - if the temperature of the catalyst increases more than 5ºC
  - when the temperature rises above the pre-determined level
  - when nitrogen supply falls below (90psi) 6 Bar or insufficient to maintain purge
  - in case of high rises in measured safety values as compared with previous readings
  - if the oxygen content on the working platform falls below 20%
  - in the event of bad weather, alarms etc.

- Upon vacating the vessel and top platform, the vessel should always be left in a safe condition, whereby it cannot cause any additional hazards to the surrounding area other than those normally accepted.

- The Supervisor/Team Leader has the authority to suspend work and evacuate the area if they are not satisfied with the work and/or environmental conditions.

Related Field Documentation

- Certain documentation is required to maintain the benchmark of IPS★ITCS quality in the field. This documentation is only a qualitative measure. It is important to understand why we do the documentation, and how to use it properly in the field.

- Management shall plan, calculate, and allow the supervisors and employees adequate time to complete and review the required documentation in the field.

- The job supervisor and inert entry team are responsible for ensuring the documentation is completed and reviewed by the entire team.

- Disciplinary actions will be taken by management if the documentation is not accurate, complete, or if it has been “pencil-whipped”, nor reviewed by supervisors or other team members.

- Only original documentation will be accepted during audits or reviews.
  - The following documentation is required for all inert entry jobs regardless of frequency, location, size, or duration:
    1. JSEA (Job Safety Environmental Analysis) – Every job is unique due to location, plant specific requirements, pre-existing hazards, and client job requirement specifications. This is where the importance of a JSEA comes into effect. It is required that every inert entry job has a JSEA wrote and reviewed by the entire inert entry team prior to beginning work.
       - It is acceptable to use a template JSEA for jobs that are done frequently; although, it is the responsibility of the Supervisor to review the JSEA with the inert entry team every time the job is started.
       - The JSEA shall be signed by all inert entry team members, understanding the risks, hazards, and conditions of the job.
       - The original copy of the signed JSEA needs to be placed in the project file for future reference.

2. Toolbox - Safety Meeting
    - A toolbox safety meeting needs to be held every shift to reiterate the specific risks, dangers, and required PPE used on the job.
    - Every toolbox safety meeting needs to be documented with the following information (minimum):
        a. Instructor(s) or Conductor(s)
        b. Specific Topics Covered
        c. Duration
        d. Attendance
3. Job Scope Change - Safety Meeting
    - Every time the scope of the job changes because of unforeseeable events, a Job Scope Change safety meeting is required.
    - The same form used for toolbox safety meetings can be used for job scope change safety meetings.
    - Every job scope change safety meeting needs to be documented with at least the following information:
        a. Instructor(s) and/or Conductor(s)
        b. Specific Topics Covered
        c. Duration
        d. Attendance
4. Inert Entry Checklist
    - An inert entry checklist is one of the most vital steps prior to starting an inert entry job.
    - The inert entry checklist should be completed prior to starting work or;
    - prior to restarting work, such as:
        a. Shift Change
        b. Lunch Breaks
        c. Anytime the entire crew has left the proximity of the reactor structure.
    - The inert entry checklist should comply with the IPS★ITCS Inert Entry Procedures Manual and the API guidelines for inert entry in confined spaces.

5. Personnel Documentation
    - Personnel documentation should be inspected prior to job commencement and available in the field for audits and/or inspections, the documentation for each inert entry technician shall include:
        a. Physician's Recommendation Letter
        b. Fit Test Card or Certificate
        c. First Aid/CPR Card or Certificate
        d. Inert Entry Technician/Rescue Specialist Card or Certificate
    - It is the responsibility of each inert entry technician to ensure their training, physician's recommendation, and fit testing documentation is current and available on site.
6. Written Rescue (Emergency) Plan
    - The rescue plan should be in compliance with the IPS★ITCS Inert Entry Procedures Manual, API guidelines for inert entry in confined spaces, and 29 CFR 1910.146 – See Confined Space Rescue Plan
    - This written emergency plan will be available on site for all personnel. This plan will detail procedures to be followed in case of various emergencies, including but not limited to loss of nitrogen supply, high nitrogen pressure, high vessel oxygen, high/increasing vessel temperature, loss of breathing air supply, emergency inside the vessel, and plant emergency outside the vessel. It will include evacuation procedures, emergency contact information, assembly points, and other relevant instructions for ensuring personnel safety during emergencies.
7. Confined Space Entry Log
    - A confined space entry log shall be used in accordance with the IPS★ITCS Inert Entry Procedures Manual and 29 CFR 1910.146.
    - The Top Supervisor/Confined Space Entry Attendant is responsible for filling out the entry log on a real-time basis.

8. Confined Space Entry Permit
    - Prior to any type of entry in a confined space, an entry permit is required to be reviewed by the entire inert entry team and signed by the appropriate personnel.
    - The confined space permit shall be in compliance with the API guidelines for inert entry in confined spaces, and 29 CFR 1910.146
9. Inert Entry Module Operators Log
    - The Inert Entry Technician and or the Stand-by Person will periodically check the reactor atmosphere.
    - The Module Operator is responsible for maintaining a periodic log or checklist of continuous air monitoring results. Log entries should not exceed 15 minutes.

TRAINING

Training shall be provided for all employees whose duties include working in or around an Inert Space. IPS★ITCS requires training has been accomplished. Certification must be made available to employees & their authorized representative.

- Inert entry personnel will undertake the IPS★ITCS Inert Entry training course prior to being authorized to undertake inert entry work. The certification shall include:
    - Employee name
    - Trainer signature/initials
    - Dates of training

- Inert entry personnel will be required to undertake refresher training every year. New ideas and equipment are discussed and introduced with thorough explanations on these matters.

- The initial/refresher training should consist of the following as outlined in the Inert Entry Training Manual:
  - Confined Space
  - Respiratory Protection
  - Confined Space Rescue
  - Lock-out/Tag-out
  - First Aid/CPR
  - Inert Entry Procedures Nitrogen Safety and Operations
  - HAZWOPER – for hazardous materials, hazardous waste and pyrophoric material

Personnel

Ideally, an inert entry team consists of a supervisor and Four Technicians:

- 1 x Inert Entry Technician
- 1 x Standby/Rescue Technician
- 1 x Top Supervisor (Confined Space Entry Supervisor)
- 1 x Life Support Module Operator

In addition to inert entry crew, additional personnel may be required to assist with ground support activities including:

- 1 x Ground Support Control Technician (Ground Supervisor)
- 1 x Vacuum Operator
- 1 x Forklift Operator
- 1 x Floating Ground Technician

These personnel must undergo a basic IPS★ITCS training session (i.e.: familiarization with inert entry and IPS★ITCS hazards) prior to assisting with the project.

A certified Inert Entry Technician is an individual who has current certification for:

- Inert Entry Technician and/or Inert Entry Rescue Specialist (See Inert Entry Training Procedure or the IPS★ITCS Training Matrix for specifics)
- First Aid/CPR
- Current Medical Evaluation/ Physician’s Recommendation
- Current Fit Test

Project Supervisor to nominate one individual at the entry level to be a team leader.

- The team leader is responsible for ensuring all applications of inert entry activities.
- This can be a rotational role shared between members of the inert entry crew.

Medical Examinations

All personnel who are involved with the use of life support equipment must have an annual medical examination.

For those projects where personnel may be coming into contact with designated hazardous substances (as defined in the Hazardous Airborne Contaminates Regulations 29 CFR 1910.1000), personnel must undergo baseline medical surveillance prior to commencing the project.

Personnel are selected for training by taking into account the results of a medical examination to determine their fitness to perform breathing apparatus work.

Life Support Unit

Life Support Equipment Components

1. The life support equipment used for inert entry should be:
   - a positive pressure supplied air system.
   - designed to control and monitor the clean breathing air supply for at least three people.
     - one working in the inert atmosphere (Entrant or Inert Entry Technician)
     - one stand-by person (Top-Supervisor or Confined Space Entry Attendant)
     - one rescue assistant (Inert Entry Rescue Specialist)

2. The life support equipment shall have the capabilities of monitoring and observing:
   - the air supply to the men working in the inert environment.
   - the atmosphere for toxicity, O2, and LEL

3. The air supply system shall consist of the following:
    - A complete primary air supply from the cylinders to the Helmet to help eliminate the possibility of a breathing air failure featuring:
        - Primary Cylinders (via 300 ft3, 6-packs or 12-packs of breathing air)
        - Primary High-Pressure Hose
        - Primary, Gauges, and Manifolds
        - Primary Low-Pressure Hose
        - Primary Helmet-Mounted Regulators

    - And an (EEL) Emergency Egress Line when necessary for vessels that would be too large to egress with only 5-minutes of breathable air.

    - The EEL would consist of the following
        - A separate 300 ft3 cylinder of breathing air per person (minimum)
        - A regulator with an alarm
        - A low-pressure hose suspended in the vessel at waist height to the entrant

4. Regulators on the primary air supply lines control and monitor both the inlet pressure from the supplied air Cylinders (Cylinder Pressure), and the actual supply pressure that the personnel under life support are breathing (Regulated Pressure).

5. High-Pressure Audio and Low-Pressure alarms are incorporated into the life support equipment that will alert the Operator that air supply has been interrupted or has been depleted to minimum acceptable level.

6. The high-pressure alarm will activate when the primary and secondary air supply (cylinder pressure) is approximately 500 psi.

7. The high-pressure audio (bell) alarm activates at approximately 500 psi on the air supply (cylinder pressure). The volume of the high-pressure audio alarm is such that it can be heard in extremely noisy conditions or at long distances from the regulator.

Life Support Equipment Operation

IPS★ITCS will supply all equipment necessary to perform inert entry work. Inert entry requires specialized equipment that must be inspected and in good working order during entry. Refer to the reference section for equipment check forms:

IPS★ITCS currently uses the Blackbox Technologies Life Support System and Commander Helmet for all inert work. This system consists of the following (Refer to HSE.PRO.Blackbox Technologies Operation Manual 2022):

1. **Breathing Air Supply**
    - Compressed Grade D breathing air in cylinders provided by either IPS★ITCS or the client will be used for both the primary and secondary air supply. The cylinders must be supplied with an SDS and a batch certificate to confirm the quality of the air that is being supplied to the technicians. It is also mandatory that air quality tests be taken with a monitor to ensure that the air is up to the standard required.

    - Operating pressures:
      Primary – 2,400 psi - 500 psi

    - The system will be capable of delivering at least 200L of air per minute to individuals connected to the system.

    - Cylinder changeover procedure

NOTE: *The primary air supply must NOT be running on only one cylinder*

    - Primary Supply (Minimum)
      1 - 2 Cylinder on (cylinder on, tap on)
      1 - 2 Cylinder ready (cylinder on, tap off)
      1 Cylinder off (cylinder off, cylinder off)

    - Secondary Supply (Minimum)
      1 - 2 Cylinders on (cylinder on, tap on)
      1 - 2 Cylinder ready (cylinder on, tap off)

    - (if using 3 cylinders)
      1 - 2 Cylinder on (cylinder on, tap on)
      1 - 2 Cylinder ready (cylinder on, tap off)
      1 Cylinder off (cylinder off, cylinder off)

NOTE: *When using individual air cylinders, when the pressure drops to 500psi (34 Bar) on the cylinder, changeover to the next cylinder in the sequence*

2. **High-Pressure Air Lines**
    - The primary high-pressure supply lines will be constructed of identical hose and will be fed from Grade D breathing air cylinders. The airline must be rated to a working pressure of not less than 2,400psi.

    - The primary air supply line will be connected to a rack of grade D air cylinders. The rack will generally consist of a minimum of six cylinders. A minimum of three Cylinders must be hooked up via the primary air supply manifold at any one time.

    - Both Primary and Secondary High-Pressure hoses must be connected to the life support panel to ensure that both supplies are always functional.

3. **Air Control System (Module)**
    - Primary Air Control System: The console includes four primary air control units color coded blue, red, green, and yellow. Each control unit includes a second stage pressure reducing regulator, gauge, and quick opening valve. A high-pressure air supply gauge and regulated air supply gauge are common to the four primary air control units. A pre-set high-pressure regulator is secured inside the console for tamper protection. A 15-micron filter protects the system from foreign material present in the air supply.

    - Secondary Air Control System: The four secondary air control units duplicate all functions of the primary system. Additionally, an air flow switch and indicator light is included in each control unit. The secondary air control system serves as an automated back up to the primary system. During normal operations the secondary system is in standby mode. If failure occurs to one of the four primary control units, the corresponding secondary control unit operates automatically. Simultaneously, a flow switch triggers a pulsing red indicator light in rhythm with breathing. The indicator light enables the operator to identify the affected Life Support Helmet and take focused corrective action. A self-contained electrical supply, (four D-cells) provides all required electrical.

- Redundant Alarms: Redundant low-pressure alarms monitor the breathing air supply. At 700 psi a pressure transducer activates an amber LED warning light on the front panel. At 500 psi pneumatically operated warning bell sounds. The bell alerts the operator to restore the breathing air supply. The bell alarm automatically resets when the breathing air supply has been replenished.

4. **Communications**
   - Communications: A communication system will be utilized. Personnel must maintain a communications system for use by the employees working inside the inert atmosphere and those monitoring the work from the outside. If for any reason the primary communication link fails, the persons working inside the space must be evacuated immediately. The communication system is capable of simultaneous communications and has an open mic system which enables all entrants and personnel who are connected to talk and hear everything. An open mic means that an activation device does not have to be enabled to talk. The Communication System is battery powered and has a warning device built in to inform the CMO when the batteries are getting low. When batteries are getting low and / or communications are lost, entrants are immediately evacuated.

5. **Umbilicals & Low-Pressure Air Lines**
   - Two umbilicals will be in use for all reactor entry work – one connected to the individual entering the reactor and the second system connected to the stand-by technician. A third airline will be available at the entry location as a part of the rescue kit should it be needed by a third operator to assist from outside the reactor in an emergency situation.

   - The umbilical cord containing the air hoses must be adequately sheathed to protect the hoses and be designed such that the hoses cannot be detached (e.g., internal wire hooked to the harness and anchored to a secure point outside the vessel). IPS★ITCS umbilical lines consist of the following which is protected by a sheath:
     - Primary Air Line
     - Secondary Air Line
     - Communication Cable
     - Stainless Steel Aircraft Cable which is rated for personnel lifting and equipped with hooks.

6. **Safety Harness and Escape Assembly**
    - The safety harness can be used to assist the wearer while entering or leaving a confined space or vessel and in cases of an emergency to assist the removal of the wearer by hand lifting to safety. In all cases, a recovery winch/device will be made available at the manway to assist in entry and removal from the confined space.

    - The escape assembly consists of a small escape Cylinder of compressed grade D breathing air that enables the wearer to exit the dangerous area in the unlikely event that both air line systems fail.

    - All entry personnel who wear the life support system must wear the auxiliary 5-minute escape air cylinder which is incorporated into the life support harness and to the helmet. This bottle valve will remain closed and will only be used in the event of an emergency when primary and secondary air is lost. This bottle is designed and will only be used to supply air to the entrant during vessel evacuation.

    - A rescue box should be readily available to the inert entry crew containing, but not limited to:
        - A hoisting device to extricate the personnel from the confined space.
        - Extra supplied breathing air equipment for entry during rescue
        - Extra protective clothing for entry during rescue
        - Additional ropes and harnesses
        - First-aid kit
        - Fire extinguishers
        - A means of lowering injured persons to the ground
        - Provisions for summoning assistance

7. **EEL – Emergency Egress Line**
    - Every Inert job requires that an Emergency Egress Line (EEL) shall be supplied for each helmet for emergency egress. The EES & EEL must be set up and ready for use before entry into an inert atmosphere is permitted. Air for these EEL lines shall be supplied from an independent source. Yellow hoses are not to be used for any service other than to connect to an EEL.

8. **Helmet**
    - The full-face positive pressure Helmet supplies the wearer with more than sufficient clean breathing air.

    - Helmets: Technicians entering the inert space must wear a lock-on helmet which is sufficiently secured to prevent inadvertent removal ('clam type' helmet with integral breathing air, which cannot be accidentally removed or dislodged are acceptable) with breathing air for inert confined space entry. The Edelhoff-Blackbox Commander Helmet system is assembled in two parts which are hinged together at the top. A silicone rubber face piece is mounted in the front section and a polycarbonate lens is fastened to the exterior surface. Upon closing, the two latches located at the base of the helmet secure the two sections together. The latches are opened by pressing the clasp assembly with the thumb pressure while lifting the helmet front section away from the head. The helmet and face piece are adjusted to the wearer by a built-in netting similar to the Scott AV2000 and a pneumatically inflated pump and bladder assembly. The inflated bladder assembly is a secondary safety device that applies sufficient pressure to the back of the head causing the face to come in contact with the helmet face piece if the netting becomes loose.

    - Two independent sources of air must be provided to a helmet. The second air supply shall cut-in automatically on loss of the primary air supply pressure. This is achieved through the Breathing Air Console.

These eight major components used together make up the life support system for our inert entry specialists. Since this system is used to perform work in atmospheres that are usually immediately dangerous to life, it is extremely important that each component is used and maintained at top efficiency.

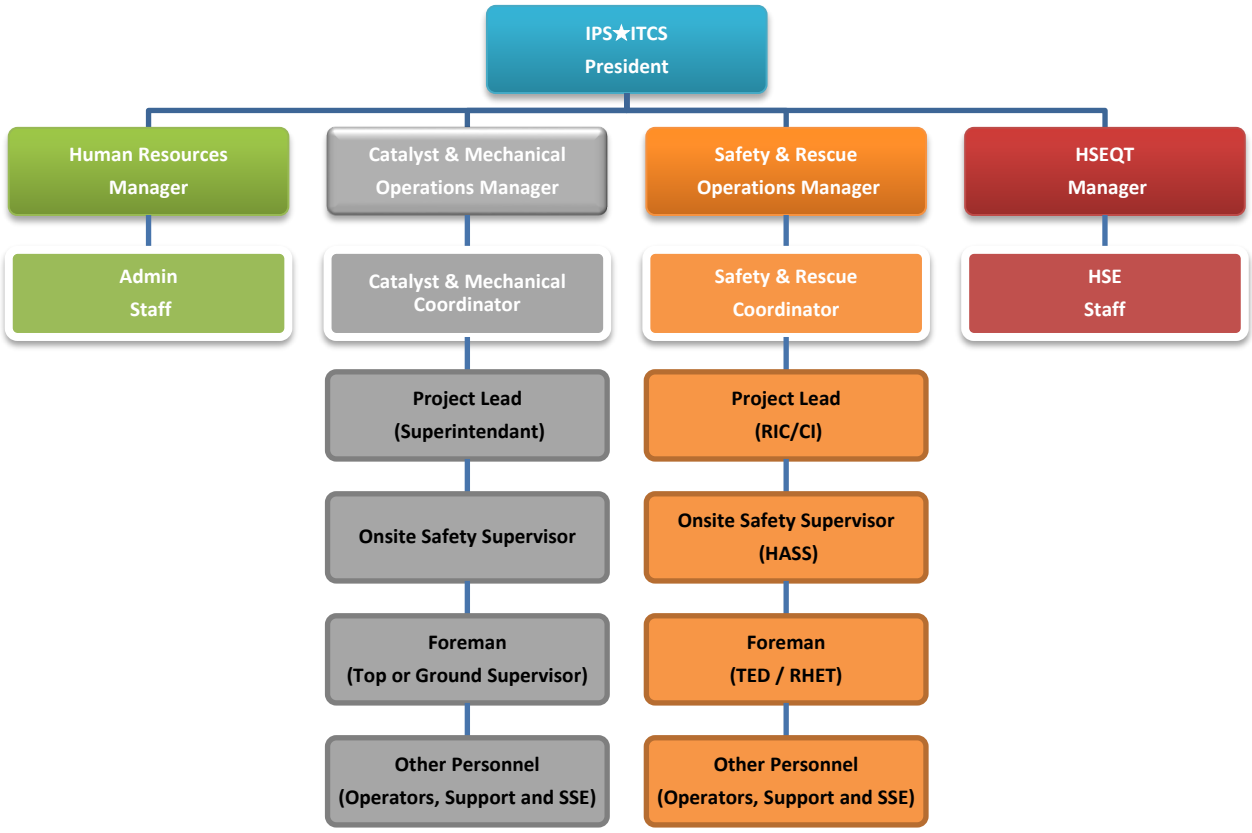
REFERENCE / TOOLS

Form(s)

IPS / IPTCS forms are available at

https://theipsgroup.us/ips-mobile-app-forms/

Organization Chart



Revision History

Rev	Rev Date	Rev By	Approved By	Description
1.0	1.3.2022	Shayne Torrans	Shayne Torrans	Initial Procedure Document
1.1	11.23.2022	Shayne Torrans	Shayne Torrans	Format Revision, Added Content
1.2	05.04.2024	Joe Rodriguez	Shayne Torrans	Format Revision, ISN Audit

Approvals:

Procedure Owner

_____ _____

Print Name Date

_____

Signature

Competency Assessment

No.	Questionnaire	C/NYC
Q1	What is the main objective of the procedure outlined for working in or around inert spaces? a) To maximize productivity b) To minimize paperwork c) To protect the health and well-being of personnel d) To reduce costs	
A1	c) To protect the health and well-being of personnel	
Q2	Which of the following standards must the main components of the inert entry system meet? a) Grade "A" Compressed Breathing Air b) Grade "B" Compressed Breathing Air c) Grade "C" Compressed Breathing Air d) Grade "D" Compressed Breathing Air	
A2	d) Grade "D" Compressed Breathing Air	
Q3	According to the procedure, what is the maximum time personnel can work continuously inside a vessel under inert conditions? a) 2 hours b) 4 hours c) 6 hours d) 8 hours	
A3	b) 4 hours	
Q4	What is the responsibility of the Entry Supervisor? a) Operating the Breathing Air Cylinders b) Monitoring air pressure gauges c) Ensuring all personnel are appropriately dressed for entry d) Determining if acceptable entry conditions are present and authorizing entry	
A4	d) Determining if acceptable entry conditions are present and authorizing entry	

Q5	What does the acronym "IDLH" stand for? a) Inert Detection Limit and Hazard b) Inert Detection and Life-saving Help c) Immediately Dangerous to Life and Health d) Immediately Detected Life Hazard	
A5	c) Immediately Dangerous to Life and Health	
Q6	Who is responsible for maintaining the required documentation for inert entry? a) Entry Supervisor b) Inert Entry Technician c) Module Operator d) Stand-by Person	
A6	c) Module Operator	
Q7	What is the purpose of an Emergency Egress System (EES)? a) To monitor air quality inside the vessel b) To provide communication between personnel inside and outside the vessel c) To supply breathing air to personnel in the event of air supply failure d) To facilitate the evacuation of personnel in case of emergency	
A7	c) To supply breathing air to personnel in the event of air supply failure	
Q8	According to the procedure, what is the primary responsibility of the Project Supervisor? a) Operating the Breathing Air Cylinders b) Maintaining the required documentation for inert entry c) Establishing communication with plant supervisors d) Monitoring air pressure gauges	
A8	c) Establishing communication with plant supervisors	
Q9	What is the primary requirement for personnel whose duties include working in or around an Inert Space according to IPS★ITCS? a) Completion of a medical examination b) Certification in Inert Entry Training c) Familiarization with IPS★ITCS hazards d) Obtaining a recommendation from a physician	
A9	b) Certification in Inert Entry Training	

Q10	Which personnel must undergo a basic IPS★ITCS training session before assisting with ground support activities? a) Inert Entry Technicians only b) All personnel involved in ground support activities c) Standby/Rescue Technicians only d) Forklift Operators only	
A10	b) All personnel involved in ground support activities	
Q11	How often are refresher training sessions required for inert entry personnel? a) Every six months b) Every year c) Every two years d) Every three years	
A11	d) Every three years	
Q12	What does the certification for Inert Entry Training include? a) Employee ID number b) Blood type c) Trainer signature/initials d) Date of birth	
A12	Trainer signature/initials	
Q13	Which component is NOT included in the life support equipment used for inert entry? a) High-pressure audio alarms b) Low-pressure air lines c) Safety harness and escape assembly d) Fire extinguishers	
A13	c) Safety harness and escape assembly	
Q14	What is the minimum requirement for the number of cylinders hooked up via the primary air supply manifold at any one time? a) One cylinder b) Two cylinders c) Three cylinders d) Four cylinders	
A14	d) Four cylinders	

Q15	What is the operating pressure range for the primary breathing air supply? a) 500 psi - 1000 psi b) 1500 psi - 3000 psi c) 2400 psi - 500 psi d) 1000 psi - 2000 psi	
A15	d) 1000 psi - 2000 psi	
Q16	What is the primary purpose of the Emergency Egress Line (EEL)? a) To supply breathing air to personnel b) To communicate with personnel inside the vessel c) To provide a means for personnel to exit in an emergency d) To monitor atmospheric conditions inside the vessel	
A16	c) To provide a means for personnel to exit in an emergency	
Q17	Before commencing any inert entry work, a pre-contract meeting between the client and IPS★ITCS must be held. Which personnel would normally attend this meeting? a) Client administrative personnel only b) Client and IPS★ITCS safety personnel, and IPS★ITCS Project Manager only c) Client mechanical, maintenance, engineering, and process and operations personnel, client and IPS★ITCS safety personnel, IPS★ITCS Project Manager, and/or Supervisor d) Client executive team only	
A17	c) Client mechanical, maintenance, engineering, and process and operations personnel, client and IPS★ITCS safety personnel, IPS★ITCS Project Manager, and/or Supervisor	
Q18	Which of the following issues should be addressed during the pre-contract meeting? a) Project budget b) Catering arrangements c) Site/Plant rules, designation of working areas, catalyst disposal d) Local tourist attractions	
A18	c) Site/Plant rules, designation of working areas, catalyst disposal	

Q19	Life support equipment must be inspected before every entry to confirm all components are functioning properly. How should this inspection be conducted? a) By visual checks only b) By the Project Manager only c) According to the Inert Entry Checklist d) By any personnel available at the site	
A19	c) According to the Inert Entry Checklist	
Q20	Who should hold a project kick-off meeting at the commencement of the inert entry project? a) The Project Supervisor and the client's HR representative b) The IPS★ITCS Project Manager only c) The Project Supervisor with all personnel involved in the project d) The client's CEO	
A20	c) The Project Supervisor with all personnel involved in the project	

Enclosed Attachments	
Risk Assessment	☑
Environmental Aspect and Impact	☑
Training and Competency	☑
Measure and Evaluation Tools	☑

Competency Checklist

Date:

Division: **Position / Title:**

Mechanism(s) of Compliance:

• Grade “D” Compressed Breathing Air	
29 CFR 1910.134	ANSI/CGA G-7.1
NIOSH 202-100	
• Egress Cylinder Assembly	
29 CFR 1910.134	ANSI/CGA G-7.1
API 2217A – 2217	NIOSH 202-100
Blackbox Technologies	
• Regulators, Gauges and Manifolds	
29 CFR 1910.134	ANSI/CGA G-7.1
API 2217A – 2017	NIOSH 200-000
Blackbox Technologies	
• High-Pressure Air Hose Manifolds	
29 CFR 1910.134	ANSI/CGA G-7.1
API 2217a – 2017	Blackbox Technologies
• Low-Pressure Air Hose Umbilicals	
29 CFR 1910.134	API 2217A – 2017
NIOSH 201-043	NIOSH 200-053
NIOSH 203-003	Blackbox Technologies
• Fall Protection and Retrieval	
29 CFR 1926.503	29 CFR 1910.146
NFPA 1983 – 2017	NIOSH 201-045
Blackbox Technologies	
• Safety Harness	
29 CFR 1926.503	29 CFR 1910.146
NFPA 1983 – 1997	API 2217A – 2017
NIOSH 202-008-1	NIOSH 202-008-2
Blackbox Technologies	
• Helmet	
29 CFR 1910.134	API 2217A – 2017
NIOSH 13F-0800	NIOSH 200-000
Blackbox Technologies	

Competency Checklist (continued)

Method of Instruction Key	Method of Evaluation Key	Self-Assessment by Employee			Method of Instruction	Validation of Competency			
IC = IPS★ITCS Class Instruction SC = Safety Council TP = Third Party Certifier PP = Kick-off Meeting (Policy / Procedure Review) SL = Self Learning Package IF = IPS★ITCS Field Instruction	SD = Skill Demonstration WT = Written Test BB = Behavior Based Safety Observation VR = Verbal Review	Never Done	Needs Review or Practice	Competent		Date	Initials	Evaluation Method	C = Competent NYC = Not Yet / Additional Comment # *(If applicable)*
☐ I. CORE COMPETENCIES	☐ II. CROSS FUNCTIONAL COMPETENCIES					☒ III.FUNCTIONAL COMPETENCIES			
F. Catalyst / Inert Entry Operations Vacuum Operation Inert Entry Platform Safety Heat Stress Management									
➢ Purpose ➢ Scope ▪ Compliance ➢ Objectives ➢ Definitions ➢ Roles and Responsibilities ▪ IPS Team Protocols ➢ Project Procedures for Inert Entry ▪ Pre-Contract Meeting ▪ Life Support Equipment • Other Equipment & Facilities ▪ Project Kick Off Meeting ▪ Vessel Conditions for Inert Entry Activities (All Other Subs-Sections) • Benzene Considerations • Furfural Considerations • Temperature Considerations ▪ Client Issues Related to Vessel Entry • Work Permits • Access • Weather • Entry • Identification of Hoses & Manifolds • Work Area • Dangerous Location • Suspending Work • Related Field Documentation ➢ Training ▪ Personnel ▪ Life Support Unit ➢ Reference / Tools ▪ Form(s) ▪ Organization Chart									

Environmental Aspects and Impacts

Identified Environmental Aspects and Impacts

The following table is a summary of the likely environmental aspects and impacts that may be identified during site inspections. The significance of each impact needs to be assessed using the Risk Assessment Model.

Activity	Aspect	Impact
Purchasing & Administrative Work	Consumption of goods	Conservation of natural resources
	Consumption of energy (e.g., Electrical equipment and facilities)	Release of greenhouse gases and atmospheric pollution. Consumption of natural resources; Habitat loss
	Generation of waste (e.g., Paper)	Consumption of space for waste disposal; Habitat loss
Climate Control	Consumption of energy	Release of greenhouse gases and atmospheric pollution. Consumption of natural resources; Habitat loss
	Generation of noise	Disturbance to community; Habitat loss
Cleaning of – offices / vehicles	Storage, use and release of chemicals	Contamination of air, water, or soil. Risk to human health
Transport (Fleet vehicles / staff travel)	Consumption of energy	Release of greenhouse gases and atmospheric pollution. Consumption of natural resources; Loss of habitat at all stages of generation; Light pollution
	Consumption of goods (e.g., Oil)	Consumption of natural resources; Generation of waste; Habitat loss; Biodiversity impacts
	Generation of waste (e.g., Oil)	Consumption of space for waste disposal; Potential contamination of water or soil; Habitat loss
	Exhaust emission	Release of greenhouse gases and atmospheric pollution
	Use of dangerous goods (e.g., Batteries)	Potential contamination of air, water, or soil; Risk to human health
	Generation of noise	Disturbance to community; Habitat degradation
Operations		

Risk Assessment

Risk Assessment // insert name here					
Step No: Logical sequence	**Sequence of Basic Job Steps documented in the Procedure, Work Instruction, and project plans. Break down Job into steps.** Each step should be logical and accomplish a major task.	**Potential Safety & Environmental Hazards/Impacts at the site of the Job** Identify the actual and potential health and safety hazards and the environmental impacts associated with each step of the job.	**Risk Rating** Refer to the risk matrix or HSEQT.PRO. Risk Mgt	**Recommended Corrective Action or Procedure** ***Determine the corrective actions necessary to reduce the risk to as low as reasonably practical (ALARP) refer to HSEQ.PRO.Risk Mgt. The risk must be reduced or controlled to ALARP before work commences.*** Document who is responsible for implementing the controls to manage each hazard identified.	**Risk Rating** Refer to the risk matrix or HSEQT.PRO. Risk Mgt
1.					
2.					
3.					
4.					
5.					

Audit

Process: insert// **Procedure**: Insert //	Date:	Audited by:
	Location of Audit:	Area Mgr./Supervisor:

Item	Question	Evidence Sited	Comments	Conformance Score 0,3,5
1.	Does the program address employees will be trained prior to entry into an inert space and the training will be certified by the employer?			
2.	Does the program address a written Job Site Analysis (JSA) will be conducted prior to entry of the vessel?			
3.	Does the program address the Job Safety Analysis (JSA) or Job Hazard Analysis (JHA) is communicated to all necessary personnel?			
4.	Does the program address a documented heat stress plan will be available on site?			
5.	Does the program address equipment used during entry will be inspected and in good working order?			
6.	Does the program address the communication system is capable of simultaneous communications?			
7.	Does the program address employees will don a lock-on helmet with breathing air for inert confined space entry?			
8.	Does the program address breathing air must be Grade D quality?			
9.	Does the program address the entrant will be equipped with an escape air bottle?			

Audit (continued)

Item	Question	Evidence Sited	Comments	Conformance Score 0,3,5
10.	Does the program address a written emergency plan will be available on site?			
11.	Does the program address the elements of the emergency plan to include but not limited to loss of nitrogen supply, loss of communication, high vessel temperature and emergency inside the vessel?			
12.	Does the program address the stand-by person cannot leave his/her post?			
13.	Does the program address first aid and CPR trained personnel will be available?			
14.	Does the program address air monitoring and the results be logged every 15 minutes?			
15	Does the program address provisions and procedures for protection of employees from external hazards?			
16	Does the program address a communication system will be utilized by employees working inside the inert space and those monitoring from the outside?			
17	Does the program address that the entrants will immediately evacuate the space if communications fail?			

AUDITOR'S SIGNATURE: SAFETY REP'S SIGNATURE:	CONFORMANCE SCORE: / 85 CONFORMANCE %:	0 – Non-Conformance 3 – Continuous Improvement Opportunity 5 – Total Conformance