

BP OIL -- TOLEDO REFINERY

Document Type: Procedure	Refinery Wide	Reference No.: SAF 086
Effective Date: October 3, 2011	Use of Nitrogen (N ₂)	Rev. No.: 7
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SCOPE	This document serves as an overview of the refinery nitrogen practices and procedures used to protect people from an oxygen-deficient exposure.
HEALTH Special PPE & Special Hazards	Nitrogen is considered non-toxic since 78% of the air we breathe contains nitrogen. It is colorless and odorless, and considered the invisible killer. When nitrogen gas displaces oxygen in the air, humans can be asphyxiated due to a lack of enough oxygen. Supplied breathing air is mandatory when oxygen levels fall below 19.5%.
SAFETY	Standard refinery PPE Safe operating procedures for any job requiring the use of nitrogen.
REFERENCE DOCUMENTS	<ul style="list-style-type: none"> • Process Safety Standard (PSME) No. 18 "Use of Nitrogen" • Operating manual for gas detection equipment. • Loss of Instrument Air Nitrogen Make-up to Instrument Air. Total loss of Instrument Air BLR 05.001 • SAF-032 Confined Space Entry
SPECIAL MATERIALS & EQUIPMENT	Direct reading, gas testing equipment Supplied air respirators Retrieval device Body harness
QUALITY	Periodic employee audits to insure knowledge of N ₂ hazards. Audits of training records.
ENVIRONMENTAL	N/A

OVERVIEW

Nitrogen (N₂), as a gas, is colorless and odorless. When nitrogen concentration increases, the oxygen concentration decreases and the atmosphere may contain less than 19.5% oxygen. Breathing atmospheres of less than 19.5% oxygen can lead to progressively more adverse health effects, including rapid death (see Table 1). Nitrogen displaces carbon dioxide in the lungs, which tells the body to stop breathing. Nitrogen is typically used to displace air to create an oxygen deficient atmosphere, but other gases such as helium and argon, can create similar hazards.

Toledo Refinery uses nitrogen in several applications. As a gas, some uses include: 1.) inerting equipment to prevent flammable atmospheres; 2.) preparing equipment for maintenance by purging out hydrocarbons; 3.) removing air/oxygen in equipment before startup; 4.) blanketing tanks to prevent the ingress of air; 5.) certain welding operations; 6.) decommissioning equipment to prevent the "rusting" process; 7.) instrument air backup. Nitrogen is also used as a liquid for cooling purposes and is stored in large quantities in liquid form. The use of nitrogen can be harmful. Due to the hazards of working in nitrogen atmospheres, alternative processes not requiring entry into an inert atmosphere must be considered and, when appropriate, become the preferred alternative.

1.0 Routine Nitrogen Use

- ___1.1 It is crucial that all nitrogen entering the refinery is of high quality. An assurance method must be in place to guarantee good nitrogen that is free from oxygen.
- ___1.2 All permanent connections into a nitrogen system must be disconnected, blanked, or blinded from the supply system. Permanent nitrogen connections REQUIRED for safety or process reasons must include a non-return device (e.g., check valve) to prevent potential contamination of the nitrogen system.
- ___1.3 Oxygen analyzers, alarms, and trips in nitrogen systems must be verified as operating correctly by testing and documenting on a periodic basis. The asset group will assure this is done.
- ___1.4 Utility stations on a nitrogen distribution system must have a non-return device (e.g., check valve), and must be clearly identified. Green signs with white lettering depict the nitrogen stations in the refinery. Special connectors and hoses that are not common to any other systems will be used.
- ___1.5 Where nitrogen is continuously in use, permanent warning signs (stating suitable precautions) must be located at all access points, such as manways, stairways, etc.
- ___1.6 Temporary warning signs must be located wherever potential personnel exposure to nitrogen exists due to the temporary use of nitrogen, i.e., during vessel or line venting or purging with nitrogen.
- ___1.7 A variety of applications for nitrogen use occur in the refinery quality laboratory. High-pressure nitrogen cylinders are used for several analyzing techniques.

- __1.8 A management system must be in place to promptly alert all affected personnel whenever nitrogen is used to supplement the site instrument air or plant air systems. This includes temporary, short-term, backup connections. See Procedure BLR 05.001 Loss of Instrument Air

Nitrogen can be introduced to the instrument air system at the following two (2) locations:

- The SGP area just outside Sat 2
- The Alky 3 area.

The nitrogen block valves shall be car-sealed closed at these two locations and warning signs shall be posted that this nitrogen source is for emergency use only.

Refinery Coordinators will normally decide when to introduce nitrogen to the instrument air system. The person who decides to introduce the nitrogen to the instrument air system shall have the responsibility to notify the Refinery Coordinator. It is the Refinery Coordinator's responsibility to notify all area Supervisors that nitrogen is being used to supplement the instrument air system. The area Supervisor will in turn notify all operators and maintenance personnel in their individual area.

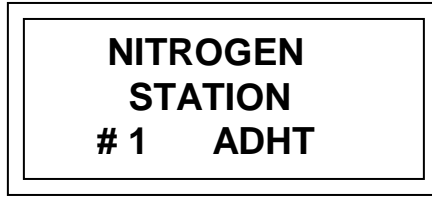
- __1.9 When alerted that nitrogen is being used to supplement the instrument air supply, operations personnel will continuously monitor their Satellites with a direct reading instrument (such as MSA Passport) to assure Oxygen levels in the building do not fall below 19.5%. If oxygen levels drop below 19.5%, the building must be ventilated with external air and evacuated until the oxygen level returns to normal levels (19.5 – 23.5)
- __1.10 A traction report and a root-cause incident investigation must occur after each event that requires the use of nitrogen to supplement the instrument or plant air system.

WARNING

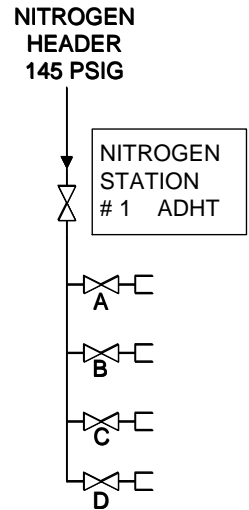
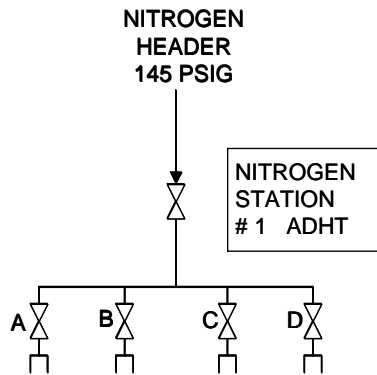
Notify all area Supervisors that nitrogen is being used to supplement the instrument air system. They will in turn notify all operators in their area. **Satellites and Analyzer buildings are not to be entered until tested for oxygen. The instrument air is used to purge analyzer buildings and could cause oxygen deficient atmospheres.**

2.0 Lock-out / Tag-out (LOTO) of Nitrogen Utility Stations

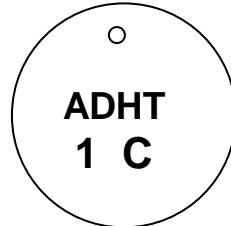
__2.1 All nitrogen utility stations that are not in use must be locked out/tagged out. All nitrogen utility stations throughout the plant will be controlled by using the following LOTO procedure. Exempted from this LOTO are the two nitrogen to air connections described in Section 1.8 Each area, or unit, will number specific **Nitrogen Stations**. The **Unit Name** will be included. Here is an example:



__2.2 At each **Nitrogen Station**, each **Nitrogen Supply Valve** will be assigned a **Letter**, from top to bottom for Vertical Manifolds and left to right for Horizontal Manifolds.



- __2.3 Each **Nitrogen Supply Valve**, at each **Nitrogen Station**, will be tagged with the **Unit Name**, the **Nitrogen Station Number**, and the **Nitrogen Valve Letter**.



Example of a tag

- __2.4 All **Lettered Valves** will be closed and locked. All **Lettered Valves** will have two (2) **Identifying Tags**.
- __2.5 One **Identifying Tag** will be fixed to the valve with a lock and chain and "S" hook or other secure method of attachment. The second **Identifying Tag** will be retained on the lock, with a split ring.
- __2.6 A **Nitrogen Lock Out Board** will be located in a **specified location** of each Unit. Keys for the locked Nitrogen valves will be fixed to the **Nitrogen Lock Out Board** with a **Car Seal**.
- __2.7 When a **Lettered Nitrogen Valve** is unlocked for service, an Identifying Tag will be secured to the **Nitrogen Lock Out Board**.

3.0 Entry into Oxygen-Deficient Atmospheres

- __3.1 Nitrogen can create an oxygen deficient atmosphere inside and around a vessel or tank that has been inerted. Working inside a vessel that contains an oxygen-deficient atmosphere is considered Immediately Dangerous to Life and Health (IDLH). Reasonable alternatives to this option must be discussed before this option is selected. The alternatives and discussion must be documented before any work can proceed.

CAUTION

Nitrogen can also create an oxygen deficient atmosphere in non-entry work activities. Examples are: work around equipment where nitrogen has been used to purge the vessel, work around equipment when nitrogen is being used for leak testing, work inside process analyzer buildings with nitrogen purging facilities, work near equipment that is nitrogen blanketed, and work in temporary enclosures where nitrogen is being used for specialty welding activities.

- __3.2 No BP employee shall enter an oxygen-deficient vessel under any circumstances. Only trained and skilled personnel expert in inert entry and rescue will be allowed into the vessel. See SAF-032 for information on inert entry.
- __3.3 All persons working around or in potentially oxygen deficient atmospheres must be trained regarding procedures, personal protective equipment, continuous monitoring, standby personnel responsibilities, emergency procedures, and rescue plan.
- __3.4 All of the requirements listed in SAF-032 Confined Space Entry shall be applied, including responsibility, approvals, and written job plan. Refer to PSME 18 for a checklist to define the minimum requirements that will be met to allow inert entry into a vessel.
- __3.5 A nitrogen restricted area shall be established around vessels with an oxygen deficient atmosphere.
- __3.6 Atmospheric (gas) testing must be performed to identify the parameters of the restricted area. Two trained and competent people from the specialty contractor group will conduct this. One will reside at a safe distance to perform rescue if needed.
- __3.7 Both individuals will wear positive pressure, continuous flow, full face supplied breathing air and rescue equipment (body harness).
- __3.8 Proper gas testing equipment must be used which will accurately measure oxygen and combustibles in a potentially oxygen-deficient atmosphere. Refer to SAF-023 using Direct Reading Gas Testing Equipment for additional guidance and explanation.
- __3.9 Once the restricted area is determined, it will be cordoned off using barricade tape and warning signs placed at all access points, i.e. stairs, ladders, etc. The following verbiage will be used:

**Danger – Nitrogen in Use
Life Threatening Hazard Present
Oxygen-Deficient Hazard – Supplied Air Required
Authorized and Trained Personnel Only**

4.0 Training

- __4.1 All persons who may be exposed to the danger of nitrogen must be trained in the hazards of nitrogen.
- __4.2 This training will include at least the following:
 - Where nitrogen is used and how its presence can result in an oxygen deficient atmosphere.
 - Potential health effects due to low oxygen exposure.
 - Methods to detect and measure low oxygen concentration.
 - Requirements and authorization to work in and around an inerted vessel.
 - Emergency procedures and rescue plans.
 - Lessons learned involving nitrogen incidents.
- __4.3 Refresher N₂ training is provided before the start of a large turnaround project and/or catalyst change out.
- __4.4 A written test is administered to insure a level of competency with the N₂ training given and to provide for a training record.

Revision History

Revision history

The following information documents at least the last 3 changes to this document, with all the changes listed for the last 6 months.

Date	Revised By	Changes
9/9/11	M. Chambers / J. Parker	Removed specified monitor style reference in Reference Documents Section. Also, updated Section 2.6 to reflect new lockout board location. MOC#: M20114894-001

Table 1**TYPICAL HUMAN PHYSIOLOGICAL RESPONSES TO OXYGEN DEFICIENCY**

Oxygen (%vol)	Effects & Symptoms
23.5	Maximum "Safe Level"
21	Typical O ₂ concentration in air
19.5	Minimum "Safe Level"
15-19	First signs of hypoxia. Decreased ability to work strenuously. May induce early symptoms in persons with coronary, pulmonary or circulatory problems.
12-14	Respiration increases with exertion, pulse up, impaired muscular coordination, perception and judgment.
10-12	Respiration further increases in rate and depth, poor judgment, lips blue.
8-10	Mental failure, fainting, unconsciousness, ashen face, blueness of lips, nausea, vomiting, inability to move freely.
6-8	6 minutes – 50% probability of death 8 minutes – 100% probability of death
4-6	Coma in 40 seconds, convulsions, respiration ceases, death

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