1.0 PURPOSE

The purpose of this standard is to ensure the risks of exposure to nitrogen are understood and adequately managed at Michigan Refining Division (MRD). This standard also establishes minimum guidelines for the safe use of nitrogen in MRD operations and maintenance. Other locations and/or situations may require additional precautions, such as inert entry into confined spaces. For more information on safe entry into inert confined spaces, refer to MRD Inert Confined Space Entry procedure.

2.0 SCOPE

This procedure applies to all persons working on MRD property, including contractors and visitors.

3.0 PROCEDURE

Nitrogen is colorless and odorless and occurs naturally in the atmosphere at approximately 78%. Because of this Nitrogen is not considered toxic but is an asphyxiant. However, as nitrogen concentration increases, oxygen concentration decreases, and the atmosphere may decrease enough to contain 19.5% oxygen or less. Atmospheres of less than 19.5% can have adverse health effects and become progressively worse as oxygen content becomes lower (Attachment A). Nitrogen displaces carbon dioxide in the lungs, which tells the body to stop breathing. When nitrogen levels are increased, oxygen levels are decreased. Oxygen content in lungs is higher than it is in the brain and the bloodstream. When oxygen deficient air is inhaled, the lungs will take oxygen from the brain and bloodstream. They become oxygen starved and can cause one to pass out. If nitrogen content is in high enough concentration, it may cause death.

3.1 Nitrogen Use at MRD - At MRD nitrogen is used in several applications. Uses of nitrogen as a gas include:

3.1.1 Inerting equipment to create oxygen deficient atmospheres, thereby preventing flammable atmospheres.

3.1.2 Preparing equipment for maintenance by purging out hydrocarbons.

3.1.3 To remove air/oxygen from equipment before start-up.

3.1.4 Blanketing tanks to prevent the ingress of air.

3.1.5 Certain welding operations.

3.1.6 Back-up to instrument air system and plant air system.

3.1.7 Purge equipment during normal operations.

3.2 Oxygen deficiencies for non-entry work – Nitrogen can create oxygen deficiencies for work in tanks and vessels, but it can also create oxygen deficient atmospheres for non-entry work. Some examples are:

3.2.1 Work around equipment where nitrogen is used to purge a vessel.

3.2.2 Work around or with equipment where nitrogen is being used to purge piping (e.g., blinding).

3.2.3 Work in analyzer buildings with nitrogen purging facilities.

3.2.4 Work near equipment that is under a nitrogen blanket.

3.2.5 Work in temporary enclosures where specialty welding is occurring.

3.2.6 Work in temporary enclosures near or adjacent to areas (e.g. manways) where a purge is expelling to the atmosphere.

3.2.7 Sampling points or venting points for units/equipment undergoing a purge to "air free" equipment

3.3 Routine Nitrogen Usage

3.3.1 An assurance method must be used to ensure that nitrogen is of high quality and oxygen free. Permanent connections to a nitrogen system required for safety or process reasons must include a non-return device (e.g. check valve) to prevent contamination of the nitrogen system.

3.3.2 Nitrogen headers located in the refinery must be marked with signage or labeling (green with white lettering) or painted green and stenciled white to distinguish them from other equipment.

3.3.3 Special connectors/fittings and hoses must be used to transport nitrogen. This equipment is unique to this type of service, not common to other uses. Please access RSW-SAF-055-DT Utility Hoses Guideline for proper usage of this equipment.

3.3.4 Where nitrogen is in constant use, warning signs must be in place to warn of potential hazards. The signage/labeling must be located at all access points (e.g. manways, stairways). The signage should also state suitable precautions to be in place in order to access these areas.

3.3.5 Where nitrogen is in constant use in the laboratory warning signs must be in place to warn of potential hazards. The signage should also state suitable precautions to be in place while the nitrogen is in use.

3.3.6 A management system must be in place to notify all affected parties in the event nitrogen is used to back up a failure of the normal instrument air system. For more information on instrument air loss see operating procedures in document librarian, Emergency Procedure, Loss of Instrument Air.

3.4 Non-Routine Nitrogen Usage

Note: There are many instances where nitrogen is used that are not considered routine. Typically this involves the installation of special nitrogen connections/fittings and transporting it with special nitrogen hose. Precautions must be taken to adequately warn and protect employees of these instances.

3.4.1 Where nitrogen is being used, all areas of potential exposure must first be identified and restricted areas determined.

3.4.2 When restricted areas are determined, they must be cordoned off using barricade tape with tags, physical barricades or warning signs at all access points. Restricted areas must be limited to essential personnel only and off limits to all non-essential traffic. See RSW-SAF-043-DT Barricading Procedure for more information. The following verbiage or similar verbiage will be used:

Danger – Nitrogen in Use

Potentially Immediately Dangerous to Life & Health

Continuous Monitoring or Supplied Breathing Air Required

Due to Vented Vapors, Areas May Contain Hazardous Vapors Requiring Respiratory Protection

3.4.3 If Nitrogen is purging to the atmosphere, it must not be in a normal area of travel by any employee. If there is no other safe alternative, the precautionary measures outlined in this procedure must be implemented to adequately protect employees from exposure.

3.4.4 Nitrogen purging and work that involves a nitrogen purge will require the use of a calibrated, fully functional four gas monitor and/or fresh air.

3.4.5 Once it is determined that nitrogen will be used for a non-routine function, a pre-job safety plan (JSA – Job Safety Analysis) must be discussed, reviewed and documented to ascertain that all hazards and potentially hazardous aspects of the function are identified and accounted for. All precautions (e.g. signage, barricading, PPE) must be in place before nitrogen is introduced. This JSA will be submitted to the safety department.

3.4.6 Non-routine also includes leaks. If a Nitrogen leak is suspected, **Do Not Approach.** Notify appropriate supervisory person immediately, stay away and warn fellow workers of the possible situation.

Note: For times when Nitrogen is used to purge equipment, it should be shut-off before maintenance work is performed. If maintaining the purge is necessary to facilitate work, maintenance workers/contractors must be given notification of the nitrogen hazard and be made aware of any additional precautions that need to be taken to complete their work (e.g. fresh air, continuous gas monitoring, etc.).

Note: CCR: Uncontaminated nitrogen supply is very important to the safe operation of the CCR, located in Complex 4. The CCR nitrogen header should not be used for any other services. No connections for alternate services, temporary connections, or hose connections are allowed.

3.5 Instrument Analyzer Buildings

3.5.1 Analyzer buildings may be connected to the instrument air system. In the event Nitrogen activates to back up instrument air, oxygen levels in the building may be at an unsafe level. Because of the potential for a hazardous atmosphere, **a**nalyzer buildings must be locked to prevent entry.

3.5.2 Verification of the atmosphere of an analyzer building must be made before entry can be made. Workers must be equipped with a continuous air monitoring device while working inside of the building.

3.5.3 Do not enter analyzer buildings if the instrument air system is on nitrogen back up.

3.5.3 Some analyzer buildings are equipped with a local audible alarm and flashing lights that will activate if a hazardous atmosphere is detected. Most buildings will also alarm at DCS. Depending on the building, alarms may include; LEL, O2, H2S, SO2, H2 or CO.

3.5.4 Responding To an Analyzer Building LEL Alarm – If the analyzer building has an observation window, check inside the building to see if there is a visible flame.

3.5.4.1 If a flame is visible:

a) Do not enter the building!
b) Notify the Owning Department Shift Foreman and close off all gas supply valves to the analyzer building if it is safe to do so.
c) Complete a CEM check sheet.
d) The Shift Foreman must notify the Fire Chief or Security.

3.5.4.2 If there is no flame:

a) Contact the Analyzer Foreman.
b) Obtain a gas monitor and check the atmosphere around the building. Notify the area shift foreman if a hazardous atmosphere is detected.
c) If necessary, analyzer techs will slowly open the door and check the atmosphere using a 4-gas monitor. If necessary they will don an SCBA to enter the building and repair the leak or malfunctioning gas detector to their level of training.
d) If the LEL is confirmed, stop any nearby hot work and let the building vent by slowly opening the door.
e) Reset the alarm when the leak is fixed or if the alarm is determined to be false.

3.6 Training

3.6.1 All employees who may be exposed to dangers associated with nitrogen exposure must be trained in these associated hazards.

3.6.2 CBT#: 09SAFREG129

3.7 Equipment Limitations

3.7.1 To reduce the risk of equipment exhibiting a brittle fracture failure and causing for an uncontrolled release of nitrogen, it is recommended nitrogen purges and blanketing of process equipment do not exceed 75 psig. In the event of conflicting information, established operating procedures supersede this guidance.

Note: Some equipment may have a maximum allowable pressure less than 75 psig; in these cases, the maximum allowable pressure shall not be exceeded.

Note: Risk of brittle fracture increases in colder temperatures. If questions arise regarding the recommended purge or blanketing pressure for a specific piece of equipment, contact the refinery's metallurgist or fixed equipment engineer.

4.0 DEFINITIONS

4.1 **Inerting** - The displacement of the atmosphere in a permit space by a noncombustible gas (such as nitrogen) to such an extent that the resulting atmosphere is noncombustible. Such atmospheres cannot support life (IDLH).

4.2 **Oxygen deficient atmosphere** - Any atmosphere containing less than 19.5% oxygen by volume.

4.3 **Immediately Dangerous to Life or Health (IDLH)** – Any condition that poses an immediate or delayed threat to life or would cause irreversible adverse health effects or interfere with an individual's ability to escape from a confined space.

5.0 REFERENCES

RSW-SAF-054-DT Inert Confined Space Entry

RSW-SAF-055-DT Utility Hose Guidelines

RSW-SAF-043-DT Barricading Procedure

6.0 ATTACHMENTS

6.1 Attachment A Typical Human Physiological Responses to Oxygen Deficiency

7.0 REVISION HISTORY

Revision number	Description of change	Written by	Checked by	Effective date
7	Corrected 2 hyperlinks	J. Taggart	L. Mazur	12-08-10
8	Added language for more specific barricading	J. Taggart	L. Mazur	03-21-12
9	Added updated link to "loss of instrument air" and inert entry, changed header, added CBT#	S. Wolf	J. Rabideau	01-13-15
10	Added Instrument Analyzer Building information from General Safety Rules	S. Kumpar	Theo Taylor	2/21/18
11	Procedure Review, No changes	J. Taggart	A. Morales	1/29/20
12	Added Equipment Limitation section in alignment with the Minimum Design Metal Temperature Maintenance Memo – Refinery Manual: MAINTM0001	M. Wilhelm	J.Taggart	11/25/20

ATTACHMENT A

Typical Human Physiological Responses to Oxygen Deficiency

Oxygen (% volume)	Effects and Symptoms
23.5	Maximum safe level
21	Typical oxygen 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, lips blue, 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