

SAFETY
PROCEDURE

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CONFINED SPACE ENTRY

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Purpose:

To establish a standard procedure for safe entry into any permit-required confined space so employees are protected from the hazards of entry into permit spaces.

Definitions:

1. **Acceptable Entry Conditions** - The conditions that must exist in a permit space to allow entry and to ensure that employees involved with a permit space entry can safely enter into, and work within the space.
2. **Attendant** - An individual stationed outside one or more permit spaces who monitors the authorized entrants and who performs all attendants' duties as outlined in this procedure.
3. **Authorized Entrant** - An individual who is authorized by the company to enter a permit space.
4. **Blanking or Blinding** - The absolute closure of a pipe, line, or duct by the fastening of a solid plate (such as a spectacle blind or skillet blind) that completely covers the bore and that is capable of withstanding the maximum pressure of the pipe, line, or duct with no leakage beyond the plate.
5. **Confined Space** - Any enclosed structure or confined area that is:
 - A. not designed for continuous employee occupancy,
 - B. is large enough and so configured that an employee can bodily enter and perform assigned work,
 - C. has limited or restricted means of access and egress. These areas include, but are not limited to, tanks, vessels, silos, ducts, storage bins, hoppers, vaults, pits, sumps, cooling towers, furnaces, rail cars, or trenches 4 feet deep or deeper.
6. **Confined Space Work Permit** - A printed document that is provided by Grace to allow the controlled entry into a permit required confined space and that contains the following information:
 - A. permit space to be entered,
 - B. the purpose of the entry,
 - C. the date and the authorized duration of the entry permit,
 - D. a list or roster of the authorized entrants within the permit space that will enable the attendant to quickly and accurately determine which authorized entrants are inside the permit space,
 - E. the name of person currently serving as attendant,
 - F. name and signature of entry supervisor, who originally authorize entry,

- G. known hazards in the permit space to be entered,
 - H. measures used to isolate permit space, i.e. Lock-out Tag-out, purging, inerting, ventilating and flushing,
 - I. the acceptable entry conditions,
 - J. results of atmospheric testing, name of person who performed the tests and time tests were performed,
 - K. phone number to call in case of emergency,
 - L. communication that will be used by authorized entrants and attendants to maintain contact during entry,
 - M. what type of personal protective equipment, testing equipment, communications equipment, alarm systems, and rescue equipment is to be provided,
 - N. any other information that is necessary to ensure the safety of the entrants,
 - O. list of any other permits that are required for work in the confined space such as a hot work permit.
 - P. Signatures of the Permit Supervisor and Permit Receiver, required for approval and closure of entry permit.
7. **Contractor** - Employees of another employer (other than Grace employees), who are contracted to do work in the Lake Charles plant.
8. **Double Block and Bleed** - The closure of a line, duct, or pipe by closing and locking or tagging two in-line valves and by opening and locking or tagging a drain or vent valve in the line between the two closed valves. **NOTE:** Air supplied actuated valves are acceptable inline valves only when confirmation of position and isolation is possible.
9. **Emergency** - Any occurrence (including failure of hazard control or monitoring equipment) or event internal or external to the permit space that could endanger entrants.
10. **Engulfment** - The surrounding and effective capture of a person by a liquid or finely divided (flowable) substance that can be aspirated to cause death by filling or plugging the respiratory system or that can exert enough force on the body to cause death by strangulation, constriction, or crushing.
11. **Entry** - The action by which a person passes through an opening into a permit required confined space. Entry includes ensuing work activities in that space and is considered to have occurred as soon as any part of the entrant's body breaks the plane of an opening into the space.
12. **Entry Supervisor** - The person responsible for determining that all permit required confined space entry precautions have been taken before any employee enters a permit required confined space and who oversees entry operations. The entry supervisor may also serve as an attendant (hole watch) as long as he/she is properly trained and equipped to perform this role. The duties of the entry supervisor may be passed from one individual to another during the course of entry operations.
13. **Hot Work Permit** - A permit giving written authorization to perform hot work such as welding, grinding, chipping, riveting, cutting, burning, or any other spark producing activity that is capable of providing an ignition source.

14. **Hazardous Atmosphere** - An atmosphere that may expose employees to the risk of death, incapacitation, impairment of the ability to self rescue, injury, or acute illness from one or more of the following causes:
 - A. flammable gases, vapor, or mist in excess of 10 percent of its lower flammable limit (LFL),
 - B. airborne combustible dust at a concentration that meets or exceeds its LFL (NOTE: This concentration may be approximated as a condition in which the dust obscures vision at a distance of 5 feet or less.)
 - C. atmospheric oxygen concentration below 19.5 percent or above 23 percent,
 - D. atmospheric concentration of any substance for which a dose or a permissible exposure limit is published and could result in employee exposure in excess of its dose or permissible exposure limit,
 - E. any other atmospheric condition that is immediately dangerous to life or health.
15. **Immediately Dangerous To Life or Health** - Any condition that poses an immediate or delayed threat to life or would cause irreversible adverse health effects or would interfere with an individual's ability to escape unaided from a permit space.
16. **Inerting** - Is the displacement of the atmosphere in a permit space by a non-combustible gas (such as nitrogen) to such an extent that the resulting atmosphere is non-combustible (Note: This process produces an IDLH oxygen deficient atmosphere).
17. **Isolation** - The process by which a permit space is removed from service and completely protected against the releases of energy and material into the space by such means as:
 - A. blanking or blinding,
 - B. misaligning or removing sections of lines, pipes, or ducts,
 - C. double block and bleed systems,
 - D. lock-out or tag-out of all sources of energy,
 - E. blocking or disconnecting all mechanical linkages.
18. **Line Breaking** - The intentional opening of a pipe, line, or duct that is or has been carrying flammable, corrosive, or toxic material and inert gas, or fluid at a volume, pressure, or temperature capable of causing injury.
19. **Non-permit Confined Space** - A confined space that does not contain or, with respect to atmospheric hazards, have the potential to contain any hazard capable of causing death or serious physical harm.
20. **Oxygen Deficient Atmosphere** - An atmosphere containing less than 19.5 percent oxygen by volume.
21. **Oxygen Enriched Atmosphere** - An atmosphere containing more than 23 percent oxygen by volume.

22. **Permit Required Confined Space (Permit Space)** - A confined space that has one or more of the following characteristics:
 - A. contains or has a potential to contain a hazardous atmosphere,
 - B. contains a material that has the potential for engulfing an entrant,
 - C. has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross section,
 - D. contains any other recognized serious safety or health hazard.
23. **Permit Required Confined Space Program (Permit Space Program)** - The overall program that has been developed in the Lake Charles Plant for controlling, and where appropriate, for protecting employees from permit space hazards and for regulating employee entry into permit spaces.
24. **Prohibited Condition** - Any condition in a permit space that is not allowed by the permit during the period when entry is authorized.
25. **Rescue Services** - The personnel designated to rescue employees from permit spaces.
26. **Retrieval Systems** - The equipment used for non-entry rescue of persons from permit spaces such as a retrieval line, chest or full body harness, wristlets (if appropriate), and a tripod with winch set-up or anchor.

Responsibilities:

1. **Authorized Entrant:** It is the responsibility of the individual performing the permit required confined space entry work to:
 - A. know the hazards that may be faced during entry, including information on the mode, signs and symptoms, and consequences of exposure,
 - B. properly use personal protective equipment as designated by the entry supervisor,
 - C. communicate with the designated attendant as necessary to enable the attendant to monitor entrant status which will enable the attendant to alert entrants of the need to evacuate the permit space should an emergency occur,
 - D. alert the attendant when warning signs and symptoms of exposure to a dangerous situation occur,
 - E. alert the attendant and exit the permit space when a prohibited condition is detected,
 - F. obtain a confined space work permit and follow all procedures set forth in this document until such job is completed.
2. **Attendant:** It is the responsibility of the confined space attendant to:
 - A. know the hazards that may be faced during entry, including information on the mode, signs and symptoms, and consequences of exposure in authorized entrants,

- C. continuously maintain an accurate count of authorized entrants in the permit space by recording authorized entrant's names, clock number, time in and time out on the entry permit roster,
 - D. remain outside the permit space during entry operations until relieved by another authorized attendant,
 - E. maintain communications with authorized entrants as necessary to monitor entrant status,
 - F. Monitor activities inside and outside the permit space to determine if it is safe for entrants to remain in the permit space and orders the authorized entrants to evacuate the permit space immediately under any of the following conditions:
 - 1. if the attendant detects a prohibited condition,
 - 2. if the attendant detects the behavioral effects of hazard exposure in an authorized entrant,
 - 3. if the attendant detects a situation outside the permit space that could endanger the authorized entrants,
 - 4. if the attendant can not effectively and safely perform all the duties of an attendant as stated in this procedure.
 - G. Summon emergency rescue personnel and other services as soon as attendant determines that authorized entrants may need assistance to escape from permit space hazards.
 - H. Takes the following actions when unauthorized persons approach or enter a permit space while entry operations are under way:
 - 1. warn the unauthorized persons that they must stay away from the permit space,
 - 2. advise the unauthorized persons that they must exit immediately if they have entered the permit space,
 - 3. inform the authorized entrants and the Entry Supervisor if unauthorized persons have entered the permit space.
 - I. Performs non-entry rescues by pulling the entrant to safety using the retrieval line attached to the entrants safety harness.
3. **Entry Supervisor:** It is the responsibility of the Entry Supervisor to:
- A. know the hazards that may be faced during entry, including information on the mode, signs and symptoms, and consequences of exposure.
 - B. Review the confined space entry permit with the supervisor issuing the permit to ensure that the following has been completed:
 - 1. permit has been properly filled out,
 - 2. ensure that atmospheric testing such as percent oxygen, explosive meter, and toxicity tests have been completed to ensure a safe, healthy working atmosphere,
 - 3. all procedures and equipment specified on the permit are in place,
 - 4. removal of as much of the contents as possible,

5. all lines leading to the vessel are disconnected and capped off, or blinded off,
 6. confined space has been purged with water or equivalent means,
 7. all switches and circuit breakers controlling agitators, pumps, etc. have been locked open and tagged properly,
 8. confined space is well ventilated,
 9. employees have proper means of access and egress,
 10. employees are equipped with proper harness, life lines, and personal safety equipment needed for the job,
 11. entrants are schooled on the possible hazards they may encounter, both inside and outside the permit space,
 12. an attendant is on standby at the entrance, who can monitor entrant status and summon help if needed,
 13. if entering a rail car, ensure wheels are chocked, and flag is in place,
 14. ensure that entrants are aware that smoking, eating, and drinking are prohibited while working within a permit space.
- C. Terminates entry and cancels the entry permit when a prohibited condition arises in the permit space, or when entry operations, as covered by the entry permit, have been completed,
- D. removes unauthorized individuals who enter or who attempt to enter the permit space during entry operations,
- E. determines whenever responsibility for a permit space entry operation is transferred and at intervals dictated by the hazards and operations performed within the permit space,
- F. determines that entry operations remain consistent with terms of the entry permit and that acceptable entry conditions are maintained,
- G. review the entry permit with the attendant and entrants to ensure that all entry personnel are aware of acceptable entry conditions and all known hazards that may be faced during entry operations,
- H. ensure that the completed entry permit is posted at the entry portal and is available to all entry personnel for review,
- I. Ensure that the "**DANGER, PERMIT REQUIRED CONFINED SPACE, DO NOT ENTER**" sign is posted at the permit space opening as soon as the manway cover is removed. The sign is to remain posted for the duration of the job and will only be taken down when the entry work is complete and the manway cover is secured.
4. **Permit Supervisor**: It is the responsibility of the Permit Supervisor to verify that emergency rescue services are available and that the means for summoning them are operable, and to properly issue a confined space work permit and perform all atmospheric testing needed for entry into **permit required confined** space.
5. **Project Engineer**: It is the responsibility of the Project Engineer or designated Grace representative to verify that emergency rescue services are available and that the means for summoning them are operable, and to properly issue a confined space work permit, and perform all atmospheric testing needed for entry into permit spaces associated with all new construction before anyone can enter those permit spaces. This includes the lay-down yard and areas inside and outside current operating areas.

Note: New Construction is defined as any 'green field' projects such as a new unit or site expansion area.

It is not meant to be interpreted as repairing, replacing, installing or tying into an established process (e.g. new tank, new process pipe etc)

6. **Any Employee:** It is the responsibility of any employee, when there is a failure to comply with these requirements, to STOP the work until the situation is corrected.

Policy:

Issuing a Permit:

1. A "Confined Space Work Permit" must be obtained before ANY EMPLOYEE can enter a permit required confined space. The proper permit will be issued by a trained, authorized **Grace Supervisor**, Project Engineer, or authorized Grace representative. The Permit Supervisor will completely and correctly fill out the permit.
2. The Permit Supervisor shall review the permit with the Entry Supervisor to ensure that both are in agreement that all provisions for safe entry into the permit space have been met prior to "SIGN ON". This permit will be valid for ONE SHIFT normally (**Grace Operations Employees 12 hour Shift Schedule**). On jobs requiring more than one single shift, the permit can be extended once verification of all applicable conditions and rescue services are confirmed by the Permit Supervisor. A new properly filled out permit must be obtained at the beginning of the next day shift, or when there is a complete change of entry workers.

NOTE: The Entry Permit shall be reviewed and signed by the oncoming person(s) if there is a personnel change in the Permit Issuer (or Entry Supervisor), Receiver, Entrant(s), or Attendant. This is done to insure that the new person(s) has the knowledge of all sections of the Entry Permit.

3. At the conclusion of entry operations the Permit Supervisor shall review the entry permit and debrief the Entry Supervisor to ensure that entry operations went as planned prior to "SIGN OFF". If any hazards were confronted or created during entry operations that were not specified on the entry permit, a review of the plant confined space entry program shall be warranted.

Ingress and Egress:

4. A safe means of entry and exit must be maintained at all times while a confined space is occupied. If ladders are utilized, they must be kept in place and be tied off at the top.
5. The area immediately around an opening to a confined space shall be barricaded in such a manner to ensure immediate access. The area adjacent to the space opening (manway) shall be kept clear of any object/s that cannot be immediately moved in an emergency, i.e. dumpsters, machines, materials, or large equipment of any kind.

Entrance Covers:

6. When entrance covers are removed, the opening shall be promptly guarded by a railing, temporary cover, or other temporary barrier that will prevent an accidental fall through the opening and will prevent foreign objects from entering the space. Any conditions making it unsafe to remove an entrance cover shall be eliminated before the cover is removed.

Temporary Shelters

7. Any totally enclosed temporary shelter that is constructed directly adjacent to and adjoining the confined space opening, shall be considered as an extension of the confined space due to the possibility of a build-up of a hazardous atmosphere within the shelter.

Securing Equipment:

8. The confined space shall be secured from all power sources such as electrical, pneumatic, hydraulic or thermal with the objective being "Zero Energy State (ZES)" in strict accordance with the current plant Lock, Tag, and Try procedure.
 - A. Equipment is to be shut down, power sources disengaged, locked out, and tagged properly.
 - B. All electrical motors are to be tested at their on-off switch.
9. Any steam tracing or vessel jackets must be de-pressurized, drained and vented, and the steam valves locked and tagged properly (i.e. inlet closed, outlet open).
10. All lines exiting or entering into the confined space must be blinded or plugged at the nearest flange to the confined space, be physically disconnected with the ends covered, or a double block valve with open bleeder in place. Blinds must be of the same compatible material as the process equipment being blinded, or an inert shield provided on the process side of the flange. All valves leading to disconnected lines must be locked and tagged as per the current plant Lock, Tag, and Try procedure.
11. The permit space and equipment shall be purged or flushed as required to remove contaminants.

Atmospheric Testing:

12. Before any employee can enter a permit required confined space, the internal atmosphere must be tested with a calibrated, direct reading instrument for oxygen, flammability, and if required, toxicity levels. When the confined space has not been occupied for one hour or longer, atmospheric testing must be repeated for entry. Any Entrant and/or their authorized representative shall be allowed to observe any/all atmospheric testing if requested.
 - A. **Oxygen** – The acceptable range for oxygen is 19.5 to 23% and is normally very close to 20.8%. However, anytime the oxygen level is above or below 20.8%, the Permit Supervisor must scrutinize the space with great care. At no time will a permit be issued if the oxygen level is outside the acceptable limits. Anytime the oxygen level

deviates from the 19.5 to 23% acceptable range, employees must exit the confined space, the work situation re-evaluated, and a new permit issued.

- B. **Flammable Vapors** - A combustible meter test must be made before entry into any confined space. Entry into a permit required space will not be permitted if the test meter detects a % LEL of greater than 10%. Every effort should be made to mitigate vapor concentration levels before and during confined space entry.
- C. **Toxicity** - Toxicity test must be performed on any confined space that is known to, or is suspected of having contained toxic substances. The Operations Supervisor will make this determination.

If a hazardous atmosphere is detected, each employee **shall** leave the area immediately until the problem has been evaluated to determine how the hazardous atmosphere developed and steps taken to prevent a similar occurrence.

- D. **Temperature** – When applicable the ambient air temperature in the confined space should be tested. Permissible entry air temperature must be \leq 100 degrees. If the temperature is outside the permissible range, safety precautions may be stipulated on the permit for the protection of entrants who will be working in these environments with approval from the safety department.

Continuous Atmospheric Monitoring:

- 13. The atmosphere within a confined space shall be continuously monitored for percent Oxygen and LEL, where applicable. Continuous monitors will normally be the personal clip on type that shall be worn at all times by at least one person working within the confined space. In the event that the personal monitor alarm is activated, all employees must exit the confined space immediately and the work situation re-evaluated, and a new permit issued. Personal monitors shall be checked for proper operation (bump tested) daily, before the monitor is used. Monitors shall be checked for proper calibration at least monthly. All records related to bump testing and calibration of personal monitors shall be retained by the Safety Department.

Hazardous Environments:

Immediately Dangerous to Life or Health (IDLH): Any condition that poses an immediate or delayed threat to life or that would cause irreversible adverse health effects or that would interfere with an individual's ability to escape unaided from a Permit Space.

NOTE: *Air supplied breathing apparatus are required where all alternate methods of providing a safe working atmosphere have been exhausted or if deemed necessary by the Safety department. If an IDLH atmosphere condition exist or is suspected, an airline respirator with a minimum of a five minute escape pack must be used in conjunction with the air line respirator.*

Confined Space Entry shall only be permitted if an appropriate respiratory protection device(s) is used by the Entrant(s) in Hazardous Environments including but not limited to:

- Atmospheric oxygen concentration below 19.5% or above 23%;
- Atmospheric concentration of any substance and or chemical, present or introduced which could result in exposure in excess of its established exposure limit;
- Any other atmospheric condition that is immediately dangerous to life or health (IDLH).

Personnel **shall** immediately leave the Permit Space if atmospheric testing/monitoring results are outside any of the limits, and appropriate respiratory protection devices are not being used. After corrective actions have been taken (including ventilation) retesting **shall** be conducted.

14. All jobs where it is necessary to use toxic or flammable chemicals in a permit space (i.e. glues, thinners, cleaners, solvents, etc.), shall be thoroughly reviewed and approved by Safety Department personnel before the permit is issued. The Safety Department must first approve chemicals that will be used inside the permit space.

Note: If a Confined Space “contains or has the potential to contain airborne contaminants”, supplied air respirators are required until continuous testing/monitoring has been done for applicable suspected airborne contaminants.

Additional safety precautions may be stipulated on the permit for the protection of entrants who will be working with these chemicals in a permit space.

The atmosphere within the space shall be re-tested after work has started as deemed necessary by the Safety Department to ensure that continuous forced air ventilation is preventing the accumulation of a hazardous atmosphere within the space.

Any job or situation that could be considered hazardous to entrants while working in a permit space after the permit is issued shall be thoroughly reviewed and approved by Safety Department personnel, the Area General Foreman, and the Production Manager before the permit is issued.

15. Any time a radioactive source is used inside a confined space, a qualified person shall verify that the source is indeed closed and safe before continuing any work.
16. Cylinders of compressed gases shall never be taken into a confined space and, when positioned outside of a confined space, shall be turned off at the cylinder valve when not in use (exceptions include cylinders that are part of self-contained breathing apparatus or resuscitation equipment).
17. No matches or lighters shall be used or carried into a confined space.

Personal Protective Equipment:

18. Required personal protective equipment shall be furnished by the company and shall be worn at all times while working in permit spaces. Each situation will be evaluated and the Entry Supervisor will designate the equipment required for that job. The following personal

protective equipment is required and must be worn in any confined space that is hazardous to one's health.

- A. Air supplied breathing apparatus will only be used in extreme cases where all alternate methods of providing a safe working atmosphere have been exhausted. If an airline respirator is being used in a confined space, a minimum of a five minute escape pack must be used in conjunction with the air line respirator.
- B. When using an airline respirator, workers should exchange places within a reasonable period of time (recommended hourly). A minimum of 30 minute self contained breathing apparatus or airline respirator is to be on hand outside the confined space where it may be quickly utilized in an emergency.
- C. Slicker suits or other approved protective suits, rubber boots, and gloves are required in any confined space that has previously contained corrosive or toxic substances. The same is required when it cannot be verified that the space is free of potential toxic or hazardous contaminants that entrants could become exposed to.
- D. In all confined spaces, a hard hat, protective eye wear, safety toe shoes, and ear plugs are required as minimum protection.
- E. To facilitate non-entry rescue, each authorized entrant shall don a full body safety harness with retrieval lifeline attached at the center of the entrants back and shall be worn while working in a permit required confined space **unless retrieval equipment would increase the overall risk of entry or would not contribute to the overall rescue of the entrant**. The harness retrieval line must be tied to a fixed point or mechanical lifting device outside the confined space.

Proper Communications:

- 19. The confined space Attendant must maintain proper communications with all entrants during entry operations. Normally, this is done verbally. However, there may be situations where a confined space is configured where the attendant and entrants cannot maintain proper verbal communications. In these situations, 2-way radios may be utilized. The Attendant must also be able to readily communicate with the Incident Commander. If entry work is being performed in close proximity to operating areas where operating personnel would immediately hear and respond to an audible air horn, then it may not be necessary to issue the Attendant a 2-way radio. However, if entry work is being done in a remote area where an audible air horn would not practical, then a 2-way radio would have to be issued. The Permit Supervisor, Entry Supervisor, and Attendant must determine if a 2-way radio/s is necessary before the permit is signed on.

Confined Space Emergency Rescue:

- 20. The Shift Foreman is the Incident Commander (IC) for the Lake Charles plant. The Permit Supervisor shall contact the IC and gain approval before proceeding with the impending entry work. To facilitate emergency rescue of entrants from a permit space, the Attendant shall immediately notify the IC of the emergency situation. The IC will immediately

summon the Emergency Rescue Team (ERT) and equipment deemed necessary to safely perform the rescue. Members of the ERT shall maintain proficiency in making confined space emergency rescues by having periodic drills (at least yearly).

All documentation pertaining to ERT training and drills shall be maintained by the ERT Coordinator

Lighting Requirements:

21. Temporary lighting utilized in confined areas shall be low voltage (12V maximum) explosion-proof design with heavy duty cords, fittings, and insulation maintained in good condition.
22. Portable (battery powered) lighting of no more than 12 Volts maximum shall be on hand outside the confined space for utilization in a power failure. These shall be capable of providing illumination for a minimum of one hour.

Electrical Power Tools:

23. Feeders supplying 120 Volt electrical power to tools being used within a confined space or wet area shall be protected by a ground fault circuit interrupter (GFCI) located outside the confined space opening.

Forced Air Ventilation:

24. Continuous forced air ventilation shall be used if there is little or no natural ventilation, if there is a known or potential atmospheric hazard, if the internal temperature is elevated, or if atmospheric testing reveals any unsafe condition. The forced air ventilation shall be so directed as to ventilate the immediate areas where an employee is or will be present within the space and shall continue until all employees have left the space. The air supply for the forced air ventilation shall be from a clean source and may not increase the hazards within the space. Air must be exhausted from the permit space. Pneumatic type air movers (using plant air) may only be used to pull air out of the confined space. Where it is necessary to force air into a confined space, electric air movers must be used. If entry is to be made in large vessels where there is no natural ventilation, it may be necessary to use more than one ventilator with one blowing through the bottom and one pulling air from within the space from a top portal. If the space to be entered is located in direct sunlight where entrants could become overheated, additional ventilation and/or cooling shall be used to provide a safe working environment. If, through atmospheric testing, it is revealed that the space is unsafe for entry, then forced air ventilation shall be installed. After forced air ventilation has been in place for at least 10 minutes, then re-test. If subsequent test still shows conditions are unsafe for entry, no person shall be allowed to enter until engineering controls are in place that will eliminate the hazards.

When toxic or flammable chemicals are to be introduced into a confined space after the permit has been issued, the atmosphere within the space shall be periodically tested as necessary to ensure that the continuous forced air ventilation is preventing the accumulation of a hazardous atmosphere.

Examples of ventilation requirements are as follows:

1. **Scenario #1:** A well ventilated area with a large opening such as a baghouse, depending on work to be done, and only after a careful evaluation has been performed, air movers may not be required.
2. **Scenario #2:** The confined space is an opened top tank, such as the wood Wet End tub, that does not have a bottom manway and where, the half-moon lids must be removed so that entry can be made from the top using a ladder. In this case, an electric air mover would have to be used and set up at the top of the space blowing down on the entrants.
3. **Scenario #3:** The confined space is a large closed top tank, such as a silicate tank, that does have one bottom manway, then an air mover (electric or pneumatic), if properly placed, pulling air out of the top, may be sufficient depending on the type work. The air mover at the top, if properly placed, would actually pull air through the bottom manway at a sufficient velocity and quantity, to adequately ventilate the entire space.
4. **Scenario #4:** The confined space is a large closed top tank where volatile or toxic chemicals will be introduced into the tank, (i.e. rubber lining or fibreglassing) then it may be necessary to have two (or more) air movers in place to eliminate the build-up of hazardous vapors. One air mover would be set up at the top (electric or pneumatic) pulling air out of the space and another electric air mover blowing air into the space where the work is being done. If the vapors are heavier than air, a pneumatic air mover should be installed at the lowest possible point pulling air from the bottom of the space.

Contractors:

25. When contractors are hired to perform permit required confined space entry work, the Authorized Grace Supervisor issuing the permit shall inform the contractor:
 - A. of the hazards associated with the permit space to be entered,
 - B. of past experience with permit space that make the space in question a permit space,
 - C. of any precautions or procedures that have been implemented for the protection of employees in or near the permit space where contractor personnel will be working,
 - D. that ANY chemicals to be used within the confined space must be pre-approved by the Safety Department before the permit is issued.
26. The Authorized Grace Supervisor issuing the permit shall coordinate entry operations with the contractor, when both Grace employees and contractor personnel will be working together in a permit space or in close proximity to the space.
27. The contractor shall be debriefed at the conclusion of entry operations by the Authorized Grace Supervisor who issued the permit regarding the Lake Charles plant permit space program to review any hazards confronted or created in the permit space during entry operations.
28. In addition to complying with the Lake Charles permit space program, each contractor

retained to perform permit space entry operations shall have access to any available process safety information regarding permit space hazards and entry operations from the area Maintenance Planner or Maintenance Foreman.

Coordinate Entry Operations

29. Normally, Grace personnel and contract personnel will not work inside a permit required confined space at the same time. However, if it does become necessary, the Grace supervisor who issues the confined space entry permit must coordinate entry operations when both Grace personnel and contract personnel will be working together in, or in close proximity to, a permit required confined space. The Permit Supervisor must consult with the Entry Supervisor and area General Foreman as necessary to determine how each group can perform work safely without affecting the safety of entry workers. If the safety of all personnel, both inside and outside the confined space can not be assured, then the issuing supervisor, in conjunction with the area General Foreman shall revise work schedules of personnel involved and make changes as needed to assure the safety of all entry workers.

Policy / Procedure Review:

30. A review of entry operations shall be warranted if Grace management has a reason to believe that the measures taken under the permit space program have not been adequate to protect employees from the hazards associated with entry into permit spaces. Examples of circumstances requiring review of the plant permit space program are:
- A. any unauthorized entry into a permit space,
 - B. the detection of a permit space hazard not covered by the permit,
 - C. the detection of a condition not covered by the permit,
 - D. the occurrence of an injury or near miss during entry,
 - E. a change in the use or configuration of a permit space,
 - F. an employee complains about the effectiveness of the permit space program.
31. All completed confined space entry permits shall be collected and reviewed in each area and then forwarded to the Safety Department and retained for at least one year. A review shall be made of all entries made during the previous 12 month period. This review will be either a continual review or a single annual review. If warranted, changes shall be made to the confined space entry program as necessary to ensure that employees performing confined space entry work are protected from the hazards associated with entry into confined spaces.

RECLASSIFICATION OF A PERMIT SPACE:

32. A permit required confined space shall only be reclassified as a non-permit required space after a thorough review has been made Grace Corporate Safety personnel, Lake Charles Safety and the area General Foreman. Typically, this will only be done after a large section of the permit space (vessel) has been removed. Normally, removing a section of a very large vessel provides access for large equipment such as a front end loader. The process by which a permit space is

reclassified to a non-permit space will normally be triggered by a request from an area General Foreman. Criteria to reclassify a permit required confined space shall be:

- A. The Safety Department has thoroughly evaluated the job and has determined that there is no actual or potential atmospheric hazards and all hazards within the space have been eliminated without entry into the space.
- B. Only after the proper reclassification form has been filled out, signed and posted by the Safety Department personnel, can work in the reclassified space begin. (NOTE: Because work of this kind can go on for extended periods, the signed permit must be enclosed in a water resistant slip cover and securely affixed to the entry point.)
- C. If hazards arise within a reclassified space, each employee in the space shall exit the space until a thorough investigation has been performed by the Safety Department. The Safety Department will determine action to be taken to prevent reoccurrence and determine if the space will remain reclassified or not.

Confined Space Entry Procedure: Permit Required

<p>NOTE: {DANGER}-CONFINED SPACE DATA SHEETS SHALL BE USED WHEN PREPARING FOR CONFINED SPACE ENTRY WORK.</p>

Pre-Entry Steps:

1. Obtain an approved work permit, Confined Space Entry Data Sheets (if available) and any process safety information deemed necessary from the area Maintenance Planner. Review work to be done with the planner and/or Maintenance Foreman.

NOTE: Confined Space Entry Data sheets may not be available for all confined spaces in the Lake Charles plant. If the data sheet is not available for the confined space to be entered, then an on-sight evaluation shall be performed by the Authorized Grace Supervisor to determine the hazards associated with the confined space to be entered.

2. Report to the lead operator in charge of the process for the confined space to be entered to gain approval for the work that is to be performed. Once approved, the work permit must be signed on by the custodian of the equipment.
3. Using the confined space entry data sheet as a guide, the custodian of the equipment shall work with maintenance or contract personnel to ensure that all provisions for safe entry including Lock, Tag, and Try, have been met. These shall include, but are not limited to:
 - A. washing vessel out with water or equivalent means, pumping vessel empty,
 - B. flushing and draining all lines leading into, and out of the confined space to be entered,
 - C. lockout and tag all energy sources to equipment such as pumps, agitator's mixers, screws, rotary valves etc,

- D. lockout and tag appropriate valves leading into, and out of the confined space to be entered,
 - E. identify blind point locations, valves and pipe spools that are to be removed.
4. Once the custodian has readied the confined space as per the confined space data sheet and current Lock, Tag, and Try procedure, an authorized Grace supervisor (Permit Supervisor) shall be responsible for issuing the Entry Permit. The Permit Supervisor shall review work that has been authorized on the work permit with the Entry Supervisor.

Verify Duties Assigned:

5. The Permit Supervisor shall verify with the Entry Supervisor that the duties of Attendant, and Entrants have been assigned. Also those personnel have been properly trained to fulfill the roles assigned.

Verify Space Purged / Lines Flushed:

6. The Permit Supervisor shall verify the following:
- A. confined space contents has been pumped out as much as possible,
 - B. confined space has been washed thoroughly both inside and out with water or equivalent means,
 - C. all lines leading to and from the confined space have been purged and flushed clean.

Verify Hazards Addressed & Eliminated:

7. The Permit Supervisor in conjunction with the Entry Supervisor shall:
- A. review the Confined Space Data Sheet, Lockout / Tagout data sheets, and any available process safety information deemed necessary to facilitate hazard evaluation for the space to be entered.
 - B. Identify and verify that all steps needed to render the space SAFE for entry have been taken. These shall include, but are not limited to:
 - 1. verify that appropriate valves or pipe spools have been properly removed,
 - 2. verify that valves that are supposed to be locked are indeed locked in the proper position including double block and bleed systems,
 - 3. verify that blinds have been properly installed in the necessary locations,
 - 4. verify that all necessary equipment has been properly de-energized locked out and tagged,
 - 5. verify that the needed mechanical ventilation has been properly installed and is adequate for the job to be done,
 - 6. verify that temporary barriers have been properly installed and tagged (flagging, temporary railing, etc.).

NOTE:{DANGER}- IF HOT WORK SUCH AS CUTTING, WELDING, GRINDING, CHIPPING, OR ANY OTHER SPARK PRODUCING WORK IS GOING TO BE PERFORMED IN THE CONFINED SPACE, A HOT WORK PERMIT SHALL BE ISSUED BEFORE HOT WORK IS ALLOWED TO BEGIN.

NOTE:{DANGER}- AS SOON AS THE MANWAY COVER IS REMOVED FROM THE CONFINED SPACE, THE PERSONS REMOVING THE COVER SHALL INSTALL THE **"DANGER, PERMIT REQUIRED CONFINED SPACE, DO NOT ENTER"** SIGN AT A POINT NEAREST TO THE ENTRY POINT.

- C. Determine if hot work is going to be performed within the confined space.
(Issue HOT WORK permit as per the current Hot Work procedure).

Perform Atmospheric Testing:

NOTE:{DANGER}- THERE MAY BE NO HAZARDOUS ATMOSPHERE WITHIN THE CONFINED SPACE WHENEVER EMPLOYEES ARE INSIDE THE SPACE!

8. The authorized Grace supervisor shall test the internal atmosphere of the confined space with a calibrated, direct reading instrument for the following conditions in the order given:
- A. OXYGEN CONTENT
 - B. FLAMMABLE GASES AND VAPORS
 - C. POTENTIAL TOXIC AIR CONTAMINANTS (Space will be tested before entry for toxic air contaminants only when the space has been known to contain toxic chemicals. Space will be tested after entry if toxic chemicals will be introduced into the permit space after the permit is issued).

Coordinate Entry Operations:

9. The Permit Supervisor must coordinate entry operations when both Grace personnel and contract personnel will be working together in, or in close proximity to, a permit required confined space. The Permit Supervisor must consult with the Entry Supervisor and area General Foreman as necessary to determine how each group can perform work safely without affecting the safety of entry workers. If the safety of all personnel, both inside and outside the confined space can not be assured, then the issuing supervisor, in conjunction with the area General Foreman shall revise work schedules of personnel involved and make changes as needed to assure the safety of all entry workers.

Fill Permit Out:

10. The Permit Supervisor shall fill out the permit, and in conjunction with the Entry Supervisor, review all points on the confined space entry work permit check-list. The Permit Supervisor shall make entries onto the permit legible, and record the following:

- A. fill out the top portion of the Confined Space Work Permit, and along with the Entry Supervisor, review each point on the permit checklist to ensure that both are in agreement that all provisions for safe entry have been addressed,
- B. record atmospheric test results, time tested and signature of person performing test in the space provided on permit,
- C. list acceptable entry conditions and known hazards on the permit and ensure that the Entry Supervisor, Attendant, and all Entrants are aware of known hazards and acceptable entry conditions,

NOTE:{DANGER}- AT LEAST ONE ATTENDANT SHALL BE STATIONED OUTSIDE THE PERMIT SPACE AT ALL TIMES AND SHALL NOT LEAVE THE SPACE. IF THE ATTENDANT MUST LEAVE WITHOUT QUALIFIED REPLACEMENT, ENTRANTS MUST EXIT THE SPACE UNTIL THE ATTENDANT RETURNS. THE ATTENDANT MUST ALWAYS MAINTAIN PROPER 2-WAY COMMUNICATIONS WITH THE ENTRANTS. THE ATTENDANT MUST ALSO BE ABLE TO READILLY SUMMON THE INCIDENT COMMANDER IN EMERGENCY SITUATIONS. IF ENTRY WORK WILL BE DONE IN A REMOTE AREA, THIS MAY REQUIRE THE ISSUANCE OF 2-WAY RADIOS.

- D. list the name of the authorized Attendant on the permit and determine if it will be necessary to issue the attendant and entrants 2-way radios in order for them to maintain proper communications with each other and with the Incident Commander. If it is determined that 2-way radios are necessary, the Attendant must be instructed how to use the radio to properly summon the Incident Commander.

NOTE:{DANGER}- THE SHIFT FOREMAN IS THE INCIDENT COMMANDER AND CAN BE CONTACTED ON RADIO CHANNEL 2 (Shift Foreman) OR PHONE EXT.-3571. THE PERMIT SUPERVISOR SHALL CONTACT THE SHIFT FOREMAN ON DUTY AND NOTIFY HIM THAT PERMIT REQUIRED CONFINED SPACE ENTRY WORK IS ABOUT TO PROCEED. THE SHIFT FOREMAN SHALL VERIFY THAT THERE ARE ADEQUATE RESOURCES (TRAINED PERSONNEL AND EQUIPMENT) IN THE PLANT WHILE ENTRY WORK IS ONGOING. IF THE SHIFT FOREMAN DETERMINES THAT THERE ARE NOT ENOUGH ADEQUATELY TRAINED EMERGENCY RESCUE PERSONNEL IN THE PLANT, THEN ENTRY IS NOT PERMITTED. THE SHIFT FOREMAN SHALL MAKE THIS DETERMINATION.

11. The Permit Supervisor shall:
 - A. contact Shift Foreman (IC) to ensure that Emergency Response Team can be assembled if needed,
 - B. list all authorized confined space Entrants on the permit,
 - C. ensure that Entrants have all personal protective equipment needed for entry,
 - D. ensure at least one entrant is equipped with a clip-on type continuous atmospheric monitor and that the monitor is operational,
 - E. verify that there is adequate ventilating equipment in place that is needed to obtain acceptable entry conditions,
 - F. ensure that equipment, such as ladders, or scaffolding, needed for safe ingress and egress by authorized entrants are in place and secured properly.

Emergency Rescue Equipment:

NOTE: In some situations, the Permit Supervisor may determine that the rescue equipment would increase the overall risk of entry or would NOT contribute to the rescue of the Entrant, therefore make the decision not to use the equipment.

12. If entering into a permit required confined space vertically the Permit Supervisor shall ensure that Entrants have donned the proper safety harnesses with rescue lines attached at the back.

Sign ON:

13. Once all provisions for safe entry into the confined space have been satisfied on the permit, the Permit Supervisor and the Entry Supervisor shall sign the permit in the SIGN ON section, TIME, and DATE.

Post Permit:

14. The Entry Supervisor shall post the confined space work permit at the entrance to the confined space.

Permit Entry Roster:

15. The authorized Attendant shall record all entrants' names on the entry roster. Then record the time Entrants enter and exit the permit space.

Entry:

<p>NOTE:{DANGER}- IF AN UNSAFE CONDITION ARISES WHILE EMPLOYEES ARE INSIDE A CONFINED SPACE, ALL EMPLOYEES ARE TO EXIT THE SPACE IMMEDIATELY UNTIL GRACE MANAGEMENT HAS REEVALUATED THE SPACE TO DETERMINE HOW THE UNSAFE CONDITION OCCURRED. MANAGEMENT SHALL EVALUATE THE PLANT PERMIT SPACE PROGRAM TO DETERMINE IF CHANGES IN THE PROGRAM ARE WARRANTED!</p>

16. Authorized Entrants may enter the confined space to perform work authorized on the work permit.

Sign OFF:

17. When entry work is complete, the Permit Supervisor and Entry Supervisor shall sign the permit in the SIGN OFF section, TIME, and DATE.

<p>NOTE:{DANGER}- PROCESS SAFETY INFORMATION IN THE LAKE CHARLES PLANT IS UPDATED CONTINUALLY TO REFLECT ANY CHANGES TO THE PROCESS THAT MIGHT HAVE OCCUR. IT IS FOR THIS REASON THAT INFORMATION, WHEN GENERATED, SHALL BE USED</p>

FOR HAZARD EVALUATION, THEN DISCARDED SO THAT ONLY THE MOST UP TO DATE INFORMATION IS USED AT ALL TIMES. THE USE OF OUT-DATED PROCESS SAFETY INFORMATION COULD HAVE SERIOUS CONSEQUENCES.

18. The Permit Supervisor shall collect all process safety information generated prior to entry and discard.
19. If a contractor has performed the entry work, the Permit Supervisor shall debrief the contractor at the conclusion of entry operations regarding the plant permit space program and any hazards confronted or created in the permit space during entry operations.
20. The Permit Supervisor shall forward the completed permit to the Safety Department for review and comments.

CHANGE DATE	DESCRIPTION OF CHANGE
06/05/09	Pg (9) Removed Operation Supervisor text Inserted Permit Supervisor Removed Maintenance/Labor Supervisor duties
	Pg (10) Removed Operations/Maintenance Supervisor text Inserted GRACE Supervisor Identified Normal Shift
06/25/09	Pg (13) Inserted "where applicable" in text requiring continuous air monitoring
06/20/11	Pg (2) Inserted: Signatures of the Permit Supervisor and Permit Receiver, required for approval and closure of entry permit. Pg (3) Inserted: NOTE: Air supplied actuated valves are acceptable inline valves only when confirmation of position and isolation is possible. Pg (4,5,13) Inserted 23 % Pg (13) Inserted :Entry into a permit required space will not be permitted if the test meter detects a % LEL of greater than 10%. Every effort should be made to mitigate vapor concentration levels before and during confined space entry. Pg (13) Inserted: <u>Temperature</u> – When applicable the ambient air temperature in the confined space should be tested. Permissible entry air temperature must be =/< 95 degrees. Pg (14) Inserted: <i>Note</i> : If a Confined Space "contains or has the potential to contain airborne contaminants", supplied air respirators are required until continuous testing/monitoring has been done for applicable suspected airborne contaminants.
06/20/11	Pg (17) Inserted: All documentation pertaining to ERT training and drills shall be maintained by the ERT Coordinator Pg (29) Inserted: The Permit Supervisor shall forward the completed permit to the Safety Department for review and comments.
2/22/12	Removed "A" operator initial requirement.
4/12/12	Changed Permissible entry air temperature must be =/<100 degrees.
10/25/12	Added: <u>Hazardous Environments:</u> Immediately Dangerous to Life or Health (IDLH): <i>Any condition that poses an immediate or delayed threat to life or that would cause irreversible adverse health effects or that would interfere with an individual's ability to escape unaided from a Permit Space.</i> NOTE: <i>Air supplied breathing apparatus are required where all alternate methods of</i>

	<p><i>providing a safe working atmosphere have been exhausted or if deemed necessary by the Safety department. If an IDLH atmosphere condition exist or is suspected, an airline respirator with a minimum of a five minute escape pack must be used in conjunction with the air line respirator.</i></p> <p>Confined Space Entry shall only be permitted if an appropriate respiratory protection device(s) is used by the Entrant(s) in Hazardous Environments including but not limited to:</p> <ul style="list-style-type: none"> • Atmospheric oxygen concentration below 19.5% or above 23%; • Atmospheric concentration of any substance and or chemical, present or introduced which could result in exposure in excess of its established exposure limit; • Any other atmospheric condition that is immediately dangerous to life or health (IDLH). <p>Additional safety precautions may be stipulated on the permit for the protection of entrants who will be working in these environments. Personnel shall immediately leave the Permit Space if atmospheric testing/monitoring results are outside any of the limits, and appropriate respiratory protection devices are not being used. After corrective actions have been taken (including ventilation) retesting shall be conducted.</p>
10/25/12	Added to D. Temperature : If the temperature is outside the permissible range, safety precautions may be stipulated on the permit for the protection of entrants who will be working in these environments with approval from the safety department.
12/4/12	Radio channel 1b changed to 2 (Silica Sol)
9/05/13	17.No matches or lighters shall be used or carried into a confined space
9/05/13	2. This permit will be valid for ONE SHIFT normally (Grace Operations Employees 12 hour Shift Schedule). On jobs requiring more than one single shift, the permit can be extended once verification of all applicable conditions and rescue services are confirmed by the Permit Supervisor. A new properly filled out permit must be obtained at the beginning of the next day shift, or when there is a complete change of entry workers.
1/17/2017	<p>Removed under proper communications – (Radios for this purpose can be obtained from the tool room)</p> <p>Also updated page 18 – Radio Channel 2 (Shift Foreman)</p>
5/11/2017	<p>Note: New Construction is defined as any 'green field' projects such as a new unit or site expansion area.</p> <p>It is not meant to be interpreted as repairing, replacing, installing or tying into an established process (e.g. new tank, new process pipe etc)</p>

END