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1. PURPOSE

The purpose of this document is to:

- Sets forth the requirements necessary for working in confined spaces at TFR to prevent exposure of personnel to dangerous air contamination, oxygen deficiency, and physical hazards associated with confined spaces. Confined spaces include, but are not limited to, tanks, ducts, pipelines, sumps, sewers, trenches, vaults, and similar spaces not intended for continuous human occupancy and meeting the criteria described in General Safety Regulations, regulation 5.
- Ensuring the proper authorization of designated work.
- Making clear the exact identity, nature and extent of the work activity and the hazards involved, including limitations on the extent of the work and the times during which the work can be carried out.
- Specifying the precautions to be taken, including safe isolation from potential risks such as exposure to hazardous substances, moving equipment and electricity.
- Ensuring the individual in charge of operations is fully aware of work activities taking place.
- Providing a system of continuous control and a record of showing the nature of the work and that necessary precautionary checks have been satisfactorily completed.
- Providing necessary information on related/interactive work activities and satisfactory completion and handover of authorized work.

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Plog, Barbara, A.: Fundamentals of Industrial Hygiene. Chicago, National Safety Council, 4th Edition, 1996;

Occupational Health and Safety Act, Act 85 of 1993

3. DEFINITIONS AND ABBREVIATIONS

3.1 Definitions

Procedure: formal documentation pertaining to a major business/operating-/technical/engineering process, which will include reference to instructions, product, equipment or process specifications, to implement the principles of a policy. It also defines the roles and responsibilities of those covered by the procedure;

Work Instruction (SOP): an exact description of an activity, which is a component of a major process, to which reference will be made within a procedure;

Attendant (standby): An individual stationed outside one or more confined spaces to monitor authorized entrants, and who performs all attendants' duties assigned in the confined-space program.

Confined space. A space that (1) is large enough and so configured that an employee can enter bodily, (2) has limited or restricted means for entry or exit (e.g., tanks, vessels, vaults, pits), and (3) is not designed for continuous occupancy.

Entry: The action by which a person passes through an opening into a permit-required confined space. Entry is considered to have occurred as soon as any body part of the entrant's body breaks the plane of an opening into the space.

Entry permit: The written permit that must be completed and posted at the worksite before a confined space is entered (see Appendix A).

Hazardous atmosphere: An atmosphere that may expose employees to the risk of death, injury, or illness from one of the following: Flammable gas, vapor, or mist exceeding 10% of its lower explosive limit (LEL), Airborne combustible dust at a concentration that meets or exceed its LEL, Atmospheric oxygen concentration below 19.5% or above 23.5%, Atmospheric concentration that exceeds the OEL, STEL, ceiling, or the manufacturer's recommendations on the Material Safety Data Sheet (MSDS);

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.

Note: These spaces become permit-required confined spaces if hazards are brought in or exposed by the work. Examples include gasoline-powered earth compactors (carbon monoxide); solvent-based coatings, epoxies, and paints; open sewer lines in the bottom of trenches; contaminated soil; welding; etc.

Occupational Exposure Limits: means a limit value set by the Minister for a stress factor in the workplace.

3.2 Abbreviations

SOP:	Safety operating procedure
SANS:	South African National Standard
OHS Act:	Occupational Health and Safety Act (Act 85 of 1993)
TFR:	Transnet Freight Rail

4. RESPONSIBILITIES AND AUTHORITIES

Senior Management - Must ensure that this procedure is implemented and adhered to.

Line Management - Must ensure that the requirements of the Act and Asbestos regulations are implemented and maintained.

Nominated Safety Manager - Must ensure that the requirements of the Act and Asbestos regulations are implemented and maintained.

- Must ensure that this procedure is implemented and adhered to.

Safety Specialist - Ensure the Asbestos inventory report is correct and oversee the implementation of any recommendations.

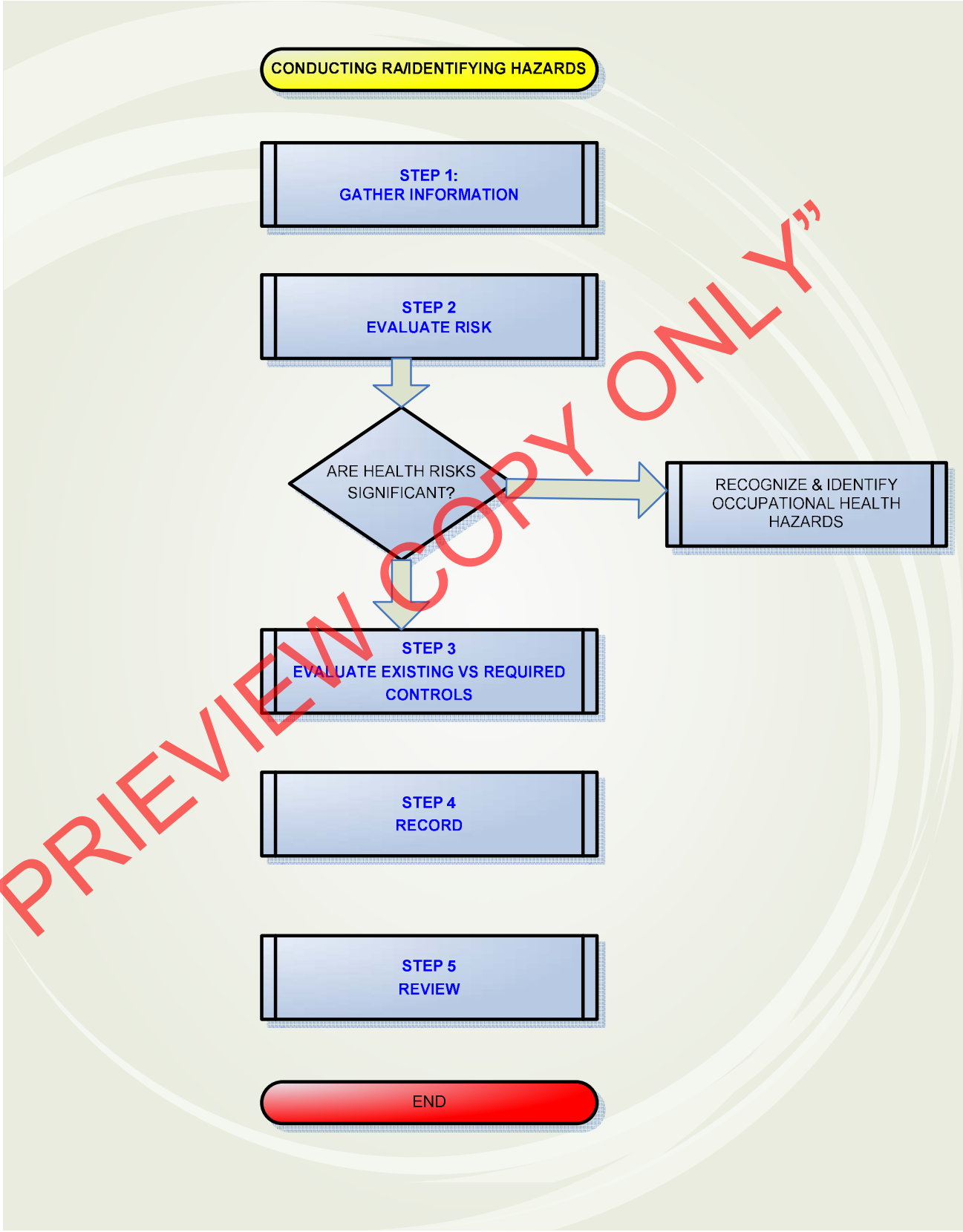
5. RISK MANAGEMENT

Hazardous Chemical Substances Regulation 5 requires the employer to conduct the assessment with regards to the potential exposure to Hazardous Chemical Substances, in which the health and safety risks to which employees may be exposed while they are at work, and record the hazards identified and significant risk assessed. As far as reasonably practicable attempts will be made to first of all to eliminate the risk, thereafter to control the risk, then to minimise the risk and thereafter, insofar as the risk remains, to provide personal protective equipment and to implement a programme to monitor the risk.
A risk assessment will be carried out to assist in deciding on appropriate action and formulating a management plan.

The risk assessment will be carried out in two parts: the first is a material assessment which assesses the condition of the material and the likelihood of it releasing fibres if disturbed; the second part is a priority assessment which takes into account maintenance activities, likelihood of disturbance, human exposure potential, occupant activity or visitors.

All possible relevant information such as incident statistics, research reports, manufacturer's specifications, approvals, design criteria and performance figure for all relevant equipment will be obtained and considered for risk assessment.
Before an assessment can be made, the relevant health and safety representative or relevant health and safety committee will be consulted and thereafter inform them in writing of the arrangements made for the assessment, give them reasonable time to comment thereon and ensure that the results of the assessment are made available to them for comment.

Occupational health risk assessment will be conducted as follows:



6. PROCEDURE

This procedure applies to all TFR employees and any worker under the technical supervision of a TFR employee. Permit authorisation is required before any person enters a confined space. A confined space is defined as “any place, including any chamber, tank, vat, silo, pit, trench, pipe, sewer, flue, well or other similar space in which, by virtue of its enclosed nature, there arises a reasonably foreseeable specified risk.

Sub-contractors may elect in their Safety Plan to comply with these procedures; in which case, this policy is applicable. If the sub-contractor chooses to use their own Health and Safety Plan for confined space procedures, it must be reviewed and approved by Safety Manager, before work may commence. The safety plan must contain procedures, which meet OHS Act requirements for entering permit-required confined spaces, and include the completion of a permit form.

6.1 CLASSIFICATION

6.1.1 Confined space requiring permit to work with high or susceptible risks

Confined Spaces that requires permit to work are confined spaces where actual hazards have been identified, or where the probability of a hazard is significant. Evaluation using the Confined Space Entry Permit (Appendix A) is required. Both the confined space trained on-site supervisor and a TFR Occupational hygienist/Technologist must sign the permit. In cases where radiological hazards are present, a Radiation Protection Officer/specialist’s signature is required for approval before any work can commence and where there are electrical cables, an Electrical Supervisor’s signature is required for approval.

6.1.2 Confined space requiring permit to work with low risks

For confined spaces where a permit is required, but hazards have been evaluated as low risk, the confined space trained on-site supervisor may approve a procedural confined space permit and the following conditions must be met:

- The TFR employees or contract employees who have completed Confined Space Entry Hazards Training program will conduct the work.
- The entry permit must be completed and signed by a confined space trained on-site supervisor and TFR Occupational hygienist/Technologist.
- All conditions for a permit-required confined space are met.

6.1.3 Non-permit required confined spaces

Confined spaces that do not contain hazards, nor have a potential to contain hazards, do not require an approved Confined Space Entry Permit. However, a permit must be completed by the confined space trained on-site supervisor, and, if hazards are found not to exist, clearly marked as a "Non-permit Space" and posted at the work site. "Non-permit Space" must be approved by the TFR Occupational hygienist/Technologist.

6.5 Confined-space entry work permit system

A Confined Space Entry Work Permit (see Appendix A) **must** be completed for all confined-spaces before entry. This permit documents in writing the location(s) and type of work to be done, certifies that all existing hazards have been evaluated by the responsible qualified person(s), and ensures that necessary control measures have been taken to protect the health and safety of the employees. Non-permit confined spaces must be identified as such by documenting that chemical and physical hazards (e.g., oxygen levels, etc.) do not exist and by writing "Non-Permit Space" in bold print across the work permit. Permits will expire when the entrance is closed or at the end of the 8-hour work shift, whichever is sooner.

6.3 Confined-space team

All person(s) entering the space (entrant) should be listed and the designated standby (attendant) person(s). If applicable, the rotation by the designated attendant(s) with personnel working in the confined space must be specified.

6.4 Requirements completed prior to entry

a) Detailed health and safety risk assessment should be conducted prior

to commencement of work.

b) If high electrical lines are present in the confined space, the Electrical Supervisor (or designee) must approve the entry permit.

c) Lockout and tagout/blockout must be done in accordance with TFR lockout and tagout procedures.

d) Lines, pipes, etc., must be blanked/capped to the extent feasible before the confined space is entered.

e) If mechanical ventilation is required, site-specific details, such as the direction of airflow and the placement of the air intake, must be documented in the "Additional Information" section. The air supply must be from a clean source: exhaust from vehicles, cranes, earth compactors, and other potential sources of contaminants must be considered when locating the blower.

f) The confined space must be emptied and purged of all hazardous materials to the extent possible prior to entry. A fresh air blower ventilation system shall be set up and in operation before and during all inspection and maintenance procedures. If hazardous materials have been identified or will be used in the confined space, an Occupational hygienist/Technologist must be present to determine their concentrations and approve the permit. If these materials exceed, or have the possibility to exceed the Occupational Exposure Limits, rescue equipments (e.g., hoist, lifelines, and harness) are required, and the standby must be CPR trained.

g) Continuous air monitoring will be required for confined space that cannot be isolated from potential contaminants. For example, flowing sewers often cannot be blanked off, and continuous air monitoring is required.

h) When entrance covers are removed, temporary barriers that will protect the entrants from external hazards, such as vehicles, and protect pedestrians from falling into the opening must guard openings.

i) A fire extinguisher must be present if "hot work" is being performed.

j) If ionizing radiation may be present, radiation levels must be monitored by radiation protection officer/specialist.

k) Required personal protective equipment should be specified before entering into the confined space as also determined during the risk assessment. If respiratory protection is required, site-specific details, such as the type of respirator and cartridges, must be specified.

l) At least one standby person must be present at all times while the high-risk confined space is occupied. The primary responsibility of the standby personnel is the health and safety of the occupants in the confined space. Standby personnel must be in constant visual/radio contact with the occupants and must immediately notify the TFR Fire Department and Occupational Health department if there are any problems. The standby person should always summon emergency rescue workers, and may never enter a confined space to attempt a rescue. However, the standby can initiate a non-entry rescue, such as by operating a hoist or lift.

m) If “hot work” will be performed, a Fire Safety Permit, available from the Fire Department, must be completed and posted at the entrance to the space prior to the start of work. All confined spaces become permit-required confined spaces when hot work is performed in them. In addition, welding gas cylinders may never be brought into a confined space.

n) Personnel entering the space must receive confined-space training prior to entering a permit-required or procedural confined space.

o) Additional lighting equipment may be needed to enable employees to see well enough to work safely and to exit the space quickly in an emergency, in these instances, explosion-proof lighting will be required.

p) The explosion-proof gas monitor must be calibrated monthly and function checked prior to each daily use. Monitoring the air inside a confined space should be conducted prior to entering and be conducted by a competent person. Testing a confined space for

atmospheric hazards should be done remotely before entering, and should be done in this order: (1) ensure that proper oxygen levels are present, (2) ensure that combustible gases are not present, (3) ensure that toxic gases are below the Occupational exposure limit. Common toxic gases in a confined space could be Hydrogen Sulfide (H_2S) and Carbon Monoxide (CO), but other toxic compounds could be present.

q) Minimum health and safety equipment required before confined space entry:

- approved gas detector (properly calibrated and that is in operation the entire time the employee is in the confined space. This is necessary due to the possibility of a rapid change in the confined space atmosphere);
- fresh air blower;
- safety harness, rope, and tripod safety system (A safety harness and lifeline which is attached to the tripod safety retrieval system);
- an approved hard hat; and
- emergency Action Plan

6.5 Confined-space monitoring procedure

In a confined space it is important to take samples at the top, middle and bottom to locate varying concentrations of gases and vapours. There are some gases lighter than air (i.e. methane and other combustible gases) that can be found at the top of a confined space. There are other gases that are heavier than air (i.e. hydrogen sulfide) that can settle near the bottom of a confined space, and still other gases that are the same weight as air (i.e. carbon monoxide) that can be found throughout a confined space.

Take air samples at several levels within the confined space and continuously monitor the space due to the fact that conditions can change. The confined space must be tested at three levels for each atmospheric condition. Each level must be tested for a minimum of 60

seconds. The gas detector itself can be lowered into the confined space atmosphere with a safety line

As the remote air monitoring is completed and the area is safe for entry, confined space entry permits should be completed and followed. After the initial entry, monitoring the air in the confined space should be continuous. A confined space entry attendant or standby should carry out the continuous monitoring. Conditions in a confined space can change without warning, due to leakage, toxic vapor release, or disturbing the contents of the space.

Testing must include: -

- Oxygen content must be at least 19.5% in the confined space, measured at all levels (bottom, middle, and top). The safe oxygen level is between 19.5% and 21%. Confined space should not be entered if the oxygen level is below 19.5% or above 21%. Due to the extreme danger of suffocation in confined spaces, constant and continuous oxygen monitoring is required throughout each work period. Oxygen content above 23% can cause explosions or vigorous burning of flammable materials, including hair or clothing.
- In circumstances where risk assessment has identified a significant possibility for the presence of fuels, combustion products, methane and/or biological action (e.g. oxyacetylene cutting, decontamination of fuel tanks, sewage systems etc.) the following tests should also be carried out: -
  - ✓ Explosive/flammable vapours – limit < 2% LEL (measure flammability at all levels of the confined space (bottom, middle, and top). Flammability is measured in terms of the Lower Explosive Limit (LEL). This is the smallest concentration of a combustible gas in air that will explode when it contacts a spark or open flame)
  - ✓ Hydrogen Sulphide – limit 10ppm (8hour TWA)
  - ✓ Carbon dioxide – limit 30ppm (8 hour TWA)

Procedure to be followed:

- Record hazard identification of area and/or confined space to be entered. Reference to additional Permits to Work must be recorded.
- Identify reason for confined space entry
- Confirmation that all necessary isolation and pre-entry activities have been carried out. Authorised persons are restricted to those who have received information, instruction and training in this and related Permit to Work procedures.
- The atmosphere within the confined space must be tested and confirmed as safe before entry is permitted. Normal practice will be to test for oxygen content however it may be necessary to test for flammable/explosive vapours and H2S, with additional parameters tested if identified as potentially present during the risk assessment process. Personnel authorised to carry out gas testing are any competent person deemed competent by the Safety Manager or Occupational Hygienist.
- A standby man must be present at all times when personnel are in the confined space, with additional precautions specified to meet identified risks, e.g. RPE, harness/lift gear, flame proof lighting etc. First aid, resuscitation and emergency communication equipment should be made available for circumstances where access to medical treatment may be restricted and/or a need for such equipment is identified during the risk assessment process. All equipment must be checked and verified as fit for use before entry of the confined space takes place.
- No person shall enter a confined space to retrieve someone who is unconscious without having required personnel above ground to assist. The person entering the confined space for rescue purposes must be equipped with the required rescue equipment and follow the specific rescue procedure.
- Confined space authorised person to confirm pre-entry checks have been completed satisfactorily. If breathing apparatus is required specify type.

- The person carrying out the work or the supervisor to confirm acceptance of conditions imposed by the permit.
- All personnel entering the confined space must confirm acceptance of the conditions imposed by the permit.
- The permit must be returned at the end of the day or on completion of the work. Should it be necessary to carry on work the following day a new work permit should be issued. The person carrying out the work or the supervisor must sign the permit to indicate that all equipment has been withdrawn or made safe.
- The authorised person must cancel the permit by signing it off.

Appendix A. Confined Space Entry Work Permit

JOB INFORMATION					
Permit start date and time			Permit end date and time		
Site Location/Description					
Task					
TYPE OF CONFINED SPACE					
Low Risk			High Risk		
List confined space team:	Standby				
	Entrants				
REQUIREMENTS REQUIRED PRIOR TO ENTRY:					
	YES	NO		YES	NO
Risk assessment conducted			Fire extinguisher		
Electrical lines present			Radiation		
Lockout/tagout completed			PPE		
Lines blanked/capped			Radio contact		
Ventilation			Emergency plan		
Hazardous materials identified			Hot work permit		
Standby CPR trained			Confined space training		
Lifelines (e.g. hoist, tripod, harness)			Lighting explosion proof		
Gas monitoring conducted			Special instructions		
Secure area/barriers					
MONITORING RESULTS					
Instrument Model and serial number					
Instrument calibration date					
Instrument calibration reading					
Oxygen %					
Flammability %					
Other Contaminants:					
ADDITIONAL INFORMATION					
APPROVAL SIGNATURES					
Supervisor			Date:		
Occupational Hygienist/Technologist			Date:		

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Hazardous Chemical Substances Regulation 5 requires the employer to conduct the assessment with regards to the potential exposure to Hazardous Chemical Substances, in which the health and safety risks to which employees may be exposed while they are at work, and record the hazards identified and significant risk assessed. As far as reasonably practicable attempts will be made to first of all to eliminate the risk, thereafter to control the risk, then to minimise the risk and thereafter, insofar as the risk remains, to provide personal protective equipment and to implement a programme to monitor the risk.
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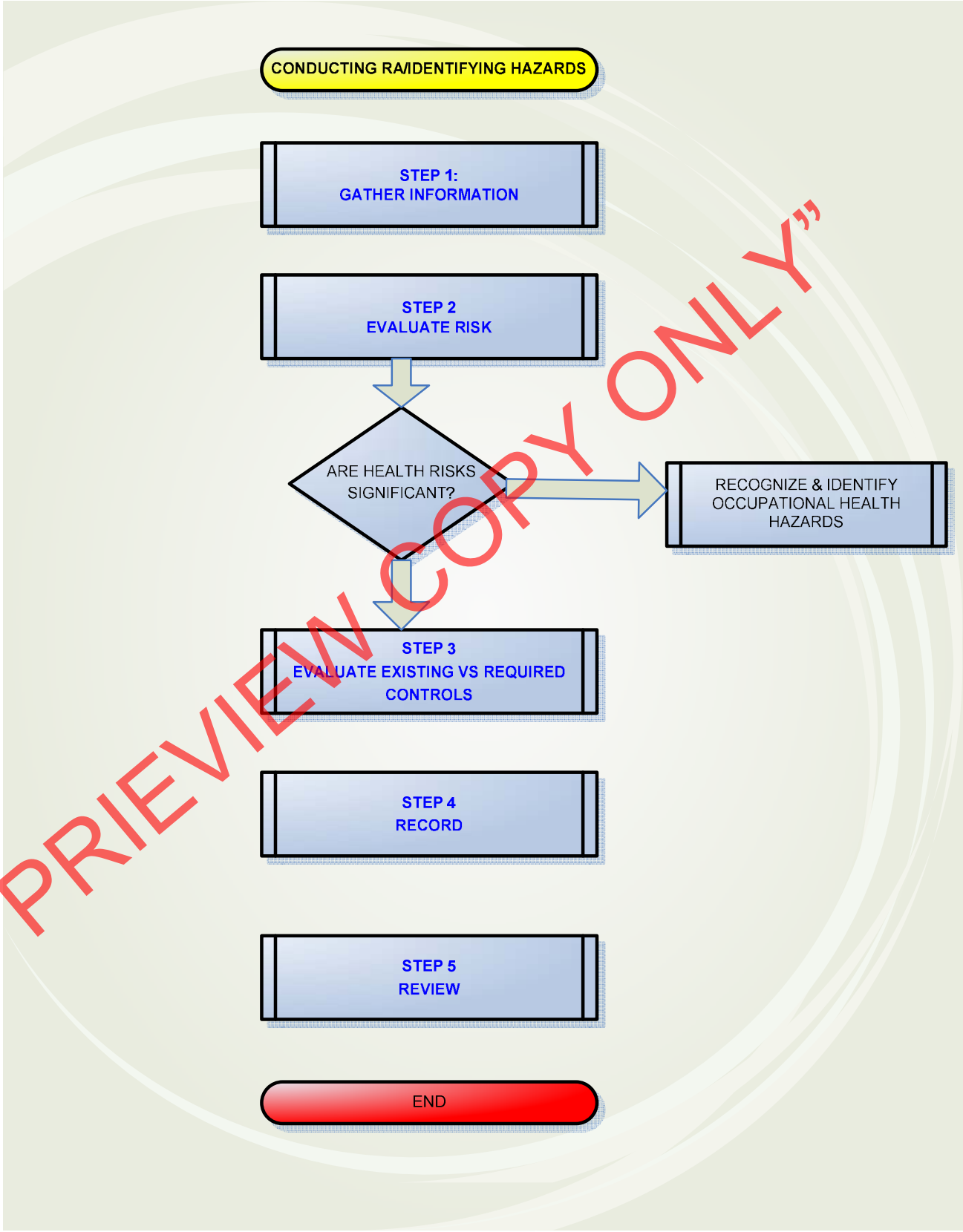

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c) Lockout and tagout/blockout must be done in accordance with TFR lockout and tagout procedures.

d) Lines, pipes, etc., must be blanked/capped to the extent feasible before the confined space is entered.

e) If mechanical ventilation is required, site-specific details, such as the direction of airflow and the placement of the air intake, must be documented in the "Additional Information" section. The air supply must be from a clean source: exhaust from vehicles, cranes, earth compactors, and other potential sources of contaminants must be considered when locating the blower.

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g) Continuous air monitoring will be required for confined space that cannot be isolated from potential contaminants. For example, flowing sewers often cannot be blanked off, and continuous air monitoring is required.

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i) A fire extinguisher must be present if "hot work" is being performed.

j) If ionizing radiation may be present, radiation levels must be monitored by radiation protection officer/specialist.

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n) Personnel entering the space must receive confined-space training prior to entering a permit-required or procedural confined space.

o) Additional lighting equipment may be needed to enable employees to see well enough to work safely and to exit the space quickly in an emergency, in these instances, explosion-proof lighting will be required.

p) The explosion-proof gas monitor must be calibrated monthly and function checked prior to each daily use. Monitoring the air inside a confined space should be conducted prior to entering and be conducted by a competent person. Testing a confined space for

atmospheric hazards should be done remotely before entering, and should be done in this order: (1) ensure that proper oxygen levels are present, (2) ensure that combustible gases are not present, (3) ensure that toxic gases are below the Occupational exposure limit. Common toxic gases in a confined space could be Hydrogen Sulfide (H_2S) and Carbon Monoxide (CO), but other toxic compounds could be present.

q) Minimum health and safety equipment required before confined space entry:

- approved gas detector (properly calibrated and that is in operation the entire time the employee is in the confined space. This is necessary due to the possibility of a rapid change in the confined space atmosphere);
- fresh air blower;
- safety harness, rope, and tripod safety system (A safety harness and lifeline which is attached to the tripod safety retrieval system);
- an approved hard hat; and
- emergency Action Plan

6.5 Confined-space monitoring procedure

In a confined space it is important to take samples at the top, middle and bottom to locate varying concentrations of gases and vapours. There are some gases lighter than air (i.e. methane and other combustible gases) that can be found at the top of a confined space. There are other gases that are heavier than air (i.e. hydrogen sulfide) that can settle near the bottom of a confined space, and still other gases that are the same weight as air (i.e. carbon monoxide) that can be found throughout a confined space.

Take air samples at several levels within the confined space and continuously monitor the space due to the fact that conditions can change. The confined space must be tested at three levels for each atmospheric condition. Each level must be tested for a minimum of 60

seconds. The gas detector itself can be lowered into the confined space atmosphere with a safety line

As the remote air monitoring is completed and the area is safe for entry, confined space entry permits should be completed and followed. After the initial entry, monitoring the air in the confined space should be continuous. A confined space entry attendant or standby should carry out the continuous monitoring. Conditions in a confined space can change without warning, due to leakage, toxic vapor release, or disturbing the contents of the space.

Testing must include: -

- Oxygen content must be at least 19.5% in the confined space, measured at all levels (bottom, middle, and top). The safe oxygen level is between 19.5% and 21%. Confined space should not be entered if the oxygen level is below 19.5% or above 21%. Due to the extreme danger of suffocation in confined spaces, constant and continuous oxygen monitoring is required throughout each work period. Oxygen content above 23% can cause explosions or vigorous burning of flammable materials, including hair or clothing.
- In circumstances where risk assessment has identified a significant possibility for the presence of fuels, combustion products, methane and/or biological action (e.g. oxyacetylene cutting, decontamination of fuel tanks, sewage systems etc.) the following tests should also be carried out: -
  - ✓ Explosive/flammable vapours – limit < 2% LEL (measure flammability at all levels of the confined space (bottom, middle, and top). Flammability is measured in terms of the Lower Explosive Limit (LEL). This is the smallest concentration of a combustible gas in air that will explode when it contacts a spark or open flame)
  - ✓ Hydrogen Sulphide – limit 10ppm (8hour TWA)
  - ✓ Carbon dioxide – limit 30ppm (8 hour TWA)

Procedure to be followed:

- Record hazard identification of area and/or confined space to be entered. Reference to additional Permits to Work must be recorded.
- Identify reason for confined space entry
- Confirmation that all necessary isolation and pre-entry activities have been carried out. Authorised persons are restricted to those who have received information, instruction and training in this and related Permit to Work procedures.
- The atmosphere within the confined space must be tested and confirmed as safe before entry is permitted. Normal practice will be to test for oxygen content however it may be necessary to test for flammable/explosive vapours and H2S, with additional parameters tested if identified as potentially present during the risk assessment process. Personnel authorised to carry out gas testing are any competent person deemed competent by the Safety Manager or Occupational Hygienist.
- A standby man must be present at all times when personnel are in the confined space, with additional precautions specified to meet identified risks, e.g. RPE, harness/lift gear, flame proof lighting etc. First aid, resuscitation and emergency communication equipment should be made available for circumstances where access to medical treatment may be restricted and/or a need for such equipment is identified during the risk assessment process. All equipment must be checked and verified as fit for use before entry of the confined space takes place.
- No person shall enter a confined space to retrieve someone who is unconscious without having required personnel above ground to assist. The person entering the confined space for rescue purposes must be equipped with the required rescue equipment and follow the specific rescue procedure.
- Confined space authorised person to confirm pre-entry checks have been completed satisfactorily. If breathing apparatus is required specify type.

- The person carrying out the work or the supervisor to confirm acceptance of conditions imposed by the permit.
- All personnel entering the confined space must confirm acceptance of the conditions imposed by the permit.
- The permit must be returned at the end of the day or on completion of the work. Should it be necessary to carry on work the following day a new work permit should be issued. The person carrying out the work or the supervisor must sign the permit to indicate that all equipment has been withdrawn or made safe.
- The authorised person must cancel the permit by signing it off.

Appendix A. Confined Space Entry Work Permit

JOB INFORMATION					
Permit start date and time			Permit end date and time		
Site Location/Description					
Task					
TYPE OF CONFINED SPACE					
Low Risk			High Risk		
List confined space team:	Standby				
	Entrants				
REQUIREMENTS REQUIRED PRIOR TO ENTRY:					
	YES	NO		YES	NO
Risk assessment conducted			Fire extinguisher		
Electrical lines present			Radiation		
Lockout/tagout completed			PPE		
Lines blanked/capped			Radio contact		
Ventilation			Emergency plan		
Hazardous materials identified			Hot work permit		
Standby CPR trained			Confined space training		
Lifelines (e.g. hoist, tripod, harness)			Lighting explosion proof		
Gas monitoring conducted			Special instructions		
Secure area/barriers					
MONITORING RESULTS					
Instrument Model and serial number					
Instrument calibration date					
Instrument calibration reading					
Oxygen %					
Flammability %					
Other Contaminants:					
ADDITIONAL INFORMATION					
APPROVAL SIGNATURES					
Supervisor			Date:		
Occupational Hygienist/Technologist			Date:		