



OCCUPATIONAL ENVIRONMENT SURFACE OPERATIONS – SURFACE SOURCES

CONFINED SPACES

PRESENTED BY: HELEN THIEL
28 JULY 2017



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1. **Introduction**
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 - 2.2. Confined Space Procedure
 - 2.2.1. Authorisation of entry into a Confined Space
 - 2.2.2. Training
 - 2.2.3. Identification of classification of confined space
 - 2.2.4. Monitoring Compliance
3. **Conclusion**
4. **Questions**

Confined Space Incidents 2017

Fatal incident claims the lives of two PetroSA employees



Nickey Le Roux



PetroSA. Picture: Mossel Bay Advertiser

As far as could be ascertained, the two men were overcome by toxic gases when working on a vessel at the Mossel Bay plant.

Assessing the Risk

The Mines Health and Safety Act 29 of 1996, section 11 refers to risk and risk management, in terms of the employer's responsibility to assess risk and establish programs to eliminate, control and or minimize risk.

However the Act does not define or refer to a confined space. The employer, is however not limited to the act, and reference can be made to other legislation, such as the Machinery and Occupational Safety Act 6 of 1983.

Confined Space definition

In the Machinery and Occupational Safety Act 6 of 1983 there is a definition and it reads;

Confined space” means an ***enclosed, restricted, or limited space*** in which, because of its ***construction, location or contents, or any work activity carried on therein, a hazardous substance may accumulate or an oxygen-deficient atmosphere may occur***, and includes any chamber, tunnel, pipe, pit, sewer, container, valve, pump, sump, or similar construction, equipment, machinery or object in which a dangerous liquid or a dangerous concentration of gas, vapor, dust or fumes may be present.

Examples of confined spaces



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Risk Assessment Process

			Content			Construction					Ventilation		Access Controlled	
VESSEL	NUMBER OF VESSELS	HAZARDS (GASES)	HAZARDOUS CHEMICALS DOSED INTO THIS VESSEL (Yes/No)	MATERIAL ADDED (Yes/No)	DANGEROUS DUE TO CONTENTS (No, Yes, Chemical Storages)	RESTRICTED ACCESS (Yes/No)	LIMITED SPACE (Yes/No)	OPEN OR CLOSED TANK	NUMBER OF ENTRANCES	VESSEL TWICE AS DEEP AS WHAT IT IS WIDE (Yes, requires Ventilation) (Yes/No)	NATURAL VENTILATED	VENTILATED BY MEANS OF FAN (yes/No)	ARE MEASURES TAKEN TO EXECUTE WORK OUTSIDE CONFINED SPACE? (NO - Clearance Required)	CLASSIFICATION
Leach feed tanks	2	Oxygen deficiency	Yes	Yes	Yes	No	Yes	Open	2	No	Yes	No	Yes	A
Mass flow tank	1	Oxygen deficiency	No	No	No	No	Yes	Open	2	No	Yes	No	Yes	A
Leach tanks	16	HCN, NH3, Oxygen deficiency	Yes	Yes	Yes	Yes	No	Open	2	Yes	Yes	No	Yes	A
Lift sump	1	HCN, NH3, Oxygen deficiency	No	No	No	No	Yes	Closed	1	No	No	No	Yes	B
Cooling water fans	4	HCN, NH3, Oxygen deficiency	No	No	No	Yes	Yes	Closed	2	No	No	No	Yes	A
Process Water Tank	1	HCN, NH3, Oxygen deficiency	No	No	No	No	No	Open	3	No	Yes	No	Yes	A
Portable Water Tank	1	Oxygen deficiency	No	No	No	Yes	No	Closed	2	No	No	No	Yes	A

Risk Assessment Process

			Content			Construction					Ventilation		Access Controlled	
VESSEL	NUMBER OF VESSELS	HAZARDS (GASSES)	HAZARDOUS CHEMICALS DOSED INTO THIS VESSEL (Yes/No)	MATERIAL ADDED (Yes/No)	DANGEROUS DUE TO CONTENTS (No, Yes, Chemical Storages)	RESTRICTED ACCESS (Yes/No)	LIMITED SPACE (Yes/No)	OPEN OR CLOSED TANK	NUMBER OF ENTRANCES	VESSEL TWICE AS DEEP AS WHAT IT IS WIDE (Yes, requires Ventilation) (Yes/No)	NATURAL VENTILATED	VENTILATED BY MEANS OF FAN (yes/No)	ARE MEASURES TAKEN TO EXECUTE WORK OUTSIDE CONFINED SPACE? (NO - Clearance Required)	CLASSIFICATION
Leach feed tanks	2	Oxygen deficiency	Yes	Yes	Yes	No	Yes	Open	2	No	Yes	No	Yes	A
Mass flow tank	1	Oxygen deficiency	No	No	No	No	Yes	Open	2	No	Yes	No	Yes	A
Leach tanks	16	HCN, NH3, Oxygen deficiency	Yes	Yes	Yes	Yes	No	Open	2	Yes	Yes	No	Yes	A
Lift sump	1	HCN, NH3, Oxygen deficiency	No	No	No	No	Yes	Closed	1	No	No	No	Yes	B
Cooling water fans	4	HCN, NH3, Oxygen deficiency	No	No	No	Yes	Yes	Closed	2	No	No	No	Yes	A
Process Water Tank	1	HCN, NH3, Oxygen deficiency	No	No	No	No	No	Open	3	No	Yes	No	Yes	A
Portable Water Tank	1	Oxygen deficiency	No	No	No	Yes	No	Closed	2	No	No	No	Yes	A

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Confined Space Procedure

General safety regulations 5 of the Machinery and Occupational Safety Act 6 of 1983, Work in Confined Space;

- ✓ The air in the confined space must be evaluated by a competent person and declared safe in writing and that it will remain safe for the duration of the work taking place in the confined space
- ✓ If the above cannot be complied to or if there is a like hood that a hazardous atmosphere may exist;
 - o steps should be taken to purge and ventilate to provide a safe atmosphere for the duration of the work
 - o The confined space must be isolated to prevent the ingress of material or product into the space for the duration of the work

Confined Space Procedure

- ✓ If a safe atmosphere cannot be provided, employees or person/s may enter using an approved breathing apparatus with the following provision in place;
 - o the person entering must have safety harness or similar equipment to which a rope is securely attached, which reaches beyond the access of the confined space
 - o A person trained in resuscitation must remain outside in the entrance of the confined space to assist or remove person if necessary
- ✓ Employer must ensure that all persons vacate a confined space on the completion of any work

Confined Space Procedure

- ✓ Where the hazardous gas, vapour, dust or fumes are explosive or flammable, the following steps must be taken;
 - o concentrations must not exceed 25 percent of the Lower Explosive Level (LEL) where the work does not create a source of ignition,
 - o where such work is performed, concentrations must not exceed 10 percent of the Lower Explosive Level (LEL).

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Authorisation of Entry into a Confined Space

PART A – CLEARANCE CERTIFICATE

Legend – Sections Highlighted

To be completed by Authorising Person
To be completed by Competent Person

Business Unit _____ **Plant/Area** _____

Section _____ **Location/Equipment No.** _____

Valid for _____ **Days(s)** _____ **From:** _____ **To:** _____ **Date** _____

Description of work to be done: _____

If yes mark with a Yes and if no mark with a No

Preparation (Name) _____ Coy No. _____

Consists with the required PPE standards and checked all safety/emergency (safety shower, antidote) equipment. Signature _____

1. Area clean and free from obvious hazards Yes ☐ No ☐

2. Was the area washed and prepared for the required work Yes ☐ No ☐

3. Equipment clean and free from obvious hazards Yes ☐ No ☐

4. Area barricaded & access controlled Yes ☐ No ☐

5. Equipment isolated / tagged / empty Yes ☐ No ☐

6. Bridge / scale removed Yes ☐ No ☐

7. Mechanical isolation e.g. valves closed & locked out Tag name _____

8. Positive isolation required Yes ☐ No ☐

9. Electrical isolation Field ☐ Substation ☐

Production Tag Name _____

Electrical Tag Name _____

10. Tested lock out in field By whom (Name) _____

11. Authorising officer verified that positive isolation has been done Yes ☐ No ☐

12. Gas clearance required Yes ☐ No ☐

13. Hot Work Permit required (consult with safety) Yes ☐ No ☐

14. Hot work Permit completed – Number _____

15. Notify other departments / sections Yes ☐ No ☐

16. Decontamination box required Yes ☐ No ☐

17. Radiation Protection Clearance (RAC) Required Yes ☐ No ☐

18. Radiation isotope lock-out at mass flows, weighbridges, Clearance certificate N/A (as used by instrumentation department) Yes ☐ No ☐

19. Authorisation / permits required, test, tag, or OHS Permit/N Yes ☐ No ☐

Cyanide work requires signature of Engineer _____

Signature _____

20. Suspended loads (Stored Energy) present in the vessel Yes ☐ No ☐

21. Was suspended loads (Stored Energy) removed Yes ☐ No ☐

22. Was a mini risk assessment conducted Yes ☐ No ☐

I have personally examined and prepared the equipment on which the above is to be done and certify its condition to be as specified above

Name _____ **Coy No.** _____

Signature _____

Precautions to be taken for points 10, 11, 12, 14 & 16 and items marked NO

Name possible hazards that may be present/become a hazards:

Authorising Official:

I am satisfied that the preparations have been carried out as stated above and that all relevant parties have been made aware of conditions and requirements:

Name	Designation	Coy No.	Date	Time	Signature

General Comments:

1. You have the right to refuse to work on grounds of SAFETY as stated in the mine Health & Safety Act, Section 23

2. For all "B" Confined Space entries, or as determined by a risk assessment, Complete Appendix A – Clearance Certificate

3. For all "A" Confined Space entries and "A – Chemicals", or as determined by a risk assessment, Complete Appendix A & B – Confined Space / Vessel Entry Permit

CLEARANCE NOTE: DETACH AND RETAIN WHILE WORKING ON EQUIPMENT

Name _____ **is permitted to work on** _____

Position No. _____ **Time** _____ **Date** _____ **Authorised person (Sign)** _____

12345

PART B – CONFINED SPACE / VESSEL ENTRY PERMIT

12345

Pre-Gas Measurements – Section 1 (To be completed by competent person)

Name	Date	Coy No.	Instrument serial number	Occupation				
Valid from _____ To _____								
		Max. allowable levels	Max conc. recorded	Time Recorded				
Gas measured by:								
1. Carbon Monoxide (CO)		30 ppm		Yes ☐ No ☐				
2. Hydrogen cyanide gas (HCN)		0.10 ppm		Yes ☐ No ☐				
3. Explosive Gas		0.14%		Yes ☐ No ☐				
4. Nitrogen dioxide (NO2)		3 ppm		Yes ☐ No ☐				
5. Sulphur dioxide (SO2)		2 ppm		Yes ☐ No ☐				
6. Ammonia (NH3)		25 ppm		Yes ☐ No ☐				
7. Chlorine dioxide (ClO2)		0.5 %		Yes ☐ No ☐				
8. Hydrogen chloride (HCl)		0.5 ppm		Yes ☐ No ☐				
9. Oxygen (O2)		Max 23% Min 15.5%		Yes ☐ No ☐				
All measured gas concentrations below recommended allowable limit.								
Signature: _____				Entrance approved Yes ☐ No ☐				
Additional Instructions:								
1. Continuous Gas measuring instrument to be used:								
X-AM 6000 ☐ Other _____								
2. _____								
3. _____								
4. _____								
Ventilation Requirements:								
Compressed Air ☐ Fan ☐ Through ventilation (Top and Manholes) open ☐								
Confined Space temperature: _____ °C								
Signature (Competent Person) _____								
Competent Person Name _____								
Additional requirements: To be verified by Authorising Person								
1. Training on X-AM 6000 ☐								
2. Only competent Persons to use continuous gas measuring instruments ☐								
3. Buddy system to be implemented ☐								
4. Only a trained and competent Buddy to be used ☐								
5. SLAM - Mini risk assessment to be done before work commences ☐								
6. Met training completed ☐								
7. Should there be a change in process, a new clearance certificate must be made ☐								
8. Valid Certificate of Fitness ☐								
9. Training on task conducted ☐								
10. Prep for maintenance completed ☐								
11. Required PPE to be used ☐								
12. Regular water breaks to be taken when required ☐								
13. Section induction completed ☐								
Signature (Authorising Person) _____								
Authorising Person Name _____								
Gas Measuring Equipment to be used for continuous measurements – Section 2								
Type of Instrument	Number of equipment	Name of Competent User	Next Calibration Date (3 monthly)	Battery checked and in order	Sensors clean	Correct Sensors	Fresh air calibration done	Signature
				Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	
				Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	
Persons assigned to enter confined space – Section 3								
Name	Occupation	Coy number	Trained on gas detection instruments	Is Advance Cyanide Certificate Valid	Signature			
			Yes ☐ No ☐	Yes ☐ No ☐				
			Yes ☐ No ☐	Yes ☐ No ☐				
			Yes ☐ No ☐	Yes ☐ No ☐				
			Yes ☐ No ☐	Yes ☐ No ☐				
			Yes ☐ No ☐	Yes ☐ No ☐				
			Yes ☐ No ☐	Yes ☐ No ☐				
Refusal to work on grounds of safety known by all workers – Mine Health & Safety Act, Section 23 Yes ☐ No ☐								
Buddy Checklist – Section 4 Name: _____ Co Number: _____								
BIA Apparatus PPE available for emergency	Yes ☐ No ☐	Do you have communication with the control room	Yes ☐ No ☐					
Antidote kit / First Aid kit available condition OK	Yes ☐ No ☐	Were you instructed on what to do if an emergency arises	Yes ☐ No ☐					
Do you know where to activate the emergency alarm	Yes ☐ No ☐	Control room - Emergency telephone numbers available	Yes ☐ No ☐					
Do you know where the nearest safety shower is	Yes ☐ No ☐	No workers assigned to enter comply with PPE requirements	Yes ☐ No ☐					
Do you have running water available	Yes ☐ No ☐	Are you fully trained in emergency response if required	Yes ☐ No ☐					
Person responsible to ensure that Continuous monitoring is done – Section 5								
Name	Occupation	Coy number	Signature					

Authorisation of entry into Confined Space

Legend - Sections Highlighted									
To be completed by Authorising Person					To be completed by Competent Person				
PART A - CLEARANCE CERTIFICATE									
Business Unit		Section		Plant/Area		Location/Equipment No.		Date	
Valid for		Days		From		To		Date	
Description of work to be done									
If yes mark with a Yes and if no mark with a No									
Preparation 1. Area clean and free from obvious hazards 2. Was the site washed and prepared for the required work 3. Equipment clean and free from obvious hazards 4. Area barricaded & access controlled 5. Equipment drained / flushed / empty 6. Sludge / scale removed 7. Mechanical isolation e.g. valves closed & locked out 8. Positive isolation required 9. Electrical isolation required ☐ Field ☐ Substation Production Tag Name Electrical Tag Name 10. Tested lock out in field by whom (Name) 11. Authorising officer verified that positive isolation has been done 12. Gas clearance required 13. Hot Work Permit required (contact with safety) 14. Hot work permit completed - Number 15. Notify other departments / sections 16. Decommission label required 17. Radiation Protection Clearance (RPR) Required 18. Radiation Isotope lock-out at mass flow, weighbridges, etc. Certificate No. (issued by instrumentation department) 19. Authorisation / Isotope permit required, test, trip or on/off Permit No. Cyanide work requires signature of Engineer Signature 20. Suspended loads (stored energy) present in the vessel 21. Was suspended loads (stored energy) removed 22. Was a risk assessment conducted I have personally examined and prepared the equipment on which the above is to be done and certify its condition to be as specified above Name _____ Coy No. _____ Signature Precautions to be taken for points 10, 11, 12, 14 & 16 and items marked NO Name possible hazards that may be present/become a hazard: _____ _____ _____ Authorising Officer: I am satisfied that the preparations have been carried out as stated above and that all relevant parties have been made aware of conditions and requirements: Name _____ Designation _____ Coy No. _____ Date _____ Time _____ Signature _____					Required PPE to be determined by Competent/Authorised Person Breathing equipment Respirator & Cartridge type Airline Mask ☐ B.A. Set ☐ Harness and Life Line Goggles ☐ Full Face Shield ☐ Chemical PVC Suit Type: ☐ PVC Boots ☐ Relevant Doggles ☐ Ear Protection Other specify: I accept that the preparations, safety and above PPE requirements have been explained to me: Name _____ Coy No. _____ Signature _____ Mechanical ☐ Electrical ☐ Instrumentation ☐ Other ☐ Electrical isolation Field ☐ Substation ☐ Mechanical Tag Name _____ Electrical Tag Name _____ Instrumentation Tag Name _____ Other Tag Name _____ Positive isolation completed, good place removed ☐ spade installed ☐ Other ☐ Coy No. _____ Sign: _____ Isolate ☐ First Aid Kit ☐ Safety Shovel ☐ Emergency Alarm ☐ Any other instructions: _____ I declare that the above actions have been completed: Name _____ Designation _____ Coy No. _____ Date _____ Time _____ Signature _____ Test run direction check Sign of Authorising Officer after testing request: Electricity released, sign (Electrician): _____ Test run/direction inspection completed: Electricity released, sign (Electrician): _____ (Authorising officer) (Secondary) PPE and equipment is decontaminated Above job completed, mechanical, positive and electrical isolation removed and safe for re-commissioning: Name _____ Designation _____ Coy No. _____ Date _____ Time _____ Signature _____				
General Comments:									
1. You have the right to refuse to work on grounds of SAFETY as stated in the mine Health & Safety Act, Section 23. 2. For all "B" Confined Space entries, or as determined by a risk assessment, Complete Appendix A - Clearance Certificate. 3. For all "A" Confined Space entries and "A-Chemical", or as determined by a risk assessment, Complete Appendix A & B - Confined Space / Vessel Entry Permit.									
CLEARANCE NOTE: DETACH AND RETAIN WHILE WORKING ON EQUIPMENT Name _____ is permitted to work on _____ Position No. _____ Time _____ Date _____ Authorised person (Sign): _____									

Lock out and Isolation with health and safety related questions;

- ✓ Is mechanical and or electrical isolation required?
- ✓ Is a gas clearance required?
- ✓ Is a hot work permit required?
- ✓ PPE requirements

Authorisation of entry into Confined Space

PART B – CONFINED SPACE / VESSEL ENTRY PERMIT 12345

Pre-Gas Measurements – Section 1 (To be completed by competent person)

Name	Date	COY	Instrument serial number	Occupation
Valid from: To:				
Gas measured for:				
1. Carbon Monoxide				Yes No
2. Hydrogen Sulfide				Yes No
3. Explosive Gas				Yes No
4. Nitrogen Dioxide				Yes No
5. Sulphur Dioxide				Yes No
6. Ammonia (NH ₃)				Yes No
7. Carbon Dioxide				Yes No
8. Hydrogen Chloride (HCl)				Yes No
9. Oxygen (O ₂)				Yes No
All measured gas concentrations below recommended allowable limit.				
Signature: Yes No Entrance approved: Yes No				

Additional Instructions:

- Continuous Gas measuring instrument to be used: X-am 6000 ☐ Other ☐
-
-
-

Ventilation Requirements:

Compressed Air ☐ Fan ☐ Through ☐

Confined Space temperature:°C

PART B

Signature (Competent Person)

Competent Person Name

Additional requirements: To be verified by Authorising Person

1. Training on X-am 6000	☐	8. Valid Certificate of Fitness	☐
2. Only competent Persons to use continuous gas measuring instruments	☐	9. Training on task completed	☐
3. Buddy system to be implemented	☐	10. Prep for maintenance completed	☐
4. Only a trained and competent Buddy to be used	☐	11. Required PPE to be used	☐
5. I/LAM - Mini risk assessment to be done before work commences	☐	12. Regular water breaks to be taken when required	☐
6. Met training completed	☐	13. Section induction completed	☐
7. Should there be a change in process, a new clearance certificate must be made	☐		

Signature (Authorising Person)

Authorising Person Name

Gas Measuring Equipment

Type of Instrument	Signature
.....	

Persons assigned to enter confined space – Section 2

Name	Signature
.....	

Name of Persons Entering

Name	Signature
.....	

Buddy Checklist – Section 3

Item	Yes	No
Is the area adequately ventilated for entry?	☐	☐
Is the area adequately lit for entry?	☐	☐
Do you know where to get the air?	☐	☐
Do you know where the nearest exit is?	☐	☐
Do you have running water available?	☐	☐

Buddy Checklist

Person responsible to ensure that Continuous monitoring is done – Section 5

Name	Occupation	COY number	Signature
.....			

This needs to be completed for type A and A-Chemical confined spaces

These confined spaces, potentially may have gases present within the confined space.

There are five sections that need to be completed;

- ✓ Pre-Gas Measurements
- ✓ Gas Measuring Equipment to be used
- ✓ Name of Persons Entering
- ✓ Buddy Checklist

Authorisation of entry into Confined Space

The final portion is the tear of slip

CLEARANCE NOTE: DETACH AND RETAIN WHILE WORKING ON EQUIPMENT				12345
Name. _____ is permitted to work on _____				
Position No _____	Time: _____	Date _____	Authorised person (Sign) _____	

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Training

Plant Employees

- ✓ Lock out and Isolation in house training
- ✓ Training on gas monitoring instruments used at the operation

The Competent person

- ✓ Lock out and Isolation in house training
- ✓ Training on gas monitoring instruments used at the operation
- ✓ Training in evaluation of the air in the confined space
 - o For A Type Confined space the competent person must have completed, as minimum, the practical portion of the Intermediate Certificate Environmental Control
 - o For A – Chemical Type Confined space the competent person must have obtained, as minimum, a Intermediate Certificate in Environmental Control

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Identification of classification of confined space



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Monitoring Compliance

[illegible]

Items	STD	SUB STD	N/A	Comment
Is the Confined space procedure readily available?				
Are confined spaces identified?				
Are confined spaces classified?				
Is correct symbolic signs displayed at the confined space (Classification A/B/C and No unauthorised entry)?				
Is clearance certificate book available?				
Are clearance certificates filled in correctly?				
Are gas measuring devices available?				
Are gas measuring devices calibrated?				
Is there a hotwork permit system in place?				
Are hotwork permits filled in correctly?				
Are extraction fans installed in thickener tunnels / Ore reception tunnels?				
Are fixed gas monitors installed at strategic points?				
Is there a procedure for the rescue of an employee that has collapsed in a confined space?				
Have selected persons been trained in confined space rescue?				

[illegible]

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Compliance is monitored quarterly through a critical control evaluation check list



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Conclusion

Referring back to the General Safety Regulation, Working in a confined space, the following has been implemented in line with the regulation;

- ✓ A competent person has declared the air safe and will remain safe for the duration of the work in Part B
- ✓ Lock out and isolation is documented in Part A
- ✓ Authorisation for entry with a Breathing Apparatus with a safety harness is documented in Part A under PPE requirements
- ✓ The availability of a “Buddy” at all times to initiate emergency procedures if required to do so

Conclusion

- ✓ Recording of employee names that enter the confined space, to ensure that all employees are counted for on completion of work
- ✓ Ensuring that flammable and explosive gases remain within 10% and 25% of Lower Explosive Levels; Part B's Pre-Gas readings, having a multi-gas instrument, with two alarm levels, available at all times while working in the confined space.

Thank –you
&
Any Questions ?

