

	WORK INSTRUCTION:	Working in an Confined space	Rev. 02
	HSEQ procedure:	Normal business operations	Date: 02.04.13

1. General

Objective

The objective of this procedure is to document the conditions that apply for opening and entering confined spaces and hazardous areas so that work can be carried out safely.

Applicability

This procedure applies to all activities in confined and confined spaces and hazardous areas within REC and must be complied with by employees of REC and third parties who perform work for REC.

Definition/Term	Description
Confined space	<p>A space that is not equipped and furnished as a space for human occupation and which is normally locked in order to prevent unauthorised entry.</p> <p>An confined space is identified by one or more of the following characteristics</p> <ul style="list-style-type: none"> • Difficult access (manhole, uneven smooth floor), • Difficult to access in the event of emergencies, • Poor lighting, • risk of being pinched/crushed by process equipment, • Presence of hazardous chemicals (solid substance, gas, liquid), • Presence of hazardous chemicals from process pipes (gas, liquid, steam), • The atmosphere in the room/area is not guaranteed to be safe at all times. <p>Examples are tanks, flue gas pipes, waste incineration furnaces, bunkers into which waste is deposited, lift shafts, cellars that can only be entered via a cage ladder and the waste water basins.</p>
Hazardous area	<p>An area other than an confined space, which may present a danger to health when entered due to the risk of suffocation, stupefaction, poisoning, fire, explosion or electrocution if no preventive action is taken.</p> <p>Examples are pump pits equipped with a permanent stairway (not a cage ladder), electrical plant rooms, rooms equipped with an automatic gas extinguisher system and housings for turbines and biogas engines.</p>
Safe atmosphere	<p>Air whose composition complies with the following criteria:</p> <ul style="list-style-type: none"> • Oxygen concentration between 19 and 21 percent by volume (target value 20.9 v/v %) • Concentration of explosive vapours of less than 10% of the LEL (Lower Explosion Limit) • Concentration of hazardous chemicals under the limit value.
Limit value	<p>Health-related limited value, concentration of a chemical in the workplace to which the person may be exposed when working 8 hours a day, 5 days a week for a period of 40 years without adverse effects on health. Prior to 1 January 2007, the limit values were known as MAC values (Maximum Acceptable Concentration)</p>

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2. Risks

The following risks are present when working in confined spaces and hazardous areas:

- suffocation due to a lack of oxygen caused by chemical reactions, biological reactions and the injection of inert gases.
- stupefaction or poisoning caused by the presence of hazardous liquids, gases and vapours.
- fire and explosion due to the presence of (remnants of) flammable liquids, gases and dust.
- crushing due to the presence of process equipment,
- electrocution due to the presence of inadequately earthed pipes, tanks and cables and the use of non-electrically safe tools.
- contact with hazardous chemicals (liquids, steam, gas) from pipes and due to the presence of chemical residues.
- injury attributable to poor lighting and the presence of process equipment and pipes.
- heat collapse caused by high temperatures.
- being hit by falling tools, materials, blasting agent and lumps detaching from caked boiler surfaces.
- in the event of an incident, the area is difficult to access particularly from the point of view of extracting a victim requiring stabilisation from the area.

Environmental aspects

The following aspects play a role:

- N/A

3. Health hazards

- Exposure to dust and airborne particles (including micro-organisms),
- Vapours and gases,
- Exposure to heat.
- Hearing damage.

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4. Working method

The paragraphs below describe the method for correctly making preparations (4.1), taking safety precautions before entry (4.2), closing a confined space (4.3), and handling emergency situations (4.4).

4.1 Preparation

4.1.1 Management measures for the work permit and TRA

The requesting party and the relevant manager are responsible, within the scope of their positions, for taking action in order to control the risks associated with entering and working in confined spaces and hazardous areas. All the precautionary measures for controlling these risks must be implemented before authorisation is given to enter the area.

Insofar as this procedure does not describe the risks adequately, it may be necessary to draw up a Task Risk Analysis (TRA).

A work permit must be requested and issued in order to enter confined spaces. The requirement for a work permit for entering a hazardous area maybe disregarded if an employee of REC carries out work that is associated with the department's normal activities.

Employees who enter confined spaces and hazardous areas and employees standing on watch at manholes are aware of the dangers, the management measures and what action to take in the event of emergencies. In order to achieve this, they have read and made sure that they understand the TRA and or specific work instructions.

4.1.2 Entering confined spaces under normal circumstances

An confined space may not be entered before the following conditions have been satisfied:

- The space is not under pressure and the medium's temperature does not exceed 40 0C,
- There is adequate lighting for orientation purposes,
- The space is safe for sparks and open flames,
- The oxygen percentage lies between 19 and 21 % by volume,
- The concentration of explosive gases/vapours is less than 10% of LEL,
- The concentrations of gases and vapours lie under the limit values,
- Personal exposure to heat is controlled,
- The level of ventilation for extracting harmful gases and vapours is sufficient to maintain the concentrations under the limit value,
- The process pipes and process equipment have been made safe,
- Only safe electrical voltages are used when working (see paragraph 4.3.1.),

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- A person is standing watch at the manhole (see paragraph 4.2.6),
- In the event of an emergency, adequate rescue measures can be implemented,
- The relevant manager has given permission for this.

4.1.3 Entering confined spaces under abnormal circumstances

On incidental occasions, it may not be possible to enter a confined space under normal circumstances. In this situation, a TRA must be drawn up and permission for the work must be obtained from the relevant manager and safety expert. For example, working under conditions of zero oxygen or low oxygen availability such as in tanks filled with nitrogen and diving activities in cooling water pipes.

4.1.4 Entering hazardous areas

If a work permit is required for work in hazardous areas, the conditions that apply to entry are specified on this work permit.

If no work permit is required for the work, the area may be entered subject to the condition that the person entering the area observes instructions on signs and pictograms.

Example 1: An area where an automatic gas extinguisher system is installed may not be entered if the acoustic and visual alarms are in operation.

Example 2: an EX-zoned area may not be entered before all electrical equipment, including mobile telephones, has been EX-classified, or no electrical equipment may be taken into the area and the explosion alarm (LEL meter) may not have activated.

Electrical plant rooms may only be entered by persons who have been given written permission to do so by the relevant plant manager.

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4.2 Safety precautions before entry

4.2.1 Electrical or mechanical immobilisation of moving parts

If electrically driven moving parts are present in an confined space (agitators, fans, beaters, butterfly valves, etc.), there is a risk that they may be switched on unexpectedly leading to people getting caught in machinery.

Consequently moving parts must be mechanically immobilised in order to eliminate the possibility of unexpected activation. When work takes place on electrical parts, the drive must be immobilised and made safe electrically. For details of how to electrically or mechanically immobilise moving parts, please refer to the work instruction entitled "Procedure for working safely on plant and equipment".

4.2.2 Blanking off pipes containing chemicals

Before entering an confined space, all pipes in that space must be made safe at a point as close as possible to the space in question by:

1. Blanking off the pipe using a prominently visible blind or spade flange or
2. Disconnecting the pipe from the confined space.
3. If the pipework cannot be disconnected or fitted with a flange, the pipe must be designed as a "double block and bleed" system. The bleed must be discharged to a safe discharge location.
4. If options 1, 2 and 3 are not possible, the plant manager discusses and agrees the required safety precautions with the HSEQ adviser.

4.2.3 Explosion hazard areas (EX zones)

The following precautions apply for work in areas where an explosive atmosphere may be present.

The product has been completely removed from the confined space before that space may be entered. This applies particularly to the activated carbon plant and underground tanks containing ((highly) volatile) flammable and combustible liquids.

The LEL is measured continuously if there is a risk that explosive liquids and gases are present.

4.2.4 Ventilation

In order to create as much natural ventilation as possible, a sufficient number of manholes in the confined space must be open. Air conditions in the confined space can change rapidly, for example, when welding work is carried out and/or work using solvents. Harmful gases or vapours can also be released by product residue or layers of rust.

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Hazardous gases or vapours can be removed by purging with air. Purging with air is achieved by extracting gases or vapours or by blowing clean air into the confined space. When doing so, give due consideration to the density of the gases and vapours as this affects the position of the ventilation or extraction source. When carrying out electrical welding work or using cutting torches, local extraction must be used because of the nitrous vapours that are released (e.g. nitrogen oxide and nitrogen dioxide).

4.2.5 Opening confined spaces

When an confined space is opened, a green "Confined space, do not enter" label is attached to each opening.

Openings that are not to be used for entry purposes must be blocked in some way so that entry is not possible. For example, scaffolding tube in front of or in the entrance, or if there is a danger of falling, red/white ribbon.

4.2.6 Measuring gas concentrations

Gas measurements must be performed in order to determine the concentrations of oxygen, toxic, flammable and/or explosive gases/vapours. The following rules apply:

- Gas and oxygen measurements must be carried out by a person who is qualified to do so and who is in possession of a valid gas measurement certificate.
- The frequency with which gas measurements must be performed and/or monitored depends on the circumstances in the confined space. The frequency specified below must be used unless indicated otherwise in a TRA or work instruction.
- In cases where a change in the percentage of oxygen, toxic gases/vapours and/or flammable explosive gases/vapours can arise, it is imperative that measurement is performed continuously.
- The gas measurements that are performed must be representative of the complete area.
- The results of the gas measurements are noted by the person qualified to carry out gas measurement on the work permit or the label at the entrance to the confined space.
- The concentration of oxygen and the LEL are measured no more than two hours before commencement of the work in the confined spaces. Other gases are also measured depending on the type of confined space.

Repeat measurements and exemption

If the work continues for longer than the duration of 1 shift (approximately 8 hours), a repeat measurement is performed every eight hours. Repeat measurements are also performed in the event of changed circumstances (for example, a different type of work activity, or the confined space has been closed in the intervening period). If, based on a TRA, gas measurement plan or risk assessment, it is found that a

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safe atmosphere is continuously present, the requirement for gas measurement can be disregarded when two consecutive gas measurements are positive after an intervening period of at least eight hours.

Continuous gas measurement

Continuous gas measurement is performed when changes can arise in the percentage of oxygen, toxic gases or vapours and flammable or explosive gases or vapours. This is the case when welding work or work involving open flame is performed, when volatile solvents are used or due to the release of gases or vapours from product residue (porous walls), layers of rust and during blasting work. An increase in temperature in the work area is also considered to be a change. Continuous measurement can be implemented by giving the person entering the space a personal gas meter or by continuously having a functioning gas meter present in the work area.

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Gas measurement in ATEX zones

Continuous LEL gas measurement is performed when high-temperature work is carried out in ATEX zone areas 0 and 1 (areas with liquids and gases).

Measuring heat load

If the temperature in an area is continuously above 25 °C, an estimation of the load must be made in accordance with the work instruction entitled “Working in warm conditions”. A WBGT measurement must be performed depending on whether the work to be carried out is light or heavy in nature.

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Hazardous areas

If there is insufficient information about the atmosphere in hazardous areas, the same gas measurement rules as those for confined spaces apply. For example, welding with argon in an area close to the floor, which may cause oxygen depletion and therefore lead to suffocation.

4.2.7 Manhole guard

During the period that one or more people are present in an confined space, one other person must stand on watch at the entrance to that space. This person is referred to as the manhole guard.

- A manhole guard may not enter the space at any time.
- The manhole guard must always be present in the vicinity of the manholes during the period when people are present in the confined space.
- The manhole guard has demonstrably been informed of the risks associated with the confined space and is familiar with the tasks that should be performed by a manhole guard.
- It is not necessary to appoint a manhole guard in cases where, based on a TRA that has been approved by the HSEQ department, no specific increased risks apply, there are no people in the confined space and there is no need to monitor the surrounding area outside the confined space and any support equipment.
- Exception for staff employed by REC: a colleague may assume the role of the manhole guard under the following conditions (e.g. when inspecting a boiler during refurbishment work):
 - The type of work permit is a logbook permit,
 - During the period of entry into the confined space, a colleague outside the confined space must supervise the person inside the space.
 - The colleague may not enter the space at any time.
 - The colleague and the person entering the space are aware of the risks associated with confined spaces,
 - The work will last no longer than 15 minutes,
 - Authorisation has been given to enter the confined space,
 - No other conflicting work activities take place in the confined space,
 - The confined space is easily accessible.
 - Standing watch over multiple manholes
- A manhole guard may stand watch over multiple manholes under the following conditions:
 - The manholes are an integral part of the space in which the work is taking place,
 - There are no obstacles in the direct access paths to the manholes,

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- The manholes are opened at the same level,
- The manholes are opened at multiple levels, the employees are in the manhole guard's direct line of sight and the manhole guard can warn them via hand/arm signals, a pull cord or communication equipment that has been tested and found to be operating normally.

Tasks of the manhole guard

A manhole guard has the following tasks:

- Gives or refuses permission to enter the confined space
- Maintains contact with people who are present in the confined space
- Notes the people who are present in the space on a registration list
- Monitors the conditions outside the confined space
- Monitors any support equipment in use (breathing air supply from outside the space)
- Ensures that manholes and escape routes are unencumbered by obstacles at all times
- In the event of danger, the manhole guard warns the people in the space from his position outside and instructs them to evacuate the space
- Stops the work in the event of a fire or gas alarm and instructs those present to leave space
- Warns the company emergency response (BHV) manager via telephone number 90 or 0517-432390 when people working inside the space require emergency aid

Instruction given to the manhole guard

The manhole guard has demonstrably received instruction in the tasks that are expected of this position.

Registration

A registration list must be used and updated if at least one of the following conditions applies:

- More than 4 people are present in the confined space at one time
- The manhole guard cannot see the people present in the space through the manhole
- People from more than 1 company have entered and are present in the confined space at the same time

4.2.8 Communication

Agreements must be made about how and using what equipment communication takes place between the manhole guard and the people present in the confined space. The following communication methods can be used:

- Contact through normal speech.

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- Walkie-talkie
- Tapping signals on the wall
- An acoustic signal
- Communication equipment in the full-face mask or helmet
- Tugging signals via a rescue line

The choice of communication must make allowance for the noise level, the degree of soundproofing in the space, the possibility of interference affecting sound signal reception of the communication equipment (Faraday's cage) and the distance between the speakers in the case of voice signals.

4.2.9 Attaching a line before entry

When the manhole guard is unable to see the person who has entered the confined space, or entry to the space is gained via a ladder or safety cage, all those who enter the space must wear a full-body harness and attach a safety line beforehand. The end of this rescue line must be securely attached to a point outside the confined space. This line is intended for use as a means of communication and as a rescue line in the event of an emergency.

4.2.10 Wearing independent respirators

If the space is entered by a persons wearing independent respirators, the manhole guard must be able to continuously monitor the persons wearing the respirators. If breathing air bottles are used, the manhole guard must monitor the time during which the breathing air bottles are used as well as the person wearing the respirator equipment. If the breathing air is fed to the person wearing the respirator by hoses, the manhole guard must monitor the breathing air supply and also ensure that contaminated air cannot be drawn in by the breathing air equipment (for example, that no exhaust gases are drawn in by the breathing air equipment).

4.3 Work in confined spaces

4.3.1 Electricity and confined spaces

A safe voltage must be used when working in an confined space that mainly features conductive walls, ceilings or floors and where freedom of movement is so limited that those present are continuously in contact with the conductive surfaces. The term safe voltage is understood to mean:

1. Mobile equipment fitted with an integral power supply (such as battery-powered or air-powered equipment) (this also applies to the lighting), or if this is not possible:
2. Equipment connected to a safe voltage (50 V AC or 120 V DC where the ripple does not exceed 5%) (this also applies to the lighting). If this is also not possible:

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3. Use of low voltage equipment (230 V AC), of double insulated design, subject to each item of the equipment being connected to a protective transformer in accordance with NEN 10742, after which no further distribution takes place. One single mobile appliance (class II, double insulated, or class I if the handles and controls are insulated) may be connected to the protective transformer.

4.3.2 Welding and/or using cutting torches

When gas welding and using cutting torches, leakage from the gas and/or oxygen hoses may increase the hazard level.

In order to minimise the risks when gas welding and using cutting torches, the following safety precautions must be taken:

- Gas and oxygen bottles may never be placed in an confined space. This also applies to central gas and oxygen systems.
- A hose rupture safety must be used on each gas bottle that is in use.
- The operator must check gas and oxygen hoses for signs of ageing and leaks before use.
- Local extraction must be used when welding and when using cutting torches.
- If the work is interrupted, the supply valves on the gas and oxygen cylinders must be closed and the feed hoses removed from the space, or disconnected from the gas and oxygen cylinders.

When using electrical welding equipment in an confined space that has conductive walls, the welding equipment used must be equipped with a voltage reduction relay and the open arc voltage may not exceed 50 volts AC or 120 volts DC. Welding transformers may not be set up inside the confined space!

4.3.3 Pressure-testing process pipes

When pressure-testing process pipes in an confined space, no persons may be present in the space in question at the time when these pressure tests commence. Only after the system has been pressurised for half an hour may the space be entered in order to check for leaks.

4.4 Closing an confined space

Before an confined space may be closed again, the relevant manager must check that:

- Nobody is still present in the space;
- The repairs have been carried out correctly;
- No items such as tools, parts and materials have been left behind in the space.

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4.5 How to act in the event of an emergency situation

The equipment and methods that are to be used to rescue people from the confined space must be determined prior to starting work. The scope can vary from a brief note on the work permit to drawing up a separate emergency plan.

Please refer to REC's emergency plan for exact instructions on how to proceed in emergency situations.

5. Mandatory PPE

- Safety footwear
- Safety helmet
- Work clothing (possibly worn under a white disposable overall fitted with a hood)
- Work gloves
- Hearing protection

6. Situation-related PPE

- Half-face or full-face mask with a P3 filter cartridge
- Full-face mask with a blower respirator unit equipped with P3 filter cartridges
- Compressed air equipment
- Dust goggles (when using a nose/mouth respirator or half-face mask)

7. Hygiene

- Clean the safety footwear if required
- Clean tools/accessories that have been used
- Take a shower and dress in clean (work) clothing

8. Relevant legislation and regulations

The following legislation and regulations apply:

- Arbobesluit (Dutch Working Conditions Decree), article 3.5c, d, e, f, g, 4.6, 4.6-1, 4.6-2, 4.7, 8.4
- Arbobeleidsregels (Dutch Working Conditions Policy Rules) 3.5g-1, 3.5g-2
- NEN 1010
- NEN 3140
- NEN 10742

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