OCCASIONAL GUIDANCE NOTE

The Classification & Management of Confined Space Entries

INDUSTRY GUIDANCE

Edition 3.0

December 2019

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1 Foreword

The Water Industry is justly proud of the influence that it has had in improving safety standards, not only within its own industry, but in the UK as a whole.

The original Occasional Guidance Note (OGN) upon which this revision has been based, was drafted at the request of the Health and Safety Executive and authored under the guidance of Rob Gwyther and Richard Locke as successive Chairs of the Water UK Occupational Health and Safety Group (WUKOHSG).

The aims of the guidance were:

- To bring clarity and uniformity to assessments and controls without overturning the traditional systems of work which have been successful for individual organisations.
- To enable the movement of contractors between client companies, and lower re-qualification costs.
- To standardise medical “fitness for entry” procedures.

In creating the original guidance the industry was supported by the Energy and Utility Skills Register who contributed their experience and knowledge to the development of an OGN that has become the basis of national training schemes.

This is the third edition of the OGN and we hope that it brings further clarity and uniformity taking into account current knowledge and technology.

Dr Jim Marshall

On behalf of the Council of Water UK

Date to be inserted

2 Introduction

UK injuries and fatalities occurring while working in confined spaces led to the enactment of The Confined Spaces Regulations 1997.

For many decades before this, UK water companies had recognised the special hazards and risks associated with confined space working and developed reliable and robust Policies Procedures and Arrangement (PPA's) designed to ensure that confined spaces work was carried out safely, in accordance with the regulations and with proper controls in place.

In times past, most confined space entry work was undertaken by the water companies Direct Labour Organisations (DLO). In more recent years however the use of indirect labour has highlighted the potential for different PPAs to be in conflict and this could result in a diverse and inconsistent specification of skills, training and equipment being required of contractors before they can work in each water company's confined spaces.

Water UK's member companies' specialist health and safety advisors assembled at Tadley Court on 10 November 1998 in order to agree a solution to the diversification of confined space entry requirements for contractors and establish industry wide standards. The authors included some of the most experienced and knowledgeable safety professionals in the industry at that time including Jeff Maddin, John Corden, Ian Cartwright, Chris Lee, Stuart Spencer, Jane May, and HSE's specialist Steve Catteral.

Working jointly with the HSE, the industry delivered an approach centred upon four standardised National Classifications for confined space entries. These have been carefully crafted to ensure that a Contract Specifier may overlay the local water company's classification and express the requirement to contractors in nationally recognisable and standardised terms; a solution that avoids any compulsory changes to water companies currently adopted PPA's for DLO's, yet provides a single national standard when specifying to contractors.

The industry was also tasked to resolve the previous lack of consistency in training standards. At this point Energy & Utilities Skills (EUS) took on the role of developing the National Occupational Standards (NOS). The NOS are expressed as statements of competence and people are assessed against these competencies. Awarding bodies approve and operate a quality assurance system for centres to carry out assessment. This also leaves the market for training providers free and open to competition. Individual providers are able to innovate and use their professional skills in training course design and delivery, whilst ensuring that all candidates reach a common prescribed output standard of competence after training.

Each water company may specify the Entry Classification for confined spaces under their control and therefore decide which NOS is appropriate.

3 Purpose

The purpose of this document is to provide a framework for the management of entry into confined spaces for contractors working for or on behalf of water companies in the United Kingdom.

The document contains National Classifications for entries to confined spaces. These are to enable a water company to specify entries to contractors using nationally agreed and understood system whilst allowing the water company to continue to use its local classification

The document also sets out nationally agreed minimum standards of management and operational performance, equipment and competence to be achieved by contractors.

The Classification system recognises that the system of work or precautions that may need to be taken for entry into a confined space will differ with the hazards, degree of risk, complexity of the operation and the location.

The National Classification system (NC) established by Water UK for confined space entries made by contractors to water companies identifies 4 entry categories designated NC1, NC2, NC3 and NC4.

4 Identification of Common Hazards & Controls

In the regulations a Confined Space is defined as “any place . . . which, by virtue of its enclosed nature, there arises a reasonably foreseeable **Specified Risk**”.

The Confined Space Regulations defines these specified risks as:

- Loss of consciousness or asphyxiation arising from gas, fumes, vapours or the lack of oxygen
- Loss of consciousness arising from an increase in body temperature
- Serious injury arising from a fire or explosion
- Drowning from an increase in the level of liquid
- Asphyxiation from a free flowing solid or inability to reach a respirable atmosphere due to entrapment in a free flowing solid.

Typical examples of areas in the Water Industry, which are both, enclosed and in which the presence of a specified risk is reasonably foreseeable include: -

- Manholes
- Sewers
- Underground tanks and reservoirs
- Adits and tunnels
- Pipelines
- Septic tanks and cesspools
- Pump wells, boreholes, surge and pressure vessels
- Trenches
- Above ground sludge tanks and screen channels.

All of these areas could be Confined Spaces to which the regulations apply.

Appendix 1 identifies the common hazards, which may be encountered during confined space work in the water industry.

Hazards can be present as a result of the **intrinsic** use of the confined space e.g. a foul sewer will contain sewage, which can produce toxic or flammable gases (appendix 1, tables 1.1 and 1.3).

In addition to the intrinsic hazards present, hazards may also be **introduced** as a result of the work being done e.g. toxic gas produced during a pipe relining project, the use of welding equipment etc. (appendix 1, tables 1.2 and 1.4)

Whilst not exhaustive, this guide to common intrinsic and introduced hazards found in the water industry may be of assistance in formulating a risk assessment. This guide does not lessen the obligation to carry out a risk assessment.

5 WATER UK National Classifications for Confined Space Entries

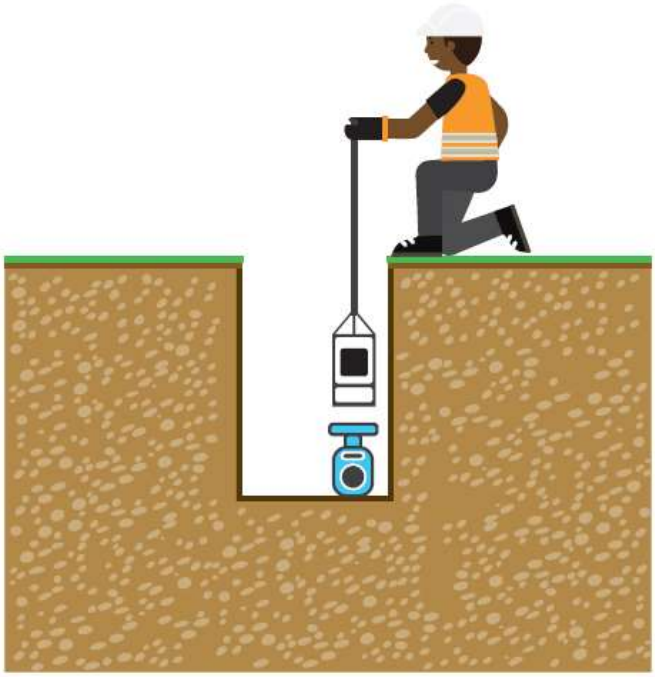
National classifications (NC) 1 to 3 are intended as generic standard classifications for vertical entry confined spaces that may be used to establish safe working methods for access and egress. They should be considered alongside the risk assessment for the characteristics of the specific workplace.

In some circumstances these three generic classifications and the supporting control principles contained in Section 7, will not fully address the risks and thus the organization controlling the entry must exercise caution and apply appropriate risk controls based on their knowledge of the workplace.

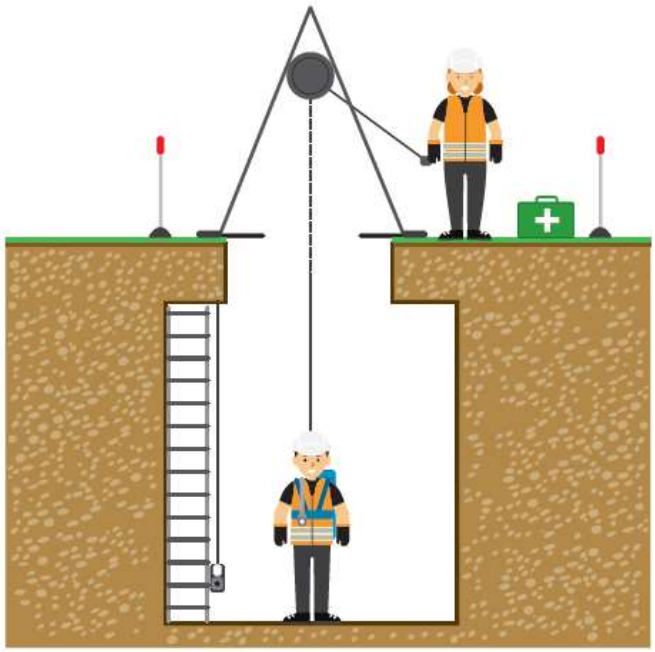
NC4 classified entries are complex and necessitate the development of a detailed risk assessment and task specific Safe System of Work (SSoW).

WATER UK Classification of Entries - Definitions

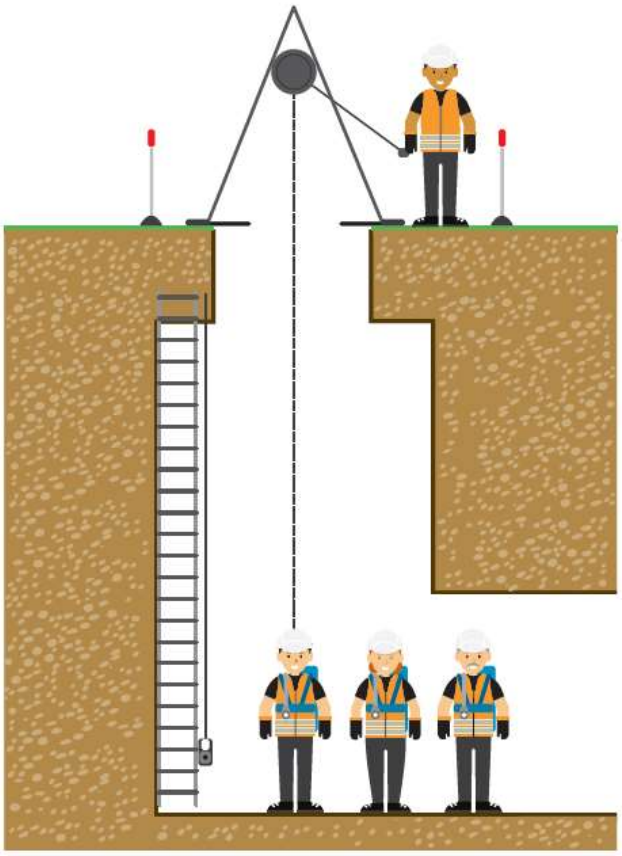
NC1 low risk shallow entry with adequate natural or mechanical ventilation, where access is simple and unobstructed and there is no likely risk of flooding e.g. meter pits, valve chambers, booster-pumping stations, PRV chambers



NC2 Vertical direct unobstructed access with continuous attachment to a person riding hoist or similar mechanical rescue device.



NC3 when it is not possible to have persons permanently attached to a safety line. Usually it will be a team entry which moves away from the entry point e.g. person entry sewers, utility service subway tunnels, aqueducts and complex wet wells. Working without an attached rescue line and includes working away from the point of entry but on an unobstructed horizontal plane.



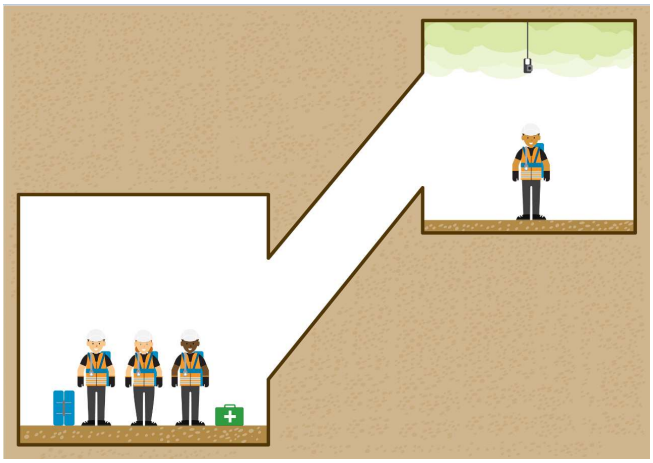
NC4 Complex access and egress that do not meet any of the classifications above or involving complex operations which introduce additional risks and require specific controls and rescue arrangements e.g. mechanical hazards, physical complexity of system introduced hazards, enhanced specific intrinsic hazards.

Circumstances, which might lead to NC4 classification include where: -

- fluid, mechanical or electrical isolation arrangements are complex
- structural conditions are in doubt
- underground systems are particularly deep or complex
- record drawings are in doubt;
- there is a history of serious atmosphere hazard;
- industrial waste discharges are insufficiently diluted to control harm from chemical, biological or radioactive agents
- the risk of drowning is only controlled by pumping or by tide
- the job involves hot work or a fume producing process
- the job requires electrical apparatus operating above Safety Extra Low Voltage
- (SELV) 25 volts or which is not explosion protected
- the work in hand is unfamiliar, complex or inherently hazardous

This list is not intended to be exhaustive

NCX Other Confined Space Entries



It should be remembered that not all confined spaces are vertical entry spaces. Some are horizontal entry (e.g. rooms or spaces with gas storage or combustion plant), others have vertical upward entry (e.g. roof spaces where methane or hydrogen could accumulate). Specific atmospheric analysis, access arrangements and rescue plans must be devised for each such space encountered.

6 Risk Assessment

Entry into a confined space will often be undertaken under a permit to work (PTW) system. Individual organisations are responsible for establishing their own procedures and rules with regard to PTWs and ensuring that those working on their behalf are aware of the requirements.

Regardless of any PTW systems, entries will require risk assessment with regard to any identified specified risks intrinsic to the space/location or introduced as a result of tasks being undertaken.

There will be circumstances where a confined space is under the control of someone other than a water company employee. An example of this will be work let to contractors. Under such circumstances the client and/or his appointed representative or principal contractor is responsible for obtaining and passing on the necessary information pertaining to the hazards to allow those organising/ carrying out the entry to effectively assess risk and classify the entry.

The organisation in control of the specific entry is responsible for the assessment and control of risk and shall establish the safe system of work (SSoW). The person in direct control of the entry on site shall carry out an assessment of the actual state and condition found and determine whether or not it is safe to work under the system of work specified. If this local assessment identifies any unexpected risks then it will automatically trigger a full re-assessment of the safe system of work (SSoW)

All confined space entries require an assessment, which considers: -

- Avoiding the need for entry and considering less hazardous or alternative means of achieving the goals wherever reasonably practicable
- the intrinsic hazards likely to be present in the particular workplace
- the complexity of entry
- pre-entry requirements such as flushing or isolation and standard of isolation to be achieved
- particular conditions and circumstances likely to increase or decrease risk
- any additional hazards likely to be introduced by the task in hand (fumes, sparks, electric shock, etc.)
- the extent to which risk can be eliminated or controlled through either engineering controls or the system of work and competency of the operatives involved
- emergency rescue arrangements

Restricted Spaces

Some spaces may be substantially enclosed and could also have complex access and egress but none of the specified risks that would make them a confined space according to the regulations. Some organisations will require them to be classed as restricted spaces and have a rescue or recovery plan in place prior to entry.

7 Principles of Procedures to be adopted by Contractors Working in Confined Spaces.

The following principles will always apply:

a) All entries will be classified in accordance with National Classifications NC1 to NC4
b) No person shall work in a confined space unless the entry category (NC1 to NC4) has been determined or confirmed through risk assessment. A documented risk assessment may be required for NC1 to NC3 entry, although this maybe in the form of a generic task assessment. Such a generic assessment would need to take into account any specific conditions met on the day of the confined space entry. For NC4 the specific risk assessment required shall be documented.
c) Emergency arrangements will be put in place as determined in the risk assessment and shall include the provisions as set out in Section 8.
d) No person shall work in a confined space unless they are deemed physically capable and medically fit for the work activity. A check list of medical conditions which would require medical guidance to be sought regarding a person's suitability for confined space work is provided in Section 10
e) No person shall work in a confined space unless they have been adequately trained, assessed and certificated for the purpose. The requirements for training, assessment and certification are set out in Section 11.
f) No person shall enter a confined space (except for operations in National Classifications NC1) unless a safety attendant ("Top Attendance") directly controls the entry at the point of entry.
g) The "Top Attendant" shall be trained in accordance with specification given in Section 11. In deep or complex systems it may be necessary to post 'relay' safety attendants or 'Bottom Attendants'. Bottom Attendants will be trained in accordance with the specification of competence given for "Top Attendants" see Section 11.
h) The "Top Attendant" will have suitable equipment so as to be responsible for;
    a. monitoring the atmosphere in the confined space prior to entry and maintaining communication to monitor the atmosphere at all points throughout the entry.
    b. maintaining communication with those working in the confined space,
    c. summoning the emergency services in the event of an emergency.
    d. maintaining their own safety, and the safety of others, at the open entry point to the confined space.
i) No person shall enter a confined space without prior and continuous atmosphere monitoring which, as a minimum, monitors for
    a. low oxygen
    b. flammable gas
    c. reasonably foreseeable toxic gases

    Some processes may require specific monitoring e.g. Chlorine, Hydrogen Sulphide, Ozone, Sulphur Dioxide, Carbon monoxide. This will be determined by the risk assessment.
j) No person shall enter or work in a confined space unless they are equipped with and using the PPE specified in Appendix 2
k) Electrical or electronic apparatus will be explosion protected/flame proof unless the risk assessment establishes that there is negligible risk of any flammable atmosphere being present or developing. Where this principle is not practicable, the risk assessment should establish a system of work which incorporates appropriate control measures to prevent the

build-up of flammable air mixtures or automatically isolate unprotected electrical equipment. In the latter case this should not lead to further risks. Temporary electrical systems employed in a confined space shall be designed installed and maintained so as to prevent electrical shock.

l) All confined space entry points shall be effectively barriered unless continuously attended or other suitable means provided to prevent falls or unauthorised entry.

m) Suitable and sufficient welfare and hygiene arrangements shall be readily available.

8 Self and Assisted Rescue at Confined Spaces

8.1 Self Rescue

Under normal operating conditions every person working in a confined space should be capable of removing themselves from the hazardous area without assistance. For NC2 classified entries this would include winching operations by the work team.

If a person(s) in the confined space becomes incapacitated, the other members of the work team should be able to assist them or sustain them in-situ pending arrival of an "Assisted Rescue" Team. This assumes a confined space 'specified Hazard' is not present.

Should a specified hazard be present the first priority is for each individual capable of doing so to affect an expedient exit from the confined space and for the planned assisted rescue provision to be called in to assist those unable to self-rescue.

Proof of competence and training requirements for all members of work teams are contained in Section 11.

8.2 Assisted Rescue

Risk assessment may identify that it is appropriate to make arrangements for Assisted Rescue in the event that a person in a confined space may become incapacitated. Assisted Rescue means a dedicated team, appropriate to the work and location, whose specific role is to be available to affect a rescue in such an emergency. These dedicated teams may be provided by in-house teams or specialist contractors.

Risk assessments must also take into consideration procedures for dealing with emergencies, even if Assisted Rescue Teams have been provided. This should include the distance the emergency services may have to travel, access to the work area, arrangements for meeting and guiding the emergency services, provision of information to the emergency services on the type of hazards, processes or chemicals that may be present, any additional hazard and any physical constraints of the confined space.

Where determined by risk assessment, organisations will need to consider appropriate pre-notification to the Emergency Services.

9 First Aid and Resuscitation

All persons who enter confined spaces or act as a “Top Attendant” must be suitably trained in emergency procedures, including any appropriate first aid and artificial resuscitation. Competencies and training requirements for all members of the work team are contained in Section 11.

When working/rescue breathing apparatus is provided/used a suitable means of resuscitation, as determined within the risk assessment, must be provided and the site team must include a suitably trained qualified First Aider. The First Aider must not be part of the team who enters the confined space, nor may he/she be the "Top Attendant" controlling the activity.

Where risk assessment identifies the possibility that a significant abnormal condition may develop, specialist first aid facilities and competence may be required.

If resuscitation is likely to be attempted within the Confined Space when breathing apparatus is being used, or if a person rendering assistance might be placed at risk from secondary inhalation of toxic gas during mouth-to-mouth, then the means of resuscitation must include a mechanical device.

The first aider must have received specialist training in the use of any specific resuscitation equipment provided.

10 Medical Standards for Breathing Apparatus Wearers

Introduction

Within the water industry confined spaces can vary from open trenches to sewers, underground and other spaces with a specified risk. Some confined spaces will require breathing apparatus to be worn or carried, while other confined spaces will have no requirement for breathing apparatus.

Therefore the medical standards for confined space workers will vary with the space and task. It is recommended that employers undertaking risk assessment and medical assessments should consult with Occupational Health Practitioners. The following information is provided as guide to what could be included within a medical assessment. It is recommended confined space workers are subject to regular assessment.

Purpose

The purpose of medical standards for confined space workers is to give guidance to Occupational Health Practitioners, both doctors and nurses, when determining the fitness of personnel for confined space work. Cases of doubt should be referred to an Occupational Physician, seeking further details of the job requirements, if necessary.

Medical Assessments

The medical assessment has three functions:

- Is the worker medically fit to undertake the task?
- Is the worker able to use Breathing Apparatus?
- Is the worker at risk of sudden incapacitation?

Suggested Medical Assessments:

NC1 No specific assessment, beyond pre-employment assessment and reassessment after significant injury or illness.

NC2 Assessment on first undertaking confined space work, Reassessment after significant illness or injury and at a period agreed with the organisation's occupational health advisors.

NC3 Assessment on first undertaking confined space work Reassessment after significant illness or injury and at a period agreed with the organisation's occupational health advisors.

NC4 As NC3, plus any assessment required by the specific risks identified. For example work with radioactive agents may require the worker to be medically assessed in accordance with the Ionising Radiation Regulations 1999.

Fit for Task

Depending upon the task, the assessment may vary from confirmation that a pre- employment medical assessment was undertaken, to a special medical examination prior to the task. The purpose of the assessment is to ensure that there is an adequate level of cardiovascular, respiratory, musculoskeletal and neurological function to undertake the task.

Where possible, the final decision on medical fitness, in borderline cases should rest with a Specialist Occupational Physician.

Fitness to use Breathing Apparatus

Breathing apparatus essentially consists of two types, self-contained air breathing apparatus (SCBA), worn during work, and escape breathing apparatus, carried but only used in an emergency. Those required to use breathing apparatus should ensure that face fit testing is undertaken as appropriate and according to published guidance.

The SCBA assessment should include spirometry, with workers who have either a low FVC (more than 1 litre below the expected value) or a low FEV1 / FVC ratio (less than 70%) or those with a history of respiratory disease, e.g. asthma, being referred to an Occupational Physician.

Risk of Sudden Incapacitation

Operational Managers, Safety Officers and Medical Advisers should consider whether the risks and hazards of sudden incapacitation (which includes the dangers to the individual and those who may rescue them) require specific medical standards to be applied.

The Driver and Vehicle Licensing Agency (www.dvla.gov.uk) publishes medical standards for drivers, which are freely available and widely used by doctors. A significant function of these medical standards is to determine which drivers are at risk of sudden incapacitation, while driving and to provide evidence based guidance for decisions as to their fitness to drive. Some organisations may use these to assess the risk of sudden incapacitation when working in a confined space and apply these standards as a specific medical requirement e.g.

NC1 No specific assessment

NC2 Meet Group 1 (car) licensing requirements

NC3+ Meet Group 2 (LGV) licensing requirements

Further Information

There should be close co-operation between the medical advisers and those providing confined space and breathing apparatus training. Workers, who pass a medical assessment, may have difficulty when faced with the reality of confined space work, for example wearing breathing apparatus in zero visibility. Alternatively, workers with medical doubts, for example borderline spirometry results, may demonstrate satisfactory performance on the training ground.

Obesity will be a factor in determining adequate cardiovascular and respiratory function. Workers with a body mass index (Weight in Kg divided by height in M squared) over 30 require careful assessment.

If there are weight limits imposed by the equipment, for example the safe working load of a rescue hoist, it is for the employer to provide details to the medical assessor.

The ability of a worker to pass through a restricted opening is an important consideration when assessing whether an individual can safely undertake an entry. This guidance does not specify a maximum girth and leaves it to individual organisations to make such an assessment based on their risk assessment and knowledge of their work area.

Some authorities suggest that anosmics (those without a sense of smell) should not undertake confined space work. However the smell threshold varies greatly between individuals and from day to day (for example due to a cold or blocked nose). This guidance is not a safe system of work (SSoW) and it is up to employers to ensure an appropriate SSoW is prepared for entry into confined spaces under their control.

11 National Occupational Standards (NOS) and Qualifications for working in confined spaces.

Introduction

The Confined Spaces Regulations 1997 stipulate that training for work at confined spaces must be provided. The regulations however make no stipulations for the;

- content or duration of the training
- credentials of the training staff
- nature, type, suitability or quantity of equipment and facilities used by the training provider organisation.

The confined spaces training provider community offers widely differing levels of commitment to training, infrastructure, course design and resourcing. It is considered inappropriate and impracticable for the water companies to vet confined spaces training providers as a means to achieving consistent and appropriate standards. It is also considered inappropriate for water companies to assume responsibility for designing or specifying the training courses that shall be provided to contractors that will enter, supervise or provide emergency assistance at their confined spaces.

The National Occupational Standards

This National Occupational Standards (NOS) specify the competency standards that will be recognised by the water industry for those that:

- Work in low risk confined spaces
- Work in medium risk confined spaces
- Work in high risk confined spaces
- Oversee work in confined spaces
- Undertake emergency rescue and recovery of casualties from confined spaces

The confined spaces training community supplies confined spaces training to many other organisations besides water companies.

Training and Assessment Organisations

Organisations that wish to carry out assessment for qualification purposes will need to go through a process of becoming approved by one of the awarding bodies who offer these five qualifications. This will involve being able to demonstrate they have the necessary resources (as outlined in the National Occupational Standards, see Appendix 3), have the necessary management and quality assurance systems in operation to carry out high quality assessment, and can support candidates through the assessment process.

Training providers would be expected to provide first rate training which enables candidates to become competent. The NOS embody the skill and knowledge requirements have been derived from Water UKs assessment of the risks and hazards found in confined spaces at water company installations.

This outcomes based approach, is consistent with training industry best practice. This flexible approach allows individual training providers to design develop and promote innovative and cost effective training solutions for their clients in an unrestricted commercial market. The qualifications are competence based.

All persons wishing to enter a water company confined space shall, after suitable training, take the appropriate assessments such that qualifications may be obtained and presented to clients as proof of post training competence.

Holders of confined space qualifications shall be **reassessed every three years** following refresher training as appropriate and a new certificate of post training competence shall be awarded to successful candidates. Some of the equipment used for confined space entry will have a more frequent training requirement and may require interim refresher training and familiarisation.

Proof, (by possession of the appropriate qualification(s)) of having attained the appropriate post training competency standard will be requested by the client (see Appendix 3). Awarding bodies will award candidates who reach the required standard of post training competence a qualification and Certificate.

Organisations wishing to become an approved assessment centre must apply to one of the awarding bodies who are accredited to award these five qualifications.

Exceptions

Some visitors needing to gain access to sites involving NC entries may be permitted to enter at the discretion of the client provided that the visitor(s);

- receive a suitable site briefing from the supervisor/entry controller prior to any entry
- is always accompanied and under the direct supervision of a person that has been awarded and holds the appropriate and current competency based assessment qualification for the NC entry specified. See Appendix

Note

All of these requirements are complimentary to the (CS Regulations 1997) and do not in any way replace them.

The provisions of this document in no way alters the responsibility of the employer to satisfy itself as to the suitability or otherwise of its chosen training provider.

12 Acknowledgements

WaterUK Council wish to thank:

- EUSkills for the great amount of time and investment in the production of this document;
- Members of the WaterUk Confined Spaces Working Group;
- HSE for its continued support and active contribution to the development of this OGN;
- City and Guilds etc
- Mines rescue etc

Appendix 1 Common Confined Space hazards at Water Company installations

TABLE 1.1 Non - exhaustive list of **intrinsic** hazards, which may be found in confined spaces - **Sewer Networks & Wastewater Treatment Works**

Generic Hazard	Specific Hazard	Common Effect	Principal Sources
Hydrogen Sulphide	Toxic/Flammable	Poisoning Death	Breakdown of biological material. Digestion plant. Sewerage and pumping stations. Geological infiltration
Methane	Flammable Explosive	Burns Asphyxiation Death	Breakdown of biological material. Digestion plant. Sewerage and pumping stations. Geological infiltration CHP units
Carbon dioxide	Lack of breathable oxygen Directly toxic at elevated levels	Asphyxiation Death	Breakdown of biological material. Geological conditions. Contaminated land e.g Brick works, landfill sites, Digestion plant. Sewerage pumping stations.
Ammonia	Toxic	Poisoning Death	Breakdown of biological material. Digestion plant. Sewerage and pumping stations. Spillages
Chlorine	Toxic	Poisoning Death	Public baths. Industrial discharges
Cyanide	Toxic	Poisoning Death	Electro-plating industry discharges
Trichloroethylene and other industrial solvents	Toxic Narcotic	Asphyxiation Poisoning Death	Dry cleaners and industrial discharges
Petrol	Flammable Explosion	Burns Death	Forecourt spillage. Road traffic accidents
Mains gas	Explosion Asphyxiation	Burns Death	Gas pipeline failure
LPG	Explosion	Burns Death	Stored gases

Generic Hazard	Specific Hazard	Common Effect	Principal Sources
Dust	Explosion	Burns Death	Sludge dryers. Gasification plant
Plant and Equipment	Entrapment Crushing Abrasion	Physical injury	Flap valves Mechanically raked screens. Pumps
Temperature	Steam Hot water	Scalding Heat exhaustion Death	Laundries. Industrial discharges
Human/Animal/Clinical waste	Infection	Ill health	Exposure to biological agents. Abattoirs. Hospital waste, sharps/needles lodged in drains & pump blockages. Rats. Exposure to sewage
Oxygen deficient or displaced air	Asphyxiation	Death	Oxidation of ferrous metals. Oxidation of biological material. Large blood discharges from Abattoirs, Hospitals. Food waste
Chemical exposure	Toxic Harmful Irritant Corrosive	Poisoning Corrosive burns	Battery Manufacturers. Electro Spillages. discharges. Digestion plant. Splashes, sprays & aerosols
Liquids and solids moving in a fluid state	Asphyxiation Drowning	Suffocation Death	Tidal flows. Storm flows. Deep storage vessels. Silos. Large industrial waste discharges. Siphons. Bellmouth outlets at services reservoirs
Physical Injury	Slips and trips Impact injury	Abrasion/bruising/ concussion/sprains & breaks	Build up of fats. Projecting pipes and fittings. Ladders and steps. Open manholes and access points. Gantries and stairways.
Access and egress	Restricted size	Entrapment	Manholes. Failure of ladders/step irons etc
Structural instability	Collapse	Crushing Entrapment Falls	Brick sewers. Corroded metal fittings.

Generic Hazard	Specific Hazard	Common Effect	Principal Sources
Electricity	Electric shock	Burns Death	Impacting on buried cables. Electrical equipment
Waste Water Treatment Processes, Chemicals and Gases			
Ferric chloride	Irritant	Damage to skin and eyes	Sewage and sludge treatment works. Odour control units
Polyelectrolyte	Dust Slips	Slips	High slip risk on batching and dosing plant.
Sodium hypochlorite	Irritant Corrosive Gas liberation (toxic)	Chemicals burns Death	Disinfectant or sweetener on W.W. Treatment Plants
Oxygen enrichment	Fire risk	Burns	Sewage and sludge treatment works. Manufactured and bulk stored oxygen for process applications eg C.O.A.S.T. plant. Prevention of septicity in rising mains. Hydrogen peroxide dosing

TABLE 1.2 Non - exhaustive list of **introduced** hazards, which may be found in confined spaces - **Sewerage Networks & Sewage Treatment Works**

Generic Hazard	Specific Hazard	Common Effect	Principal Sources
Oxygen enrichment	Increased fire risk	Burns	Oxygen Flame cutting
Carbon monoxide	Toxic	Asphyxiation Death	Internal combustion. Fire in or adjacent to space. Boilers.
Nitrogen	Lack of breathable oxygen	Asphyxiation Death	Inerting gas for purging sludge digesters
Electrical and electronic equipment	Ignition of gases Electric shock	Burns Death	Non explosion protected or flameproof equipment
Exposure to chemical agents	Paint Sandblasting Epoxy resins Cement etc.	Asphyxiation Intoxication Burns Dermatitis Poisoning	Repairing seals, walls etc. Painting

Generic Hazard	Specific Hazard	Common Effect	Principal Sources
Mechanical	Physical injury Fire	Abrasions Breaks Sprains Death	Percussive tools. Abrasive wheels. Cutting gear
Rat poison	Anti coagulant Attack on central nervous system	Ill health	Rodent control
Manual handling	Bending lifting carrying	Physical injury	Raising/lowering loads. Operating in restricted spaces. Lifting manhole covers

TABLE 1.3 Non - exhaustive list of **intrinsic** hazards, which may be found in confined spaces – **Water Supply and Distribution Networks**

Generic Hazard	Specific Hazard	Common Effect	Principal Sources
Methane	Explosive	Asphyxiation Burns	Borehole strata. Geological condition. Breakdown of biological material at spring water sources. Sediments in storage reservoirs. Mains gas. Contaminated land e.g. Brick works, town gas works, rubbish tip
Carbon Monoxide	Toxic	Poisoning	Internal combustion engines. Boilers.
Chlorine	Toxic	Lung and skin burns Death	Process Dosing plant. Sodium Hypochlorite dosing.
Sulphur dioxide	Toxic	Lung and skin burns Death	Process Dosing plant. Metabisulphate dosing plant
Ozone	Toxic	Death	Process Dosing plant.
Ammonia	Toxic Flammable	Lung damage	Compressed process gas
Radon	Carcinogen	Lung cancer	Mine Adits. Granite strata

Generic Hazard	Specific Hazard	Common Effect	Principal Sources
Asbestos dust	Carcinogen Harmful	Cancer Asbestosis Mesothelioma	Asbestos mains cutting & Handling
Low oxygen	Asphyxiation	Death	Wells and Borehole head spaces. Geological conditions. Tanks, Reservoirs Vessels, Trenches. Sudden Large fractures in uPVC mains when drilling/tapping. Tanks/Reservoirs Vessels. Washdown outlet in service reservoirs.
Algal blooms	Toxic	Skin irritation Ill health	Impounded water sources tunnels and pipes
Carbon dioxide	Lack of breathable oxygen Toxic at elevated levels	Asphyxiation Death	Contaminated land e.g Brick works, landfill sites
Physical injury	Slips and trips	Abrasions, cuts, broken bones	Ladders, wet surfaces. Projecting pipes and fittings
Electricity	Electric shock	Burns Death	Impacting on buried cables. Electrical equipment
Access and egress	Restricted access	Entrapment Collapse	Tanks/Reservoirs Vessels. Meter pits, valve chambers, boosterpumping stations. Trenches.

TABLE 1.4 Non - exhaustive list of **introduced** hazards, which may be found in confined spaces – **Water Supply and Distribution Networks**

Generic Hazard	Specific Hazard	Common Effect	Principal Sources
Carbon monoxide	Toxic	Poisoning	Vehicle exhaust. Petrol driven tools etc.
Carbon dioxide Halon	Lack of breathable oxygen Directly toxic at elevated levels	Asphyxiation Death	Pipe freezing equipment. Fire damping systems
Styrene	Irritant Toxic	Irritation of eyes/ lungs. Tiredness/ slower reaction times	Pipe relining work
Trichloroethylene and other solvents	Flammable/Highly Flammable. Causes respiratory sensation	Irritation of eyes/ lungs or skin. Unconsciousness/ Death. Increased risk of fire/explosion.	Butt fusion welding in trenches.
Interaction of chemicals used in water treatment process e.g. sulphuric acid/ Caustic soda/ soda ash , Hydrofluorosilicic acid etc.	Adverse reactions generating heat, liberation of toxic gases or loss of containment of chemicals	Poisoning. Asphyxiation Chemical burns	Bulk storage of chemicals, uncontrolled delivery. Failure of pipework and storage vessels. Fluoridation plant
Oxygen enrichment	Enhanced fire risk	Burns Death	Oxygas Flame cutting. Ozone process plant.
Hydrogen	Explosion	Burns Death	By-product of onsite electro chlorination oSEC
Electrical and electronic equipment	Igniting gases Electric shock	Burns Death	Non explosion protected or flameproof equipment
Exposure to chemical agents	Paint, Sandblasting Epoxy resins, cement etc	Asphyxiation/ intoxication. Burns Dermatitis. Poisoning	Repairing seals, walls etc. Painting
Electricity	Electric shock	Burns Death	Electrical equipment

Appendix 2 Equipment Specification for Entry to Confined Spaces in the Water Industry

The following denotes the level of equipment required for each entry classification.

NC1 Access Equipment

- Personal Protective clothing eg overalls/waterproofs.
- Safety footwear
- Portable Gas monitor (capable of detecting low oxygen, flammable gas and appropriate toxic gases).
- Intrinsically safe lighting (where there is a risk of flammable or explosive atmospheres)
- Travelling First Aid kit

NC2 Access Equipment

- Protective clothing as appropriate
- Safety footwear
- Portable Gas monitor (capable of detecting low oxygen, flammable gas and appropriate toxic gases).
- Intrinsically safe lighting (where there is a risk of flammable or explosive atmospheres)
- Hand line for lowering detector, tools etc.
- First aid kit (1 to 5 or larger)
- Safety helmet
- Mechanical lifting device (Note; where a fully suspended descent is planned a secondary rescue system is required)
- Appropriate Harness
- Escape breathing apparatus
- Safety barriers road signs etc as appropriate
- Life jacket (Where necessary)
- Means for calling emergency services

NC3 Access Equipment

- Protective clothing as appropriate
- Safety footwear
- Portable Gas monitors to equip each and every entry team member (capable of detecting low oxygen, flammable gas and appropriate toxic gases.
- Intrinsically safe lighting (where there is a risk of flammable or explosive atmospheres)
- Hand line for lowering detector/tools
- First Aid kit (1 to 5 or larger)

- Safety helmets
- Mechanical lifting device for vertical entries (Note; where a fully suspended decent is planned, a secondary rescue system is required)
- Appropriate Harnesses
- Sufficient escape BA sets to equip each and every entry team member. Duration time of sets to provide adequate escape time
- Means to call emergency services
- Means of communication with members of the team
- Sufficient working/rescue BA sets to address the rescue arrangements (minimum of 2 sets)
- Safety barriers road signs etc as appropriate
- Life jacket (Where necessary)

NC4 Access Equipment

As for NC3 above plus specific equipment specified by the Safe System of Work. In addition to the personal and team equipment listed in NC3 above, consideration should be given to the following where applicable:

- Air movers/local exhaust ventilation
- Specific detectors, possibly involving continuous monitoring
- Means for locking off electrical/mechanical equipment
- Flame/spark proof tools and equipment
- Suitable respiratory protection for dust and sewage spray hazards
- Chemical resistant suits, gloves, eye protection and hearing protection
- Compressed or forced air feed breathing apparatus to address introduced or serious intrinsic chemical hazards
- Life jacket

Appendix 3 National Occupational Standards for working in confined spaces.

The most up to date National Occupational Standards can be found on the Energy & Utility Skills web page www.euskills.co.uk