Phillips, Kim (NRCan/RNCan)

From: Calum MacLean <calum.maclean@technical-limits.com>
Sent: Friday, September 16, 2016 8:02 AM
To: Phillips, Kim (NRCan/RNCan)
Cc: Matt Lewin
Subject: RE: Atlantic OHS Regulations Initiative Stakeholder Consultation - Follow-up
Attachments: Atlantic OHS regs phase 1 feedback - MTL.DOCX

Kim,

Please find attached review comments from MTL regarding the confined space entry and hotwork sections of the draft OHS policy intent. We've tried to bring our experience to the regulations and understand that you will get a diverse range of comments from others. If your workgroup would like to clarify any points which either we have highlighted or others have brought up that are in conflict with our comments, please feel free to contact us.

We would also be interested in participating in the review of the main section of the regulations relating to hotwork in hazardous areas.

Regards

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From: Phillips, Kim (NRCan/RNCan) [mailto:kim.phillips@canada.ca]
Sent: 12 September 2016 14:49
To: Phillips, Kim (NRCan/RNCan)
Subject: RE: Atlantic OHS Regulations Initiative Stakeholder Consultation - Follow-up

Good morning,

Just a reminder that the deadline for submitting comments on the Atlantic OHS Regulations policy intent is this **Friday, September 16, 2016.**

Please note, there was language missing from Section 217 (Fall Protection – personnel safety nets). The requirement should also include the following:

(g) where connected to another personnel safety net, the splice joints connecting it with the other personnel safety nets are equal to, or greater in strength than, the strength of the weakest of the personnel safety nets.

Looking forward to receiving your feedback.

Kim Phillips
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From: Phillips, Kim (NRCan/RNCan)
Sent: August 3, 2016 14:51
To: Phillips, Kim (NRCan/RNCan)
Subject: Atlantic OHS Regulations Initiative Stakeholder Consultation - Follow-up

Thank you for attending the stakeholder consultation sessions held last week in Halifax and St. John's. Your participation and feedback are very much appreciated.

Please find attached the deck that was presented at the sessions, as well as the attendance list for the two sessions. As noted in the St. John's session, **we have extended the deadline for written comments to Friday, September 16, 2016.** Written comments can be sent to me and will be posted as received to the NRCan website.

Looking forward to receiving your feedback.

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Marine Technical Limits

Atlantic Offshore Occupational Health and Safety Initiative – Phase 1 policy intent review.

Context

Below are the comments and view of Marine Technical Limits, specialists in the management of confined space entry inspection and repair projects within the hull spaces of producing FPSO / FSU installations. These views are based on 15 years of experience of executing FPSO hull maintenance activities in the UK, West Africa and Canada – within differing regulatory regimes and cultural requirements. MTL have been closely involved with the structural integrity management of both Canadian FPSO's and in particular the preparation and review of RQF's for hotwork repairs during production. Within the UK offshore sector, MTL manages over 10 hotwork repair projects and 15 confined space inspection projects each year, with an exemplary safety record.

Having seen how regulations are regarded, quoted and applied within the Atlantic Offshore area, we understand the importance that these regulations have and the need to ensure that the working within the regulations is clear, unambiguous and targeted at protecting the health and safety of workers. Fundamentally the test for every line of the regulation must be to ensure that these requirements are met.

Introduction

As our expertise relates primarily to confined space entry and hotwork, our feedback is limited to clauses 92 through 138, however, the principles of these comments may be equally applied to other sections of the policy intent document where appropriate.

It is fully understood that the policy intent document is effectively an early draft of what could be included as content for the ultimately published regulations and that there is a great deal more work to do on developing the content following this review exercise prior to "legalising" the language. The comments and advice provided below is intended to help progress this process quickly and to aid the production of good regulations which will protect worker safety, whilst enabling essential inspection and maintenance tasks to be carried out and minimising the need for RQF's (deviations and substitutions.) MTL have seen essential inspection and maintenance tasks being deferred in many operating areas due to a view that the work cannot be managed safely within the regulatory regime applicable or inappropriate corporate standards. Deferring essential tasks won't make anything safer or provide integrity.

MTL developed the Ageing and Life Extension Guidance for Floating Offshore Installations as part of the FPSO Forum at Oil and Gas UK. A key principle that we learned throughout this process was that "less is more". The guidance had more impact by being concise and making a few points once only than by repeating the same requirement in many places and losing the impact through explanations. This was a very useful approach which we feel would significantly benefit these regulations; e.g. make it clear what performance requirements must be met, but don't explain in detail how to do it.

Comments by section

92) Confined space definition

> "*confined space*" means an enclosed or partially enclosed space that
> a) is not designed or intended for human occupancy except for the purpose of performing work;
> b) has restricted means of access and egress, or an internal configuration, that could make first aid, evacuation, rescue, or other emergency response services difficult to perform; and
> c) may become hazardous to any person entering it owing to
> d. its design, construction, location or atmosphere;
> e. the materials or substances in it; or
> f. any other conditions relating to it.

It is understood that this definition is inherited from other Canadian regulations. Although it appears to be concise, there are undefined terms which may make it legally difficult to enforce e.g. what constitutes a condition relating to a space which may make it hazardous to personnel? An alternative more general phrasing may achieve the same effect e.g.

A confined space is a place which is substantially enclosed (though not always entirely), and where serious injury can occur from hazardous substances or conditions within the space or nearby (e.g. lack of oxygen)

93) Assessment of confined spaces

> When assessing whether a space is or may become hazardous to a person entering it, a person must not take into account the protection afforded to a person through the use of personal protective equipment or additional ventilation.

This clause seems more like guidance than a regulatory requirement. It would be better to include in an approved code of practice or interpretation note.

94) and 95) Confined Space Management Program

> 94) Employer must develop, establish, implement and maintain a confined space management program in accordance with this section.
>
> 95) The confined space management program must be integrated as part of the broader OHS management system and OHS program.

It is not at all clear what the content of the management program should be, what it's aims should be and what the minimum requirements are. How would a regulator be able to determine whether a document presented by an employer meets the requirements of these clauses? We suggest that these clauses are removed from the regulations. A responsible offshore installation operator would develop his own confined space entry management procedures without a need for a regulation.

to create a suite of hazard assessments for tasks which might be carried out in confined spaces – years before these are required or used, or the tasks to be carried out are properly defined. The danger is that once these hazard assessments have been recorded and reported, the operational management on board the installation will not feel any ownership for the content or feel empowered to change, amend or question any of the content.

As a regulatory requirement it is much more important to clearly state that:

- For each program of entry into a confined space, a hazard assessment must be carried out by suitably competent and experienced persons with a detailed knowledge of the space, the work/activities to be carried out within the space and the hazards which are present.
- The hazard assessment shall identify all hazards which may be present, assess the risk and determine what precautions must be put it in place.
- The hazard assessment shall be reviewed and understood by all persons involved in the work.
- The hazard assessment must also consider risks outside the confined space i.e. simultaneous operations such as breaking hydrocarbon containment, offloading, startup/shutdown, non-routine operations, etc. which could affect the ability to respond to a CSE emergency or create an increased risk of entrapment within the confined space.

103) Procedures

> (1) Where a confined space exists in the workplace, the employer shall, in consultation with the health and safety committee or health and safety representative, establish written work procedures that are to be followed by a person entering, exiting or occupying a confined space.
>
> (2) Written work procedures must specify:
>
> a) The required controls specific to the known hazards or the task to be performed;
> b) The standard protective equipment that is to be used by every person who is entering a confined space;
> c) Retrieval equipment to be worn by every person entering a confined space, including the type of full body harness to be worn, where practicable;
> d) Additional rescue equipment, including a yoke and adequate means to extract an unconscious person;
> e) The processes for preventing entanglement of life-lines and other equipment where one or more employees are entering the confined space;
> f) Equipment to be used for atmospheric testing, including calibration requirements; and,
> g) All training requirements for entrants, attendants and rescuers.

The wording of this clause suggests that a confined space entry work procedure will be developed which will be applied to all confined spaces on the installation. Whilst there are some generic requirements which will apply to every confined space (e.g. gas testing and the need for communication), trying to encompass everything is likely to lead to some spaces requiring deviations from the general requirements. For example, procedures for entry into FPSO engine room void spaces and small double bottom spaces is completely different from those required for double bottom ballast tanks (very large and complex spaces.)

This clause appears to be the home for defining the minimum requirements of the installation operator's confined space entry management procedure. It should require that:

- Entry to confined spaces should be avoided where possible (e.g by doing the work from outside the confined space)
- If it is not possible to avoid entry to the confined space, a risk assessment must be carried out taking full considerations of the condition of the space, the tasks to be carried out, the skills of the personnel involved and any simultaneous operations on the installation which could affect the work, the safety of personnel involved, the access/egress from the workspace to the safe refuge or the ability to respond to an emergency in the confined space.
- The space should be isolated from sources of hydrocarbon and hazardous - substances/vapours and any residual liquids removed prior to entry where possible. -
- Confined spaces should be ventilated using fresh air from a non-hazardous area
- Emergency response plans must be prepared specific to each confined space being entered. These must consider communications, actions on alarms and rescue procedures.
- The safety of rescuers must be addressed in the development of any emergency rescue plans.
- Atmospheric testing is carried out by suitably trained persons using calibrated equipment.
- Frequency of atmospheric testing and re-validation
- Minimum equipment requirements (e.g. personal gas detectors, lighting, communication, escape sets.)

Note that with respect to the stated requirements in 103 (2):

c) only twice within MTL's 15 years of working in FPSO tanks has it been appropriate for tank entry personnel to wear retrieval equipment / life lines. The focus should be on making the atmosphere safe and properly illuminating the space so that accidents do not occur. It is important that work can be carried out efficiently within confined spaces to minimise the exposure to the identified hazards. Similarly we always prepare a specific rescue plan for each space and once the tank has been made safe for entry, ventilated and illuminated, we carry out a rescue exercise to prove that the rescue/recovery plan will work and that all the personnel involved know what they are doing.

d) We have never used a yoke on any project and have never considered recovering a casualty, unconscious or otherwise from a hull tank by any means other than in a stretcher. A "sked" stretcher or similar is far suitable for handling through structural openings and is likely to result in less additional injury to the casualty. The point which the regulations should make is that the rescue plan must specify the required equipment and this must be checked as being available on site and in serviceable condition before confined space entry commences.

e) this is a very specific consideration for situations where lifelines are being used or line-fed breathing apparatus. It should be specified in any risk assessment where these are necessary rather than as generic procedures. The requirements will clearly be very different for entry into a process vessel (one or two people in a small space) compared with a team of 6 people cleaning a slops tank 25m deep with lots of ladders and platforms.

f) means by which a written emergency procedure would be initiated; -
g) communicating with other employees in the vicinity and other personnel, as - appropriate; -
h) The protective equipment and emergency equipment to be used and/or worn by - a person who takes part in the rescue of a person from the confined space or in - responding to other emergency situations in the confined space; and, -
i) Regular conduct of emergency response drills and exercises. -

The implication is that a generic emergency response plan will be created which sits on the shelf waiting to be referenced when work is planned within a particular space. In our experience, it is best practice to create the rescue plan whilst planning the work such that you can take appropriate consideration of the skills of the CSE work party, the equipment available, the nature of the space, any temporary physical/operational constraints (e.g. blocked access to preferred rescue hatch), duration of the CSE work. For example, if the work is being carried out by rope access technicians in a hull tank, a rope access rescue plan may be more efficient/suitable.

In our experience, the frequency of emergency response drills and exercises is never stipulated in regulations which leads to a wide variation between operators. On one installation in West Africa, a rescue exercise had never been carried out by the crew in 3 years and when they did execute the exercise it was found that the rescue stretcher wouldn't fit through the tank opening and the winch couldn't reach the tank bottom. It is clear that the regulatory requirement should be that the emergency plans which have been put in place must be appropriate for the space/tasks, all required equipment must be readily available and maintained in serviceable condition and the personnel with responsibilities under the emergency plan must understand the plan and be ready to respond as required. Clearly recording that an exercise has been carried out would be a good way to demonstrate compliance.

107) and 108) Training

107) An employee shall not work in a confined space unless he or she has completed a confined space training program that includes, at minimum, the following components:
a) This section of the regulations;
b) Definition of confined spaces with identification of confined spaces and their hazards;
c) Hazard assessment;
d) Confined space work permit systems and standard procedures;
e) Familiarization with the operation of gas monitoring equipment;
f) Atmospheric testing;
g) Methods to safely ventilate and/or purge confined spaces;
h) Isolation requirements for substances, energy and equipment;
i) Duties of supervisors and entrants;
j) Confined space safety watch responsibilities;
k) Entrant tracking;
l) Overview of rescue and emergency response (including rescue plan);
m) Emergency Escape Breathing Devices;
n) Identification and use of appropriate confined space PPE and rescue equipment;
o) Hot work and other hazardous activities.

108) Training program must be renewed, at minimum, every three years

and <1% LEL throughout the space. Tests for other hazardous substances should be carried out when this target is achieved and upon initial entry.

The key reason for stipulating a very narrow allowable oxygen range is that this is a key indicator for the presence of other hazardous components in the confined space atmosphere. In any operational circumstances on an offshore production facility entry into a confined space with an oxygen enriched atmosphere should not be attempted (> 21% detected.) Normally high readings indicate that the gas detector needs to be calibrated as pure oxygen sources are very rare. Atmospheric tests with oxygen level < 20.9% indicate the presence of a significant volume of something other than air in the atmosphere. As an example, if the oxygen level is measured at 19.9%, this tells us that 5% of the normal volume of oxygen has been displaced and hence 5% of the atmosphere by volume is not air. It only requires 1 – 2% by volume of some volatile organic compounds to achieve their lower explosive limit.

The < 1% LEL test limit before permitting entry is consistent with industry guidance such as ISGOTT although the basis of this is not clearly explained anywhere. From our experience, even with very significant levels of forced ventilation, it is difficult to attain a reading of <1% LEL if there remains a source of hydrocarbon gas or liquid evolving gas within the confined space. This pre-entry test should be performed with the forced ventilation disabled or removed and is therefore is aimed at proving that the isolations are sound and no gas source remains in the confined space.

Note that the 10% LEL limit is what personal gas detectors should be set to alarm at, consistent with work carried out in other hazardous areas, to bring attention to workers that the atmosphere is changing whilst still providing a significant buffer below the LEL risk for electrical equipment and mechanical spark activities. If this were changed to 1% LEL (as we have seen suggested in some cases) there would be many false alarm evacuations and equipment problems with no benefit to safety of personnel. Remember that human beings themselves are sources of low level methane emissions!

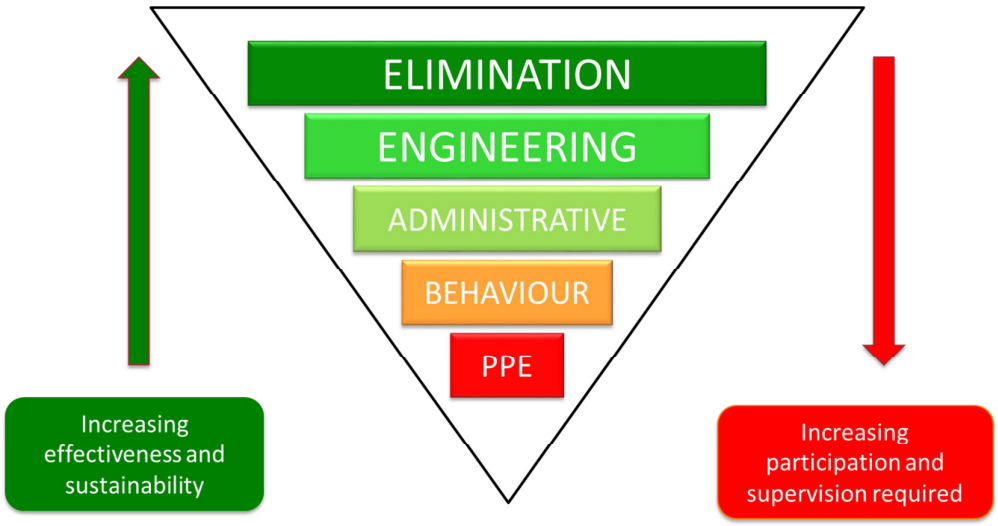

Figure 1 - Hierarchy of Controls

As currently written, this section has a great focus on gas detection but pays no attention to - ventilation, which we believe should always be a mandatory requirement in confined space entry. -

Any review of historic confined space fatalities will show that in nearly all cases the space was not being ventilated at all (e.g. ship's chain lockers) or that the ventilation provided was not effective. In the hierarchy of controls, isolation and ventilation will eliminate the atmospheric hazard in most cases, whilst gas detection can only be considered as an administrative control (relying on equipment, calibration and training.)

Clause 112) a) makes reference to exposure to hazardous substances – these requirements are no different for personnel working anywhere on the installation. Why is this specifically included under confined space entry? Limiting exposure to harmful substances should consider not only their presence but also the exposure pattern, engineering controls in place and finally respiratory protective equipment. Placing this as the first requirement for atmospheric control is misleading in terms of its specific importance to confined space management.

> Tests
> 113) The employer shall appoint a qualified person to carry out appropriate tests to verify the requirements in Section 112 can be achieved throughout the period of time that the person will be in the confined space.

Clause 113) appears to put the responsibility on the qualified gas tester to conclude from his/her measurements alone that the space will remain safe for the duration of entry. As stated earlier, the gas test is only indicating that the isolations are sound, to ensure that the atmosphere will remain safe requires assurance that any forced ventilation will not introduce a harmful atmosphere. In our work, we draw air from a non-hazardous area and pass all ventilation supplies through in-line gas detection with automatic dampers and alarms.

> 114) Atmospheric testing should be conducted, and results recorded,
> a) Before entry into a confined space;
> b) After an interruption in the work procedures;
> c) At appropriate intervals; and
> d) Shall not exceed 12 hours being testing.

Clause 114) - Agree with requirements. More specifically the recorded results should be displayed at the CSE entry point. It is much more important for them to be available for scrutiny by people about to enter the space than it is to carefully store them in an office!

Missing from clauses 113 and 114 is any reference to the principle that if confined space entry should be avoided wherever this is practicable. Applying this principle to gas testing, it would be useful for the regulations to explicitly encourage the employer to conduct gas tests from outwith the confined space.

> 115) The employer shall ensure the confined space is continuously monitored and that the atmosphere remains at all times in compliance within Section 112.

Clause 115) – Continuous monitoring of the atmosphere is normally satisfied by each work party within the confined space carrying a personal gas monitor. Is this the intent or is the intent that the ventilation supply should be monitored or that the attendant monitors a gas detector sampling with confined space whilst people are inside?

> 116) The employer shall ensure that tests referred to in Section 113 are performed on adjacent areas that may be affected by, or may affect, the work performed in the confined space.

117) Tests shall be performed by a qualified person who has been adequately educated and trained in:

a) The proper use of testing and monitoring equipment;
b) Limitations of the equipment;
c) Properties of the potential contaminants to be tested; and
d) Any other relevant information specific to the task at hand.

118) Equipment used in testing and monitoring shall be calibrated, maintained and used according to the manufacturer's instructions, and shall be bump tested, at minimum, every 12 hour shift.

119) Precautions Prior to Entrance

119) The employer shall ensure:

a) the opening for entry and exit is sufficient to allow safe passage of a person wearing personal protective equipment;
b) mechanical equipment in the confined space is
    i. disconnected from its power source, and
    ii. locked out and tagged;
c) pipes and other supply lines whose contents are likely to create a hazard are blanked off, or otherwise locked out or controlled to ensure that no contents are inadvertently discharged into the confined space;
d) measures have been taken to ensure that, where appropriate, the confined space is continuously ventilated;
e) liquid in which a person may drown or a free-flowing solid in which a person may become entrapped has been removed from the confined space;
f) adequate explosion-proof illumination is provided where appropriate;
g) a source containing a hazardous substance leading to the confined space is safely and completely disconnected or blanked;
h) Adequate barriers are erected to prohibit unauthorized entry;
i) PPE and emergency equipment identified in section 103(2)(b) are provided as close as reasonably practicable to the entrance to the confined space.

Many of these points have been addressed in earlier comments. It is sufficient within the regulations to state that the CSE risk assessment shall consider these hazards and the permitry system must ensure that all identified control measures are put in place prior to work commencing.

The MTL pre-entry check list incorporates:

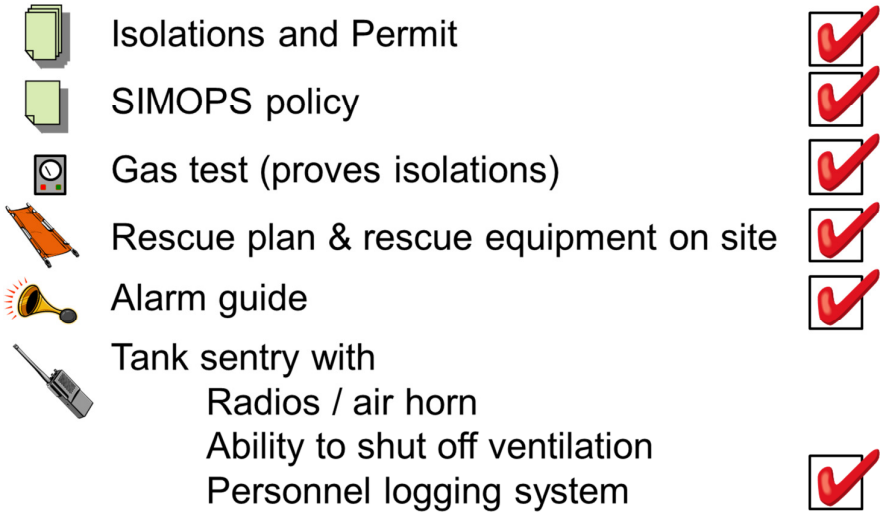

Figure 2- Pre-Entry Checklist

119) g) is open to interpretation in terms of whether this means sources of hydrocarbon oil and gas or sources of "hazardous substances" such as Benzene. If the intent is that all sources of hydrocarbons are completely disconnected and blanked prior to entry then this is a significant and costly change in the regulations for cargo tank inspections on FPSO's and tankers with cargo headers. With these cargo pipework arrangements, the positive isolation (blanking) can only be achieved within the confined space itself, and this is safely carried out under multiple levels of valve isolation.

120) Entry without a safe atmosphere

> 120) Where atmospheric gas testing under section 113 indicates presence of a harmful or explosive substance and it is not feasible to provide a safe atmosphere using engineering and administrative controls, an employer shall ensure that:
> a) An employee entering the confined space is provided with and wears respiratory and personal protective equipment appropriate to the hazards likely to be encountered;
> b) Where a flammable or explosive gas or liquid is present all sources of ignition is eliminated; and
> c) Conditions are monitored to ensure protection afforded by controls remains adequate.
>
> 121) The employer shall provide
> a) appropriate respiratory protective equipment to a person who enters a confined space where the concentration of chemical substance or a mixture of chemical substances in a confined space is hazardous to the health and safety of an employee; and
> b) Positive pressure respiratory protective equipment to a person who enters a confined space where the concentration of oxygen is less than 19.5%.

This clause is not strong enough in discouraging entry into confined spaces under breathing apparatus. The level of safety provided to individuals will always be less than if the atmosphere was safe. If an incident occurs within the confined space, communications will be more difficult and emergency response actions will also need to be carried out using breathing apparatus. Effective use of and correct function of the breathing apparatus are the only barriers to prevent harm, and these should be considered as PPE.

Within UK legislation, it is the duty of the employer to make all efforts to ensure that a safe atmosphere can be achieved without PPE. The only situations where it remains acceptable are for emergency response or in order to carry out actions which will make the atmosphere safe i.e. put in place isolations or install equipment to remove the source of the hazard.

122) – 124) Respiratory protective equipment

> 122) The employer shall ensure that the respiratory protective equipment referred to in section 121 is in accordance with the most recent version of CSA Z94.4 Standard and for escape from IDLH atmospheres the SCBA or Escape SCBA shall have a rated Service time in excess of the anticipated time needed to escape.
>
> 123) Additionally, the respiratory protective equipment must be:
>
> a) a Pressure-Demand SCBA with an audible alarm that sounds when the air supply has diminished to 20% the capacity of the unit; or
>
> b) a Multifunctional SCBA/Airline Respirator with auxiliary self-contained air supply, with a minimum rated service time of 15 minutes and the escape route shall be planned such that the time needed to esc ape does not exceed the rated service time of the auxiliary air supply.

The combination of RPE specifications and SCBA service time within clause 122 is misleading in that it may lead regulation users to believe that it is permissible to use escape SCBA as respiratory protection. The equipment described in 123) a) is suitable only for escape whilst the equipment in 123) b) would be suitable for escape and to satisfy the requirements of 121) a) and b).

125) Electrical shock

> 125) Where there is a hazard of electrical shock in a confined space, and employer shall ensure that electrical equipment taken into the confined space is:
>
> a) Battery operated;
>
> b) Double insulated;
>
> c) Bonded to ground and not exceeding 30 v and 100 volt-amps; or
>
> d) Equipped with a ground fault, circuit interrupter of the Class A type that complies with the most recent version of CSA standard CSA C22.1, *Canadian Electrical Code Part 1 – Safety Standard for Electrical Installations*, and that its tested before each use.

There controls described are appropriate for all electrical equipment in the workplace, not just within a confined space. These requirements don't really fit within this section of the OHS regulations. It would be more appropriate to stipulate the explosion protection requirements for lighting and any equipment which would need to be operated within a confined space in an emergency scenario. Similarly it would be appropriate to stipulate that all entrants are equipped with an explosion proof flashlight.

126) Entrance Into a Confined Space

> 126) The employer shall ensure that one or more attendants are:
>
> a) assigned the employees who are entering the confined space;
>
> b) stationed outside and near

i. The entrance to the confined space; or
ii. Where there is more than one entrance to the confined space, the one that best allows the attendant to perform his or her duties;
iii. And shall ensure effective record keeping of persons in and out of the confined space

c) in continuous communication with the employee using an appropriate means of communication provided with a device for summoning an adequate rescue response.

Clauses 126) a) and b) are appropriate. Clause 126) c) should recognise that there may be more than one entrant within the confined space. We normally consider that each work party should have a radio when working in large confined spaces where direct communication is not possible. In these situations we also stipulate that there is a back-up communications system (air horn).

127) An attendant shall not enter a confined space and shall
a) Not be assigned any additional duties beyond the duties outlined in (b) through (d);
b) Monitor the safety of the employee in the confined space;
c) Provide assistance to persons inside the confined space;
d) Summon an adequate response where one is required.

In addition to the requirements in 126 and 127, it is important to stipulate that the attendant must not leave the confined space entry point until all entrants have safely exited the confined space and barriers / notices to prohibit entry have been placed. The only circumstances where the attendant may leave personnel unmonitored within the confined space is where the attendant's personal safety is endangered. Typically, confined space regulations do not recognise this situation as it is inherently assumed that the attendant is safe and confined space entrants are always in greater danger. For FPSO tank entry works, explosions or fire incidents on the upper deck will directly endanger a tank entry attendant whilst the personnel within the hull tanks may be in risk of entrapment but not direct danger unless the event escalates.

129) – 131) Hot Work

The inclusion of general hotwork requirements within the confined space section of the OHS regulations is confusing without reference to any other sections of the regulations covering hotwork. Essentially there is little difference between how hotwork should be managed in a confined space and within any other location on an offshore installation. The golden rules are:

- Hotwork can only be performed in a location which is non-hazardous or which has been temporarily designated as non-hazardous through enhanced controls such as ventilation, gas barriers, gas testing and continuous monitoring.
- All flammable materials must be removed from the area affected by the hotwork and suitable spark / spatter barriers put in place as necessary.
- Any potential sources of flammable or explosive gases directly affecting the worksite or any ventilation system supplying the worksite must be blanked.
- All hotwork activities must be specifically risk assessed with full consideration given to both explosion (ignition of a flammable atmosphere) and fire (heat in contact with combustable materials).

- A fire watch, equipped with suitable fire extinguishing equipment must monitor the area during hotwork activities and for a cool down period prior to leaving any hotwork site unattended.
- Where a habitat is used to create a gas barrier around a hotwork site, fire watches must be positioned both within and outwith the habitat.

129) An employer shall ensure that an employee does not perform hot work in a confined space unless all of the following conditions are satisfied:

a) In the case of an explosive or flammable gas vapour, the atmospheric concentration is less than 5% of the lower explosive limit, as determined by a combustible gas instrument,
b) The atmosphere in the confined space does not contain, and is not likely to contain while an employee is inside, an oxygen content greater than 22.5%,
c) The atmosphere is continuously monitored,
d) The entry permit includes adequate provisions for hot work and corresponding control measures, and
e) An adequate alarm system and exit procedures are provided to ensure that employees have adequate warning and are able to exit the confined space safely where either or both of the following occur, in the case of an explosive or flammable gas or vapour
i. The atmospheric concentrations exceeds 5% of its lower explosive limit, or -
ii. The oxygen content of the atmosphere exceed 22.5% by volume. -
f) all potential sources of flammable and explosive gases are identified and blocked - off/locked out, -
g) a qualified person patrols the area surrounding the confined space and maintain a fire-protection watch in that area until all fire hazard has passed, -
h) fire extinguishers specified as emergency equipment are provided in the area referred to - in (d) above. -

130) Hotwork shall not be performed in a confined space where:

a) Concentrations of flammable or explosive substances exceed 5% of the LEL;
b) Oxygen concentrations are in excess of 22.5%; or
c) Where flammable liquids are present.

Referring back to the comments provided in section 112) it is MTL's opinion that the atmospheric requirements for confined space entry and for hotwork in confined spaces are the same (20.9% Oxygen and <1% LEL). If it is not possible to conclude that a confined space only contains air, then it is certainly not safe to execute hotwork.

Setting the flammable gas vapour limit at 5% may be problematic in terms of false gas alarms during hotwork in very enclosed spaces. The same 10% LEL alarm limit as specified for normal CSE activities is more appropriate and still provides a good level of safety.

Compliance with 129) g) would be impractical for hotwork in very large confined spaces such as FPSO ballast tanks where the confined spaces are very large sections of the hull structure. This clause is clearly aimed at pressure vessels or similar stand-alone confined spaces rather than integrated spaces.

In our experience, the following points are essential for ensuring safe execution of hotwork in confined spaces:

- The ventilation air supply to the confined space must be drawn from a non-hazardous area and incorporate gas detection.
- Electrical welding and cutting processes should be used in preference to gas welding and cutting which would involve the introduction of flammable gas supplies or oxygen supplies into the confined space.
- Welding gas, propane, acetylene or oxygen pressurised cylinders must not be placed within a confined space.
- Flammable gas and oxygen hoses must be continuous lengths containing no joints or repairs. Hoses must be tested for leaks prior to being fed into the confined space and depressurised and withdrawn from the confined space immediately after each use.
- The attendant must be provided with the ability to isolate all hotwork supplies and flammable gas hoses in the event of an emergency.
- The noise created by hotwork activities must be considered in managing communications between entrants and the CSE attendant.
- Adequate fume management arrangements will be necessary to protect workers from exposure to hazardous substances and to prevent loss of visibility within the confined space.
- Wherever possible all equipment used to support hotwork activities shall be non-flammable, flame retardant.

Please note that a pressurised habitat is not an essential requirement for hotwork in a confined spaces. Within a hazardous area, a pressurised habitat is a means of creating the gas barrier necessary to temporarily re-classify a location as non-hazardous. It is often much more effective to consider the boundaries of the confined space (structural steel) as the gas barrier and considering the over-ventilation of the confined space (net flow of air from confined space outwards through any openings) to be an adequate barrier to prevent the ingress of any external gases or smoke.

131) Cleaning for hotwork

131) Where flammable liquids are present, the employee must ensure all flammable liquids are removed and the area cleaned and inspected to ensure no residue exists, prior to permitting any hotwork to be performed in the confined space.

The responsibility for acceptable levels of cleaning would reside with the permit issuing authority (employer) rather than the employee (e.g. welder).

Clause 131 does not insist that the entire confined space is cleaned so that no residue remains but states that the “area” must be cleaned. The extent of the defined area is open to wide interpretation ranging from the area 1m around the hotwork site to the entire confined space. The position we promote at MTL is that cleaning is necessary wherever sparks and spatter could come into contact with residues. This is usually 2m above the hotwork site, and 3m horizontally around the site projecting downward until meeting continuous structure. Prevention on fire must not rely on cleaning alone, therefore spark and spatter containment measures should also be applied using fire blanket or steel barriers.

132) – 137) Entry Permit

132) An employer shall ensure that no person enters a confined space until the employer has fulfilled the requirements of this section and a competent person has provided a written work permit

Does a work permit need to be written or will a permit produced by a computer system be sufficient? The language should be changed to “authorised work permit.”

133) The written work permit must, at minimum, identify:
- a) Date and time if when the tests referenced in section 113 were performed, and their results;
- b) The type of work that:
  - i. Can be performed in the confined space; and
  - ii. Is explicitly banned in the confined space.
- c) Any engineering and administrative control measures identified as necessary;
- d) Specific PPE that must be worn by every employee entering the confined space;
- e) The means by which the work is to be performed;
- f) The expiry date and time of the permit;
- g) Names of all employees entering the confined space; and
- h) The method to be followed by an employee entering into, exiting from, or occupying a confined space.

There is nothing in these requirements which states that the work permit needs to be supported by a confined space risk/hazard assessment and validation that all control measures have been put in place.

Specifically including the names of the personnel permitted to enter the space on the permit is cumbersome without bringing any real safety value. Then names of all entrants will be provided under the requirements of 134) c) It would be more important to state a limit of how many people are permitted within the confined space.

It is unclear what is intended by 133) h) and why this is a specific requirement of the permit whilst there is no mention of the requirement for ventilation, continuous gas testing or any reference to the communications protocols or emergency response plans applicable to the confined space entry.

134) The written permit must include:
- a) the signature of the competent person(s) completing the work permit, and
- b) The signature of qualified person(s) completing the tests identified in Section 113;
- c) the signatures of all persons entering the confined space, verifying that they have read and understood the permit.

It is commonplace that a separate gas testing sheet is attached to the permit in order to record all measurements, equipment used, time of test and the name of the gas tester. This should support the authorisation of the permit, be updated throughout the shift as necessary and maintained with the permit at the confined space entry point for examination by the attendant and entrants.

135) No permit issued shall be valid for longer than 12 hours after the time the tests required under section 113 were performed.

136) An employer shall post a copy of the valid permit required at the entrance to the confined space for the duration of the confined space occupancy.

In our view this requirement should be expanded to refer to a "permit package" containing the valid permit, gas testing measurements, risk assessment, alarm guide and emergency response procedures.

> 137) The employer shall retain the permit for 12 months following the date of entrance.

Is this a specific requirement only for confined space entry permits or for all permits? It isn't clear how this will enhance or ensure the safety of personnel entering confined spaces.

138) Confined space closure

> 138) No person shall close off a confined space until a qualified person has verified that no person is inside it, and verify that all locks and isolations are removed, as required.

The intent of this clause is not clear. If it is intended to say that "no person shall close off a confined space PERMIT until …", it would be unclear what is meant by "closing off a permit". The comments provided against clause 126) are sufficient to ensure that no person remains in a confined space when unattended and that all entrants are accounted for.

If clause 138) is intended to state that the **confined space entry point/access hatch** will not be closed until the stated requirements are met then this is physically problematic. Most confined spaces are blanked and positively isolated from outwith the confined space. The sequence for returning to service in these cases is to close and seal all hatches then commence de-isolation activities. For cargo tanks with bottom lines and some designs of ballast tanks, it is only possible to remove the blanking flanges/spades from within the confined space, therefore the entry hatches must remain open and a valid entry permit issued to cover de-isolation activities.

From an employee safety perspective, the hazards associated with closing up a confined space have already been covered by earlier clauses: personnel must not enter a confined space without a permit and all entrants must be accounted for.

Further information / Contacts

If the workgroup requires any further information on the above comments or opinions on any other comments received by NRCAN during the draft policy review, please contact either Calum MacLean or Matthew Lewin at Marine Technical Limits Ltd. Contact details are available at www.technical-limits.com