Confined Space Entry - Standardization

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Abstract
Most of our time is spent at the workplace. In this sense risk assessment becomes a key instrument for the welfare and health of workers. An accurate risk assessment can only be made if hazardous situations are acknowledged, by anticipating existing and arising dangers. In this context, it is important to define standardized methodologies, easy to apply and understand, and recognized by all. The aims of this study are to demonstrate the importance and need for a national uniformity in Portugal, regarding a methodology for identification, classification and implementation of a confined space entry system. It was showed that confined spaces have a risk likelihood of serious work related accidents. Risks found in these locations are diverse, constantly changing and depending on several factors. Following an accurate confined space program, accidents can be prevented on these workplaces. The definition, characterization and classification of confined spaces influences risk assessment and in that sense the methodology to be use. As a result of this investigation, it is recommended to standardize the definitions, classifying them into three categories (A, B and C), and the implementation, in Portugal, of a national system for confined space entry/ entries, so that an accurate risk assessment can be done, in order to prevent any accident.

Keywords: confined space; authorized spaces, risk assessment, work related accidents.

1. INTRODUCTION
Protecting physical and mental well-being of workers are the main goals of any occupational safety. This can be achievable through the paradigm of anticipation, recognition, evaluation and risk control of their workplaces (Toffel & Birkner, 2002). In this process, risk assessment is one of the critical steps in preventing accidents. Assessing risks consists in the proper identification of all hazardous activities, which could potentially be the cause of harm to workers, estimating the level of risk involved, in order to implement preventive and protective measures (Grassi, Gamberini, Mora, Rimini, 2009). There are many workplaces that contain spaces that are considered confined by their configurations, but workers must enter, stay in, and come out to perform their activities. In many situations, workers who are in these spaces are not always informed about the risks and procedures to be adopted. It is not always possible to eliminate the need to enter in these spaces, so it is important to provide employees with sufficient knowledge for a safe intervention (Wilkinson, Burns, Simpson, Walker & Hunter, 2012). OSHA estimates that in the United States of America (USA), there are approximately 239 000 industrial establishments that have confined spaces. About 1.6 million people enter in confined spaces annually. If employers comply with existing legislation, 53 deaths, 5 000 lost-day cases and 5 700 other accidents can be avoided annually. The road to safety begins with the assessment of the workplace, identifying confined spaces (N.C., 2012). This study intends to demonstrate the importance and the need for a national uniformity in Portugal, regarding a methodology for identification, classification and implementation of a confined space entry system.

2. MATERIALS AND METHOD
Several steps were undertaken to accomplish this study. The first one consisted on a literature review about work related accidents occurring in confined spaces, and their impact on society. This literature was performed using the search engine Exlibris MetaLib, Academics Google, official bodies in the USA, Australia and the UK, doctoral thesis repositories and international specialist journals. Then, confined space definitions, characterizations and associated risks. Finally a case study was applied to demonstrate different understandings and approaches about confined space entry systems in three construction sites, two of them national and one international.

3. DIFFERENT APPROACHES
3.1. European and Portuguese Perspectives
The Directive 92/57/EEC (C.D., 1992), that transposes into the Portuguese legal framework (D.L., 2003) the minimum requirements for safety and health at work in temporary and mobile construction sites, makes no reference of the definition or preventive measures to work in confined spaces. Annex IV of the UE Directive listed above was not included in the Portuguese legal framework. This Annex IV, although not defining a program of measures to be implemented, addresses three characteristics of prevention and protection related to this kind of works: 1) the atmospheric hazards and their prevention; 2) monitoring and surveillance outside it and 3) emergency and evacuation if necessary (Dumortier, 2011).

3.2. Confined Space / Permit Spaces
There is no universally accepted definition of confined spaces (MacCarron, 2006). Although varying from country to country (Australia, UK, USA), by comparison it is possible to find similarities (Peake, 2006). This diversity of

definitions is a result of the existing (or not) laws on each country to perform works on confined spaces and how these rules are understood. In England, Germany and Ireland, confined spaces are defined in a broad way and focus on the notion of restraint space and predictableness of risks associated. Differently, Japan and South Korea adopted a definition focused on oxygen deficiency in these places, while China's definition of confined space refers to the number of possible occupants. This confined space definition discrepancy applied in different countries could void the classification of confined space. For China confined space is a place where no more than 2 persons can enter and stay, so if 3 workers can enter it, it ceases to be a confined space, while in England or Ireland, the workplace in question remains under the confined space law (Dumortier, 2011). In the USA confined spaces are defined as (OSHA, 1993):

- Large enough and so configured that an employee can bodily enter and perform the assigned work;
- Have limited or restricted means for entry or exit (for example, tanks, vessels, silos, storage bins, hoppers, vaults, and pits are spaces that may have limited means of entry);
- Not designed for continuous employee occupancy.

However, to classify areas that pose potential and unique hazards to enter, rescue and save, OSHA has introduced a new concept – Permit-required confined space– which defines a confined space with one or more of the following characteristics (Wilson, Madison, Healy, 2012):

- Contains or has a potential to contain a hazardous atmosphere;
- Contains a material that has the potential for engulfing an entrant;
- Has an internal configuration that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and the cross section becomes gradually smaller;
- Contains any other recognized serious safety or health hazard.

4. CASE STUDY

In this study three companies were checked according to their own practice on confined space entry. All companies had on-going construction works and several workplaces could be defined as confined spaces according to OSHA and NIOSH standards. To guarantee secrecy, these companies will be named has project 1, 2 and 3 (table 1). All these companies work on Oil & Gas industry. Project 1 and 2 are Portuguese Clients and Contractors, but are both managed by foreign corporations, project 3 is a foreign Client and a Portuguese Contractor. None of these countries has specific regulation on confined spaces works. No confined space incidents happened in these three projects.

Table 1 Evaluation Results

	Project 1	Project 2	Project 3	Observation
Confined Space location	Tanks 15.2 m 60.000mm 40.000m^3	Tanks 14.4 m /12.000 mm / 1500 m^3 9.2 m / 9.140 mm / 500 m^3 8.0 m / 7.400 mm / 350 m^3 7.55 m / 6.500mm / 250 m^3 5.3 m / 5.300 mm / 112 m^3 6.6 m / 5.000 mm / 129 m^3 4 m / 4.000 mm / 50 m^3	Tanks 30m 36.000 mm / 30.000 m^3 33.000 mm / 25.000 m^3 26.000 mm / 15.000 m^3 18.000 mm / 7.500 m^3 15.000 mm / 5.000 m^3	Height Dimensions Volume
Confined Space Definition	OSHA	UK	OSHA	
Confined Space Identification	No	Yes	Yes	
Confined Space Signalization	No*	No*	Yes	*Signalization was only done during works
Confined Space Classification (A, B, C)	C	C	C	
Permit-Space	No	Yes	No*	*Classified as a non-permit space
Specific Work Permit	No	Yes	No	
Permanent Gas Measurement	No	Yes	No*	*Measurements were done twice a day: before entering and lunch break
Risk Assessment	Yes	Yes	Yes	
Training Requirement	Yes	Yes	Yes	
Standby Person	No	Yes	No*	Access control was done with individual badges posted on each tank identifying workers inside
Emergency and Rescue Program	No	Yes	Yes	

Abbreviations: OSHA = Occupational Safety and Health Administration; UK = United Kingdom of Great Britain and Northern Ireland; m = meters

5. RESULTS AND DISCUSSION

This evaluation was done with the same parameters as defined by OSHA confined space regulation so, results could be accurate and assessment could produce relevant information about the uniformity of practice on confined space

methodology. The chosen confined spaces were new and in construction phasing. Although they all were built within Oil & Gas industries, no chemicals were used before, and no connection with process lines was done. Works performed inside are reduced to welding, cutting and hand tasks with no electrical tools. To guarantee acceptable air quality inside the tanks due to the tasks performed, forced ventilation was used at some point in all three projects.

6. CONCLUSIONS

As a result of this investigation, outcomes show different approaches in confined space methodology. In the first project the two tanks were not considered confined spaces. In the second project, permit- required confined spaces classification was immutable from the beginning, even when evidence showed no atmosphere or physical hazards during the construction phase. In project-one a proper risk assessment would classify it as a non-permit confined space. Project-two, depending on foreseen atmospheric hazards in the spaces, due to activities related to the dimensions of the tanks, and their dimension could be classified as non-permit first, and permit-required after, or always as a permit-required space. The lack of methodological rules for confined spaces in Portugal, lead companies to apply inaccurately OSHA's standards. With a standardization of confined space entries, an accurate risk assessment could define whether it is a non-permit confined space or a permit one, and apply the appropriated procedures. With a specific standard methodology, these three companies would apply the same procedure even when working in different countries where confined space laws and regulations do not exist.

7. ACKNOWLEDGMENTS

The authors would like to thank Master in Occupational Safety and Hygiene Engineering (MESHO), from Faculty of Engineering of the University of Porto (FEUP), all the support in the development and international dissemination of this work.

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