

Free essay on quantified risk assessment

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Several forms of incidents happen at hazardous facilities. They can be very dangerous for workers, the whole community and the environment. This paper will basically define the concepts of MHF or major hazard facilities, QRA or quantified risk assessment, individual risks, societal or group risks, FAR or fatal accident rate, among others. QRA is the accepted methodology that is used to quantify the risks in major hazard facilities. The paper will also exemplify certain industries which are hazardous to the workers and the general environment and how its operators manage the risks involved in their operations of such facilities. It will also discuss how QRA are conducted in an MHF, including its limitations and applications.

Major hazard facilities (MHFs) are locations in such industries like oil refineries, chemical plants and large fuel and chemical storage sites where large quantities of hazardous materials are stored, handled or processed (Robinson, 2009). MHFs also include liquid petroleum gas facilities, gas processing plants, and other manufacturing and transport depots. It also includes other locations wherein potential incidents can cause serious damage to employees, people in surrounding areas and the environment. There are about 200 workplaces in Australia which are considered to be MHFs (ASCC 2004b). (Ibid.) Examples are Longford gas plant, Geelong Refinery, Mobil Refinery, Buncefield Oil Storage Depot, among others.

MHF Regulations of 2007 are one of seven sets of regulations which are provided under the Dangerous Goods Safety Act 2004 (WA) (Government of Western Australia Website, 2012). Safe Work Australia is the Australian government's agency which is primarily responsible to improve work health and safety and workers' compensation systems all over the country. (Safe <https://assignbuster.com/free-essay-on-quantified-risk-assessment/>

Work Australia Website, 2012) It implements the MHF Regulations and has developed guidance material for Major Hazard Facilities (MHF) operators. Among other safety organizations, Safe Work Australia obliges the operators of these MHFs to conduct a comprehensive safety assessment of their facilities and systematically analyze all aspects of risks involved in their operations. It also admonishes the MHFs to implement control measures, emergency plans, and Safety Management System (SMS) to control the risks and mitigate crucial emergency scenarios which might occur in their facilities (Safe Work Australia Website, 2012).

MHF operators should demonstrate their readiness in mitigating all foreseeable on-site and off-site risks and emergencies. (Government of Western Australia Website, 2012) Hence, the main goal of their risk assessment should be the development of a comprehensive understanding of all hazards and risks which could turn as major facility accident. They must have adequate control measures which are all embedded in safety reports (NSW Safety Report, 2002).

Among the many risk assessment processes and methods, the Quantified Risk Assessment (QRA) is one of the most accepted methodologies used to quantify risks in MHF. This paper will explore the various features and components which make this risk assessment method as a preferred practice among many Australian MHFs.

QRA Defined

Quantitative Risk Assessment (QRA) is a formalized and specialized method for calculating individual, environmental, employee and public risk levels for

comparison with regulatory risk criteria (Biosecurity Australia, 2001).

According to Apostolakis (2004), QRA is a top down approach which likely answers the following crucial questions: 1.) What can go wrong?, 2.) How likely it is? And 3.) What are the consequences? In other words, QRA is a method of quantifying the degree of risk by a procedural evaluation of various risk factors in an MHF which can have severe consequences. It also defines the likelihood of these incidents. QRA has been an important instrument for the management of MHF risk analysis and for planning risk mitigation measures (Liu, Huang & Hu, 2007).

QRA is described by the Multilingual Health and Safety Resources (2011) as a “ formalized and procedural approach in identifying prospective hazardous incidents, estimating the possibility and consequences of those incidents and stating the outcomes as risk to others, to businesses and to the whole community. “ QRA is a risk assessment method which involves some or all of the following features:

- An examination of the outcomes of accident or any untoward incidents
- Predicted total victims or fatalities for each case scenario
- Risk for individuals
- Risk for the group
- Potential loss of life
- Facility related risk
- Further analysis of untoward scenarios which are “ as low as practically reasonable“
- Preventive measures

- Sensitivity of outcomes based on assumptions and uncertainties

The various MHFs which need QRA studies may include the production and processing facilities, high pressure pipelines or storage and importation sites including liquefied natural gas (LNG) (Safety Institute of Australia Website, 2012). QRA may be required by government legislation and/or by the company's internal governance to evidence their risk management initiatives i. e. to show that it has identified and controlled its organizational risks to an acceptable level. The criteria for risk acceptability is also defined by national regulations or company/stakeholder policy (Techneau, 2010).

QRA is used for different purposes. It is considered as the most important part of a risk management program. Management of risk consists of identifying and controlling hazards, through both management and technological solutions. Sometimes, QRA is conducted primarily to meet a regulatory requirement. However, it is always part of a company's risk management program. (Ibid.) This is because QRA addresses many risks such as risks to employees and third parties, environmental risks, loss of capital, business interruptions, penalties, etc. (Melhem, 2011).

QRA Process

Fundamentally, the following processes are addressed in a QRA process of quantifying risks:

1. Collection of data – it consists of collecting pertinent data and knowledge of the MHF's operations and facilities to help in the formulation of several models for conducting frequency and consequence analysis. These data can be used in the following: hazard analysis, frequency analysis and occurrence

assessment. Collection of data is the foundation of QRA. It is deemed very useful if these data is set up in a database for data management. The data information often includes aerial photographs, historical documents, monitoring investigations, etc. Generally, these data should be identified by experienced engineers to check the reliability and usefulness of available (Safe Work Australia, 2012).

2. Hazard analysis – a comprehensive hazard analysis of the MHF should be carried out. This will aid the decision-makers and managers with regards to their risk management. In the hazard analysis process, actual facility conditions, historical information and monitoring investigations must be gathered. Based on this analysis, several specific hazard scenarios can be identified and selected. After that, occurrence probability of these scenarios must be evaluated. (Ibid.)

3. Consequence assessment – after the hazard analysis, the consequence analysis of the selected scenarios must be performed. Consequence analysis serves to calculate the consequences, both the urgent consequence and the known effects which could result from the hazards considered under the second process. (Ibid.) This takes due account of any present mitigation measures and conditions which might affect the consequence. Under this final analysis, four categories must be undertaken and these are: the identification of elements at risk, estimation of the value of the elements at risk, analysis of the vulnerability, and consequence computation. Elements at risk are often classified in two specific categories, namely, the material assets and persons. (Ibid.)

QRA can be applied in calculating the absolute level of risk of an activity or the comparative risks of other options. The outcomes of absolute risk assessments can be compared with predetermined risk tolerability standards (Melhem, 2006). For examples, in a manufacturing site, risks towards the employees, workers and the surrounding community must be considered. If the risks are to be calculated for single units, it must be determined that the unit may represent only a portion of the total risk. Whole divisions or product lines may put a greatly diverse and ill-defined group at risk. Since this manufacturing company may have various facilities internationally, the general risk from all of these facilities and all product lines may affect the risk tolerability standards. (Ibid.)

Special Topic on QRA: Individual Risk (Fatal Accident Rate (FAR)) and Societal (or group) Risk

Individual risk is the risk to an individual person of a facility. This includes the probability of death. Individual Risk is often quantified as “ Fatal Accident Rate.” (Robinson, 2009) FAR is the number of fatalities per 10 exposed hours. (Ibid.)

For example, on the average:

- One person works for an average = 7.5 hours per day
- One person works on the average = $7.5 \times 5 = 37.5$ hrs/wk
- One person works on the average = 37.5×52 (weeks) (year) = 1950 hrs/year (Ex., 2000 hrs.)
- Hence, 1,000 persons in lifetime (50 years) would work = $1,000 \times 50 \times 2,000 = 100,000,000$ i. e. 10 exposed hours

Exposed hours is the mean hours at work

FAR of 1 means one fatal accident over 1, 000 working lifetimes OR 1 fatal accident per 50 years for a site employing 1, 000 employees. For example, the FAR in Australia's forestry industries is 70 while it is 40 in coal underground mining work. These fatalities are over 100 million work or exposed hours (Fell, 1995).

Societal risk calculates the risk to a group of people. It calculates both the prospect and the probability of incidents with various adverse outcomes. Examples of societal risks are fire fatalities, explosion or exposure to toxic vapors. This is basically calculated through this equation: F-N Curve, which is Frequency-Number (F-N) Curve. (Ibid.)

Limitations of QRA

It must be understood that QRA is just one tool under the overall risk assessment toolkit. Generally, there is no single tool which will be able to satisfy the requirements for risk assessment. All these tools have limitations and weaknesses. In QRA, for instance, if the major contributor to a major accident relates to the age of the equipment and the related mechanical integrity problems, then, an analysis of breakdown data, corrosion rates, mechanical integrity, reliability and inspection/testing/maintenance matters may be needed in order to develop the required understanding. In this case, the quantitative risk assessment may not suffice. This is because QRA is often based on generic data and it may not provide the needed information or lead to effective problem solving (Melhem, 2011).

Also, the QRA is not a requirement of the MHF Regulations. It is not a requirement for risk assessment. The risk assessment methods, whether qualitative or quantitative, must be able to cover for the hazards, the available alternatives, the MHF safety philosophy, and the management choices that are required with the assessed risk/s. A stand against QRA does not inhibit the MFH operator to implement special quantitative calculations as per frequencies, outcomes or other risk components. If QRA helps in comprehending the risks and the selection of the proper control measure, then it must be taken as an instrument to support risk assessment. In reality, QRA may not give all the answers and is usually best conformed to differentiate design, blueprint, location, and engineering alternatives. QRA is often considered to be very effective in quantifying off-site risk. However, it can also be used in assessing on-site risk if sufficient information and an understanding of the reality of people's response to accidents are included (Apostolakis, 2004).

Conclusion

QRA is often used to analyze and assess various risks in a major hazard facilities or MHFs. Major hazard facilities (MHFs) are facilities located in several industries such as oil refineries, chemical plants and large fuel and chemical storage sites. In these sites, large quantities of hazardous materials are stored, handled or processed. MHFs also include locations where potential incidents can cause serious damage to employees, people in surrounding areas and the environment.

Management of risk consists of identifying and controlling hazards, through both management and technological solutions. It consists of several methods and the most accepted one is the Quantified Risk Assessment (QRA). QRA is used for several purposes. It is an integral part of a hazardous company's risk assessment program. Sometimes, QRA is conducted primarily to meet a regulatory requirement. However, it is always part of a company's risk management program. (Ibid.) This is because QRA addresses many risks such as risks to employees and third parties, environmental risks, loss of capital, business interruptions, penalties, etc. QRA conducted through the three main processes: 1. Collection of data, 2. Hazard analysis and 3. Consequence assessment.

Various examples of QRA components which are very helpful in detecting and pre-empting hazards and accidents are the FAR, societal risks, individual risks, among others. FAR of 1 means one fatal accident over 1,000 working lifetimes OR 1 fatal accident per 50 years for a site employing 1,000 employees. Examples of societal risks are fire fatalities, explosion or exposure to toxic vapors.

It is important to note that the QRA is not a requirement of the Australian MHF Regulations. It is not necessarily needed for risk assessment. The risk assessment methods used must commensurate to the hazards, the available options, the facility safety philosophy, and the decisions that are necessary with the assessed risk/s. The wise choice of the QRA depends on the specific needs and requirements of the MHF operators.

To conclude, QRA is a vital component of a more scientific risk assessment. However, it must also be considered as a major component of risk management. Qualitative assessment is also important. This is because there is no single tool which will be able to satisfy the requirements for risk assessment. All these tools serve specific purposes and must be strengthened by various tools and processes.

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