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Importance of Risk Tolerance Criteria in the Application of Quantitative Risk Assessment in Oil & Gas Industry

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PRIMARY CATEGORY: Managing Risks and Uncertainties

Abstract

The Chemical, Petrochemical and Oil& Gas industry has had an excellent safety record when compared with industry as a whole¹. Nevertheless few major incidents like MIC gas leak in Bhopal, LPG plant explosion in Mexico etc. with heavy loss of life led to public concern about the hazards of process industry, resulting in legislations requiring manufactures to demonstrate that appropriate safety measures are taken. This led the industry to resort to predictive Quantitative Risk Assessment Technique (QRA)

The Piper Alpha and Alexander Kielland accidents led to prescriptive regulations on use of QRA in process industries in both UK and Norwegian sector of North Sea. As a result, interest in use of QRA technique for assessing safety of process plants has grown considerably. Overall use of Quantitative Risk Assessment has continued to increase although some countries still remain skeptical about of the value of use of QRA.

A major difficulty faced by industry in using QRA is setting Risk Tolerance/acceptance Criteria. What is the Target Risk Acceptance Criteria to be followed? Is there a Universal Risk Acceptance Criteria? A literature search reveals that different regulatory bodies world over have recommended different acceptance criteria for Individual Risk. The Criteria for few important countries are presented in Table-1.

Table-1: Individual Risk Acceptance Criteria

Country	Intolerable risk to worker /year	Intolerable risk to public /year	Broadly acceptable risk/year
UK	$\geq 10^{-3}$	$\geq 10^{-4}$	$\leq 10^{-6}$
Netherlands	$\geq 10^{-3}$	$\geq 10^{-5}$	$\leq 10^{-6}$
Australia	$\geq 5 \times 10^{-5}$	$\geq 10^{-6}$	$\leq 5 \times 10^{-7}$
Canada	$\geq 10^{-4}$	$\geq 10^{-5}$	$\leq 10^{-6}$
Russia	$\geq 10^{-4}$		$\leq 10^{-6}$

There is wide variation in Acceptance Criteria for Societal Risk also as presented in Figre-1. As it is evident from the Figure, different nations have adopted different risk aversion factors. UK and Hong Kong did not consider any risk aversion factor and slope of the lines is -1. Netherlands and Denmark have adopted a more stringent risk aversion factor as indicated by the slope of -2 for these lines. Australia has adopted moderate risk aversion factor as the slope of the line is between -1 and -2. On the contrary certain developed countries like USA, France, and Germany etc. do not prescribe any Risk Tolerance Criteria both for individual and Societal risk. Further, there are great uncertainties in risk estimation.^{2,3}

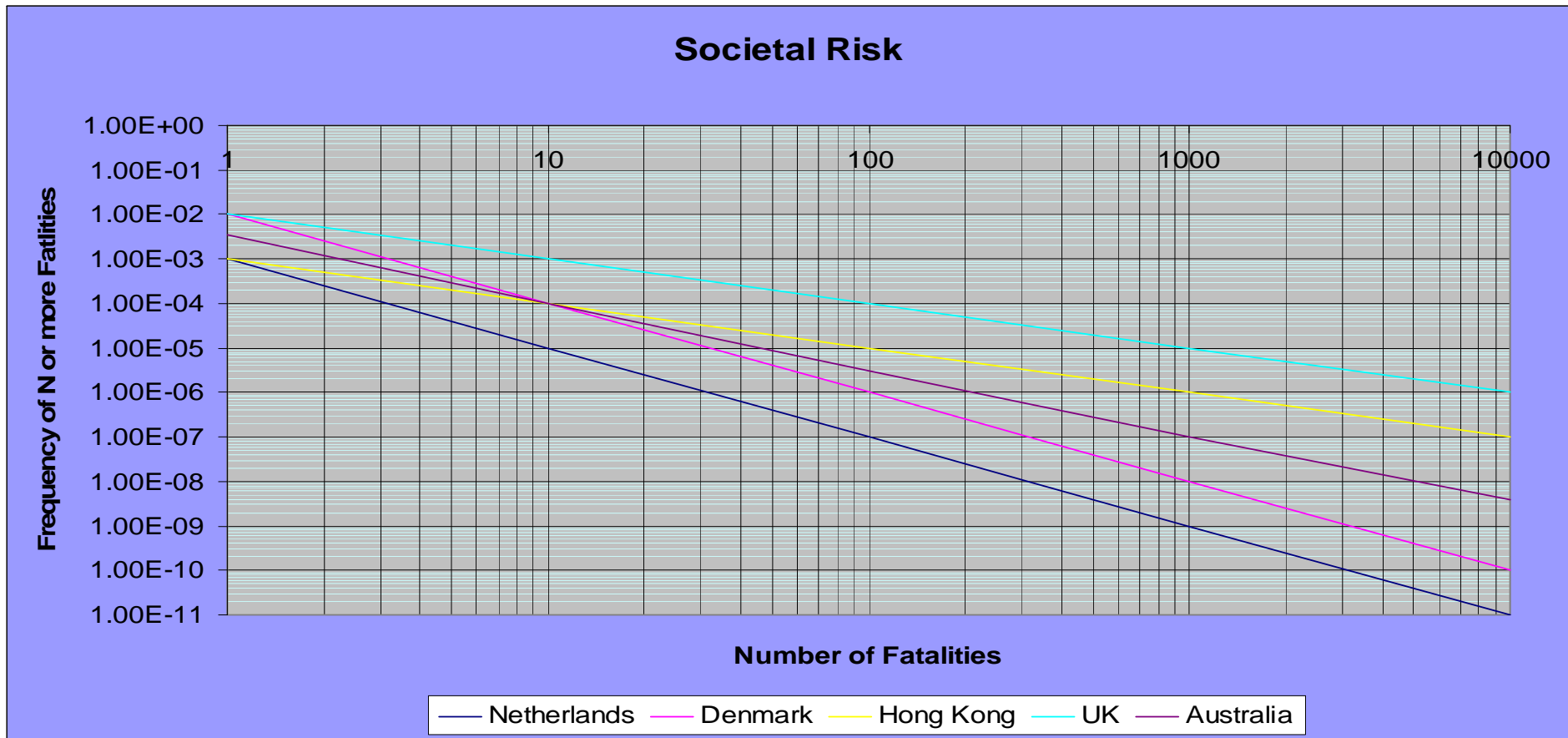


Figure-1: Societal Risk (F-N) Curves

In view of the above problems, industry finds it difficult to arrive at a Risk Criteria. In general, the industry looks for advice from QRA consultant on risk criteria and consultant seeks guidance from industry to define the risk criteria. Most industries, particularly in developing countries, are not well equipped to understand the complexities involved in risk estimation and selection of appropriate Risk Tolerance Criteria relevant to local political, social and economic conditions. The Criteria recommended by the consultant may be very stringent with little relevance to the local conditions leading to problems for the industry with recommendations requiring heavy demand on scarce resources. Knowledge of complexities involved risk estimation, the end use of the risk estimates, the origin, basis and development of Risk Acceptance Criteria are prerequisite for the Industry to be able to decide on the Risk Acceptance Criteria in an effective manner relevant to the local conditions. In order to assist the industry, this paper

- Analyses the problems with quantitative risk estimation and uncertainties associated in the estimation,
- Critically reviews the Risk Acceptance Criteria recommended by different regulatory bodies, and
- Provides guidelines, based on author's experience, for path forward in setting appropriate Risk Acceptance Criteria relevant to the industry objectives.

It is expected that the guidelines along with the discussion on risk estimation and uncertainties will make the life of operator a lot simple in making a decision on Risk Acceptance Criteria.

Literature cited

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