HSE response to the IChemE report ‘An independent review of HSE methodology for assessing societal risk’

First published 2009

HSE Response to the IChemE report "An independent review of HSE methodology for assessing societal risk" (January 2006)

1. Foreword:

1.1 In 2005, the Interdepartmental Task Group on Societal Risk requested an independent review of HSE's methodology for assessing societal risk. HSE agreed terms of reference with the Cabinet Office and contracted the Institute of Chemical Engineers to carry out the review.

1.2 The exact terms of reference are reproduced in the final report at appendix 1. In summary, the IChemE were asked to consider whether HSE's methodology was technically sound for the task it had been used for and whether any changes could be made to improve accuracy and robustness.

1.3 The review was carried out under conditions of strict confidentiality. However, since 2006, a public consultation has been carried out and in 2008, ministers agreed for HSE to work with others to include the assessment of societal risk in both the regulation of on-shore major hazard installations and in decisions on planning for development near such installations. It is now appropriate (April 2009) that this review is made available along with other relevant reports.

2. Introduction

2.1 IChemE found that HSE has developed its approach to societal risk in a responsible manner that is, subject to some important concerns, fit for purpose, and that HSE's use of QuickFN[1] (to screen sites for attention to societal risk) is wholly appropriate.

2.2 However, IChemE also concluded that it was most important that the engineering profession and industry had a better understanding of HSE's approach to societal risk in order that they could work together to meet the common goal of improved safety. This is now being undertaken as work streams deliver.

2.3 The report considers each of the terms of reference in turn, and makes a number of detailed findings. These findings (italicized) and HSE's observations are set out below.

3. IChemE observations on the use of the approximate risk integral (ARI).

'The initial screening tool created by HSE, ARI_{COMAH}, has serious technical limitations and is difficult to understand. In recognising these limitations, HSE has developed a more sophisticated ranking tool QuickFN, which in the Institution's view should replace ARI_{COMAH}. However, IChemE does not believe that existing ARI_{COMAH} results should be abandoned, and they should continue to be used in deciding the priorities for carrying out QuickFN.'

[1] See RR283 - Development of an intermediate societal risk methodology at http://www.hse.gov.uk/research/rrhtm/rr283.htm

3.1 HSE accepts that ARI_{COMAH} has limitations and is difficult to understand. ARIcomah is now rarely used by HSE but as a screening tool can help decide priorities and in general, if a site appears to present a low societal risk using ARI_{COMAH}, there will be no further scrutiny.

4. Societal Risk and Scale Aversion

'In order to improve clarity and transparency, societal risk calculations should be performed without the inclusion of any risk aversion factors and expressed graphically as the cumulative frequency of N or more fatalities occurring at frequency F – called an FN Curve. Any risk aversion should be incorporated into the criteria, and displayed graphically. This will improve clarity and will also enable more direct comparisons with other countries.

'The aversion debate needs to be clarified and made explicit. HSE recognise the need for further discussion with stakeholders on criteria and the way in which risk aversion should be taken into account.'

4.1 HSE does not altogether agree with IChemE's finding that societal risk should only be calculated without aversion and expressed graphically (as an FN curve). There is no particular difficulty, in a COMAH compliance context, in agreeing that an FN curve (which may be a QuickFN output) might be a useful staging post for clear and transparent communication of the risks.

4.2 It is less clear that this will be useful in a land use planning context. It is also HSE's view that there is no clear and satisfactory basis for ranking or classifying sites based on the collection of their FN curves. Ranking and classifying are necessary objectives for HSE in focusing its resources (in regulation or land use planning).

4.3 A risk integral approach is, for HSE, helpful when ranking and classifying installations (with or without scale aversion).

4.4 HSE has some difficulty with the proposition that "Any risk aversion should be incorporated into the criteria, and displayed graphically". Whilst the rationale for this is accepted (transparency and clarity), HSE believes that the implication (that the candidate criteria are restricted to things that can be depicted on an FN curve) is too restrictive and eliminates some useful classes of criteria (including risk integrals, whether or not averse).

5. Long distance dispersion

'The models used by HSE in QRA and in the calculation of societal risk are technically sound and incorporate many recent developments. In general they are considered 'fit for purpose', although IChemE has some concerns over long distance dispersion.'

'Although the dispersion models used by HSE are comparable with others used in industry there remains great uncertainty about long distance dispersion effects under

inversion (stable) atmospheric conditions. This factor, taken together with the inclusion of a risk aversion factor in the criteria, results in the greatest weight being placed on those parts of the assessment where the uncertainties are the greatest. These technical uncertainties need to be taken into account by those setting criteria.'

5.1 HSE has been aware of the issue of long distance dispersion for several years. Indeed and the wider major hazard and risk community accepts that this is a problem area. The limits of current technical knowledge make it unlikely that this problem will be resolved in the near future.

5.2 HSE is redeveloping its toxic modelling suite. Part of this work involves developing new models based on new scientific work, replacing some out-of-date models, assessing validity of the models used and reviewing technical policy adopted. This is a significant undertaking and is on-going.

6. Quick FN described as "wholly appropriate" as an indicator for further scrutiny

'Quantified Risk Analysis (QRA) is the most effective way to represent the societal risks associated with COMAH installations. However, a full QRA is sufficiently resource intensive to make its application disproportionate for low risk installations and HSE accepts that such sites may not need to include QRA in their COMAH Safety Reports (this includes those sites with minimal off-site population). HSE has developed a screening tool, QuickFN, to indicate which sites need to undertake their risk assessments in greater depth. It has also been used by the HSE to indicate where existing off-site development may be a problem. These uses of QuickFN are considered to be wholly appropriate.'

6.1 HSE accepts this view of QuickFN. HSE also welcomes the implication that QRA should be expected for higher risk installations.

7. Failure Frequencies – pressure vessels

'HSE uses failure data provided by industry where this has been provided and is seen as credible. In other cases HSE uses data from its own sources. The 'default' data used by HSE appears to be more pessimistic than that used by other authorities such as those in the Netherlands. Industry bodies have expressed concern that such differences could result in the process industries in the UK being seriously disadvantaged.

'IChemE believes it is in the interests of both HSE and industry to seek to identify failure rates which have broad support. Frequency data should be urgently reviewed to establish suitable failure rates for equipment engineered and managed to 'best practice'. Alongside HSE, IChemE would recommend the participation of members of other engineering institutions and of industry in this study.'

7.1 HID commissioned a comparative review of key failure frequencies for high-pressure storage vessels at COMAH establishments. The report[2] stated that there was

[2] Now published at http://www.hse.gov.uk/comah/highpressure.pdf

no convincing evidence to support the view that the HSE failure frequencies were unduly pessimistic. On the contrary, on the basis of the evidence some values could be viewed as optimistic.

7.2 Whilst acknowledging that there has always been some uncertainty in failure frequencies, HSE considers that the provenance of its data (based on up-to-date literature and subjected to external review) and the scope of its data (accounting for all failure mechanisms) remains suited to HSE's purposes.

8. Toxicity data disparity between HSE and others

'The review team noted the very wide disparity in the calculation of fatalities with different assessments of toxicity. IChemE recognises that this is a difficult area but sees it as one requiring resolution in order to improve compatibility with other European countries using QRA.'

8.1 HSE's toxicity levels for chlorine are neither the highest nor lowest in the spectrum of values used across Europe.

9. Risks & effects be validated with industry/world experiences

'The calculated risks and effects of accidents should be validated against industry/world experience of accidents associated with handling hazardous materials. For example the predictions of fatalities from chlorine releases appear to be high when set against over 100 years' experience in handling this material.'

9.1 HSE's view is that the rarity of incidents and the relatively low levels of predicted risks make such studies unlikely to be conclusive. In the context of discussing LUP, the Advisory Committee on Major Hazards stated that "absolute safety in any sphere of human endeavour is impossible and it would be imprudent not to take account of the possibility of a major accident, however remote."[3]

10. HSE to bring its guidance on Societal Risk into one place

'HSE should bring its guidance on societal risk together into one publication. In addition it should give consideration to the establishment of a process to review its QRA modelling on a regular basis. Such a review should involve both its own staff and members of professional institutions where industry has a voice.'

10.1 HSE accepts that it should review the need for and format of this guidance when the work of incorporating societal risk into its major hazards work is further advanced. This is now progressing.

[3] ACMH 3rd Report Paragraphs 80 and 164 (HSC, 1984).

10.2 HSE accepts the need for periodic review of HSE's QRA modelling. Indeed HSE already undertakes external reviews of its modelling when appropriate[4].

11. Scenario selection for Quick FN

'The rules used in scenario selection for QuickFN should be clarified. In addition, research should be undertaken to explore methods which could identify those sites where intermediate level events (those affecting the nearby population) could lead to the overall risk being higher than estimated from Quick FN.'

11.1 HSE agrees that QuickFN might underestimate societal risk where intermediate events are unusually significant.

[4] http://www.hse.gov.uk/landuseplanning/ifrlup/independentreview.htm & http://www.hse.gov.uk/landuseplanning/ifrlup/methodologiesreview.htm