

## Status summary of '23 Issues February 2010

HSE are developing a model for the estimation of societal risk from major accident hazard installations. The results may be used to advise local authorities on proposed land use allocations around certain major hazard installations, and to complement PADHI advice.

A public consultation exercise on broad proposals for the use of Societal Risk to address risks from Major Hazards around Top Tier COMAH sites (CD 212) was undertaken in 2007. Arising from the consultation, and other contributions, a list of 23 areas of technical and policy matters was compiled for further consideration.

In order to address these matters HSE formed a special “task and finish“ Technical Advisory Group (TAG) to advise, challenge and support the development of societal risk methodology, criteria and delivery mechanism suitable for use in land use planning. These issues were developed within HSE and during TAG meetings in 2008 and 2009 as part of the Societal Risk (SR) Land Use Planning (LUP) project.

As a result of the discussions and advice from the TAG, HSE has developed an ‘Adopted Position’ for these issues for the purpose of moving forward with this project, one output of which will be a revision of the 1989 document ‘Risk Criteria for land use planning in the vicinity of major hazards.’ These adopted positions are not yet HSE Policy.

The attached summary, is a distillation of the discussions and are not intended to be a complete summary of every aspect discussed, but to highlight some of the more important considerations. Where relevant, reference to supporting work is included.

‘Prevention and control’ involves the assessment of risks by the operator of the major hazard site and the implementation of appropriate safety measures. These requirements are enforced via the HSW Act and other relevant legislation, including COMAH and PSR. Prevention and control by the operator reduce the risk of a major accident to a very low level, but do not completely eliminate the possibility that one could take place. There is therefore a ‘residual risk’ of an accident happening

### **No. 1 Representation of Societal Risk**

- Is it appropriate to use societal risk to control risks to people around major hazard installations;
- How should SR be represented;
- What criteria should the risks be assessed against, and should these be considered alone or in combination with other non-numerical criteria?

#### **Rationale:**

The consultation exercise (CD212) conclusively concluded that, in principle, societal risk should be used to control risks around major hazard installations.

The Institution of Chemical Engineers (IChemE) definition of societal risk is:

*The relationship between frequency and the number of people suffering from a specified level of harm in a given population from the realization of specified hazards.*

The definition of societal risk was discussed at TAG meetings, and it was concluded that the estimation of societal risk would be based on the IChemE definition. Some members of the TAG, and probably the wider risk assessment fraternity, consider that the definition of societal risk should be much wider. However we consider that social or socio-economic factors must be considered separately to the risks to peoples' health and safety. How and by whom these socioeconomic factors are considered is yet to be decided, but the key stakeholders include Local Authorities, Local people, and Major Hazard Installation operators.

This HSE project is considering risks to people from the activities carried out by major hazard installations. Therefore we will limit our risk assessment and analysis to *local societal risk*, the direct consequences of events that could harm people in the vicinity of these major hazard installations, and the relationships between the frequencies of these events and the numbers of people harmed. (The harm criterion is discussed later, Issue 8.)

With respect to the assessment and analysis of risks from major hazard installations, criteria are needed, so that assessment of the risk (calculation) results is simple and straightforward. This is a good, if ideal objective, and criteria are being developed at the time of writing which include the following parameters.

- Societal Risk curves are understood by most risk practitioners in terms of the outline of the information they portray. SR curves can be set against commonly regarded criteria and a view on the risk profile they show can be taken.
- Expectation (EV) from now on referred to as Potential Loss of Life (PLL) is a criterion on which initial judgements may be based, noting that this presumes no aversion in calculations.
- Other criteria such as  $N_{\max}$ , and  $PLL_{\text{density}}$  may be used to supplement the above.

No individual criteria is likely to be sufficient to support a rigorous decision making process, but the use of more than one criterion should lead to more robust decisions.

### **HSE ADOPTED POSITION**

HSE's LUP advice will, where appropriate, take account of societal risk in addition to IR. Societal risks will be evaluated using event frequencies and the numbers of estimated fatalities. Societal concerns will be taken into account by LPAs when they consider HSE's advice along with the socioeconomic benefits of a development proposal.

**ISSUE CLOSED**

**No. 2 Substances on site – should the calculations (*of risk to persons for LUP advice*) be based on consented quantities and substances or what is actually present on site?**

Rationale:

- Consented quantities are legally granted to an installation, and an operator can store quantities of hazardous substances within these limits, without being obliged to inform the LA or HSE;
- LUP and development control is looking a considerable time into the future and quantities of hazardous substances held on site could vary up to the consented quantities;
- The HSE site risk assessment for LUP purposes is based on consented quantities of hazardous substances located for typical plant operations.

**HSE ADOPTED POSITION**

Societal risk estimation will be based on consented quantities and declared vessel/container sizes, including consideration of factors such as frequency of operations to ensure that assessments are reasonably realistic.

**ISSUE CLOSED**

**No. 3 The scale aversion factor**

Rationale:

- There is some research based evidence for scale aversion and some against. The greater weight of research demonstrates that, even where it is evident, scale aversion is not consistent and is dependent on numerous factors many of which are themselves subject to change and are subjective. Therefore, although scale aversion may exist in some situations, it is not a consistent phenomenon.
- As there is little by way of consistent, 'tidy', predictable evidence for scale aversion both in research and public reaction to major accidents, it is neither practical nor sensible to attempt to measure it in mathematical terms.
- There is evidence that factors other than scale of consequence contribute to risk perception and aversion. A revised decision making framework that seeks to address societal concerns by focussing solely on scale aversion may misrepresent the real issues affecting the concerns of different communities and groups subject to any decision making process.
- There is evidence that the means by which risk is communicated by experts to 'lay people' affects the extent to which people feel concern and can influence in a negative sense people's perception of risk associated with a specific development. Consideration of this should be made in any policy aiming at addressing societal concern.
- Assessing public reactions to major accidents as a means to establish evidence of scale aversion is challenging as the measure of public reaction for any such assessment is very dependent on the media coverage, which in itself is 'an amplifier' of people's reactions (Kasperson, 1992).
- Social impact assessments have shown that the perception of risk and loss in society/communities/groups and individuals is not limited to a remote sense of 'fatality'. There is a 'wider sense of loss' which incorporates a much broader notion of loss/consequence than that considered by 'traditional' measures of risk. For example people worry about what might happen to their homes. There is a lack of 'compartmentalism' in public perception of risk (Irwin, Simmons, Wynne & Walker 1998); people do not tend to limit their perception of risk to accident risk but frequently also reason in relation to other effects such as the impact of a plant on a local area and pollution.

Reference: The ERM report when finalised.

**HSE ADOPTED POSITION**

A numerical factor for scale aversion will not be included in risk calculations.

**ISSUE CLOSED**

**No. 4 On-site and industrial populations**

Rationale:

- To be consistent all relevant populations should in principle be included in Societal Risk calculations and assessments because all affected people will contribute to the overall risk;
- For people working for neighbouring companies it is not ethical to exclude them from the risk assessment when they are exposed to risks from another operator;
- Transient site populations can influence the situation;
- COMAH, HSWA compliance will address the risks to an onsite population;
- On-site populations do not influence existing LUP advice for developments outside a site boundary under existing arrangements, which is based on individual risk;
- On-site populations could be a significant contributor to Societal Risk. For example an office on a hazardous site may introduce a considerable number of people into an area of high individual risk.

It was noted that on-site populations could be a significant contributor to societal risk, but that the on-site population is protected by other safety regimes (COMAH, HSWA). The current Land Use Planning (LUP) system does not take on-site population into account. As such, including an on-site population in societal risk estimations would mean that an LUP system was being used to address on-site safety issues (albeit indirectly). However, while leaving on-site populations out of the consideration would make the system more manageable, there were potential safety concerns where there is a significant office-based population on-site.

It was suggested that where a large office building is incidental to the work of the site, then the population of that office building could legitimately be included qualitatively, but outside the numerical calculations, while leaving the rest of the on-site population out of consideration. Alternatively, all on-site populations could be considered outside of the numerical calculations, to inform the qualitative nature of HSE's advice and of any decisions, such as whether to consider call-in.

However, it was also submitted that it is fundamentally important not to consider on-site populations in making LUP decisions, except in extreme cases.

**HSE ADOPTED POSITION**

Occupied buildings located at major hazard installations will be subject to Occupied Building controls. Any workers located on a major hazard installation not subject to occupied building controls will be included in societal risk assessments. Workers on sites adjacent to a major hazard installation will be included in the societal risk assessment. This conclusion will be subject to public consultation in the revised RCD.

**ISSUE CLOSED**

**No. 5 Transient Population – such as on transport links adjacent to a major hazard installation, or a large contractor workforce present for a relatively short period.**

Rationale:

- All populations should in principle be included in a societal risk assessment;
- Different assessment strategies are required for populations in such areas as motorways, train stations, stadia.
- The risk assessment model may require flexibility to model different situations
- The National Population Database (NPD) can provide population data for roads.

**HSE ADOPTED POSITION**

All populations should, in principle, be included in societal risk calculations for Land Use Planning. It is proposed that existing major roads within 300m of a hazardous installation will be taken into account, and new major roads within 1km of the hazardous installation.

**ISSUE CLOSED**

**No. 6 Should LUP assessment extend to the “hazard range” or be limited in some way?**

Rationale:

- A large development outside 2x the Consultation Distance (CD) may contribute to societal risk, but in most foreseeable cases this should not significantly alter the PLL;
- Individual risk at 2x CD are generally likely to be negligible.;
- Modelling over longer distances increases uncertainty, often involves more than one Local Authority, and adds significantly to the complexity of the calculations with diminishing returns;
- The difference between the CD and hazard ranges can be significant.

**HSE ADOPTED POSITION**

Detailed SR LUP assessment will be restricted to a maximum distance of twice the installation consultation distance.

**ISSUE CLOSED**

**No. 7 Should intervention (COMAH safety report assessment and COMAH inspection) extend to the “hazard range” or be limited in some way?**

**HSE ADOPTED POSITION**

For COMAH assessment and enforcement there should be consideration of the hazard range, in particular for off-site emergency and civil contingency planning.

**ISSUE CLOSED**

**No. 8 Should consideration given to harm to people be limited to estimation of fatal harm (or include for example, long term ill health)?**

Rationale:

- All harms should be included in principle but this will be difficult to implement;
- The Buncefield MIIB has recommended using fatal harm estimates for LUP for consistency with other estimates;
- Forecasting health issues is increasing in importance.

**HSE ADOPTED POSITION**

The HSE SR model is using TROD (Total Risk of Death) to calculate the risks in the vicinity of major hazard installations. (*ref A.G.Rushton, D.A.Carter. Total Risk of Death – Towards a Common and Usable Basis for Consequence Assessment. IChemE Symp. Series No.153, 2007.*) DD will continue to be used for setting consultation distances around major hazard installations.

**ISSUE CLOSED**

**No. 9 Should consideration given to harm to people be extended to including building damage, loss of facilities, environmental damage etc?**

Rationale:

- Estimation of health/safety/environment risk should be separate from estimation of commercial/property risk, but both should be included in the decision framework;
- Building damage could be interpreted to be part of societal risk, i.e. having an impact on people or society, and therefore considered as part of wider socio-economic factors;
- Environmental issues are covered by Environmental legislation, and for the Local Authority to take due account.

**HSE ADOPTED POSITION**

Building damage risks should be considered in the decision making process but not in the initial calculation of risks to people.

**ISSUE CLOSED**

**No. 10 Should more vulnerable (or less vulnerable) populations be given a different weighting?**

Rationale:

- Vulnerable populations should be considered as far as practicable by all involved in the decision making process;
- Typical populations will include a range of 'vulnerable' people, such as the elderly, infirm, and young.

**HSE ADOPTED POSITION**

Population sensitivity should be a factor in any decision making process, but not on a mathematical

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basis in the risk estimates. No allowance for population vulnerability is currently included in the risk calculation; it will be considered qualitatively in a way that will be consistent with the PADHI+ system.

**ISSUE CLOSED**

**No. 11 Should explicit attention be given to all current risk reduction measures? e.g. should non-passive measures be included or other measures not routinely accounted for in assessments to set CDs? These may not necessarily be enforceable under health and safety or planning legislation?**

Rationale:

- In principle all measures in place could be taken into account in the SR estimation;
- Only those risk reduction measures linked to LUP legislation can be enforced for LUP processes;
- Only those measures enforceable by external authority should be taken into account as others could be removed at any time;
- The COMAH regime requires a HSE (Competent Authority) inspection schedule to be in place;
- Enforcement activities seek to ensure compliance with the requirements of the COMAH Regulations which should ensure the on-site and off-site risks are ALARP.

**HSE ADOPTED POSITION**

Only those risk reduction measures enforceable through LUP controls, or that are written in the conditions of the Hazardous Consent can be taken into account in the LUP societal risk assessment, and the procedure for setting the CD.

**ISSUE CLOSED**

**No. 12 Should mitigation (e.g. through building design) be taken into account?**

Rationale:

- In principle mitigation through building design could be taken into account;
- Building condition and may deteriorate during its lifetime;
- ERM Building damage report is examining this issue. (Reference when completed.)

**HSE ADOPTED POSITION**

Mitigation through building design is not included in the LUP risk assessment methodology.

**ISSUE CLOSED**

**No. 13 Should emergency response (e.g. evacuation) be taken into account (and if so how)?**

Rationale:

- Some allowance for personnel taking 'evasive' action is included in risk assessment;
- ER arrangements are not explicitly taken into account under existing LUP considerations;
- Allowance for escape from radiation events is included in the LUP risk assessment;

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- No credit for evacuation should be given for toxic releases.

**HSE ADOPTED POSITION**

No allowance for emergency response is included in the LUP risk assessment methodology.

**ISSUE CLOSED**

**No. 14 To what extent are 'reality checks' such as site visits necessary?**

Rationale:

- Reality checks are assumed to mean inspection work carried out as part of, or co-incidental with, COMAH inspection;
- Reality checks may be undertaken to ensure the basis for the risk assessment is sound;
- The COMAH regime requires an HSE inspection schedule to be in place

**HSE ADOPTED POSITION**

Inspection work is used to verify COMAH compliance and may be used to verify data used in the LUP risk assessment process.

**ISSUE CLOSED**

**No. 15 To what extent are new approaches, such as accounting for topography possible or necessary?**

Rationale:

- Awareness of the importance of topography in particular situations is important;
- Accounting for topography can be complex and the results may not justify the effort.

**HSE ADOPTED POSITION**

Existing approaches for topography within LUP risk assessment will continue to be used. Ground roughness length is normally assumed to lie within the range 0.1 to 0.4 metres. In practice, for the majority of land use planning assessments, HSE normally uses 0.1 to represent rural environments and 0.3 to represent suburban environments.

**ISSUE CLOSED**

**No. 16 Should the operator's past performance be taken into account (and if so how?)**

Rationale:

- Majority view that the operator's past performance should not be taken into account;
- Minority view that the operator's past performance should be taken into account;
- Operator's performance could change when site management or conditions change;
- For Land Use Planning frequency/probability estimates err on the side of caution;

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- Any assumptions are made as realistic as possible, to achieve a 'cautious best estimate';

**HSE ADOPTED POSITION**

Frequency and probability estimates used in the LUP risk assessment will be based on 'cautious best estimates'. These results of the risk assessment are intended to be valid for a substantial time.

**ISSUE CLOSED**

**No. 17 How should installations or establishments (in common or separate ownership) with overlapping “hazard ranges” be dealt with?**

Rationale:

- Overlapping hazard ranges could be a factor in decision making
- For overlapping hazard ranges consideration of risks is limited to 2 x CD;
- There could be more than one ‘Legal person’ responsible for the risk to which the surrounding population would be exposed;
- For a location which is exposed to risks from two installations, the total risk will not be greater than 2x the higher risk. Allowing for uncertainties in the risk calculation process it is considered reasonable to use the higher of the risk values in the decision making process for this situation;
- For a location exposed to risks from more than two installations, these will be considered on a case by case basis;
- HSE does not identify overlapping hazardous zones;
- For the 50+ installations under consideration for this project it is a feasible task to identify where overlap will occur. It would be a considerable task to do this for all known hazardous installations.

**HSE ADOPTED POSITION**

For locations that are subject to risks from two installations, the higher of the risk values will be used in the decision making process. Locations affected by risks from more than two installations will be considered on a case by case basis.

**ISSUE CLOSED**

**No. 18 Should value added (by the installation or a proposed development in the vicinity) be taken in to account (and if so how?)**

Rationale:

- This is not part of the risk assessment;
- Considerations of value added should be part of the planning process;
- HSE could contribute to this process but it should be driven by the planning process;
- Economic models are being considered to look at this.

**HSE ADOPTED POSITION**

Value added by the installation or proposed development in the vicinity should be taken into account, but this is not included in the LUP risk assessment process. This is a consideration for the wider planning process.

**ISSUE CLOSED**

<b>No. 19 At which hazardous installations is explicit attention to societal risk necessary?</b>
<p>Rationale:</p> <ul style="list-style-type: none"> <li>• The list of priority installations was based on assessments using RI<sub>COMAH</sub>(Ref needed);</li> <li>• The RI<sub>COMAH</sub> assessments used actual quantities as opposed to consented quantities;</li> <li>• Issue No. 2 recommends that consented quantities of hazardous substances should be used for societal risk calculations.</li> </ul>
<p><b>HSE ADOPTED POSITION</b></p> <p>The list of priority installations will be reassessed as part of the SR modelling using the societal risk overlay.</p>
<p><b>ISSUE CLOSED</b></p>

<b>No. 20 Should the assessment be updated for every decision or only occasionally and on what basis?</b>
<p>Rationale:</p> <ul style="list-style-type: none"> <li>• There was a broad consensus that the assessment should be updated for every decision (or after every 'significant' change.);</li> <li>• Off-site population data will be reviewed regularly and the latest information used;</li> <li>• The extent of the work involved in this approach requires consideration.</li> </ul>
<p><b>HSE ADOPTED POSITION</b></p> <p>Societal risk estimates will be reviewed where establishment risks may be significantly affected by changes that significantly increase risk. Significant incremental PLL additions will be monitored otherwise a periodic review will be undertaken.</p>
<p><b>ISSUE CLOSED</b></p>

<b>No. 21 How should differences in approach between PADHI and more explicit societal risk estimation be managed?</b>
<p>Rationale:</p> <ul style="list-style-type: none"> <li>• There is potential for conflicting advice between PADHI and risk based assessments because PADHI includes aversion and other societal concerns, as well as an aim not to restrict all development close to the hazardous installation;</li> <li>• The Approaches could be integrated, or a single approach should be used;</li> <li>• Changes to PADHI could be considered to reduce potentially conflicting outcomes.</li> </ul>
<p><b>HSE ADOPTED POSITION</b></p> <p>PADHI will be applied initially to developments within CD. PADHI does not apply outside the CD. If AA this decision will stand. If DAA the SR risk decision making process will then be applied.</p>

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**ISSUE CLOSED**

<b>No. 22 Should the scope (<i>for SR advice</i>) include existing populations within the consultation distance and “Retrospective risk reduction” considerations (and how should the various possible “legacy” positions be handled)?</b>
Rationale: <ul style="list-style-type: none"><li>• General consensus is that dealing with existing populations within the consultation distance and “Retrospective risk reduction” consideration is difficult and will require careful handling;</li><li>• For some sites estimated risks are considered to be very high;</li><li>• The scope should include existing populations;</li><li>• HSE’s SR guidelines (in preparation) will recognise this issue.</li></ul>
<b>HSE ADOPTED POSITION</b>  Existing populations will be taken into account in the risk calculation. SR results will not be applied retrospectively. Where the societal risk is estimated to be at a ‘serious’ level then HSE would recommend that societal risk should be stabilised and reduced.
<b>ISSUE CLOSED</b>

<b>No. 23 Should pipelines be included?</b>
Rationale: <ul style="list-style-type: none"><li>• Broad consensus that pipelines should be included;</li><li>• Major Hazard installation fixed site risks are the priority;</li><li>• The current methodology is not suitable for pipelines.</li></ul>
<b>HSE ADOPTED POSITION</b>  HSE agree in principle that pipeline assessment should be included in LUP risk assessment. This will be considered in the future.
<b>ISSUE CLOSED</b>

END