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HSE principles for Cost Benefit Analysis (CBA) in support of ALARP decisions.

PURPOSE

This guide has been drawn up to help explain the uses and limitations of Cost Benefit Analysis. This guide is particularly concerned with the correct use of CBA as part of 'As low as reasonably practicable' (ALARP) decisions and is in accordance with HSE's aim to create,

"A culture in HSE that values the principles of risk assessment and management; and working practice that embeds proportionate and effective risk governance."¹

It should assist HSE staff in assessing a duty holder's case. A separate [checklist](#) has been developed detailing individual points that Inspectors may wish to consider when reviewing a duty holders CBA.

BACKGROUND

'Reducing Risks and Protecting People' (R2P2) discusses reasonable practicability and affirms the expectation that risk reduction action is to be taken using established relevant good practice as a baseline. Where relevant good practice is a good fit to the circumstances, then decisions on risk reduction action are straightforward.

In circumstances where established good practice does not exist, is out of date or, the situation is complex and the relevance of individual good practices is questionable (e.g. the combination of discrete hazards is not foreseen in the good practice documents) the decision making process on risk reduction action is less straightforward. CBA aids the decision making process by giving monetary values to the costs and benefits and to enable a comparison of like quantities. The analysis can help make an informed choice between risk reduction options.

A CBA cannot form the sole argument of an ALARP decision nor can it be used to undermine existing standards and good practice.

For many ALARP decisions the HSE does not expect duty holders to undertake a detailed CBA and a simple comparison of costs and benefits may suffice. Where major health and safety issues are being considered a more rigorous CBA may be of value.

WHAT IS A CBA?

In a CBA all costs and benefits are expressed in a common currency, usually money, so that a comparison can be made between different options. It is a defined methodology for valuing costs and benefits that enables broad comparisons to be made between health and safety risk reduction measures on a consistent basis, giving a measure of transparency to the decision making process.

¹ Annex: Summary of RPU Embedding programme.

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In undertaking a CBA all relevant costs, which accrue from the inputs into a health and/ or safety intervention must be identified and costed. Inputs are defined as any additional human, physical and financial resources that are used to undertake an intervention.

Likewise all relevant health and safety and non-health and safety benefits arising from the intervention must be identified and expressed in monetary terms. Health and safety benefits include the costs of actions (such as land interdiction, food bans, evacuation) aimed at preventing societal effects. Non-health and safety benefits are savings and should be included in the CBA as an offset to the duty-holder's costs.

ISSUES ARISING FROM CBA'S

There are several processes to bear in mind when completing a CBA. The processes below are particularly relevant to ALARP decisions.

GROSS DISPROPORTION

What is Gross Disproportion?

- The concept of gross disproportion requires duty-holders to weigh the costs of a proposed control measure against its risk reduction benefits. Specifically, it states that a proposed control measure must be implemented if the 'sacrifice' (or costs) are not grossly disproportionate to the benefits achieved by the measure "

Why do we use Gross Disproportion?

- The Courts (notably in *Edwards v. National Coal Board* (1949: 1 All ER 743) have decided that, in judging whether duty-holders have done enough to reduce risks, practicable measures to reduce risk can be ruled out as not 'reasonable' only if the sacrifice (in money, time, trouble or otherwise termed costs) involved in taking them would be grossly disproportionate to the risk.

Other Issues:

- there is no authoritative guidance from the Courts as to what factors should be taken into account in determining whether cost is grossly disproportionate;
- the duty-holder needs to consider both the level of individual risk and the level of societal risk².
- for a given benefit, the higher these risks, the higher the degree of disproportion (i.e., the ratio costs to benefits) can be before being judged 'gross';
- HSE has not formulated an algorithm which can be used to determine, in any case, when the degree of disproportion can be judged as 'gross'; the judgement must be made on a case by case basis;
- rules of thumb adopted by D/Ds;
 - NSD takes as its starting point the HSE submission to the 1987 Sizewell B Inquiry that a factor of up to 3 (i.e., costs three times larger than benefits) would apply for risks to workers; for low risks to members of the public a factor of 2, for high risks a factor of 10;
 - HID uses similar rules of thumb;

² For details see <http://www.hse.gov.uk/dst/alarp1.htm>.

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- Any activity or practice falling in the unacceptable region³ in the HSE framework for the tolerability of risk would, as a matter of principle, be ruled out unless the activity or practice can be modified to reduce the degree of risk, i.e. irrespective of cost and without the test of gross disproportion, until it falls within the tolerable or broadly acceptable regions or there are exceptional reasons for the activity or practice to be retained.

SENSITIVITY ANALYSIS

What is Sensitivity Analysis?

- A sensitivity analysis consists of varying one or more of the parameters/assumptions of the CBA to see how these variations affect the CBA outcomes. Duty-holders ought to conduct a sensitivity analysis, particularly if the CBA is being used to "show" further measures are not reasonably practicable

Why do we use Sensitivity Analysis?

- When undertaking a CBA duty holders are likely to have limited information about some of the key inputs such as the frequency of events and the number of potential fatalities involved. Sensitivity analysis is a way to deal with these uncertainties.
- A sensitivity analysis highlights whether suitably cautious assumptions have been made and allows the duty holder and HSE to assess the robustness of the outcomes of the CBA. The more robust are the results of a CBA, the more suitable it is as a tool for ALARP decisions.

ANNUALISATION

What is Annualisation?

- Annualisation is a procedure through which the average cost and the average benefit per year are worked out. This is simply done by summing up all discounted costs and all discounted benefits over the appraisal period and by dividing the outcomes by the length of the appraisal period.

Why do we use Annualisation?

- Usually the costs of a health and safety intervention are not constant over time. There will often be initial costs occurring in the first year and then (possibly lower) recurring costs in each subsequent year. Benefits could also vary from year to year, though they are more likely to be fairly constant⁴.

Other issues:

- In general, the annual cost will be smaller than the actual cost in the first year and larger than the actual cost in subsequent years. The annual benefit will generally be of similar magnitude of the actual benefit accruing each year.

³ For details about the concept of 'unacceptable region' see [R2P2](#).

⁴ This before discounting has been applied (see next section).

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DISCOUNTING

What is Discounting?

- Discounting is a procedure that allows a comparison between costs and benefits arising in different time periods. In general, the costs of implementing a risk reduction measure will comprise an initial capital outlay and occasional later payments for maintenance and replacement. The benefits will recur year upon year. It is conventional practice in a CBA to (a) choose an appraisal period (usually 10 years) and (b) discount the values of all costs and benefits arising each year to the first year of the appraisal period, before comparing them.

Why do we use Discounting?

- The principal behind discounting is that normally people prefer to receive benefits sooner rather than later, and prefer to incur costs later rather than sooner. In line with this, more weight is given to earlier costs and benefits than later ones by applying a discount rate.

Recommended Discount Rates;

- The Treasury recommended discount rate for both costs and benefits is 3.5%⁵. However, it is considered that individuals place an increased value on health and safety benefits as their living standards increase. This leads, currently, to an effective discount rate for health and safety benefits of 1.5%⁶.

WHERE CAN I GET MORE INFORMATION?

The following links highlight the key sources of information available;

- Reducing Risks, Protecting People: (HSE's decision-making process, appendix 3) <http://www.hse.gov.uk/dst/r2p2.pdf>
- ALARP suite:
 - <http://www.hse.gov.uk/dst/alarp1.htm> (Principles And Guidelines To Assist HSE In Its Judgements That Duty-Holders Have Reduced Risk As Low As Reasonably Practicable)
 - <http://www.hse.gov.uk/dst/alarp2.htm> (Assessing Compliance With The Law In Individual Cases And The Use Of Good Practice)
 - <http://www.hse.gov.uk/dst/alarp3.htm> (Policy And Guidance On Reducing Risks As Low As Reasonably Practicable In Design)
- Inspectors checklist to CBA in aiding ALARP decisions
- HSE guidance on RIAs: (only for those with HSE intranet access) <http://intranet/admin/gaps/gap23.htm>
- Treasury guidance on option appraisal: www.hm-treasury.gov.uk/greenbook
- New Earnings Survey 2002: (useful when estimating staff costs) http://www.statistics.gov.uk/downloads/theme_labour/NES2002_GB/NES2002_Streamlined_analyses.pdf

⁵ Lower discount rates apply to costs and benefits accruing more than 30 years into the future (see <http://greenbook.treasury.gov.uk/annex06.htm#longv>).

⁶ It is considered that the Value of Preventing a Fatality has a constant utility value over time and it is therefore uprated in real terms each year by real GDP per capita growth (i.e., currently, by about 2% per year, since at the moment the real per capita GDP growth is forecast at around 2% per annum). This uprating, coupled with a 3.5% discount rate, gives an 'effective' discount rate for health and safety benefits of 1.5% (lower effective discount rates apply to health and safety benefits accruing more than 30 years into the future). It needs to be noted that the real per capita GDP growth forecast could change over time. For further details see www.hm-treasury.gov.uk/greenbook.

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