Development of a Societal Safety Goal Workshop University of Maryland Group A – Safety and Performance Goals and Measures

M. Modarres University of Maryland March 20, 2012



Objective of Breakout Group A

- To Address: Need and implications of a new societal safety goal.
 - If we need new societal safety goal(s):
 - Is the proposed societal safety goal adequate?
 - Other feasible societal safety goal options?
 - Implications, difficulties, scope of application of such safety goal(s)?
 - Next steps?
 - If we don't need one:
 - Are the present safety goals adequate or need adjustments?
 - What adjustments, if any?
 - Next steps?

Individual Vs. Societal Risks: Defined

- Individual Risk shows expected frequency of fatality, morbidity or loss of assets to individual members of the society in a defined radius.
- Societal Risk measures the overall impacts of fatality, morbidity and economic risks such as loss of life expectancy, changes in the number of cancers or economic impacts (for example reduction in GDP).

A Useful Categorization of Societal Risks (Ball & Floyed – 1998):

- •Collective risks: non-accidental exposures
- •Societal risks: accidental exposures to a large population
- •Societal concerns: overall impacts (economics, security, environmental, etc.)

Representing Risk: Examples

- Risk itself may be shown in form of:
 - Risk vs. Consequence (per individual or population group)
 - Risk vs. (time, distance, units of energy production, etc.) per unit of population exposed
 - Magnitude of Exposure vs. Time
 - Performance vs. Time
 - Loss of Life Expectancy
 - Equivalent Annual Risk (amount of exposure that increase annual frequency of death by one in one-million)
 - Risk per unit of exposed population that leads to occurrence of a single loss (event) per unit of time
 - Relative contribution to total risk

Types of Safety Goals: Examples

Relative or Absolute limits may be applied to:

- frequency or probability of occurrence of significant incidents (e.g., CDF, LERF, LRF, CCFP).
- rate, duration, frequency or probability of exposures leading to individual or societal risks (e.g., present QHOs, F-C curves)
- minimum performance level of safety functions or SSCs designed to prevent, protect or mitigate exposures (e.g., safety margins, minimum reliability or availability).
- Individual or societal risks involving large consequences (risks involving numerous fatalities, environmental disasters or substantial economical losses). Risk aversion may be added, for example to F-C;

 $R = FC^{a}$ or $\log R = \log F + a \log C$ where a = risk aversion factor

 risk characterization factor (maximum or minimum) such as importance measure of a risk contributor.

Related Issues

- Do we really need a new societal risk? Why?
- What costs to consider? Direct vs. Indirect, Absolut vs. Relative, Tangible vs. Intangible (environmental, psychological, value of life, value judgment vs. gross measures, discount rate...)
- Consideration of Uncertainties?
- Fukushima met QHOs but would have violated NRC's subsidiary goals! (tsunami frequency was probably underestimated, inadequate protective and mitigate feature, lack of multi-unit site,...etc.)

Related Issues (Cont.)

- To what extent the Japanese experience is relevant to the U.S. (different value judgments and systems, replacement costs, etc.)?
- How to assess loss of life expectancy? (how to address the subjectivities)?
- What energy production risks to consider? What costs to consider in each?
- Is it acceptable to time average risks or do large infrequent events need to be specially weighted (through risk aversion factors)?
- Should risk perception factored in?

BACKUPS

Interpretations of Risk

- Hovden(2003) identifies four views:
 - Rationalist: risk is a real world phenomenon that should be measured or estimated, and then managed
 - Realist: risk is an objective threat that should be estimated, but may be subjectively distorted through frameworks of interpretation
 - Constructionist: risk does not exist in itself, it is a product of cultural ways of seeing
 - Middle positions: risk is an objective threat that should be seen from the lenses of social and cultural processes

(Risk Perception is central in the realist and middle positions)