Development and Application of a Safety Goals Framework for Nuclear Installations

A Review of the draft Tecdoc and a request for input on its content

Geoff Vaughan
Member of the Tecdoc drafting group

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INTRODUCTION

Why the Tecdoc?

• The fundamental safety objective is to protect people and the environment from harmful effects of ionizing radiation [SF-1]

How do we know we have achieved this objective?

• Measures for controlling radiation risks must ensure that no individual bears an unacceptable risk of harm [SF-1, Principle 6]

How do we identify the measures?

• Criteria for what constitutes an ‘unacceptable risk’ need to be established.
Safety Goals

Establishing “safety goals” allows identification of the safety measures needed.

In this Tecdoc the term “SAFETY GOALS” is used to encompass the whole spectrum of nuclear safety

Safety goals may be expressed qualitatively and/or quantitatively and the term ‘risk’ is used to cover all situations that have the potential to cause harmful consequences.
Why do we need this Tecdoc now?

Some IAEA publications exist which describe qualitative, semi-quantitative and quantitative criteria eg BSS, defence-in-depth and several IAEA Safety Standards on safety assessment. but there is little guidance on a comprehensive, integral and holistic consideration of safety goals and the main current basis for the consideration of some quantitative safety goals for NPPs is INSAG-12
Integration and Harmonisation

The high-level objective is to promote a greater understanding, harmonization, and communication of the use of safety goals in Member States.

The specific objectives are to build on the TM (April 2011):

- to develop high-level guidance on the way to establish a consistent and coherent formal framework for safety goals;
- to provide information on how compliance with the safety goals could be assessed; and
- how to use safety goals to support integrated risk-informed decision making for nuclear installations safety.

The focus is on NPP but applicable to all nuclear installations.
Some Issues to Consider on Section 1

• Has the Introduction explained the need for this Tecdoc clearly?
• Is the definition of Safety Goals sufficiently clear at this stage
• Is the scope of the Tecdoc clear?
• Additional examples of National approaches: any suggestions?
2 - DISCUSSION ON OBJECTIVES AND BENEFITS OF INTRODUCING A SAFETY GOALS FRAMEWORK

The question “how safe is safe enough?” is often answered by comparing with a set of characteristics related to the achievement of safety.

These characteristics are the “safety goals” – called “safety” rather than “risk” as it is safety which is the aim.

The Tecdoc considers the following in relation to deriving safety goals:

• On what basis have the safety goals been determined?
• How have they been derived?
• Where do they come from? and
• How are they accepted by society at large as being adequate?

Answering these questions will improve understanding, coherency and consistency in safety decision making.
2 -DISCUSSION ON OBJECTIVES AND BENEFITS OF INTRODUCING A SAFETY GOALS FRAMEWORK

The rest of this section briefly considers;

• how safety goals can be expressed, from high level principles to very detailed requirements; and

• how they may be fitted into a framework so that detailed goals can be related to higher level aims;

• how a framework can enhance understanding and hence international harmonisation, as well as improve public communication.

Finally, the role of stakeholders in setting safety goals is considered
Some Issues to Consider on Section 2

• Is the discussion of the different levels of safety goals a useful introduction?
• Does this section provide sufficient background on the reasons behind the concept of a framework linking the safety goal levels?
• Is the concept of a hierarchy and its advantages sufficiently explained?
3 - CONCEPTS RELATED TO THE SAFETY GOALS FRAMEWORK

• The difficulty of applying the IAEA Fundamental Safety Objective directly to determine what features of the facility should be addressed and what specific safety measures should be implemented is obvious.

• To do this a more detailed set of safety aims at a more technical level, are required.

• Hence, a set of safety goals, covering different aspects of safety, from high level aims to detailed technical requirements, must be derived.

• This section of the Tecdoc sets out the desirable characteristics and aspects to be considered in developing a safety goals framework.
3 - CONCEPTS RELATED TO THE SAFETY GOALS FRAMEWORK

The TM in April 2011 discussed the issue and the work done by organisations such as MDEP, WENRA and The Nordic PSA Group, which all suggested hierarchies of Safety Goals: in addition the implied hierarchies within the IAEA Safety Standards is reviewed. The conclusion of the TM suggested the use of a hierarchy consisting of:

• Fundamental Safety Objective and Safety Principles
• Generic safety goals which capture the current level of societal risk tolerance.; These should be technology neutral and apply to all nuclear installations: maybe qualitative or quantitative;
• Site/Facility Specific safety goals – these are dependent upon technology and site selection; such goals will tend to be quantitative rather than purely qualitative.
3 - CONCEPTS RELATED TO THE SAFETY GOALS FRAMEWORK

Desirable characteristics of a safety goal framework:

- A Hierarchical Structure
- A Logical Interrelationship
- Consistency with the IAEA Safety Standards
- Recognition of the Defence in Depth Safety Concept
- Site Neutrality (i.e., the safety goals apply to all sites, but specific requirements would be highlighted; and, the safety goals should be essentially independent of the demographics around the site)
3 - CONCEPTS RELATED TO THE SAFETY GOALS FRAMEWORK

Certain aspects should be considered in defining the framework:

• Overall individual and societal risk goals – the effects on populations need to be considered
• Application to older facilities – do the same safety goals apply?
• Quantitative/qualitative safety goals – the pros and cons
• Sources of radioactive hazard – several sources should be covered
• Plant states and lifetime stages – all relevant states/stages should be covered
• Adequate models and data - including consideration of PSA quality
• Treatment of uncertainties – both in setting and comparison
• Treatment of external events – difficulties of treating these events
• Multi-unit or multi-facility sites – dealing with dependencies
• Communication – who with and how
Some Issues to Consider on Section 3

- Is the discussion on the TM outcomes and the IAEA Safety standard framework useful?
- Are the framework characteristics adequate or should more be added or some deleted?
- And are they defined and described adequately?
- Are the developmental aspects adequate or should more be added or some deleted?
- And are they defined and described adequately?
- Is the treatment of multi-facility sites sufficient or too detailed?
4 - A GENERAL FRAMEWORK FOR SAFETY GOALS

This is a key section: if the concepts described here are not accepted, the rest of the paper is irrelevant!

• This section discusses in more detail the different types of Safety Goal

• It also lists a set of requirements for a hierarchy based on the earlier considerations (section 4.3): an important aspect being – “The structure shall be clearly and unambiguously defined, making it easy to understand, implement and communicate.”

• Finally, the safety goals levels are described in more detail, but in general terms
4 - A GENERAL FRAMEWORK FOR SAFETY GOALS

- **Top Level**
  - Primary goal
  - IAEA's Fundamental Safety Objective

- **Upper Level**
  - Adequate protection
  - Providing adequate protection in all operational modes of all facilities and installations at the site

- **Intermediate Level**
  - General Safety Provisions
  - Providing necessary safety provisions based on proven approaches and good practices to ensure adequate protection

- **Low Level**
  - Specific Safety Provisions
  - Providing necessary specific safety provisions for all facilities and installations at the site

Operational states | Accident conditions
Some Issues to Consider on Section 4

• Are the basic types of safety goals described adequately?
• Are the general descriptions of the safety goal levels sufficient and useful (Table 2)?
• Is the proposed hierarchy sufficiently well introduced and explained?
• Is the diagram clear and the relationships in the side bars useful?
• Should there more consideration of management aspects?
5 - DERIVATION OF SAFETY GOALS WITHIN THE HIERARCHY

This is the key section of the Tecdoc in terms of how the hierarchy content will be populated

• This section deals with the derivation of safety goals on the four levels within the hierarchy.
• The context and process of defining safety goals is described and who typically defines on the four levels.
• The definition of safety goals of the hierarchy is addressed as well as examples of potentially relevant safety goals
• Important to stress the examples are intended illustrate the type of safety goal not recommendations
5 - DERIVATION OF SAFETY GOALS WITHIN THE HIERARCHY

The roles of stakeholders in defining different levels of safety goals, is considered - from Government at the top level; then, as the goals become more technical and operational, the role of regulatory body becomes important; and increasingly at the lower levels involvement of expert technical organisations and the licensees becomes important.
5 - DERIVATION OF SAFETY GOALS WITHIN THE HIERARCHY

• The main part of this section describes the goals at the different levels, what there relationship is to the higher level goals and issues related to the description of the goals

• The text points out some of the difficulties in defining safety goals exactly enough that they are unambiguous

• Various examples of safety goals at the four levels are given
Some Issues to Consider on Section 5

- Is the role of stakeholders clear and accepted?
- Is it clear how the different levels of safety goals are defined?
- Are the difficulties and issues in defining safety goals covered sufficiently?
- Is there sufficient information that the reader could develop a hierarchy?
- Are the examples in the text and the table useful?
- Is figure 5 clear and useful?
- Is figure 6 clear and useful?
- Is Table 8 (and hence 7) useful?
Section 6 covers uses of the safety goals framework:

- **Applications during operational stages and activities**: mainly an application during design and operation in terms of the SSC and management procedures to control changes and modifications.

- **Compliance assessment**: a process of checking the design and operation against safety requirements.

- **Use of Integrated Risk-informed Decision-making**: a process for considering all safety issues in an integrated manner, moderated by risk considerations, which requires a set of safety goals to be possible.
Some Issues to Consider on Section 6

- Is the range of applications sufficient?
- Are there other issues that should be considered?
- Should the issue of short-term risks be considered explicitly?
- Is the description sufficient to explain the use, bearing in mind that this Tecdoc is not a guide to these areas?
- Is the sub-section on Safety Performance Indicators useful?
References

• There is an extensive reference list to support the document and the issues discussed
• Some are IAEA documents, some from other sources
Some Issues to Consider on References

• Are the references sufficient?
• If not what should be added?
• Should any references be removed?
• If so, which?
• Are the non-IAEA references easily obtainable in your countries?
A large number of terms that are not in the IAEA Glossary are covered in Appendix 1

These are given to avoid confusion where several different definitions are in use or where there are specific meanings that are relevant to the Tecdoc.

For example:

- “best estimate” – not a simple concept
- “limit” – used in various ways
Some Issues to Consider on the Glossary

• Should more terms be defined?
• Should some definitions be removed?
• Are the definitions sufficiently clear and concise?
APPENDICES

2 SPECIFIC EXAMPLES OF SAFETY GOALS FRAMEWORK

A2-1. Developments by Western European Nuclear Regulators Association
A2-2. Developments by Multinational Design Evaluation Project
A2-3. Nordic PSA Group Project on safety goals for Nuclear Power Plants

3 DEVELOPMENT OF USNRC SAFETY GOALS FOR LIGHT WATER REACTORS
Some Issues to Consider on Appendices 2 & 3

• Are these appendices needed?
• Are they sufficiently clear?
• Is there a need for further Appendices?
• And if so on what subjects?
What the Tecdoc is not!

The intention of the Tecdoc is not to propose actual safety goals

The intention is to propose a systematic approach to the development of lower level safety goals, which will be used in practice in determining the necessary safety measures, so that the intentions and aims in the high level goals are translated in a coherent manner to achieve a consistent degree of safety in different technologies.
CONCLUSIONS

• The issue of how to decide if a facility is adequately safe requires a set of criteria against which the design and operation can be judged
• These criteria should be developed so that there is clarity of how the detailed requirements relate to the overarching safety aims
• A safety goal framework allows judgement to be made in a coherent manner across a range of safety issues
• This approach should lead to the achievement of a consistent degree of safety across different technologies which is communicable to a range of stakeholders
Your Role!

The Tecdoc was drafted by a group comprising a small group of consultants from Canada, Germany, Sweden, UK and USA plus IAEA staff: the output of the TM in 2011 provided general direction.

The drafting group have produced this complete, final draft; but it needs consideration by a wider group to check for completeness, clarity and usability.

That is your role!

We ask you to suggest actual changes, additions, deletions, not general comments and then next week the drafting group will complete the Tecdoc.