CARAT
An Operational Approach to Risk Assessment Definitions, Processes, and Studies

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Background

- OECD Workshop - Paris - 1995
- Presentations by various organizations
- Use of terms was inconsistent
- Methodologies were difficult to compare

Purpose of CARAT

- To make more transparent the various approaches to risk assessment

- To promote understanding of, and communication about, chemical accident risk assessment processes

- To facilitate communication concerning chemical accident risk assessment

The CARAT

- does not attempt to harmonize or establish standard terminology or

- to make judgement on the value of various risk assessment methodologies.

- captures only what risk assessment professionals understand to be the state of understanding of particular laws, regulations, or procedures

The CARAT

- Can be considered as a "translation engine"
  - captures the intended meaning of a risk assessment item
  - "translates" it into objective or operational language.
- The System has evolved
  - OECD Computer Dictionary/Thesaurus of Risk Assessment Processes
  - OECD Dictionary/Thesaurus.

Structure of the Entries

- Definitions of words and phrases associated with risk assessment

- Laws and regulations concerning risk assessment of hazardous facilities

- Guidelines, policies or codes related to risk assessment

- Specific risk assessment studies that have been conducted on particular cases

Session   Logout

Entries
 New
 Open
 Finalize

Identify the type of item to be entered

○ **Definition**

◉ **Regulation or Law**

○ **Specific Risk Assessment Case**

○ **Risk Assessment Guidance**

[Submit] [Reset]

Hierarchy of the Entries

- *Generic elements*, a set of related, operationally defined process steps

- *Sub-elements*, one of the operationally defined process steps contained in a Generic Element

- *Terms*, the concept which is the subject of the process defined in the Sub-element

- *Categories*, a set of examples used to give specific operational meaning to a Term

- *Descriptors*, single examples illustrative of specific operational situations in the Category.

Generic Elements

- Pre-assessment

- Hazard identification;

- Hazard release and exposure scenarios;

- Source and subject interaction; and

- Expression of the risk

- Post-assessment

Select a Generic Element

Pre-assessment — Identification of aspects of the risk assessment process that are not captured by Generic Elements I to IV, and are judged to precede them, e.g., scope, or purpose of the risk assessment

Element I — Identification of sources with the potential to cause undesired outcomes to subjects of concern that is the focus of the estimation of likelihood

Element II — Identification of sequences of events that can lead to loss of containment of the potential to cause undesired outcomes and its entry into a domain defined by specified boundaries. Identification of the basis for estimating the distribution of both the released potential and the subjects of concern within this domain

Element III — Identification and description of how the specified undesired outcome is related to the intensity, time and mode of contact of a specified potential to cause the undesired outcome to the subjects of concern

Element IV — Consists of two parts: Part A: Identification of the methods for estimating and expressing the likelihood of a specified effect and describing the quality of such estimates. Part B: Identification of the basis for comparing derived estimates of likelihood to specified guidelines and describing the dependence of these estimates on explicitly specified assumptions

Post-assessment — Identification of aspects of the risk assessment process that are not captured by Generic Elements I to IV, and are judged to follow them, e.g., the risk assessment/risk management interface

Sub-elements and Terms

- Element I
  - *Sub-element I i:* Identification of sources with the potential to cause undesired outcomes to subjects of concern
    - *Term I i:* Sources with the potential to cause undesired outcomes
  - *Sub-element I ii:* Identification subjects of concern
    - *Term I ii:* Subjects of concern
  - *Sub-element I iii:* Identification undesired outcomes to subjects of concern
    - *Term I iii:* Undesired outcomes to subjects of concern

Categories

- **Element I, Sub-element I, Term 2: Subjects of concern**
    - People
    - Ecosystems/environment
    - Cultural assets
    - Property and physical systems
    - Facilities
    - Other subjects of concern

Hierarchy of the OECD CARAT

- Hierarchical Feature   Number of Components
  - *Elements*   4
  - *Sub-elements*   19
  - *Terms*   19
  - *Categories*   70
  - *Descriptors*   368

Other Aspects

- The entry includes:
  - the name of the entry
  - the identify of the country
  - the name of the organization
- full reference information
- the URL of an Internet web site where the reference might be viewed or downloaded

Are **Sources with the potential to cause undesired outcomes** addressed in the entry under consideration?

| Yes | No (skip) | Yes, but not specifically defined |

Other Aspects

- the ability to skip an element or sub-element
- the ability to add new descriptors
- use of "undefined" as the descriptor
- use of "*explicitly*" or "*implicitly.*"
- the ability to include "*criteria*" and/or "*tools*" associated with the selection
- use of reference details to allow for library retrieval of the reference material

Other Aspects

- a free-text comment field for the reasons for, or explanation of, the particular selection.

- use of other descriptors.

  - Wording that better describes the meaning under that category.

  - The system adds the new item to the existing list.

Query Capability

- A "Comparison" facility allows the user to make a side-by-side comparison

- A comparison can be made at the element, term, category, or descriptor levels.

- CARAT can perform searches for entries that contain either certain combinations of hierarchical descriptor details

- can be conducted in Boolean 'and/or' mode

Entry Reports
 About
 Example
 Index

Comparisons
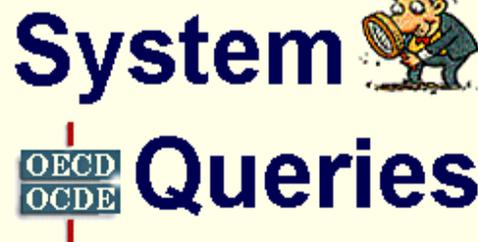 About
 Example

Definitions
 About
 Example
 Index

**Descriptor
 Queries**
 About
 Example

**Hierarchy
 Queries**
 About
 Example

System
Queries

Regulatory Entries

Definitions

Risk Assessment Guidances

Specific Risk Assessments

There are several ways that the Chemical Accident Risk Assessment Thesaurus (CARAT) database can be searched.

1. Reports may be generated for Regulatory entries, for Specific Risk Assessment cases, for Risk Assessment Guidance documents, or for other classes of entries. To run such a report, click on Entry Reports on the left panel.

   For an index of all Entry Reports, click on Index under Entry Reports on the left panel.

2. A comparison of the details of Regulatory entries, Specific Risk Assessment cases, Risk Assessment Guidance documents, or Definitions among these entries in any combination can be made by selecting Comparison on the left panel.

3. Reports of definitions of words and phrases associated with risk assessment processes may be obtained by clicking on Definitions on the left panel.

   For an index of all Definition Reports, click on Index under Definitions on the left panel.

4. Generalized searches of the operational language used to characterize all entries can be made by selecting Descriptor Queries on the left panel.

5. Generalized searches based on the hierarchical structure of the CARAT can be made by selecting Hierarchy Queries on the left panel.

More information about any of these searches and an illustration of example reports can be obtained by selecting "About" or "Example" for any of the search types above.

Comparison of Two Risk Assessments of Chlorine Storage

Case 1 **Chlorine Truck Storage QRA**
Case 2 **Continuous Chlorine Release from One Tonne Container**

1 2   **Addressed:**   *e* **explicitly**   *i* **implicitly**

3 3		***Element I*** **Identification of sources with the potential to cause undesired outcomes to subjects of concern that is the focus of the estimation of likelihood**
3 3		**Identification of sources with the potential to cause undesired outcomes to subjects of concern**
3 3		**Substances**
e e		Toxic to humans
3		**Energy**
i		Pressure
3		**Physical situations**
	e	Systems containing regulated chemicals
3		**Legally specified sources**
e		Listed substances
3 3		**Identification of subjects of concern**
3 3		**People**
e e		Residents
e		Sensitive resident populations
e		Transient people

○ **Elements**
  ○ **Sub-Elements**
    ○ **Categories**
      ◉ **Descriptors**

More specific

Ordinance on Protection Against Major Accidents (Ordinance on Major Accidents, OMA,), 27 February 1991

Hans A. MERZ	
Switzerland	Ernst Basler + Partners Ltd.
Regulation or Law	10/9/98 8:50:36 PM

e explicit   *i* implicit   *c* criteria   *t* tools   **Prepare Report**   ☐ *Full report*

Element I

Identification of sources with the potential to cause undesired outcomes to subjects of concern that is the focus of the estimation of likelihood

			1		Identification of sources with the potential to cause undesired outcomes to subjects of concern	
			1	1	Substances	
e	*c*	*t*	1	1	1	**Explosive**
e	*c*	*t*	1	1	2	**Flammable**
e	*c*	*t*	1	1	3	**Reactive**
e	*c*	*t*	1	1	4	**Oxidizing**
e	*c*	*t*	1	1	5	**Toxic to humans**
e	*c*	*t*	1	1	6	**Toxic to ecosystems**
e			1	1	7	**Carcinogenic substance**
e			1	1	8	**Teratogenic substance**
e			1	1	0	**Genetically modified micro-organisms**

Application of the CARAT

- Comparing various laws and regulations, definitions or specific risk assessments.

- Companies can put specific standards, guidelines, risk assessments, or other risk-related applications into the system and use the comparison feature to determine where the specific input may be at variance with the legal system in the country. e.g. NOVA

Application of the CARAT

- The system source code can be obtained from the OECD
    - enter specific standards and codes of practice
    - compare work from the various sites to assure that the requirements have been met.
    - Act as a repository for specific risk assessments
    - provide an archive facility for those wishing to update risk assessments on a regular basis

Conclusions

- System is available and in use
- More entries are required
- Uses are extensive, especially with the source code
- Training is available from OECD, etc
- Brochure outlines the system and access