# International Conference on the Safety and Security of Radioactive Sources: Maintaining continuous global control of sources throughout their life cycle

## Abu Dhabi, UAE, 27-31 October 2013 (IAEA-CN-204)

# IAEA GUIDELINES FOR AUTHORS ON PREPARATION OF MANUSCRIPTS FOR PROCEEDINGS

## General requirements for the submission of papers

The full paper should not exceed ten pages and must be sent, only upon request by the IAEA, electronically (no paper copies) in Microsoft Word format directly to CN204@iaea.org by 1 July 2013.

Before the conference, authors will have been requested to sign the "Form for Submission of a Paper" (*Form B)*, assigning to the IAEA either copyright or a non-exclusive, royalty free license to publish. Authors are responsible for ensuring that nothing in their papers infringes any existing copyright. If previously copyrighted material is included, authors must provide evidence that the copyright holder has given permission for its use.

The final decision on whether a paper will be published in the proceedings will be taken by the IAEA after the conference. Should the IAEA decide to publish the papers in another form, the authors will be notified.

## Manuscript

The manuscript should be supplied in electronic form in Microsoft Word format. The *Instructions for Formatting A4 Manuscripts Using Microsoft Word for IAEA Publications* should be followed (see below).

*Sample A* shows two manuscript pages, indicating the preferred style for ***headings*** and ***footnotes***. ***Mathematical symbols*** must be clearly and consistently typed to ensure that their meanings and positions are unambiguous.

The ***first page*** must begin with the title of the paper, the names of the authors, and the names and locations of their institutes. The present postal address of an author, where different from the affiliation, should be given as a footnote.

The paper must begin with an ***abstract***. The abstract should be typed as one paragraph not exceeding 200 words and should not contain references or footnotes. In the case of a summary presentation, no abstract is required.

The ***SI system of units*** should be followed, or conversions given where non-SI units have to be retained.

***Abbreviations*** likely to be unfamiliar to readers must be explained the first time they occur.

***References*** (see *Sample B)* should be numbered (Arabic numerals in square brackets) in the order in which they are first mentioned, and listed at the end of the paper. If a reference is cited first in a figure, figure caption or table, it should be numbered according to the place in the text where the figure or table is first mentioned. Attention should be paid to punctuation.

A ***bibliography*** for background reading, i.e. whose entries are not cited in the text, should be set out in reference form and put in alphabetical order by author. The entries should not be serially numbered. References by the same author should be ordered chronologically, with the earliest reference first.

***Figures and tables*** should be clear and reproducible (type area: 16 cm × 25 cm). All figures and tables should be mentioned in the text and should be numbered in the order in which they are first mentioned. They should be placed as close as possible to the place where they are first mentioned, but text must not be wrapped around them. For photographs (which should be kept to a minimum), good quality glossy prints should be supplied.

*Instructions for Formatting A4 Manuscripts Using Microsoft Word for IAEA publications*

1. **Default language:** Should be set to English (UK). However, please note that Agency style is to use "…zation" rather than "…sation" and "…ize" rather than "…ise" in the corresponding verbs. The corresponding spelling will have to be added to the spellchecker or the indications of misspelling ignored.

## PAGE LAYOUT

2. **Paper size:** Standard, 21 cm × 29.7 cm (A4).

3. **Page set-up:** Margins:

| | | | | |
|---|---|---|---|---|
| — top: 2 cm; | — Gutter: 0 cm. | | |
| — bottom: 2.7 cm; | — From edge: | Header: | 1.25 cm; |
| — left/right: 2.5 cm. | | Footer: | 1.25 cm. |

   **Resulting type area:** 16 cm × 25 cm.

4. **Justification:** Full (or left only, if preferred).

5. **Line spacing:** Line spacing should be set at 1. The first line of a paragraph should not be indented. Leave a line space between paragraphs.

6. **Numbering of pages:** Alignment outside (Under Page Setup/Layout/Headers and Footers, select "different odd and even"), with numbers in Times New Roman 11 point.

7. **Section headings:** Do not use more than four levels of heading. The number should always end with a full stop.

8. **Leave only one space after a full stop.**

9. **'Widow/Orphan' lines:** Never start a page with the last line of a paragraph or of a displayed list, and never finish a page with the first line of a paragraph or of a displayed list. Make sure that all headings are followed on the same page by at least two lines of text.

10. **Displayed (single and multilevel) itemized lists:** For single lists, set each item identifier, e.g. (a), (1) or em dash — (i.e. ALT 0151), at the margin and start the text on the paragraph indent of 1 cm.

11. **Facing pages should not differ in length** by more than two lines. Line spaces should be introduced, as necessary, for this purpose.

## FONTS

12. **Font and point size for text:** Use only Times New Roman 11 point or 12 point (do not use CG Times). Do not use any sanserif font (except Arial).

13. **Special characters/signs:** Use the "Insert/Symbol" feature in MS Word to insert special characters. In the dialog boxes under the "Symbols" tab select the font "(normal text)" and use one of the subsets "Basic Latin", "Latin 1", "Latin Extended-A" or "Latin Extended-B". Do not set the font to "Symbol" in the "Insert/Symbol" dialog box. Special characters/signs can also be inserted using "ALT" + numeric keypad. This solution is particularly well suited for inserting special characters in the "Show Paper Properties" dialog box. Please note that "Num Lock" must be switched on in order for this method to work. For equations, use the Microsoft equation editor accessible through Insert/Object/Microsoft Equation.

    For manuscripts originally created with fonts other than Times New Roman or Arial, select "Embed True Type fonts" under Tools/Options/Save before saving a file.

14. **Mathematical signs:** Use the special characters: × (ALT 0215) for the multiplication sign; en dash – (ALT 0150) for minus; and raised dot (ALT 0183) for combining units (e.g. MW·h).

15. **Footnotes:** Arabic numerals, Times New Roman 10 point.

16. **Do not underline:** Use *italics*, **bold** or ***bold italics*** instead.

## FIGURES AND TABLES

17. **Do not wrap text around tables and figures.** Tables and figures should be placed at the top or bottom of the page if possible. (If tables or figures are not available in the Word file, leave appropriate blank spaces.)

18. **Figures:** Line drawings should not contain detail that will not reproduce clearly at the final, printed page size (e.g. plotted symbols, fine lines and shading). Photographs should be supplied as good quality glossy prints.

    Figures should be included into the Word document using the "Insert/Picture" menu in Word. Figures should not be included using the "Insert/Object" functionality.

    Otherwise figures should be submitted as separate files as follows:
    — scanned images in TIF format,
    — image files produced with a vector graphics capable software in EPS format.

    Photographic images should be scanned using a resolution of 300 dots per inch (dpi).
    Graphs or diagrams should be scanned using a resolution of 600 dpi.

19. **Figure numbering and captions:** Arabic numerals, Times New Roman 11 point or 12 points italics. Examples:

    *FIG. 24. Determination of optimum contact time for uranium extraction [5].*

    *FIG. 25. Tonnage of uranium recoverable from EAR-I at costs of up to US $80/kg U for the period from 1977 to 1990.*

20. **Table formatting:** Do not use boxes; use horizontal lines only, but not between consecutive rows. Width: do not exceed 16 cm (if less than 16 cm, centre table) or, for a table in landscape format, 25 cm.

21. **Table numbering and headings:** Roman numerals, Times New Roman 11 point or 12 point. Footnotes should be indicated by raised lower case letters.

**Finally:** Run the manuscript through the spelling checker.

# Scenario selection procedures in the framework of the ETNA project[*] *A case study*

**Weidong Ma[a†], P.A. Aarnio[b], A.E. Smith[a]**

[a] Joint Department of Physics,
British Nuclear Fuels plc,
Sellafield, Seascale, Cumbria,
United Kingdom

[b] Helsinki University of Technology,
Helsinki, Finland

**Abstract.** In the framework of the ETNA project, five organizations involved in waste management have harmonized their methodologies for selecting a final set of scenarios to be considered for sensitivity analysis studies. The independent initiating event methodology is based on the production of a limited list of about twenty independent initiating events. The PROSA methodology starts from a comprehensive list of about 150 features, events and processes. These schemes result in a final list of scenarios which are quite similar for the same site and rock formation. In the framework of ETNA these scenarios are treated in a qualitative or semiquantitative manner.

## 1. Introduction

The ETNA project is a co-operative effort between five organizations. The working group deals with scenario development and is in charge of:

- Reporting the scenario selection procedures developed by each participating organization,
- Setting up a list of the scenarios to be considered in the project and producing a synthesis of this work.

## 2. Description of scenario selection procedures

### *2.1. Independent initiating event methodology*

#### *2.1.1. First step: Listing of independent initiating events and associated induced events*

The structure of the independent initiating event (IIE) methodology is shown in Figs 1 and 2.

2.1.1.1. Comparison methodogy

The selected methodology was based on [1]:

(a) Separation of the comparison into two sub-analyses:
  (i) Technology for excavation/construction:
    — disposal
    — backfilling and sealing;
  (ii) Long term performance and safety.

(b) Structuring of the problems in a hierarchical system containing several levels, with each problem separated into more and more detailed elements on each lower level.

[*] Work performed within the framework of the European Commission's Programme on Storage of Waste.

[†] Present address: Ionizing Radiation Standards, Institute for National Measurement Standards, National Research Council Canada, Ottawa, Ontario, Canada k1A 0R6.

Table I. Secondary wastes arising from column materials used in the reprocessing of 350 t HM [2]

| Material | Element | Amount of element (g) | Amount of material (kg) |
|---|---|---|---|
| $Sb_2O_5$ and $MnO_2$ | Sb, Mo | 1155 | 70[a] |
| CMPO (on SM 7) | Am, Eu, Ce | 552 | 30[b] |

[a] Estimated value taken from 1 L experiments as a basis.
[b] Determined value from breakthrough curves.

The different kinds of secondary wastes generated are summarized in Table I and Fig. 3. Management techniques for the liquid wastes generated are given in Section 8.1.1.

Figure 4 shows three basic concepts for plugging shafts in rock salt. Examples [3–7] of 15 seal designs are given in Figs 5 and 6.

As discussed in Ref. [8], the light water reactor (LWR) situation will change in the near future for Europe, where incentives exist for increasing the fuel burnup (up to 60 000 MW·d/t HM). Cladding will have to be improved to solve problems caused by pellet–clad interaction (PCI).

Equation (16) of Ref. [9] can be rewritten, after combining Eqs (14) and (15), as:

$$C = Q(r_s)^{-1}(K_H K_V)^{-1/2}C' \quad (1)$$

where

- $C$ is the concentration of the radionuclide ($Bq/m^3$),
- $Q$ is the rate of release of the radionuclide concerned into the ocean (Bq/s),
- $r_s$ is the radius of the source (m),
- $K_H$ is the horizontal eddy diffusivity in the water column ($m^2/s$),
- $K_V$ is the vertical diffusivity in the water column ($m^2/s$),

and C' is calculated using Eq. (15).
Reference [1] describes the following processes:
(a) Filtration
(b) Ion exchange – permanent and mobile
(c) Evaporation.

## 2.2. Confinement in the near field

In Fig. 3 the distribution of the nuclides between the components as a function of time is shown. In both cases only a fraction of the initial inventory is released into the far field.[1]

In some safety assessments of waste repositories, the peak doses are estimated to occur around 1000 to 10 000 years after repository closure. The dominant radionuclides are $^{14}C$, $^{239,240}Pu$, $^{129}I$ and, in the short term, $^{90}Sr$.

[1] At this stage, the non-linear sorption behaviour of Cs in the far field has not been considered.

## REFERENCES

[1] FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS, INTERNATIONAL ATOMIC ENERGY AGENCY, INTERNATIONAL LABOUR ORGANISATION, OECD NUCLEAR ENERGY AGENCY, PAN AMERICAN HEALTH ORGANIZATION, WORLD HEALTH ORGANIZATION, International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources, Safety Series No. 115, IAEA, Vienna (1996).

[2] INTERNATIONAL ATOMIC ENERGY AGENCY, Regulations for the Safe Transport of Radioactive Material, Safety Standards Series No. ST-1, IAEA, Vienna (1996).

[3] INTERNATIONAL ATOMIC ENERGY AGENCY, Quality Assurance for Safety in Nuclear Power Plants and other Nuclear Installations, Code and Safety Guides Q1–Q14, Safety Series No. 50-C/SG-Q, IAEA, Vienna (1996).

[4] INTERNATIONAL ATOMIC ENERGY AGENCY, Establishing and Implementing a Quality Assurance Programme, Safety Guide Q1, Quality Assurance for Safety in Nuclear Power Plants and other Nuclear Installations, Code and Safety Guides Q1–Q14, Safety Series No. 50-C/SG-Q, IAEA, Vienna (1996).

[5] INTERNATIONAL ATOMIC ENERGY AGENCY, State of the Art Technology for Decontamination and Dismantling of Nuclear Facilities, Technical Reports Series No. 395, IAEA, Vienna (1999).

[6] INTERNATIONAL ATOMIC ENERGY AGENCY, Evolutionary Water Cooled Reactors: Strategic Issues, Technologies and Economic Viability, IAEA-TECDOC-1117, Vienna (1999).

[7] FIL, N.S., et al., "Balancing passive and active systems for evolutionary water cooled reactors", Evolutionary Water Cooled Reactors: Strategic Issues, Technologies and Economic Viability, IAEA-TECDOC-1117, Vienna (1999) 149–158.

[8] Energy from Inertial Fusion, IAEA, Vienna (1995) 95–111.

[9] Topical Issues in Nuclear, Radiation and Radioactive Waste Safety (Proc. Conf. Vienna, 1998), IAEA, Vienna (1999); Contributed Papers (CD-ROM).

[10] INTERNATIONAL ATOMIC ENERGY AGENCY, Isotope Techniques in Water Resources Development and Management, C&S Papers Series No. 2/C, IAEA, Vienna (1999) (CD-ROM).

[11] LAO, L.L., et al., "Effects of plasma shape and profiles on edge stability in DIII-D", Fusion Energy 1998 (Proc. 17th Int. Conf. Yokohama, 1998), IAEA, Vienna (2000) (CD-ROM file EX8/1).

[12] INTERNATIONAL COMMISSION ON RADIOLOGICAL PROTECTION, Evaluation of Radiation Doses to Body Tissues from Internal Contamination due to Occupational Exposure, Publication 10, Pergamon Press, Oxford and New York (1968).

[13] Nuclear Power Performance and Safety (Proc. Conf. Vienna, 1987), 6 vols, IAEA, Vienna (1988).

[14] TAIT, W.H., Radiation Detection, Butterworth, London (1980).

[15] GRAMBOW, B., et al., "Chemical stability of a phosphate glass under hydrothermal conditions", Scientific Basis for Nuclear Waste Management (Proc. Symp. Boston, 1979), Vol. 2 (NORTHRUP, C.J.M., Jr., Ed.), Plenum Press, New York (1980) 109–116.

[16] DURAND, M., KAWASHIMA, R., ibid., pp. 375–379.

[17] FORSYTH, R.S. (Ed.), The Hot Cell Laboratory — A Short Description of Programs, Facilities and Techniques, Rep. STUDSVIK/NF(P)-86/29, Studsvik Energiteknik, Nyköping (1986).

[18] NATIONALE GENOSSENSCHAFT FÜR DIE LAGERUNG RADIOAKTlVER ABFÄLLE, Repository for High Level Waste: Construction and Operation, Rep. 85-04, Nagra, Baden, Switzerland (1985).

[19] Del Castillo, D., Dynamics and Transport in Rotating Fluids and Transition to Chaos in Area Preserving Non-twist Maps, PhD Thesis, Univ. of Texas, Austin (1994).

[20] KUANG, Guangli, et al., Lower hybrid current drive experiments and improved performance on the HT-7 superconducting tokamak, Nucl. Fusion **39** (1999) 1769.

[21] WlLLE, H., BERTHOLDT, H.O., Chemical decontamination of components and systems, Nucl. Eur. **8** 10 (1988) 41.

[22] DIAMOND, B.A., Binding of Lectins to the Cell Surface of *T. cruzi* (in preparation).

[23] VON DRASCHE, R., Acquired cell mediated immunodepression effects in acute Chagas' disease, J. Clin. Invest. (in press).

[24] REFORMATSKIJ, I.A., Laboratories for Work with Radioactive Substances, Atomizdat, Moscow (1979) (in Russian).

[25] PHILLIPS, S.M., Kernforschungsanlage Jülich, KOCH, D., Physikalisch-Technische Bundesanstalt, Braunschweig, personal communication, 1995.

[26] UNITED STATES DEPARTMENT OF ENERGY, Aerosol Fog System for Fixing Radioactive Contamination, Technology Deployment Fact Sheet (1999), http://www.hanford.gov/techmgmt/factsheets/deploys/fogger.htm.