

THE RESULTS OF A COORDINATED RESEARCH PROJECT ON THE SURFACE CONTAMINATION OF PACKAGES

PATRAM 2010

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Yongkang ZHAO (IAEA) *

Makoto HIROSE (NFT)

Presented by Jean-Yves RECULEAU (IAEA)



IAEA

International Atomic Energy Agency

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Summary

- Background
- CRP
- Meetings (CM in London and TM in Japan)
- TRANSSEC decision
- Conclusions

Background

- A coordinated research project (CRP) on the surface contamination of packages
 - conducted by the IAEA
 - in 2000-2003 (Final report IAEA-TECDOC No. 1449 of June 2005 - Radiological aspects of non-fixed contamination of packages and conveyances)
 - to determine whether the current requirements for surface contamination of packages remain adequate
- Deliberations to revise the regulatory limits on the surface contamination were followed.

Current Limits for Non-Fixed Surface Contamination in TS-R-1

- ***Current limits are based on “Fairbairn Model”:***
 - ***Beta emitters, low toxicity alphas: 4 Bq/ cm²***
 - ***Other alpha emitters : 0.4 Bq/cm²***
 - ***TS-R-1 2005 Ed. Para. 508***
- ***The model was adapted from workplaces, not transport specific scenarios.***
 - ***See IAEA Safety Series No.7 (1961)***

Surface Contamination of Nuclear Spent Fuel Shipments

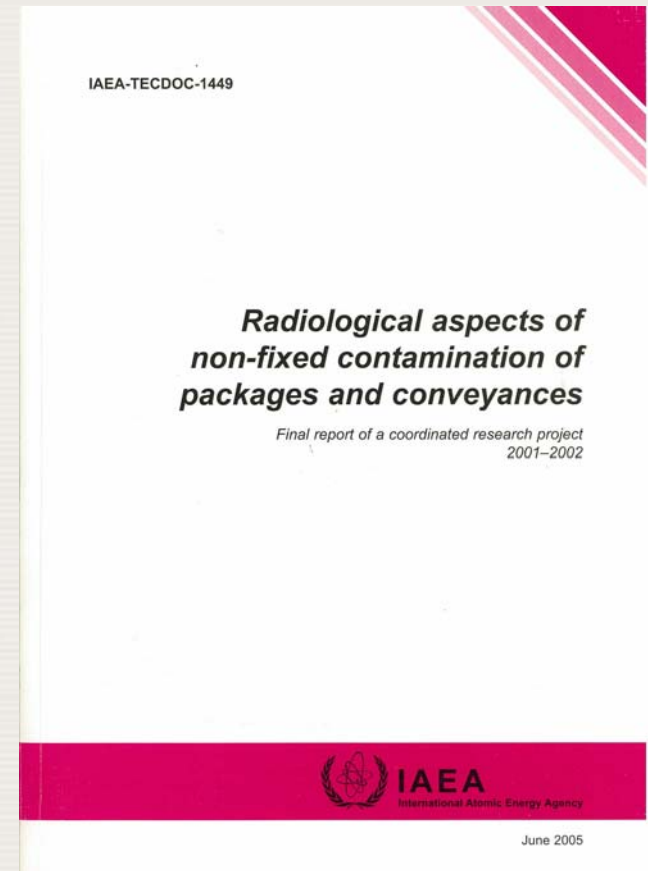
- ***1998: Contamination of rail wagons***
 - ***Mainly in France, Germany and Switzerland***
 - ***Spent fuel shipments stopped for years***
- ***Packages and conveyances were surface contaminated up to several thousands Bq/cm²***
 - ***Radiological risks to workers and public were negligible***

Coordinated Research Project (CRP)

- ***May 2000: TRANSSC recommended a coordinated research project to include:***
 - ***Causes and methods of reduction of contamination, and radiological impact***
 - ***Review of scientific basis for current limits***
 - ***Develop models to assess radiation doses from contamination***
 - ***MSs and IO participated: France, Germany, Japan, Sweden, UK, USA and WNTI.***

Coordinated Research Project (CRP)

- ***Meetings, model development and final report - 2001 to 2003***
- ***June 2005 – Publication of TECDOC-1449: “Radiological aspects of non-fixed contamination of packages and conveyances”***



Results of the CRP

- ***Basic Model developed: gives annual doses to workers and public from 1 Bq/cm² on package surface***
- ***Worker doses typically 3 orders of magnitude greater than public doses***
- ***Doses range over 7 orders of magnitude, depending on radionuclide. Typically:***
 - ***Beta emitters give doses in lower part of range***
 - ***Alpha emitters give doses in the upper part of range***
 - ***“Low toxicity” alpha emitters give doses at upper end of range***

Typical Results from the CRP-TECDOC



Consultants Meeting (CM-84) - 6-9 June 2006

- ***Held in accordance with a recommendation of TRANSSEC 12, to develop rationalized approach to package surface contamination***
- ***Terms of Reference included:
Developing a rationalized approach to determining the limits for non-fixed contamination on package surfaces***
 - ***MSs and IO participated: Belgium, France, Germany, Japan, UK, USA and WNTI***

CM-84 Discussions

- **Choices for moving forward:**
 - *Keep existing limits (4 and 0.4 Bq/cm²)*
 - *Move to radionuclide specific approach, using Basic Model results and annual dose criterion*
 - *Keep existing limits with an option use radionuclide specific limits*
- **Concerns:**
 - *Difficulty in measurement?*
 - *need to know the mixture of radionuclides*
 - *Higher limits for beta emitters*
 - *build up of contamination?*
- **However:**
 - *Would allow for dose optimization?*
 - *Would be consistent with IAEA approach for: A₁ and A₂, Clearance, Exemption, D-Values?*

CM-84 Dose Criterion

- *Basic Model gives annual dose from unit contamination on package : mSv/y per Bq/cm²*
- *For radionuclide-specific dose-based limits need to specify an annual dose criterion*
- *Some workers may be considered members of the public*
 - *1 mSv/y or 0.3 mSv/y ?*

CM-84 Dose Criterion

- 1. *Keep existing limits:***
 - a. As they are***
 - b. And allow factor of 10 for reporting requirements***
- 2. *Move to dose-based system using Basic Model***
- 3. *Keep existing limits, with an option for dose-based limits for spent fuel packages.***

Majority view for option 2 with a criterion of 0.3 mSv/y.

Some participants preferred option 1.

Consultants Meeting, London 6-8 February 2007

- ***Held in accordance with a recommendation of TRANSSEC to examine the issues identified by CM-84.***
 - ***Participants: Germany, UK, USA and WNTI***
- ***Objectives:***
 - ***Follow up on CM-84 and prepare draft recommendations***
 - ***Identify preferred option and consider impact on other parts of the Regulations***
 - ***Propose a dose-based system that is practical***

CM London Outcomes (1/3)

- ***Dose Criterion : 1 mSv/y***
 - ***The overall conservatisms of the Basic Model***
 - ***Derived limits for the most restrictive radionuclides similar to current values***
- ***Range of derived limits:***
 - ***Lower boundary – 0.4 Bq/cm²***
 - ***Upper boundary – 100 Bq/cm²***
- ***Proposal recommended by the meeting:***
 - ***Retains the option of using the current limits***
 - ***Introduces the option of using radionuclide-specific limits with lower and upper boundaries for exclusive use shipments only.***

CM London Outcomes (2/3)

- ***Effects of the proposed system on other aspects of the Regulations;***
 - ***Definition of contamination – No change***
 - ***SCO definitions – No change***
 - ***Conveyance (internal surfaces) – No change as under exclusive use no limits currently specified***
 - ***Conveyance (external surfaces) – No change***
 - ***Low toxicity alpha emitters – No change***

CM London – Issues for discussion (3/3)

- ***Use of average contamination level
(with the current limit or the radionuclide specific approach)***
 - ***The Basic Model assumes a uniform contamination level over the package.***
 - ***The same principle would also apply to the use of the current limits***
 - ***Area of the package surface in excess of the limit would therefore be in compliance, provided the average contamination level over the whole surface is below the limit***

TM Japan – November 2008

Outcomes of the meeting

1) Radionuclide specific limits should be Subject to:

- Multi-lateral approval,
- Applied to Irradiated Nuclear Fuel (INF) packages with an activity greater than 10^5 A2,
- List in column 6 of Table 2 of the latest Regulations, based on 0.3 mSv dose criterion for CRP results based on INF packages with a lower boundary of 0.4 Bq/cm².

TM Japan – November 2008

Outcomes of the meeting

- 2) There was consensus that the numbers for radionuclide specific limits should be contained within the regulations and guidance will be given on the application and restrictions of applying this approach.
- 3) There was a consensus to use the current maximizing method where the maximum value found was compared with the contamination limit defined in the Regulations.

TM Japan – November 2008

Outcomes of the meeting

- 4) It was agreed to have a capping method to provide a ceiling value, but the mechanism would need to be proposed.
- 5) On measurements techniques it was agreed to produce information on the use of radioisotope fingerprinting to make easier implementation,
- 6) Proposed texts were developed for paras 401, 402, 403, 404, 508, 509, 513, 520, 820, 822, 832 (TS-R-1 2005 Ed.).

Decision of TRANSSC

- TRANSSC 19 (October 2009) addressed the issue of contamination and reviewed the suggestions made by the CRP and previous meetings. TRANSSC concluded that
 - the surface contamination issue is not accepted for regulatory change at this time
 - mainly because simple regulations and regulatory limits were preferred and practicability of radionuclide specific control were of concern.
 - The current regulations were considered to provide adequate safety.
 - Although differences in opinion between MSs, proposed consensus changes to the Regulations subject to further detailed review and the normal revision process for IAEA documents.

Conclusions

- Since events in 1998, it was recognized that the issues related to contamination control of package and conveyance needed to be re-evaluated.
- The existing conservative limits may lead to operational problems, non-compliance issues, and public perceptions of significant health risks when the actual risks are very low.
- Although these efforts do not result in regulatory changes at this time, they did demonstrate the resolution path for the pb.

Conclusions

Some important outputs are:

- 1) New dose-based approach (Basic Model) was developed specifically for the transport of radioactive material;
- 2) The conservatism of current limits was confirmed by the new model;
- 3) Optimization was implemented when assessing the surface contamination limits;
- 4) The reasons of recontamination during transport were recognized and measures coping with the problem were developed;
- 5) The radionuclide specific limits were suggested which are supposed to be the optimized approach for the surface contamination control.

Conclusions

Still some outstanding questions are not answered yet which are the obstacles to the application of the radionuclide specific limits and need further work:

- 1) Certain uncertainties inherent to new model may not be conservative like the resuspension rate. The external doses due to beta and neutron emitters, and the influence on the skin dose or on ingestion of 'hot spots' are not taken into account.
- 2) The measurements techniques for specific radionuclides approach need further work to make the method easier to be implemented.

WORKING TOGETHER