Introduction of "Work Management to Optimise Occupational Radiological Protection at Nuclear Power Plants"

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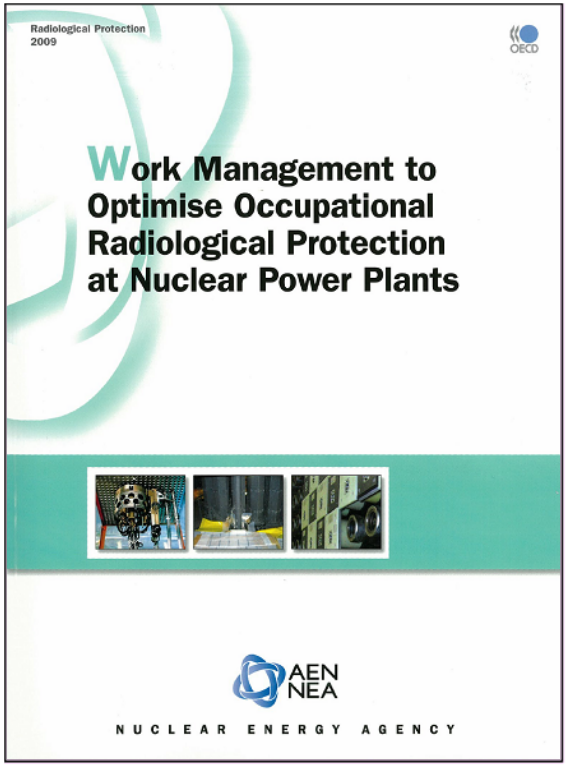
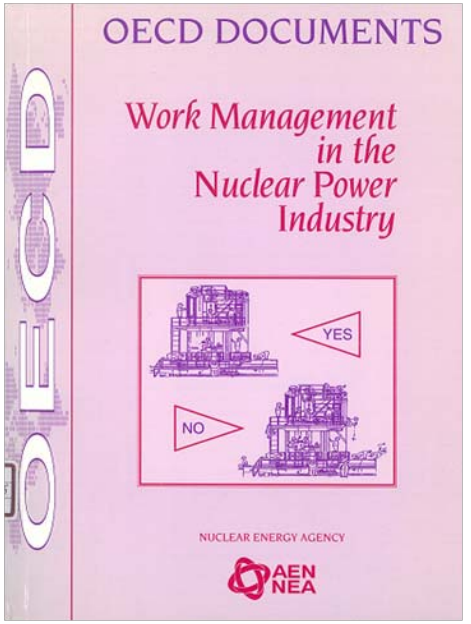


Background

1997: "Work Management in the Nuclear Industry" (Pinkbook) was issued.

- This report provides work management principles from planning to preparation, implementation, assessment and feedback with the abundant examples..



Background

- **Pinkbook has been put to practical use in NPPs worldwide to reduce dose and cost.**

  "The ISOE Expert Group Report on Work Management at Nuclear Power Plants issued in 1997 has been a key resource to US utilities in the planning, execution and analysis of refueling outages."
  (David W. Miller, ISOE Symposium at Essen, 2006)

- **Ten years has past, and knowledge, technologies and experiences in occupational radiation protection has been obtained.**

➡ **2006: Revision of Pinkbook was decided at the Steering Group Meeting.**

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EGWM
Expert Group on Work Management

EGWM was launched in March 2007.

- **Chair : Mr. W. Mizumachi, ISOE Chair**
- **Vice-chair: Ms. C. Schieber, ISOE ETC**
- **Participants from ISOE member countries**

- Website for information exchange was constructed in JNES.

- The revised “Greenbook” was approved at Management Board Meeting in 2008, and issued in July 2009.

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EGWM member

Mr. W. Mizumachi, Japan
Ms. C. Schieber, France
Mr. B. Ahier, OECD/NEA
Ms. H. Bertin, France
Mr. B. Breznik, Slovenia
Mr. W-C. Choi, Korea
Mr. P. Deboodt, IAEA
Dr. R. Doty, United States
Mr. F. Drouet, France
Mr. F. Garrote, Spain
Dr. V. Glasunov, Russia
Dr. Y. Hayashida, Japan
Mr. S. Hennigor, Sweden
Mr. M. Kobayashi, Japan
Mr. M. Lunn, United Kingdom
Dr. D. Miller, United States
Dr. S. Na, Korea
Mr. K. Ohr, United States
Mr. G. Renn, United Kingdom
Mr. V. Simionov, Romania
Mr. D. Steinel, Germany
Mr. S. Zorrilla, Mexicoa

Also, contribution from ISOE member (discussion, examples)

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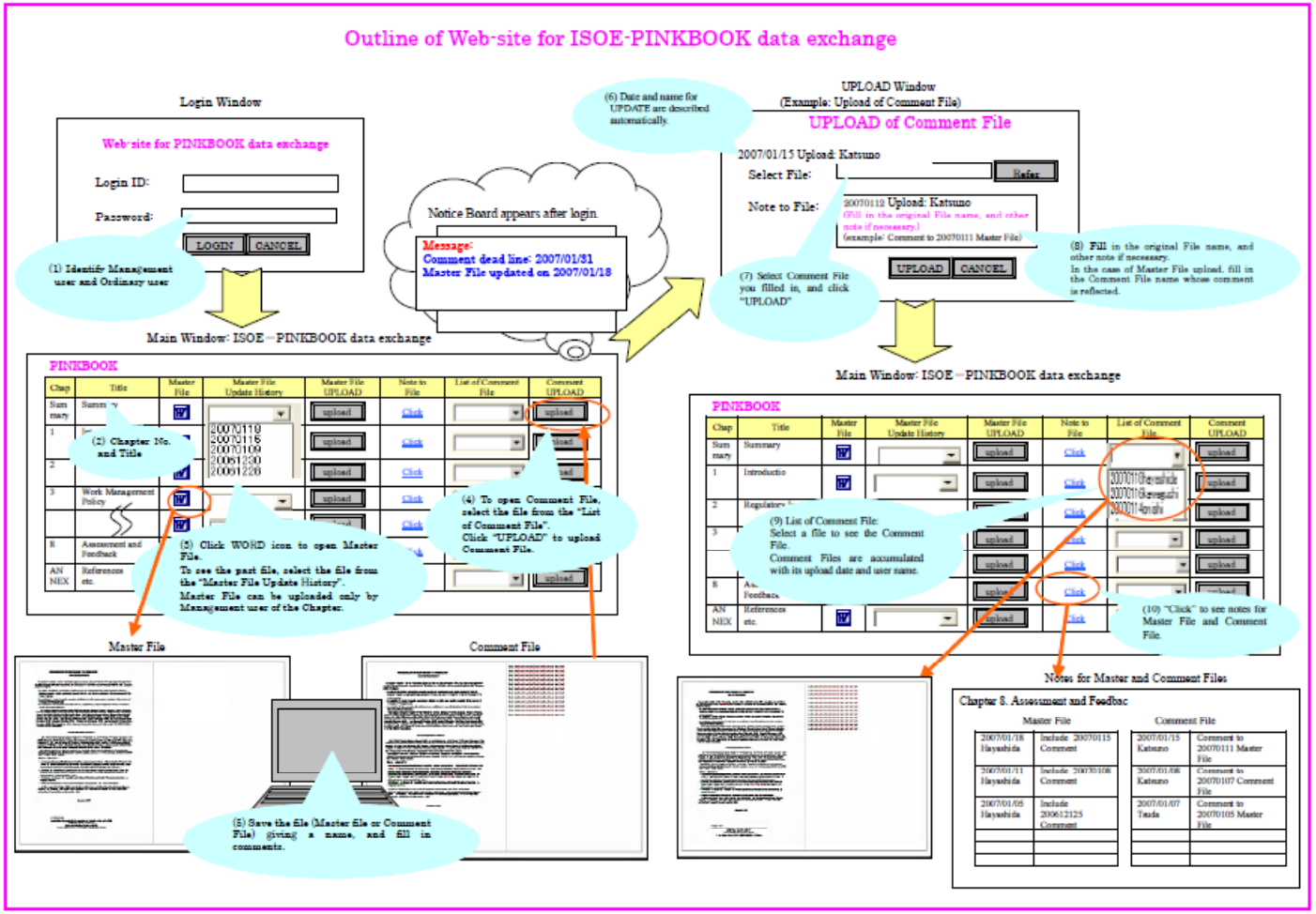
Website for information exchange



Contents of Greenbook

1. Introduction
2. Regulatory aspects
3. ALARA management policy
4. Worker involvement and performance .
5. Work planning and scheduling
6. Work preparation
7. Work implementation
8. Work assessment and feedback
9. Ensuring continuous improvement
10. Conclusions

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Outline of Chapter 1
- Introduction -

The philosophy of work management is a continuous loop that consists of planning and scheduling, preparation, implementation, assessment and follow-up in order to make the overall work progressively optimised.

Work management elements and their iterative nature

Outline of Chapter 2
- Regulatory Aspects -

The main principles of radiation protection are established at the international level.

National regulations are elaborated to provide a radiological protection framework consistent with these principles.

Within this framework, utilities should also develop and set their own internal procedures and develop targets to manage individual and collective exposures on a case by case basis.

Occupational dose limits (whole body)	Country
20 mSv in one single year	Germany, Italy, the Netherlands, Pakistan,[6] Romania, Slovenia,[6] United Kingdom
20 mSv/year per 12 rolling months	Belgium, France
100 mSv/5 years and 50 mSv per any single year	Armenia, Brazil, Bulgaria, Canada, China, Czech Republic, Finland, Hungary, Japan, Korea, Lithuania, Russian Federation, Slovak Republic, South Africa, Spain, Sweden, Switzerland
50 mSv/year	Mexico, United States

Regulatory occupational dose limits (whole body) in ISOE participating countries

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Outline of Chapter 3
- ALARA Management Policy -

ALARA is usually considered as a way of thinking, a philosophy, continuously questioning whether all reasonable action has been done to reduce exposures.

To foster the practical implementation of this philosophy, it is necessary to create specific organisations, distribute individual and collective responsibilities regarding ALARA and establish common rules to be applied.

Outline of Chapter 3
- ALARA Management Policy -

-Plant ALARA program

"A structured ALARA program should be developed and implemented at all nuclear power plants."

- Roles and responsibilities for the implementation of ALARA

"All workers and managers must share the responsibility for the implementation of the ALARA program in their field of activity."

- The ALARA Committee and other specific ALARA organisations

"According to a utility's organisation, ALARA Committees might be established at various levels"

- ALARA reviews

"ALARA reviews should be performed by teams composed of RP staff and technical specialists relevant to the job under review."

- Industry ALARA guidance

"Some utilities have developed their own internal RP guidance"

Outline of Chapter 4
- Worker Involvement and Performance -

- ALARA cannot be achieved without worker involvement. There are many features that contribute to worker performance and which can be supported or improved by worker involvement.
- By engaging the worker in the task undertaken, the worker is more likely to be motivated to perform the job to the best of his/her abilities. This will be reflected in lower job doses and higher job quality.
- In order to realise this, top management must also be committed to this process and favour a structure that encourages and takes into consideration the feedback of workers.

Outline of Chapter 4
- Worker Involvement and Performance -

-Worker performance contributing to ALARA implementation

"To use the knowledge and experience of the workforce, it is essential to actively engage the workforce in decision-making processes."

-Education and training to implement the ALARA approach

"Education deals with the concepts and good practices in radiation protection and informs personnel of their responsibility to maintain exposures ALARA."

-Factors contributing to worker involvement

-Role of management
-Involving worker in planning, preparation and ALARA review
-Information and communication
-Additional incentives to motivate and involve workers"

Outline of Chapter 5
- Work Planning and Scheduling -

- Work activities in nuclear power plants must be carefully planned to ensure that radiological protection is optimised, recognising their multi-disciplinary nature.
- The objective of this section is therefore to identify the key elements in planning and scheduling that permit work at nuclear power plants to be accomplished efficiently and the radiological protection of workers to be optimised.
- Particular attention should be paid to the optimisation of outage duration in the planning stage.
- Work planning and scheduling should use feed-back experience and benchmarking to ensure that the most effective approaches are implemented.

Outline of Chapter 5
- Work Planning and Scheduling -

-Optimising outage duration

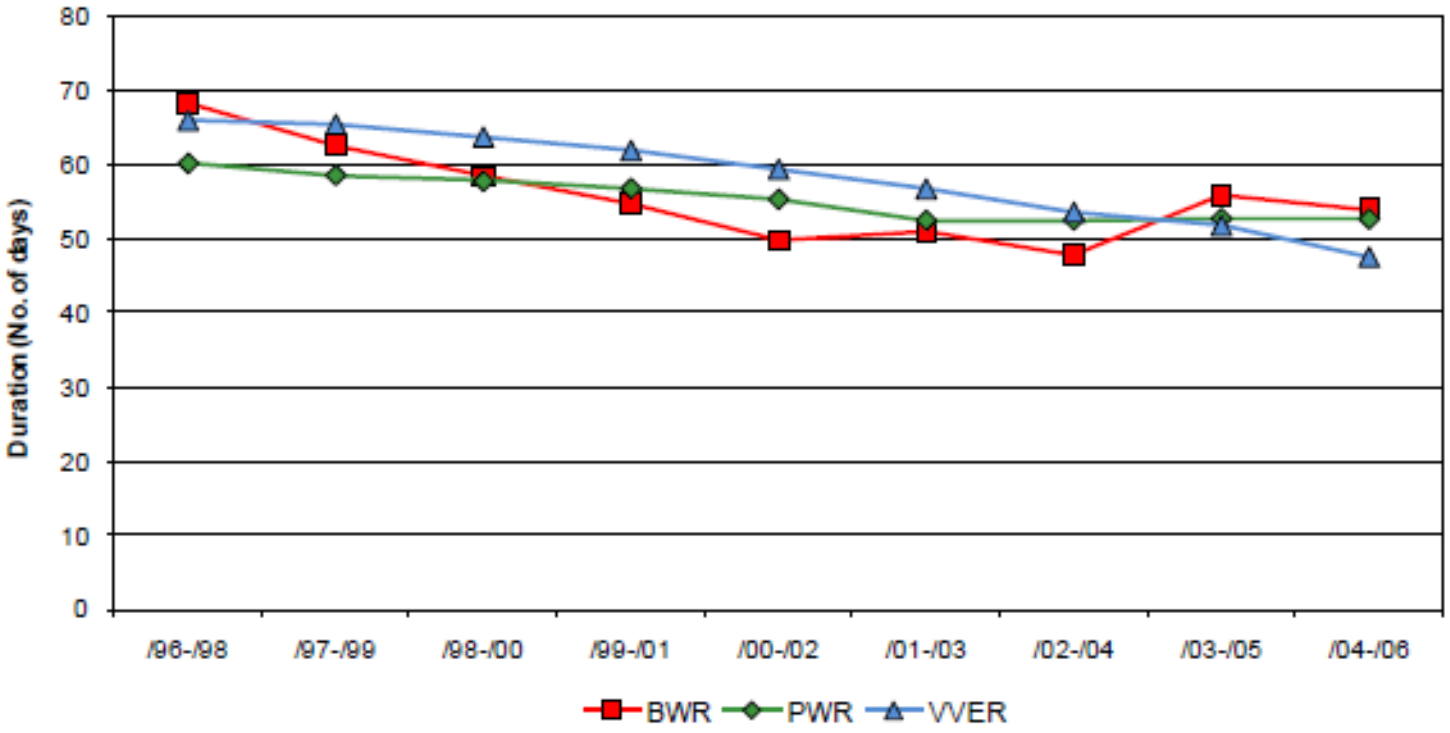
Work selection:

Selection of work will determine the duration of the outage and impact dose and cost.

Technically appropriate work which contributes to nuclear safety and equipment reliability should be scheduled.
However, other modifications, new installations or changes to existing systems may also be suggested by those initiating the work.

Outline of Chapter 5
- Work Planning and Scheduling -

Average outage duration by reactor type



Outline of Chapter 5
- Work Planning and Scheduling -

Moreover, the following is dealt with in this chapter:

- The job planning process.
  During planning, it is important to have a clear understanding of all work to be done in an area, and how various jobs are related.
- Work process control systems
- Job planning for high dose jobs
- Benchmarking
  The sharing and pooling of experience across the industry is an important factor in minimising outage duration.
- Personnel preparation

Outline of Chapter 6
- Work Preparation -

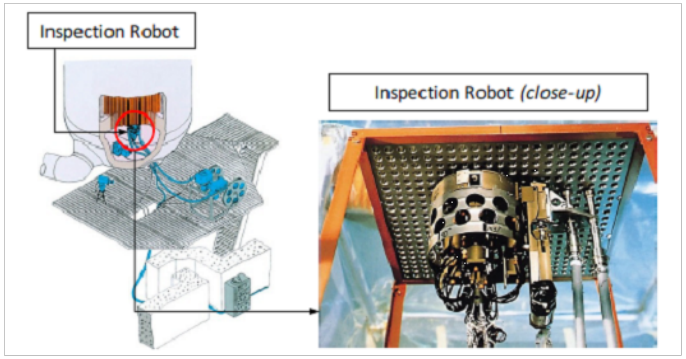
- In order to optimise radiological protection, factors affecting the source term, the duration of work and the number of workers need to be addressed as part of the work preparation.

- This chapter focuses on the technical and operational aspects of this preparation, with particular focus on the source.

Outline of Chapter 6
- Work Preparation -

The following content is addressed in this chapter.

- **Source term reduction techniques**
  - **water chemistry control, filtering, decontamination, shutdown operation etc.**
- **Exposure reduction techniques such as shielding and transfer of work away from sources**
- **Tools and equipment such as hot workshop and robotics**
- **Personal protective equipment**
- **Work site optimisation and job co-ordination**



Outline of Chapter 7
- Work Implementation -

- During work implementation, it is essential to ensure an efficient control of radiation protection "in the field".
- This includes organisational aspects such as the presence of radiation protection personnel and specific procedures, as well as technical aspects, such as the use of remote monitoring, access control systems, etc.
- As many people will be involved in the work process controls, it is important to clearly establish the responsibilities of each.
- It is also important to create a flexible organisation to co-ordinate work and to resolve any problems encountered.

Outline of Chapter 7
- Work Implementation -

Examples:

- EDF in France has experimented during refuelling outage with the use of a full time reactor building co-ordinator, who is the central contact point for any problems encountered.

- US nuclear power plants typically use "Make-it-happen" managers to assure continuous monitoring and field-coaching of the critical path work.

Moreover, the following is dealt with in this chapter:

- Access control systems

- Remote monitoring systems

etc.

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Outline of Chapter 8
- Work Assessment and Feedback -

- Assessment and feedback is the final stage of work and, at the same time, the first stage of the continuous loop.

- Therefore, the lessons-learned should be collected carefully and exchanged not only with the workers but also with the plant, industry and international colleagues.

- Continuous improvement can be achieved by sharing and using experiences.

- The entire system of management implementation should be audited periodically to assure that it is functioning properly.

Outline of Chapter 8

- Work Assessment and Feedback -

This chapter describes importance about the following items, and the related examples are shown.

- **Job Review and Follow-up**
- **Operational Experience Databases**
- **Comparison of ALARA practice**
- **Sharing Feedback Experience**
- **Programme Audits**

Outline of Chapter 9
- Ensuring Continuous Improvement -

- This chapter was added considering the constraction of a new nuclear power plant.

- There are lot of exposure reduction measures which become very effective by considering it from the design stage.

- This chapter summarises noteworthy technologies and work management aspects deemed relevant for ensuring continuous improvement in occupational radiation protection, with special consideration for new nuclear build (design and construction).

- However, the majority of these technologies and work management aspects are also applicable to further exposure reduction in plants currently in operation.

Outline of Chapter 9
- Ensuring Continuous Improvement -

Technologies and work management aspects in this chapter include:

- **Source Term Reduction in the Design and Construction of New NPP.**
  - **Clean Plants**
    (to keep the quantity of CP that could be brought into the reactor core and activated to the lowest possible level.)
  - **Adoption of low cobalt materials**
  - **Surface treatment within piping**
  - **Installation of filters**
- **Shielding**
- **Remote Monitoring Systems**
- **Robotics Technologies**
- **Maintenance-free Components in New Nuclear Power Plants**
- **Work Management Aspects in New Nuclear Power Plants**
  - **Training**
  - **Feedback (benchmarking**
  - **Risk-informed design**

Summary

- This book provides practical guidance in the key areas of work management to optimise occupational radiation protection.

- The book is distributed to ISOE member, and can be download from ISOE network website.
  Some countries including Japan will make a native language version, so it is available in many countries.

- The revised edition is expected to be used effectively in each country as well as the first edition.

- It is effective for the new nuclear power plants which is expected to increase in the future in the age of nuclear power Renaissance, and it will contribute to the exposure reduction in the world.

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