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New IAEA Training Materials For NORM Related Activities

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Purpose of Talk

To present you with an overview of training materials that the Agency has been developing over a period of several years.

We hope to pique your interest in this work and stimulate further development of training for those who are engaged with management of NORM.

Challenges

Tajikistan, Abandoned Mine

Tajikistan, Village Beside Mine

Uranium mining and processing operations produce significant quantities of radioactive mill tailings and other residues that remain after the decommissioning and closure of the operation.

Some countries have both legacy uranium mining sites created at a time when regulatory supervision was weak or absent, and are struggling to regulate new uranium production facilities.

Some sites have been abandoned by the original operators and lack any or effective institutional control (IC). Providing IC of such sites based on a sound safety assessment is a challenge some countries face.

Challenges (cont'd)

Remediation challenges arise from past practices that resulted in poorly sited and designed tailings facilities which, in some cases, were not remediated and closed, or not remediated and closed in accordance with current international standards.

Mozambique

Legacy sites are sometimes located in countries that do not have sufficient infrastructure to provide regulatory supervision of such sites, nor technical capacity for their remediation.

Background

About 7 years ago, the IAEA Division of Radiation, Transport and Waste Safety started a systematic programme for development of training materials for safety aspects of uranium production and for remediation of legacy uranium production sites.

This work was needs driven – requests for assistance from Member States and gap analysis were the main drivers.

The training materials:

- Consist of a 7 module package with about 140 lectures, including comprehensive E-learning materials.
- Have been developed to provide for application of relevant IAEA Safety Standards, and to incorporate good practices from the Member States.
- Incorporate case studies, as well as regulatory and technical experiences from national sources.

Scope and Objectives

These training materials were developed:

1) To address safety aspects of the life cycle of a uranium production facility, including prospecting and exploration.
2) To disseminate knowledge on practical intervention techniques to reduce public doses at uranium mining and milling legacy sites.
3) To strengthen the capacity of national authorities for regulatory oversight of these facilities, including review of remediation plans and activities for uranium production sites.

The broad objectives of the programme were to promote safe and sustainable development of uranium resources for planned and operating facilities, and to prevent “legacy” site situations arising in the future.

Process for Training Materials Development

The process followed for development of these training materials has been to:

1) Engage experts to design and develop the training packages by means of consultancies and home based assignments.
2) Design the materials so that they could be used in a modular fashion, to suit the needs of the particular situation.
3) Field test the materials at pilot events (workshops and Technical Meetings).
4) Refine/improve the materials based upon experience and feedback from pilot events.

Training Modules

Safety of Uranium Mining and Processing

Module 1: General Overview (17 lectures).

Module 2: Prospecting, exploration, construction and operation (20 lectures).

Module 3: Decommissioning, Closure and Long-Term Monitoring and Surveillance (22 lectures).

Module 4: Remediation of Uranium Mines and Processing Sites (26 lectures).

Module 5: Authorization and Inspection of Uranium Mining and Processing Activities (20 lectures).

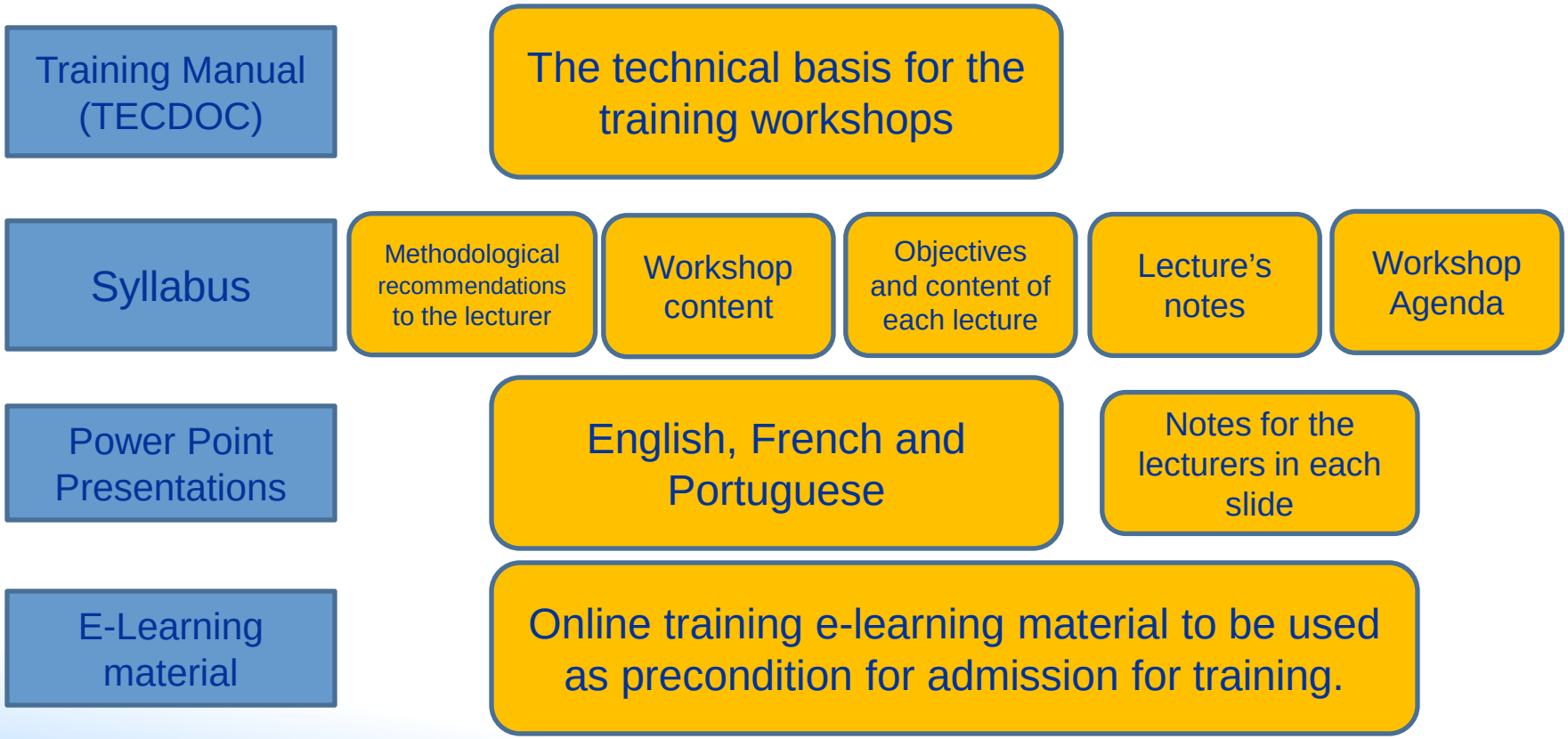
Training Modules (cont'd)

Safety of Uranium Mining and Processing:

- Module 6: Practical Intervention Techniques to Reduce Public Doses at Uranium Mining and Processing Legacy Sites (20 lectures).
- Module 7: Review of Remediation Plans and Activities for Uranium Mining and Milling Sites (24 lectures).

General Structure of Training Materials

The seven modules have for the most part been developed with the following structure.



Sample Output – Training Manual

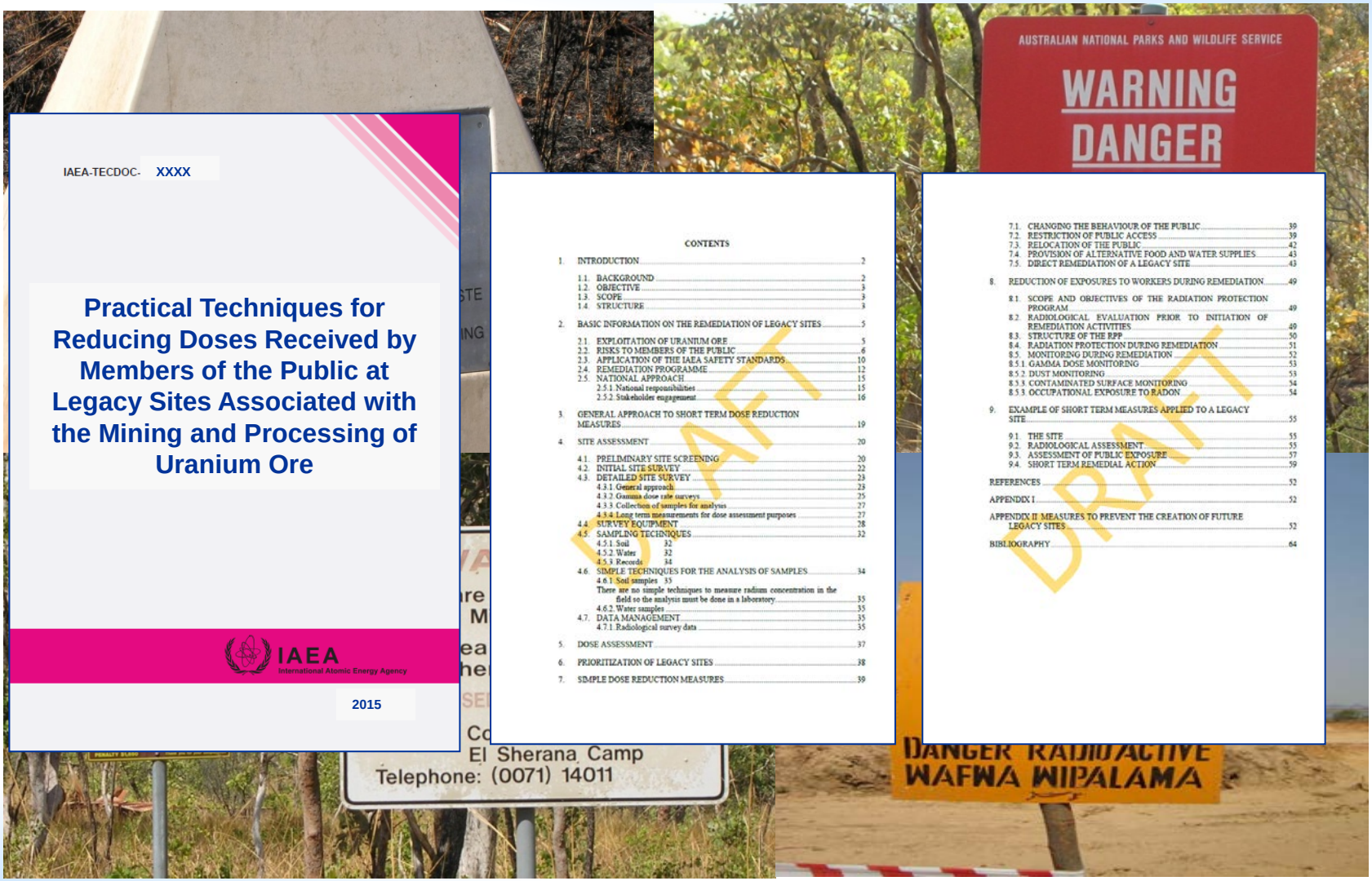
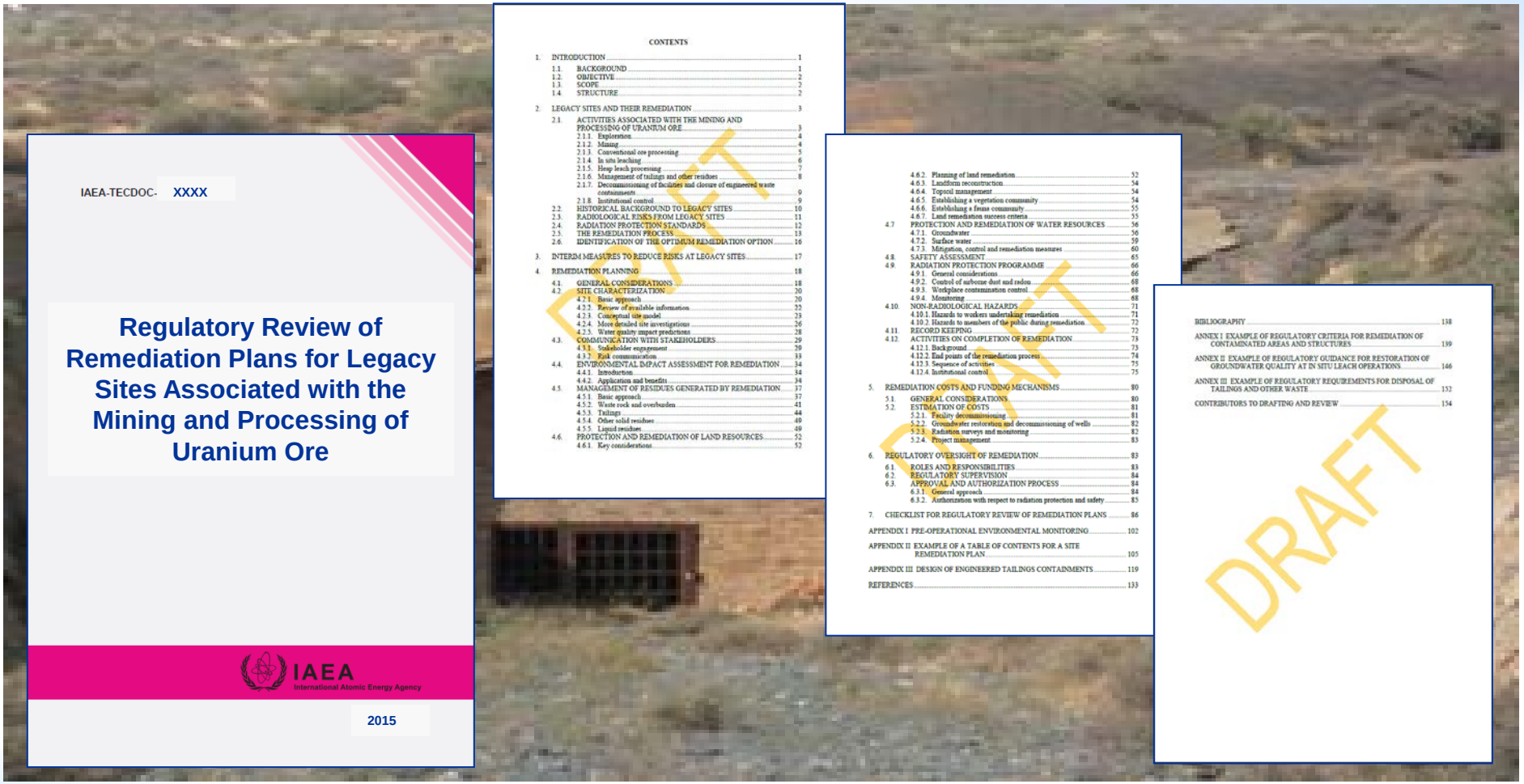
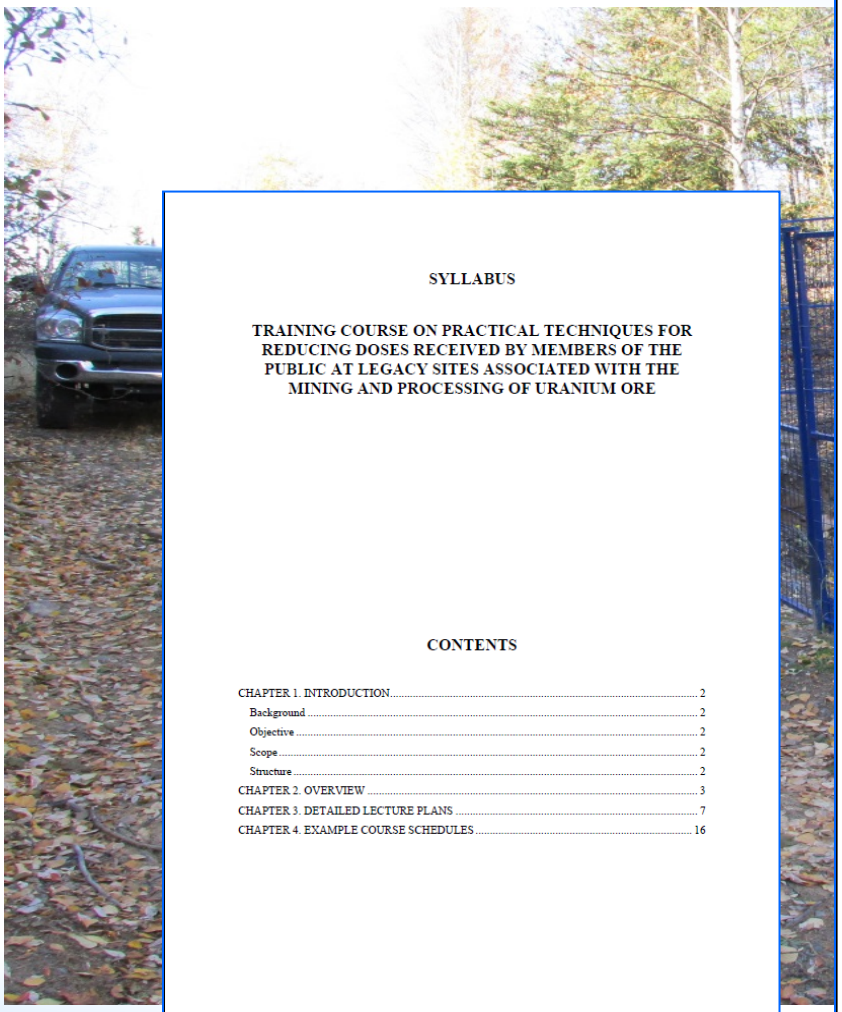


Figure 16: Examples of radiation warning signs at legacy sites (Australian and Zambian case studies).

Sample Output – Training Manual



Sample Output – Syllabus and Agenda



SYLLABUS

TRAINING COURSE ON PRACTICAL TECHNIQUES FOR REDUCING DOSES RECEIVED BY MEMBERS OF THE PUBLIC AT LEGACY SITES ASSOCIATED WITH THE MINING AND PROCESSING OF URANIUM ORE

CONTENTS

DRAFT AGENDA FOR A ONE-WEEK TRAINING WORKSHOP

Project B.1. Practical Intervention Techniques to Reduce Public Doses at Uranium Mining and Milling Legacy Sites

	Monday	Tuesday	Wednesday	Thursday	Friday
08.30-9.30	Opening statements (IAEA & MS representatives) House Keeping	Development of a national inventory of legacy sites (L-7) (30 minutes)	Exercise 5: Simple gamma radiation dose calculation (60 minutes)	Case study presentation (L-18) (South Africa and Mozambique)	Exercise 6.- Presentation and discussion of the group exercise results by group (cross-cutting review of each groups results)
	Round table introduction (everyone)	Exercise 2: Possible Sources of Resources and Expertise			
9.30-10.30	Workshop overview and introduction (L-1) (30 minutes)		Exercise 6: Planning initial site visit (60 minutes)	Case study presentation (L-19) (Germany, Canada, USA) (60 minutes)	CONTINUATION
	Introduction to radiation and radiation protection (L-2) (30 minutes)	Exercise 3: Stakeholder Engagement and Communication			
10.30-10.45	Break				
10.45-11.45	Historical overview of legacy sites (L-3) (30 minutes)	Exercise 3: Stakeholder Engagement and Communication (continued)	Exercise 7: Field sampling and monitoring equipment (60 minutes)	Case study presentation (L-20) (Australia) (60 minutes)	Exam/test An overview of simple intervention techniques to reduce public doses, Part 1 – non-physical aspects (L-15)
	Risks to the public arising from legacy uranium sites (L-4) (30 minutes)	Initial site visits (L-8) (30 minutes)			
11.45-12.45	Existing exposure situations (L-5) (30 minutes)	Overview of the Site Characterization (L-9) (including non-radiological aspects) (30 minutes)	Prioritisation of sites and public risks (L-12) (60 minutes)	Exercise 4	Workshop wrap-up Workshop recommendations for improvements Closing remarks
	Regulatory aspects: authorization and inspection of remediation (L-6) (30 minutes)				
12.45-14.00	Lunch break				
14.00-15.00	Exercise 1 Pre-Course assignment Member State Reports (10 minutes presentation based on IAEA template) *Time slot adjustable to amount of presentations*	Simple Radiological Survey, Dose Assessments and Data Reduction (L-10) (60 minutes)	Remediation objectives and criteria (L-14) (60 minutes)	Exercise 5	An overview of simple intervention techniques to reduce public doses, Part 2 – physical aspects (L-16)
15.00-16.00		Simple Sampling and Analysis Techniques (L-11) (60 minutes)	Radiation protection programmes for workers (L-13) (60 minutes)		
16.00-16.15	Break				
16.15-17.15	Continuation of Pre-Course assignment	Exercise 4: Non-radiological issues (60 minutes)	Exercise 3	Exercise 5	Prevention of future legacy sites (L-17)

Additional comments:

- Presenters would preferably be experts with both regulatory and hands on field experience
- MS reports: IAEA would provide a template for the presentations
- Develop Excel spreadsheets for calculations and for pre- and post-course questionnaires
- Participants should bring laptops
- Exam course evaluation: A short multiple choice (20-30 questions) would be of use to focus the attention of the participants during the course.

1. Pre-course assignment,

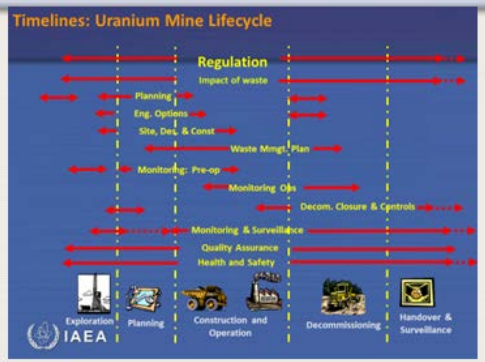
Topics under Module 6: Practical intervention techniques to reduce doses at legacy sites

Twenty one presentations and lectures notes were elaborated.

1. Workshop overview and introduction
2. Introduction to radiation and radiation protection
3. Historical overview of legacy sites
4. Risks to the public arising from legacy uranium sites
5. Existing exposure situations (GSR Part 3)
6. Regulatory aspects: authorization and inspection of remediation
7. Development of a national inventory of legacy sites
8. Issues to be considered in the initial site visits
9. Overview of the Site Characterization. (including non-radiological aspects)
10. Simple Radiological Survey, Dose Assessments and Data Reduction
11. Simple Sampling and Analysis Techniques
12. Prioritisation of sites and public risks
13. Radiation protection programmes for workers
14. Remediation objectives and criteria
15. An overview of simple intervention techniques to reduce public doses. (Part 1)
16. An overview of simple intervention techniques to reduce public doses. (Part 2)
17. Prevention of future legacy sites
18. Case study presentation (South Africa studies and Mozambique)
19. Case study presentation. (US, Canada, Germany)
20. Case study presentation. (Australia)
21. Case study presentation. (China, Zambia)

Example of Presentation Materials (PP Slides)

The lifecycle of U mining and milling activities



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Lecture 5: Life cycle and graded approach

Mesure du radon à court terme

- À l'aide d'instruments électroniques
- Efficace pour l'étude des concentrations élevées de radon dans les maisons
- Sur une période d'une heure jusqu'à dix jours
- Les concentrations fluctuent au fil du temps, de sorte qu'ils pourraient ne pas être fiables pour estimer les concentrations moyennes de radon à long terme

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Lecture 10: Simple Radiological Survey, Dose Assessments and Data Reduction 20

Radon short term measurements

- Using electronic instruments;
- Effective for investigating high radon concentrations in homes;
- Over periods from an hour up to ten days;
- Concentrations fluctuate over time, so they could not be reliable when estimating long term average radon concentrations.

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Lecture 10: Simple Radiological Survey, Dose Assessments and Data Reduction 20

Rystkuil Site

Figure 4: Rystkuil Incline Shaft, Ore Drums and Stockpiles

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Lecture 18: Uranium Legacy Site Case Study: Republic of South Africa and Republic of Mozambique 12

...acy sites - sources of risk

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Lecture 5: Existing exposure situations

Medidas de Radônio de Curta Duração

- Usando instrumentos eletrônicos
- Efetivo para investigar valores altos de concentração de radônio nas casas
- Por períodos de uma hora a 10 dias
- Concentrações flutuam ao longo do tempo, portanto não são confiáveis para estimar médias de concentração no longo prazo

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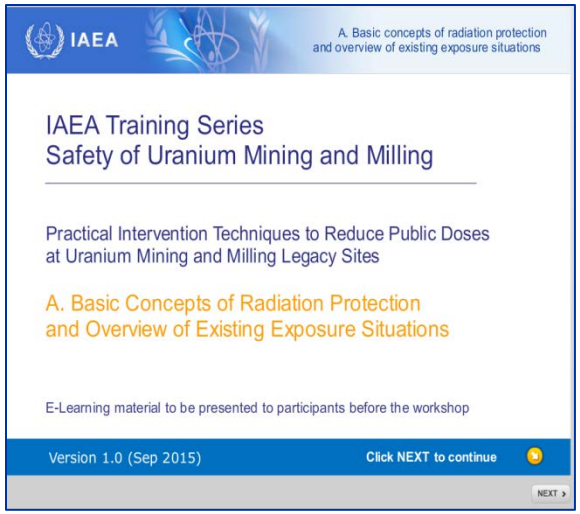
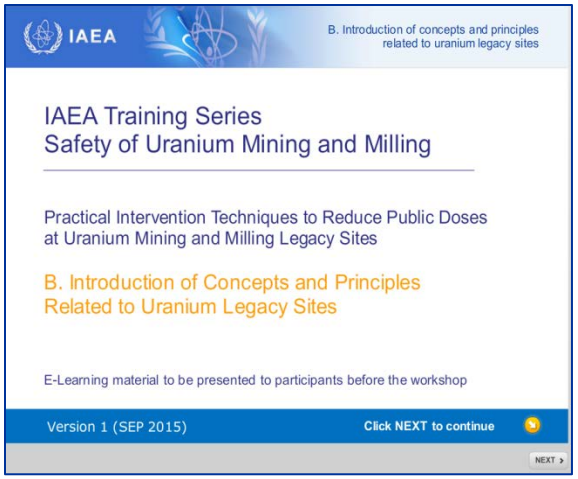
Levantamento Radiológico Simples, Avaliação de Dose e Redução dos Dados 20

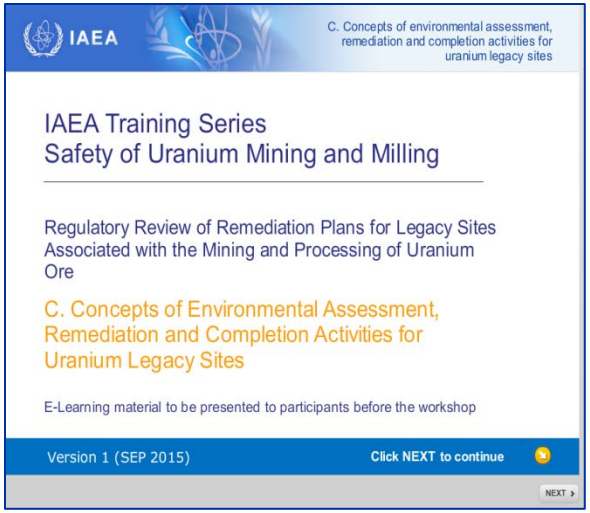
Example: E-learning Materials

E-learning materials - three modules relating legacy site remediation

Designed to be used as preparatory materials for workshop participants (i.e., before they come to workshop).







Example for Content – Checklist and Table of Contents for a Site Remediation Plan

Check List for the Regulatory Review of the Remediation Plan

APPENDIX II

EXAMPLE OF A TABLE OF CONTENTS FOR A SITE REMEDIATION PLAN

Headings can be deleted or additional headings inserted to suit the type and condition of the site for which the remediation is being planned.

Independent Expert Review of Training Materials

Technical Meeting to review the draft technical document and training materials on:

Review of Remediation Plans and Activities for Uranium Mining and Milling

Vienna, 9–13 Mar 2015

Participation of 13 experts from:	
USA	Netherlands
Australia	Portugal
Germany	United Kingdom
France	Tanzania
Mozambique	

Consultancies and Home Based Assignments

- Consultancy in Vienna 16–20 Mar 2015 to incorporate recommendations from March 2015 Technical Meeting on draft training materials.
- Home Based Assignment (HBA) to assist the IAEA with reviewing and editing the draft TECDOC on "*Review of Remediation Plans and Activities for Uranium Mining and Milling Sites*", 4- 19 May 2015.
- HBA to develop, prepare and finalize the editing of the MS Power Point presentations of the French and Portuguese versions of the training materials, May – June 2015.

Pilot Event for Field Testing

Regional Training Workshop on Practical Intervention Techniques to Reduce Public Doses at Uranium Mining and Milling Legacy Sites

Centurion, South Africa, 15–19 June 2015 in **English** (TR-49588).

Participants (20) from 9 Member States**:**

Egypt, South Africa, Tanzania, Sudan, Nigeria, Malawi, Zambia, Botswana, Sudan

Experts from**:** IAEA, Canada and the Netherlands

Feedback: Participants were active and expressed positive feedback. Suggestions for small improvements were received - for the most part feedback indicated that the material presented was appropriate and of sufficient detail.

Pilot Event for Field Testing

Workshop on Practical Intervention Techniques to Reduce Public Doses at Uranium Mining and Milling Legacy Sites

Vienna, Austria, 28 Sept – 2 Oct 2015, **in Portuguese** (TR-48454).

Participants (9) from 3 Member States: Angola, Brazil and Mozambique.

Experts from: IAEA, Brazil and Portugal

Feedback: Participants were active and expressed positive feedback and acknowledged the benefit of having training in their own language, allowing deeper discussions. It was judged that more time was needed to get through all of the material.

Pilot Event for Field Testing

Workshop on the Review of Remediation Plans and Activities for Uranium Mining and Milling Sites

Rabat, Morocco, 12–16 Oct 2015, **in French**.

Participants (19) from 8 Member States**:** Cameroun, Central Africa Republic, Congo, Gabon, Mali, Morocco, Niger and Senegal.

Experts from: IAEA and France

Feedback: The workshop was viewed as successful. Participants learned how to review remediation plans. Exercises were highly appreciated by the participants but they wished for more practical examples and field work.

Topical meeting on prevention of legacy situations arising from uranium production

***Regional Meeting on Prevention of future legacy sites in Uranium mining and processing,* Vienna, Austria, 14–15 Dec 2015 in English.**

Participants (12) from 9 Member States: Cameroon, Congo, Gabon, Madagascar, Malawi, Mali, Niger, Tanzania and Uganda.

Experts from: IAEA, Australia, Canada and USA.

Targeted at senior decision makers. Participants came away with a good understanding of the need for establishing sound policies, regulatory frameworks and infrastructure to achieve sustainable levels of safety compatible with the requirements of the IAEA Safety Standards and with the objective to prevent future legacy sites.

Conclusions

- A comprehensive and high quality package of training materials on safety of uranium mining and processing activities including remediation has been made available;
- The training materials are comprised of implementation manuals, presentations, lecture notes, exercises, case studies and e-learning materials;
- The training materials have been extensively reviewed and field tested;
- All the materials are available in English, with some modules available in French and Portuguese.

Future Outlook

- These materials will soon be available for roll out to all Member States and all regions.
- Training to be broadened to other interested parties, operators as well as regulators.
- Planning for translation of the materials into Russian and Spanish is underway.
- Consideration to be given to follow up training missions, for example to promote elaboration of national strategies and site-specific plans for remediation.

Future Outlook

- Training Manuals have been submitted for publication through the Agency's publication process.
- Feedback from senior policy and decision makers indicated there is further need for workshops on legacy site prevention – these will be offered on an "as requested" basis.
- Although the training materials have been developed for uranium sites, we feel they can be readily adapted to broader NORM management situations.
- Integration of model regulations for remediation of uranium legacy sites into the package of materials.

Acknowledgements:

Many people who contributed to the development of these materials, however, three of the Scientific Secretaries deserve special mention: Mr Russel Edge (USA), Mr Shaun Guy (South Africa) and Mr Luis Jova Sed (Cuba).

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Thank you!