## **IAEA Publications**

## Catalogue 2014–2015







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#### **Atoms for Peace**

The IAEA serves as the world's intergovernmental forum for scientific and technical cooperation in the nuclear field. It was set up as the world's "Atoms for Peace" organization in 1957 within the United Nations family. The IAEA works with its Member States and multiple partners worldwide to promote safe, secure and peaceful nuclear technologies.

The IAEA's mission is guided by the interests and needs of Member States, strategic plans and the vision embodied in the IAEA Statute. Three main pillars — or areas of work — underpin the IAEA's mission: Safety and Security; Science and Technology; and Safeguards and Verification.

#### **IAEA Publications**

The IAEA is one of the leading publishers in the field of nuclear science and technology, with titles on nuclear and radiological safety, emergency response, nuclear power, nuclear medicine, nuclear waste management, nuclear law and safeguards as well as relevant topics in food and agriculture, earth science, industry and the environment.

Key publications include the IAEA Safety Standards, which detail the principles of safety for protection against ionizing radiation, and IAEA Safety Reports, which describe good practices and give practical examples and detailed methods that can be used to meet safety requirements.

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# Publications Catalogue 2014-2015

full details of publications published 2013–2015, forthcoming publications and a stocklist of publications published 2011–2014

### Introduction

This publications catalogue lists all sales publications of the IAEA published in 2013 and 2014 and those forthcoming in 2014-2015.

Most IAEA publications are issued in English; some are also available in Arabic, Chinese, French, Russian or Spanish. This is indicated at the bottom of the book entry.

A complete listing of all IAEA priced publications is available on the IAEA's web site: http://www.iaea.org/books

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Please note that only firm orders are accepted. Returns require prior approval and are only granted if publications were received damaged or defective or if incorrect titles were dispatched.

Prices of books are quoted in Euros. Prices do not include local taxes and are subject to change without notice. Shipping will be charged at cost. Publications are normally sent by surface mail. Delivery by air mail, courier service or by air freight is possible upon request.

#### Prepayment

For prompt delivery of publications, it is recommended that all orders be prepaid either by credit card (MasterCard/VISA), cheque payable to the IAEA, or bank transfer (for details please contact sales.publications@iaea.org).

#### **Discounts**

For information on discounts for bulk orders, please contact the Marketing and Sales Unit.

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To set up a standing order for one of the book series, or for books in a particular subject area, please contact the Marketing and Sales Unit.

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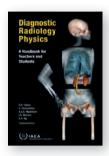
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### HumanHealth



## MEDICAL PHYSICS, DOSIMETRY AND DIAGNOSIS



#### Diagnostic Radiology Physics: A Handbook for Teachers and Students

This publication is aimed at students and teachers involved in programmes that train medical physicists for work in diagnostic radiology. It provides, in the form of a syllabus, a comprehensive overview of the basic medical physics knowledge

required for the practice of modern diagnostic radiology. This makes it particularly useful for graduate students and residents in medical physics programmes. The material presented in the publication has been endorsed by the major international organizations and is the foundation for academic and clinical courses in both diagnostic radiology physics and in emerging areas such as imaging in radiotherapy.

(680 pp., 244 figs; 2014) • ISBN 978-92-0-131010-1 • STI/PUB/1564 • €90.00



## Dosimetry in Diagnostic Radiology for Paediatric Patients

IAEA Human Health Series No. 24

This publication draws on an IAEA coordinated research project and provides recommendations specific to the

measurement and interpretation of radiation dose to children received as a result of undergoing diagnostic radiological examinations. It complements the work of Dosimetry in Diagnostic Radiology: A Code of Practice (Technical Report Series No. 457) and extends this work in methodologies for dosimetry in clinical environments to that required for non-adult patients. It includes dosimetry methodologies for general radiography, fluoroscopy and computer tomography for both phantom and patient measurements. Details are given on dose audit strategies that take into account the size of children and on how the results of such audits can be used to indicate or be related to diagnostic reference levels. The effects of radiation on non-adults are also reviewed, as are the factors involved in the management of paediatric dosage in the clinical setting.

(160 pp., 14 figs; 2014) • ISBN 978-92-0-141910-1 • STI/PUB/1609 • €46.00

## Guided Intra-operative Scintigraphic Tumour Targeting (GOSTT); Implementing Advanced Hybrid Molecular Imaging and Non-Imaging Probes for Advanced Cancer Management

IAEA Human Health Series No. 29

This publication provides an updated source for professionals involved in employing guided intra-operative scintigraphic tumour targeting (GOSTT). Its content contributes to supporting both the clinical decision making process and the implementation of minimally invasive surgical procedures. The publication provides an update on innovations in the use of radiopharmaceuticals for sentinel lymph node mapping and sentinel lymph node biopsy. In addition, it provides an update on advances in the implementation of hybrid imaging technologies for the surgical management of patients with cancer in conjunction with intraoperative regional lymph node mapping. The experience with the use of small field scintigraphic imaging devices in the operating theatre is also presented.

(Forthcoming 2014) • ISBN 978-92-0-102214-1 • STI/PUB/1648 • €75.00



## Implications for Occupational Radiation Protection of the New Dose Limit for the Lens of the Eve

IAEA TECDOC Series No. 1731

This publication provides interim guidance on the implications of the new dose limit for the lens of the eye for occupational

radiation protection that is applicable to planned, exposure situations. The new dose limit for the lens of the eye is included in GSR Part 3: Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards, Interim Edition.

(2013) • ISBN 978-92-0-115213-8 • IAEA-TECDOC-1731 • €18.00



#### Nuclear Medicine Physics: A Handbook for Teachers and Students

This publication provides the basis for the education of medical physicists initiating their university studies in the field of nuclear medicine. The handbook includes 20 chapters and covers topics relevant to nuclear medicine physics, including basic

physics for nuclear medicine, radionuclide production, imaging and non-imaging detectors, quantitative nuclear medicine, internal dosimetry in clinical practice and radionuclide therapy. It provides, in the form of a syllabus, a comprehensive overview of the basic medical physics knowledge required for the practice of medical physics in modern nuclear medicine.

(Forthcoming 2014) • ISBN 978-92-0-143810-2 • STI/PUB/1617 • €105.00



## PET/CT Atlas on Quality Control and Image Artefacts

IAEA Human Health Series No. 27

Positron emission tomography/computed tomography (PET/CT), as any other imaging modality, is acceptable for routine clinical and research applications only

if technical pitfalls can be avoided. Artefacts from incorrect or sub-optimal acquisition procedures should be recognized and, if possible, corrected retrospectively and the resulting image information interpreted correctly, which entails an appreciation of variants of the represented image information. This publication provides guidance on the physics and technical aspects behind PET and PET/CT image distortions. Cases are presented to provide nuclear medicine and radiology professionals with an assortment of examples of possible image distortions and errors in order to support a correct image interpretation. Nearly 70 typical PET and PET/CT cases, comprising image sets and cases, have been collected in this volume, all catalogued and augmented with explanations as to the causes of, and solutions to, each individual image problem. The atlas will prove useful to physicists, physicians, technologists, and service engineers in the clinical field.

(99 pp., 101 figs; 2014) • ISBN 978-92-0-101014-8 • STI/PUB/1642 • €60.00



Proceedings of an International Conference on Radiation Protection in Medicine: Setting the Scene for the Next Decade

Proceedings of an International Conference held in Bonn, 3–7 December 2012

**Proceedings Series** 

This publication presents the proceedings of the International Conference on Radiation Protection in Medicine: Setting the Scene for the Next Decade, held in Bonn, 3–7 December 2012. The aims were to indicate gaps in current approaches to radiation protection in medicine; identify tools for improving radiation protection in medicine; review advances, challenges and opportunities in the field and assess the impact of the international action plan for the radiation protection of patients, in order to prepare new international recommendations.

(Forthcoming 2014) • ISBN 978-92-0-103914-9 • STI/PUB/1663 • €130.00



## Quantitative Nuclear Medicine Imaging: Concepts, Requirements and Methods

IAEA Human Health Reports
No. 9

This publication reviews the current state of the art of image quantification and provides a solid background of tools and

methods for medical physicists and other professionals who are faced with quantification of radionuclide distribution in clinical practice. It describes and analyses the physical effects that degrade image quality and affect the accuracy of quantification, and describes methods to compensate for them in planar, single photon emission computed tomography (SPECT) and positron emission tomography (PET) images.

(59 pp., 23 figs; 2014) • ISBN 978-92-0-141510-3 • STI/PUB/1605 • €33.00



## Radiation Protection in Paediatric Radiology

Safety Reports Series No. 71

This publication provides guidance to radiologists, other clinicians and radiographers/technologists involved in using ionizing radiation for diagnostic procedures with children and adolescents, and should also be of value to medical

physicists and regulators. It focuses on the measures necessary to provide protection from the effects of radiation using the principles established in the IAEA's Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards (IAEA Safety Standards No. GSR Part 3 (Interim)) and the priority accorded to the area. The emphasis throughout is on the special requirements of paediatrics.

(111 pp., 2 figs; 2013) • ISBN 978-92-0-125710-9 • STI/PUB/1543 • €38.00



## Roles and Responsibilities, and Education and Training Requirements for Clinically Qualified Medical Physicists

IAEA Human Health Series No. 25

This publication addresses the shortfall of well trained and clinically qualified

medical physicists working in radiation medicine. The roles, responsibilities and clinical training requirements of medical physicists have not always been well defined or well understood by health care professionals, health authorities and regulatory agencies. To fill this gap, this publication provides recommendations for the academic education and clinical training of clinically qualified medical physicists, including recommendations for their accreditation certification and registration, along with continuous professional development. The goal is to establish criteria that support the harmonization of education and clinical training worldwide.

(71 pp., 2 figs; 2013) • ISBN 978-92-0-142010-7 • STI/PUB/1610 • €32.00



## Standard Operating Procedures for PET/CT: A Practical Approach for Use in Adult Oncology

IAEA Human Health Series No. 26

Over the last 20 years, PET (positron emission tomography) and PET/CT

(positron emission tomography/computed tomography) have revolutionized the care of cancer patients. It is one of the fields in medical imaging with the highest growth rate. Proper cancer management requires highly accurate imaging in order to select the correct treatment that applies to the individual patient. The ability to provide, in a single imaging session, detailed anatomical and metabolic/functional information, has established PET/CT as an indispensable imaging procedure in the management of many types of cancer. The reliability of the images acquired on a PET/CT scanner depends on the quality of the imaging technique. This publication addresses an important aspect of PET/CT imaging, namely how to perform the <sup>18</sup>F-FDG PET/PET scan in an adult patient with cancer.

(116 pp., 19 figs; 2013) • ISBN 978-92-0-143710-5 • STI/PUB/1616 • €35.00



## The Information System on Occupational Exposure in Medicine, Industry and Research (ISEMIR): Interventional Cardiology

IAEA TECDOC Series No. 1735

This publication presents the results achieved by the Working Group on

Interventional Cardiology in assessing the status of occupational radiation protection in interventional cardiology (IC) throughout the world. It also reports on the main activities in developing an international database to be used by IC facilities as a tool for benchmarking and improving their implementation of occupational radiation protection.

(2014) • ISBN 978-92-0-100514-4 • IAEA-TECDOC-1735 • €18.00

## Worldwide Implementation of Digital Imaging in Radiology

IAEA Human Health Series No. 28

This publication provides a basic introduction to digital technology and digital networks as well as an overview of the issues to consider when implementing such technology in diagnostic radiology. In an area that is under rapid development, it gives a careful analysis of the principles and advice on implementation and sustainability of digital imaging and teleradiology. The transition from film to digitally based medical imaging is complex and requires knowledge and planning to be successful. This comprehensive resource guide contains information on the needs and implications of a transition to digital imaging with case studies for different facilities requiring different levels on communication connectivity. It is aimed at hospital administrators and managers, radiologists and

radiographers/technologist, medical physicists and clinical engineers as well as information technology staff.

(Forthcoming 2014) • ISBN 978-92-0-102114-4 • STI/PUB/1647 • €60.00

#### RADIOTHERAPY

## **Design and Construction of Radiotherapy Facilities**

IAEA Human Health Reports No. 10

This publication provides guidelines on how to plan a radiotherapy facility in terms of the strategic master planning process including the legal, technical and infrastructure requirements. It outlines a risk assessment methodology, a typical project work plan and describes the professional expertise required for the implementation of such a project. Generic templates for a block design are suggested, which include possibilities for future expansion. These templates can be overlaid onto the designated site such that the most efficient workflow between the main functional areas can be ensured. A sample checklist is attached to act as a guideline for project management and to indicate the critical stages in the process where technical expert assistance may be needed. The publication is aimed at professionals and administrators involved in infrastructure development, planning and facility management, as well as engineers, building contractors and radiotherapy professionals.

(Forthcoming 2014) • ISBN 978-92-0-101914-1 • STI/PUB/1645 • €29.00



#### Development of Procedures for In Vivo Dosimetry in Radiotherapy

IAEA Human Health Reports No. 8

This publication, which draws on the experiences of an IAEA coordinated research project (CRP) and on input from

experts in the field, provides a comprehensive overview of the development of procedures for in vivo dosimetry in radiotherapy. It elaborates on the technology behind in vivo dosimetry and describes an initial set of measurements. Emphasis is given to patient dose studies, both evaluating the clinical value of in vivo dosimetry and comparing different in vivo dosimetry systems in a clinical setting. The findings of the CRP, which are summarized in this publication, will serve as a useful resource for hospital physicists seeking to establish an in vivo dosimetry programme in a radiotherapy centre and will help them in the selection of appropriate dosimetry systems.

(179 pp., 117 figs; 2013) • ISBN 978-92-0-141610-0 • STI/PUB/1606 • €34.00



#### Management of Cervical Cancer: Strategies for Limited-resource Centres — A Guide for Radiation Oncologists

IAEA Human Health Reports No. 6

Clinical guidelines for the management of cervical cancer exist in the published

literature. However, these guidelines have usually been developed in and for an affluent environment where all modern diagnosis and treatment modalities and tools are available to the practitioner. This publication is aimed at radiation oncologists working in centres with limited resources and treating a large number of patients with cervical cancer. The approach, and the techniques recommended, are intended to be evidence based, simple, feasible and resource sparing, to the extent that this is possible when dealing with a complex treatment modality such as radiotherapy.

(77 pp., 17 figs; 2013) • ISBN 978-92-0-128810-3 • STI/PUB/1556 • €18.00



#### Practical Guidance on Peptide Receptor Radionuclide Therapy (PRRNT) in Neuroendocrine Tumours

IAEA Human Health Series No. 20

This publication provides comprehensive multidisciplinary quidance to promote

standardized, effective and safe implementation of best practices for treating neuroendocrine and gastroenteropancreatic tumours through applying peptide receptor radionuclide therapy (PRRNT). Taking into account the latest international classifications of neuroendocrine tumours, both PRRNT as a sole treatment and as a treatment in combination with other options are considered. Comprehensive protocols for employing either 90Y or 177Lu tagged somatostatin receptor targeting peptides and clinically tested protocols for renal protection are presented. The publication comprises a comprehensive compilation of medical evidence and experience. Furthermore, it contains clinical presentations, eligibility criteria and means of assessing the effectiveness of therapy utilizing molecular and morphological medical imaging techniques. The publication is a practical reference for specialists in clinical oncology and in nuclear medicine deploying and executing a comprehensive programme for treating patients with neuroendocrine tumours.

(123 pp., 5 figs; 2013) • ISBN 978-92-0-129210-0 • STI/PUB/1560 • €39.00

## Radiotherapy in Cancer Care: Facing the Global Challenge

Cancer treatment is complex and calls for a diverse set of services. Radiation therapy is recognized as an essential tool in the cure and palliation of cancer. Currently, access to radiation treatment is limited in many countries and non-existent in some. This lack of radiation therapy resources exacerbates the burden of disease and underscores the continuing health care disparity among States. Closing this gap represents an essential

measure in addressing this global health equity problem. This publication presents a comprehensive overview of the major topics and issues to be taken into consideration when planning a strategy to address this global problem, in particular in low and middle income countries. With contributions from leaders in the field, it provides an introduction to the achievements and issues of radiation therapy as a cancer treatment modality around the world. Dedicated chapters focus on the new radiotherapy technologies, proton beams, carbon ion, intra operative radiotherapy, radiotherapy for children, treatment of HIV-AIDS malignancies, and costing and quality management issues.

(Forthcoming 2014) • ISBN 978-92-0-115013-4 • STI/PUB/1638 • €62.00



#### Record and Verify Systems for Radiation Treatment of Cancer: Acceptance Testing, Commissioning and Quality Control

IAEA Human Health Reports No. 7

This publication serves as a useful guide for medical physicists in radiation oncology, radiation oncologists and radiation therapists, in ensuring accuracy, safety and quality in radiation therapy. Record and verify systems (RVSs) were developed to reduce the risk of treatment errors in radiation oncology. These have recently evolved into complete radiotherapy information management systems that interface with imaging systems, treatment planning computers and treatment delivery systems. To function as intended, RVSs must be subject to a comprehensive quality assurance (QA) programme. This publication provides practical guidelines for a comprehensive QA programme and its implementation. It describes the QA programme, including acceptance tests and the commissioning process that should be used in conjunction with the installation of a new RVS. It is also highlighted that some of the tests performed at installation must be repeated regularly as part of the periodic quality control checks.

(39 pp., 1 fig.; 2013) • ISBN 978-92-0-141710-7 • STI/PUB/1607 • €22.00

## Strategies for the Management of Localized Prostate Cancer: A Guide for Radiation Oncologists

IAEA Human Health Reports No. 11

Clinical guidelines for the management of prostate cancer exist in the published literature. However, these guidelines have usually been developed in and for affluent health care environments where all modern diagnostic and treatment modalities are available. In limited resource environments, the radiation oncologist is faced with the question: what would be the minimum acceptable (evidence based) line of action with the limited resources available? Clinical guidelines focusing on low to middle income countries aim to provide a practical tool for these practitioners. This publication is aimed at the radiation oncologists working in centres with limited resources and treating a large number of patients with prostate cancer

on a daily basis. The approach and techniques recommended are intended to be simple, feasible and resource sparing to the extent that is possible when dealing with a complex treatment modality. It takes into consideration the cost–benefit of the intervention to avoid unnecessary overtreatment of indolent tumours.

(Forthcoming 2014) • ISBN 978-92-0-102014-7 • STI/PUB/1646 • €38.00

## NUCLEAR MEDICINE (INCLUDING RADIOPHARMACEUTICALS)



#### Non-HEU Production Technologies for Molybdenum-99 and Technetium-99m

IAEA Nuclear Energy Series
No. NF-T-5.4

Technetium-99m (99mTc) is used in approximately 85% of diagnostic imaging

procedures in nuclear medicine worldwide. Interruptions in the supply of molybdenum (99Mo), which is used to produce 99mTc, prompted governments and international agencies to step up efforts to identify both short and long term solutions to supply shortages. These calls for action resulted in economic and technology studies on the 99Mo supply chain. The present publication supports global efforts to eliminate the civilian use of highly enriched uranium in 99Mo/99mTc production and proposes several alternative or supplementary technologies.

(60 pp., 20 figs; 2013) • ISBN 978-92-0-137710-4 • STI/PUB/1589 • €24.00

## Radiolabelled Autologous Cells: Methods and Standardization for Clinical Use of

IAEA Human Health Series No. 5

This publication serves as a useful resource for nuclear medicine physicians, radiologists, radiopharmacists, pharmacologists and other researchers engaged with radiolabelling of autologous products for clinical application. It provides practical guidelines towards clinical work with radiolabelled autologous products and aims to streamline the variety of strategies that have evolved, for example, in the handling of radiolabelled red and white blood cells. The publication highlights the importance of the quality of radiolabelling services, provides advice on safety issues, and also addresses the use of other radiolabelled autologous products and their translation into the clinical environment.

(Forthcoming 2014) • ISBN 978-92-0-101310-1 • STI/PUB/1437 • €55.00

#### Yttrium-90 and Rhenium-188 Radiopharmaceuticals for Radionuclide Therapy

IAEA Radioisotopes and Radiopharmaceuticals Series No. 5

This publication presents the findings of an IAEA coordinated research project (CRP) on the development of therapeutic radiopharmaceuticals based on <sup>188</sup>Re and <sup>90</sup>Y for radionuclide therapy. It is a comprehensive summary of the activities carried out within the CRP and highlights the main achievements. The CRP focussed on the validation of quality control methods for <sup>188</sup>Re and <sup>90</sup>Y generator eluates and, specifically, on optimization of separation procedures of <sup>90</sup>Y from the parent radionuclide <sup>90</sup>Sr. A parallel programme was also undertaken to investigate the design of new target specific therapeutic radiopharmaceuticals prepared through the labelling of relevant biomolecules with <sup>188</sup>Re and <sup>90</sup>Y. The publication illustrates the results of these studies with the aim of supporting and further accelerating the development of clinically useful <sup>90</sup>Y and <sup>188</sup>Re radiopharmaceuticals in Member States.

(Forthcoming 2014) • ISBN 978-92-0-103814-2 • STI/PUB/1662 • €52.00

#### **NUTRITION**



## **Body Composition Assessment** from Birth to Two Years of Age

IAEA Human Health Series No. 22

This publication was developed by an international group of experts as an integral part of the IAEA's efforts to contribute to the transfer of technology and

capacity building in this field in order to assist Member States in their efforts to improve the nutrition and health of the most vulnerable population groups, infants and young children. The book provides practical information on the assessment of body composition from birth up to two years of age and is intended for nutritionists, paediatricians and other health professionals. The body composition assessment techniques included in this publication were selected as methodologies with the highest potential for standardization globally — based on considerations such as access to equipment, cost and the training needs of staff — and include stable isotope dilution for total body water assessment, as well as dual energy X ray absorptiometry and air displacement plethysmography. In addition, the book highlights the importance of standardization of anthropometric measurements as basic measurements of body weight and length are crucial for accurate body composition assessment.

(62 pp., 21 figs; 2013) • ISBN 978-92-0-127710-7 • STI/PUB/1550 • €36.00



Introduction to Body
Composition Assessment Using
the Deuterium Dilution
Technique with Analysis of
Saliva Samples by Fourier
Transform Infrared
Spectrometry

IAEA Human Health Series No. 12

This publication provides information on the theoretical background as well as on the practical application of state of the art methodology to monitor changes in body composition, based on the analysis of deuterium in saliva by Fourier transform infrared spectrometry.

English Edition (77 pp., 30 figs; 2011) • ISBN 978-92-0-103210-2 • STI/PUB/1450 • €37.00

French Edition (84 pp., 30 figs; 2013) • ISBN 978-92-0-214513-9 • STI/PUB/1450 • €37.00

Spanish Edition (81 pp., 30 figs; 2013) • ISBN 978-92-0-314013-3 • STI/PUB/1450 • €37.00



Introduction to Body
Composition Assessment Using
the Deuterium Dilution
Technique with Analysis of
Urine Samples by Isotope Ratio
Mass Spectrometry

IAEA Human Health Series No. 13

This publication complements the IAEA publication Assessment of Body Composition and Total Energy Expenditure in Humans Using Stable Isotope Techniques by providing practical guidance on the use of stable isotope techniques to assess body composition in settings where biological samples can be analysed by isotope ratio mass spectrometry.

English Edition (65 pp., 18 figs; 2011) • ISBN 978-92-0-103310-9 • STI/PUB/1451 • €36.00

French Edition (71 pp., 18 figs; 2013) • ISBN 978-92-0-214113-1 • STI/PUB/1451 • €36.00

Spanish Edition (69 pp., 18 figs; 2013) • ISBN 978-92-0-313913-7 • STI/PUB/1451 • €36.00

## NuclearMeasurement TechniquesandInstrumentation



#### **NUCLEAR ANALYTICS**



## Development and Applications of Residual Stress Measurements Using Neutron Beams

Technical Reports Series No. 477

This publication is the result of an IAEA coordinated research project and

presents a survey of the basic principles, requirements, preparation, design, execution and standardization of residual stress measurements using neutron beams. It includes details of experimental techniques, associated equipment and instrumentation, their commissioning and calibration, control and data acquisition. A separate chapter is dedicated to data analysis and interpretation. Finally, the document provides, with a number of selected examples and applications of residual stress measurements as well as future trends for the development and use of this powerful technique. The publication is a comprehensive and useful resource for the neutron beam user community, including academia and industrial partners. It may serve as an introduction to the field for young researchers and graduate students as well as guidelines to those operating or planning to implement or modernize their facilities for residual stress measurements. In summary, the publication presents neutron beams as a valuable and effective tool for performing residual stress measurements for both basic research and various applications.

(158 pp.; 63 figs; 2014) • ISBN 978-92-0-113313-7 • STI/DOC/010/477 • €40.00

## RESEARCH REACTORS AND PARTICLE ACCELERATORS (APPLICATIONS)

#### Utilization of Accelerator Based Real Time Methods in Investigation of Materials with High Technological Importance

IAEA Radiation Technology Reports No. 4

This publication presents the state of the art in the development and application of various accelerator based real time techniques. It reports examples of multidisciplinary scientific topics and challenges where application of accelerator based methods would bring significant benefits in terms of research data and further understanding of the scientific issues. The research activities that can profit from real time material characterizations using synchrotron radiation, neutron, ion and electron beams, and simultaneous combinations of different techniques are also briefly discussed. A recurrent theme emerging from the presented papers is that further

work is needed to develop more robust and longer working life materials for energy applications.

(Forthcoming 2014) • ISBN 978-92-0-102314-8 • STI/PUB/1649 • €37.00

#### **NUCLEAR DATA**

#### Handbook of Parameter Values for the Prediction of Radionuclide Transfer to Wildlife

**Technical Reports Series No. 479** 

This handbook provides generic parameter values for estimating the transfer of radionuclides from environmental media to wildlife for the purpose of assessing potential radiation exposure under equilibrium conditions. These data are intended for use where site specific data are either not available or not required, and to parameterize generic assessment models. They are based on a comprehensive review of the available literature, including many Russian language publications that have not previously been available in English. The publication addresses the limitations of the parameter values and the applicability of data. Some general background information on the assessment of potential impacts of radioactive releases on wildlife is also included. It complements the existing handbook in the same IAEA series with parameter to assess the radiological impact to humans.

(Forthcoming 2014) • ISBN 978-92-0-100714-8 • STI/DOC/010/479 • €55.00



## Library of Recommended Actinide Decay Data, 2011

High quality decay data are an essential input across a wide range of nuclear applications, and none more so than in the case of the actinides and their related decay chain data. Well defined nuclear data are essential to ensure safe procedures within mining operations.

various nuclear fuel cycles for energy generation, environmental monitoring, specific analytical techniques, and diagnostic and radiotherapeutic treatments in nuclear medicine. A major objective of the IAEA nuclear data programme is to promote improvements in the accuracy and quality of nuclear data used in science and technology. The contents of this report constitute the results of a coordinated research project established to assemble an updated decay data library for actinides. Recommended half-lives and decay scheme data have been comprehensively evaluated, and are tabulated in terms of a carefully selected set of actinide radionuclides.

(428 pp.; 2013) • ISBN 978-92-0-143910-9 • STI/PUB/1618 • €60.00

### EarthSciences



## URANIUM GEOLOGY, EXPLORATION AND MINING



## Advances in Airborne and Ground Geophysical Methods for Uranium Exploration

IAEA Nuclear Energy Series
No. NF-T-1.5

Due to growing global energy demand, many countries have seen a rise in uranium exploration activities in the past

few years, and newly designed geophysical instruments and their application in uranium exploration are contributing to an increased probability of successful discoveries. This publication highlights advances in airborne and ground geophysical techniques and methods for uranium exploration, succinctly describing modern geophysical methods and demonstrating their application with examples.

(58 pp., 31 figs; 2013) • ISBN 978-92-0-129010-6 • STI/PUB/1558 • €26.00

#### **HYDROLOGY**



#### Application of Isotope Techniques for Assessing Nutrient Dynamics in River Basins

**IAEA TECDOC Series No. 1695** 

This publication presents the application of isotope techniques as a powerful tool for evaluating nutrient dynamics

in river systems. Nutrient assessment and management in river systems has been an important part of water resource management for the past few decades, but the provision of appropriate and effective nutrient assessment and management in water resource management still remains a challenge due to the diversity of sources, pathways and transformations of nutrients. The topics discussed in this book show that the application of isotope techniques could enable or facilitate the examination of sources, pathways, transformations, and fates of nutrients in river systems, contributing to integrated water resource management.

(2013) • ISBN 978-92-0-138810-0 • IAEA-TECDOC-1695 • €18.00



## Isotope Methods for Dating Old Groundwater

This guidebook provides theoretical and practical information on using a variety of isotope tracers for dating old groundwater, i.e. water stored in geological formations for periods ranging from about 1000 to one million years. Theoretical underpinnings of the methods and guidelines for their use

in different hydrogeological environments are described. The guidebook also presents a number of case studies providing insight into how various isotopes have been used in aquifers around the world. The methods, findings and conclusions presented in this publication will enable students and practicing groundwater scientists to evaluate the use of isotope dating tools for specific issues related to the assessment and management of groundwater resources. In addition, the guidebook will be of use to the scientific community interested in issues related to radioactive waste disposal in geological repositories.

(357 pp., 178 figs; 2013) • ISBN 978-92-0-137210-9 • STI/PUB/1587 • €70.00



#### Isotopes in Hydrology, Marine Ecosystems and Climate Change Studies

Proceedings of the International Symposium held in Monaco, 27 March–1 April 2011 (2 Volumes)

**Proceedings Series** 

This publication presents the proceedings

of the latest IAEA symposium on isotopes in hydrology, marine ecosystems and climate change studies. At the symposium, five major topics were addressed through invited talks and oral presentations. These five sessions covered: the role of isotopes in understanding and modelling climate change, marine ecosystems and the water cycle; carbon dioxide sequestration and related aspects of the carbon cycle, such as ocean acidification; isotopes and radionuclides in the marine environment; groundwater assessments for large aquifers; and analytical methods and instrumentation for the application of isotopes in environmental, climate and hydrological studies. Leading scientists in the field of climate change and hydrology, as well as representatives from climate change and environmental bodies and organizations, exchanged their views and experience.

(1165 pp., 205 figs; 2013) • ISBN 978-92-0-135610-9 • STI/PUB/1580 • €90.00

## **Industrial**Applications



#### RADIATION PROCESSING



#### Design, Development and Optimization of a Low Cost System for Digital Industrial Radiology

IAEA Radiation Technology Reports No. 2

Systems for digital industrial radiology are currently quite expensive and, therefore,

often unaffordable for many institutes and non-destructive testing groups worldwide. This publication provides guidance on the development of such systems at a relatively lower cost. The aims are to facilitate the acquisition of state of the art digital technology, which has tremendous potential for enhancing the speed as well as the quality of radiographic inspection, in the long run ensuring the quality of industrial equipment and components.

(89 pp., 69 figs; 2013) • ISBN 978-92-0-129310-7 • STI/PUB/1561 • €40.00



#### Guidelines for Development, Validation and Routine Control of Industrial Radiation Processes

IAEA Radiation Technology Series No. 4

Quality assurance is vital for the success of radiation technologies and requires

the development of standardized procedures and the harmonization of process validation and control. The guidelines in this publication have been developed based on requests from Member States to provide guidance on fulfilling the requirements of the International Standard for Development, Validation and Routine Control for a Radiation Process, published by the International Organization for Standardization (ISO). While the

ISO standard was developed for the sterilization of healthcare products, the present guidelines are generalized and are therefore relevant to any radiation process. This is possible since the principles involved in regulating a radiation process for achieving quality products are generally the same for any product or application. In several places, additional information has been included to provide insight into the radiation process that could help irradiator operators and their quality managers to provide better service to their customers.

(129 pp., 15 figs; 2013) • ISBN 978-92-0-135710-6 • STI/PUB/1581 • €29.00

#### **TRACERS**



#### Radiotracer Generators for Industrial Applications

IAEA Radiation Technology Series No. 5

This publication, which draws on the outcome of an IAEA coordinated research project and on input from experts in the field, provides a unique source of

information pertaining to the development of radiotracer generators and their use in troubleshooting and optimizing industrial processes. It describes the results of research undertaken on the characterization of <sup>68</sup>Ge/<sup>68</sup>Ga, <sup>137</sup>Cs/<sup>137m</sup>Ba, <sup>99</sup>Mo/<sup>99m</sup>Tc and <sup>113</sup>Sn/<sup>113</sup>mIn radiotracer generators and their validation in industrial process investigations. Looking at trends in the industrialization process of developing countries, there is evidence that radiotracer techniques will continue to play an important role in industry for many years to come, and the findings of this research project will help Member States to make larger use of radiotracer technology for problem resolution in industry and environment.

(203 pp., 96 figs; 2013) • ISBN 978-92-0-135410-5 • STI/PUB/1579 • €34.00

## NuclearandRadiological SafetyandSecurity





## Computer Security at Nuclear Facilities

IAEA Nuclear Security Series No. 17

This publication provides guidance specific to nuclear facilities on implementing a computer security programme and evaluating existing programmes. The use

of computer systems to cover an increasing range of functions at nuclear facilities introduces new vulnerabilities that could seriously endanger nuclear security if not addressed in a rigorous and balanced manner. Digital systems are increasingly being introduced in safety, safety related and security systems throughout facilities. Non-availability or malfunction of these systems can seriously impact nuclear safety and security, and potentially facilitate sabotage of the facility and/or theft of material. Computer security must, therefore, be a key component of overall facility security.

Arabic Edition (76 pp., 7 figs; 2013) • ISBN 978-92-0-642210-6 • STI/PUB/1527 • €33.00

Chinese Edition (62 pp., 7 figs; 2012) • ISBN 978-92-0-536110-9 • STI/PUB/1527 • €33.00

English Edition (69 pp., 7 figs; 2011) • ISBN 978-92-0-120110-2 • STI/PUB/1527 • €33.00

French Edition (75 pp., 7 figs; 2013) • ISBN 978-92-0-237010-4 • STI/PUB/1527 • €33 00

Russian Edition (80 pp., 7 figs; 2012) • ISBN 978-92-0-435510-9 • STI/PUB/1527 • €33.00

Spanish Edition (75 pp., 7 figs; 2013) • ISBN 978-92-0-337310-4 • STI/PUB/1527 • €33.00

#### **Decommissioning of Facilities**

IAEA Safety Standards Series No. GSR Part 6
General Safety Requirements

Decommissioning is the last step in the lifetime management of a facility. It must also be considered during the design, construction, commissioning and operation of facilities. This publication establishes requirements for the safe decommissioning of a broad range of facilities: nuclear power plants, research reactors, nuclear fuel cycle facilities, facilities for processing naturally occurring radioactive material, former military sites, and relevant medical, industrial and research facilities. It addresses all the aspects of decommissioning that are required to ensure safety, aspects such as roles and responsibilities, strategy and planning for decommissioning, conduct of decommissioning actions and termination of the authorization for decommissioning. It is intended for use by those involved in policy development, regulatory control and implementation of decommissioning.

(Forthcoming 2014) • ISBN 978-92-0-102614-9 • STI/PUB/1652 • €25.00



## Establishing a National Nuclear Security Support Centre

**IAEA TECDOC Series No. 1734** 

In recent years, requests for IAEA support in human resource development and for technical and scientific support in nuclear security have significantly increased. As a result the IAEA has identified the need to develop a concept that seeks to

effectively pass ownership of nuclear security knowledge and associated technical skills to states through the establishment of nuclear security support centres (NSSCs). This publication provides an overview of the functions and the structure of a NSSC and provides guidance on implementing the suggested NSSC concept. It outlines the developmental, organization and financial framework that should be considered in conjunction with the decision to establish a NSSC and highlights the importance of implementing national commitments stemming from adherence to international instruments for nuclear security. The publication is primarily addressed to senior decision makers responsible for nuclear security functions.

(2014) • ISBN 978-92-0-100414-7 • IAEA-TECDOC-1734 • €18.00



#### Establishing the Nuclear Security Infrastructure for a Nuclear Power Programme

IAEA Nuclear Security Series No. 19

This publication provides guidance on the actions to be taken by a State in implementing an effective nuclear security

infrastructure for a nuclear power programme. The topics covered are: development of national policy and strategy; common nuclear security measures; infrastructure issues relating to nuclear and other radioactive material; associated facilities; and cooperation with other States. The guidance provided is intended primarily for use by national policy makers, national legislators, competent authorities, institutions and individuals involved in the establishment, implementation, maintenance or sustainability of the nuclear security infrastructure for a nuclear power programme.

(73 pp., 1 fig.; 2013) • ISBN 978-92-0-138010-4 • STI/PUB/1591 • €29.00



## Identification of Vital Areas at Nuclear Facilities

IAEA Nuclear Security Series No. 16

This publication provides detailed guidance with regard to the identification of vital areas at nuclear facilities. It presents a structured approach to identifying those

areas that contain equipment, systems and components to be protected against sabotage. The process for selection of a specific set of vital areas to be protected is based on consideration of the potential radiological consequences of sabotage, and on the design, operational and safety features of a nuclear facility. The method builds upon safety analysis to develop logic models for sabotage scenarios that could cause unacceptable radiological consequences. The sabotage actions represented in the logic models are linked to the areas from which they can be accomplished. The logic models are then analysed to determine areas that should be protected to prevent these unacceptable radiological consequences. The publication is part of a set of supporting publications in the IAEA Nuclear Security Series with the aim of assisting States in the design. implementation and evaluation of their physical protection systems for nuclear material and nuclear facilities.

(37 pp., 2 figs; 2013) • ISBN 978-92-0-114410-2 • STI/PUB/1505 • €22.00



## Nuclear Security: Enhancing Global Efforts

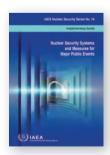
Proceedings of an International Conference held in Vienna, Austria, 1–5 July 2013

**Proceedings Series** 

This publication presents the proceedings of an international conference on nuclear

security, which was convened at the IAEA's headquarters in Vienna, 1–5 July 2013, the first such conference to include ministerial level participation. The conference adopted a ministerial declaration and provided a forum where experiences and lessons learned could be discussed. Ideas were exchanged to identify emerging trends and to consider medium and long term objectives for international nuclear security efforts, as well as to inform the development of the IAEA's Nuclear Security Plan 2014–2017. The President's summary highlights the main conclusions and key issues, drawing on the reports from the main and technical sessions. The conference attracted more than 1300 registered participants from 125 Member States, 34 of which were represented at ministerial level, and 21 intergovernmental and non-governmental organizations.

(119 pp.; 2014) • ISBN 978-92-0-101514-3 • STI/PUB/1643 • €90.00



#### Nuclear Security Systems and Measures for Major Public Events

IAEA Nuclear Security Series
No. 18

This publication provides an overview, based on practical experience and lessons learned, for establishing nuclear security

systems and measures for major public events. It covers technical and administrative nuclear security measures for developing the necessary organizational structure, developing plans, strategies and concepts of operations, and making

arrangements for implementing the developed plans, strategies and concepts.

English Edition (56 pp., 14 figs; 2012) • ISBN 978-92-0-127010-8 • STI/PUB/1546 • €30.00

Russian Edition (67 pp., 14 figs; 2014) • ISBN 978-92-0-401414-3 • STI/PUB/1546 • €30.00

## Options to Enhance Proliferation Resistance of Innovative Small and Medium Sized Reactors

IAEA Nuclear Energy Series No. NP-T-1.11

This publication addresses specific considerations for proliferation resistance and safeguards for small and medium sized reactors (SMRs). It describes the framework analysis through comparing and harmonizing the Generation IV International Forum and the International Project on Innovative Nuclear Reactors and Fuel Cycles methodologies, defines the proliferation resistance assessment and safeguards by design approach and presents the current implementation of proliferation resistance measures in innovative SMRs. The appendices include information on the example of a procedure to support a facility's analysis of the safeguarding situation in support of safeguards by design, and a template listing required proliferation resistance related design information. An overview of SMR design and development activities and States' national perspectives is given in the annexes.

(68 pp., 2 figs; 2014) • ISBN 978-92-0-145510-9 • STI/PUB/1632 • €28.00

## Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards

IAEA Safety Standards Series No. GSR Part 3

#### **General Safety Requirements**

This publication is the new edition of the International Basic Safety Standards. The edition is co-sponsored by seven other international organizations — European Commission (EC/Euratom), FAO, ILO, OECD/NEA, PAHO, UNEP and WHO. It replaces the interim edition that was published in November 2011 and the previous edition of the International Basic Safety Standards which was published in 1996. It has been extensively revised and updated to take account of the latest finding of the United Nations Scientific Committee on the Effects of Atomic Radiation, and the latest recommendations of the International Commission on Radiological Protection. The publication details the requirements for the protection of people and the environment from harmful effects of ionizing radiation and for the safety of radiation sources. All circumstances of radiation exposure are considered.

(Forthcoming 2014) • ISBN 978-92-0-135310-8 • STI/PUB/1578 • €68.00



## Regulatory Oversight of Safety Culture in Nuclear Installations

IAEA TECDOC Series No. 1707

Experience across the international nuclear industry and in other technical fields has demonstrated the importance of an effective safety culture in maintaining the safety of workers, the public and

the environment. Both regulators and the nuclear industry recognize the need for licensees to develop a strong safety culture in order to support successful and sustainable nuclear safety performance. This publication addresses the basics of regulatory oversight of safety culture and describes the currently implemented approaches at several regulatory bodies around the world and provides practical guidance on the basis of this experience.

(2013) • ISBN 978-92-0-141110-5 • IAEA-TECDOC-1707 • €18.00



#### The Management System for Nuclear Installations Safety Guide

IAEA Safety Standards Series No. GS-G-3.5

#### Safety Guide

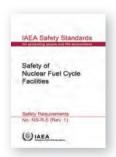
This Safety Guide has been issued in support of the Safety Requirements

publication on the Management System for Facilities and Activities, IAEA Safety Standards Series No. GS-R-3. It contains detailed recommendations in relation to nuclear installations, to complement the general recommendations provided in IAEA Safety Standards Series No. GS-G-3.1. This Safety Guide is applicable throughout the lifetime of a nuclear installation, including site evaluation, design, construction, commissioning, operation and decommissioning.

English Edition (139 pp., 5 figs; 2009) • ISBN 978-92-0-103409-0 • STI/PUB/1392 • €35.00

Russian Edition (160 pp., 5 figs; 2014) • ISBN 978-92-0-400614-8 • STI/PUB/1392 • €35.00

#### **FUEL FABRICATION AND STORAGE**



## Safety of Nuclear Fuel Cycle Facilities

IAEA Safety Standards Series No. NS-R-5 (Rev. 1)

#### Safety Requirements

This publication covers the broad scope of requirements for fuel cycle facilities that, in light of the experience and present state of

technology, must be satisfied to ensure safety for the lifetime of the facility. Topics of specific relevance include aspects of nuclear fuel generation, storage, reprocessing and disposal.

(102 pp., 4 figs; 2014) • ISBN 978-92-0-100114-6 • STI/PUB/1641 • €20.00

#### **NUCLEAR POWER PLANTS**



### Ageing Management for Nuclear Power Plants

IAEA Safety Standards Series No. NS-G-2.12

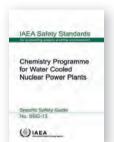
#### Safety Guide

The median age of nuclear power plants connected to the grid worldwide is increasing. Ageing management has

become an important issue in ensuring the availability of required safety functions throughout the service life of a plant. This Safety Guide provides recommendations on meeting the requirements for safe long term operation and identifies key elements of effective ageing management for nuclear power plants.

English Edition (48 pp., 6 figs; 2009) • ISBN 978-92-0-112408-1 • STI/PUB/1373 • €20.00

Russian Edition (54 pp., 6 figs; 2014) • ISBN 978-92-0-400214-0 • STI/PUB/1373 • €20.00



## Chemistry Programme for Water Cooled Nuclear Power Plants

IAEA Safety Standards Series No. SSG-13

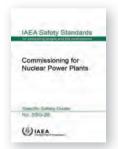
#### Specific Safety Guide

This publication provides guidance on establishing a high standard chemistry programme in accordance with plant

safety policy and regulatory requirements. It will be useful to managers of operating organizations and other staff responsible for supporting or monitoring plant activities and for oversight of the plant chemistry programme, as well as to regulatory bodies.

English Edition (46 pp.; 2011) • ISBN 978-92-0-107610-6 • STI/PUB/1469 • €25.00

Russian Edition (52 pp.; 2014) • ISBN 978-92-0-400914-9 • STI/PUB/1469 • €25.00



### Commissioning for Nuclear Power Plants

IAEA Safety Standards Series No. SSG-28

#### Specific Safety Guide

This Safety Guide provides recommendations on the basis of international best practices, as currently

followed in IAEA Member States, on how to meet the requirements for the commissioning for nuclear power plants. These requirements enable the commissioning of a nuclear power plant to proceed safely and to a high quality. The recommendations will also enable the necessary assurances to be provided that the plant has been constructed in accordance with the design intent and can be operated safely.

(84 pp., 2 figs; 2014) • ISBN 978-92-0-140110-6 • STI/PUB/1595 • €40.00



#### Development of a Regulatory Inspection Programme for a New Nuclear Power Plant Project

Safety Reports Series No. 81

This Safety Report provides general principles, guidance and technical rationale for regulatory inspections related to new

nuclear power plant projects, and is based on the consideration of IAEA safety standards and experiences of Member States. The publication covers regulatory inspection during siting, design, construction and commissioning stages as well as the transition to operation. It takes into account approaches and practices of Member States recently involved in new nuclear facility projects, and it includes examples of Member States' regulatory inspection programmes and experiences.

(112 pp., 3 figs; 2014) • ISBN 978-92-0-113513-1 • STI/PUB/1636 • €35.00

## Management of Spent Fuel from Nuclear Power Reactors

Proceedings of an International Conference held in Vienna, Austria, 31 May-4 June 2010

#### **Proceedings Series**

This publication presents the proceedings of an international conference on spent fuel management organized by the IAEA in cooperation with the NEA of the OECD. The conference covered a broad range of topics from national strategies through safety and regulatory aspects, transport, technical innovation, fuel and material behaviour, operational experience with storage, new fuel and reprocessing developments, and long term storage and disposal. The conference also featured two round table discussion sessions covering regulatory frameworks and stakeholder issues. The proceedings include the opening presentations and the President's summary and conclusions of the conference. A CD-ROM with contributed papers accompanies the publication.

(Forthcoming 2014) • ISBN 978-92-0-103714-5 • STI/PUB/1661 • €40.00



#### Periodic Safety Review for Nuclear Power Plants

IAEA Safety Standards Series
No. SSG-25

#### Specific Safety Guide

This Safety Guide provides recommendations and guidance on conducting periodic safety review (PSR) of

an existing nuclear power plant. PSR is a comprehensive safety review of all important aspects of safety, carried out at regular intervals, typically every ten years. In addition, PSR may be used in support of the decision making process for licence renewal or long term operation, or for restart of a nuclear power plant following a prolonged shutdown. The review process described in this Safety Guide is valid for nuclear power plants of any age and may have a wider applicability, for example to research reactors and radioactive waste management

facilities, by means of a graded approach. Although PSR may not be an appropriate means for identifying safety issues in the decommissioning phase, the documentation resulting from PSR of an operating nuclear power plant will be an important input when planning decommissioning.

(106 pp., 5 figs; 2013) • ISBN 978-92-0-137410-3 • STI/PUB/1588 • €37.00



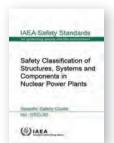
#### Review of Seismic Evaluation Methodologies for Nuclear Power Plants Based on a Benchmark Exercise

IAEA TECDOC Series No. 1722

This publication presents the results of the Kashiwazaki-Kariwa research initiative for seismic margin assessment (KARISMA)

benchmarking exercise to estimate how well the analytical results can predict the actual response and performance of structure, system and components (SSCs) and to identify the areas that may need reinforcement, or highlight those areas where analytical results are not an accurate predictor of SSC performance.

(2014) • ISBN 978-92-0-114913-8 • IAEA-TECDOC-1722 • €18.00



#### Safety Classification of Structures, Systems and Components in Nuclear Power Plants

IAEA Safety Standards Series No. SSG-30

#### Specific Safety Guide

This Safety Guide provides and guidance on how to meet the recommendations requirements established in Specific Safety Requirements No. SSR-2/1 and in General Safety Requirements No. GSR Part 4 for the identification of structures, systems and components (SSCs) important to safety in nuclear power plants and for their classification on the basis of their function and safety significance. This Safety Guide is intended primarily for use by organizations involved in the design of nuclear power plants, as well as by regulatory bodies and their technical support organizations. The Safety Guide can also be applied to other nuclear installations subject to appropriate adjustments relevant to the specific design of the type of the facility being considered.

(24 pp., 2 figs; 2014) • ISBN 978-92-0-115413-2 • STI/PUB/1639 • €22.00

#### RESEARCH REACTORS



#### Implementation of a Management System for Operating Organizations of Research Reactors

Safety Reports Series No. 75

The requirements for management systems for research reactors are set out in the IAEA safety standards. To

ensure that an integrated management system based on the IAEA safety standards is tailored for the size of the different organizations and commensurate to the risks of an activity, the safety requirements for management systems for facilities and activities (IAEA Safety Standards Series No. GS-R-3) includes a requirement to grade the application of the management system and the deployment of resources appropriately. This publication not only applies the relevant standards and presents the processes for larger operating organizations of research reactors to ensure safe operation and utilization, but it also provides a case study of a graded approach to the application of the management system requirements as implemented by a small research reactor. This report will be useful for research reactor operating organizations, particularly those intending to implement a process based integrated management system, and may also be of interest to other nuclear facilities and to regulatory bodies.

(161 pp., 63 figs; 2013) • ISBN 978-92-0-136010-6 • STI/PUB/1584 • €30.00



#### Passive Safety Systems in Advanced Water Cooled Reactors (AWCRs). Case Studies

IAEA TECDOC Series No. 1705

This publication is the final report of the INPRO collaborative project on advanced water cooled reactor (AWCR) case studies

in support of passive safety systems. The participating Member States were Argentina, India and the Republic of Korea. It presents case study results on natural circulation and thermal stratification phenomena in selected passive safety systems, as well as major findings and conclusions drawn from these case studies. This publication will be a useful resource for researchers in the area of core physics and reactor thermohydraulics and for technical experts and engineers engaged in experimental investigation and theoretical simulation for developing passive safety systems.

(2013) • ISBN 978-92-0-139810-9 • IAEA-TECDOC-1705 • €18.00

## RADIATION SOURCES AND ACCELERATORS



#### Control of Orphan Sources and Other Radioactive Material in the Metal Recycling and Production Industries

IAEA Safety Standards Series No. SSG-17

#### Specific Safety Guide

Accidents involving orphan sources and

other radioactive material in the metal recycling and production industries have resulted in serious radiological accidents as well as in harmful environmental, social and economic impacts. This Safety Guide provides recommendations, the implementation of which should prevent such accidents and provide confidence that scrap metal and recycled products are safe.

English Edition (82 pp., 3 figs; 2012) • ISBN 978-92-0-115510-8 • STI/PUB/1509 • €31.00

Spanish Edition (90 pp., 3 figs; 2013) • ISBN 978-92-0-344010-3 • STI/PUB/1509 • €31.00



## Criticality Safety in the Handling of Fissile Material

IAEA Safety Standards Series No. SSG-27

#### Specific Safety Guide

This Safety Guide provides guidance and recommendations on how to meet the relevant requirements for ensuring

subcriticality when dealing with fissile material and for planning the response to criticality accidents. The guidance and recommendations are applicable to both regulatory bodies and operating organizations. The objectives of criticality safety are to prevent a self-sustained nuclear chain reaction and to minimize the consequences of this if it were to occur. The Safety Guide makes recommendations on how to ensure subcriticality in systems involving fissile materials during normal operation, anticipated operational occurrences, and, in the case of accident conditions, within design basis accidents, from initial design through commissioning, operation, and decommissioning and disposal.

(77 pp., 2 figs; 2014) • ISBN 978-92-0-140010-9 • STI/PUB/1594 • €40.00



## Model Regulations for the Use of Radiation Sources and for the Management of the Associated Radioactive Waste

IAEA TECDOC Series No. 1732

This publication provides advice on an appropriate set of regulations covering all aspects of the use of radiation sources

and the safe management of the associated radioactive waste. The publication provides the framework for the regulatory requirements and conditions to be incorporated into individual

authorizations for the use of radiation sources in industry, medical facilities, research and education, and in agriculture. It also establishes criteria to be used for assessing compliance. The content allows States to appraise the adequacy of their existing regulations and regulatory guides, and acts as a reference for those States developing regulations for the first time. The publication is a supplement to the guidance in the IAEA Safety Guide GS-G-1.5, Regulatory Control of Radiation Sources.

(2013) • ISBN 978-92-0-115613-6 • IAEA-TECDOC-1732 • €18.00



#### National Strategy for Regaining Control over Orphan Sources and Improving Control over Vulnerable Sources

IAEA Safety Standards Series No. SSG-19

#### Specific Safety Guide

This Safety Guide is intended to provide

recommendations on the establishment of a national strategy for regaining control over orphan radioactive sources and for improving control over vulnerable radioactive sources. It provides guidance on how to assess the national situation, and develop and implement a national strategy to achieve these goals.

Arabic Edition (92 pp., 4 figs; 2012) • ISBN 978-92-0-636210-5 • STI/PUB/1510 • €35.00

English Edition (100 pp., 4 figs; 2011) • ISBN 978-92-0-115610-5 • STI/PUB/1510 • €35.00

Spanish Edition (102 pp., 4 figs; 2013) • ISBN 978-92-0-337110-0 • STI/PUB/1510 • €35.00

## TRANSPORT OF RADIOACTIVE MATERIAL

#### Advisory Material for the IAEA Regulations for the Safe Transport of Radioactive Material 2012 Edition

IAEA Safety Standards Series No. SSG-26

#### Specific Safety Guide

This Safety Guide provides recommendations and guidance on achieving and demonstrating compliance with IAEA Safety Standards Series No. SSR-6, Regulations for the Safe Transport of Radioactive Material (2012 Edition), which establishes the requirements to be applied to the national and international transport of radioactive material. Transport is deemed to comprise all operations and conditions associated with and involved in the movement of radioactive material, including the design, fabrication and maintenance of packaging, and the preparation, consigning, handling, carriage, storage in transit and receipt at the final destination of packages. This publication supersedes IAEA Safety Standards Series No. TS-G-1.1 Rev. 1, which was issued in 2008.

(Forthcoming 2014) • ISBN 978-92-0-136910-9 • STI/PUB/1586 • €70.00



#### Legal and Institutional Issues of Transportable Nuclear Power Plants: A Preliminary Study

IAEA Nuclear Energy Series No. NG-T-3.5

A transportable nuclear power plant (TNPP) is a factory manufactured, movable nuclear power plant, which when

fuelled is capable of producing final energy products such as electricity and heat. Transportable nuclear power plants are not designed to operate during transportation. This publication highlights the potential benefits of TNPPs, describes the legal and institutional issues for their deployment in countries other than the country of origin, reveals challenges that might be faced in their deployment, and outlines pathways for resolution of the identified issues and challenges in the short and long terms. It is addressed to senior legal, regulatory and technical officers in Member States planning to embark on a nuclear power programme or to expand an existing one by considering the introduction of a TNPP.

(95 pp., 6 figs; 2013) • ISBN 978-92-0-144710-4 • STI/PUB/1624 • €33.00



#### Regulations for the Safe Transport of Radioactive Material

2012 Edition

IAEA Safety Standards Series No. SSR-6

#### Specific Safety Requirements

This publication establishes the regulations

that apply to the transport of radioactive material by all modes of transport on land, water or in the air, including transport that is incidental to the use of the radioactive material. The objective and scope of the regulations are described in detail as well as the range of their application. The publication provides requirements useful to governments, regulators, operators of nuclear facilities, carriers, users of radiation sources and cargo handling personnel.

Arabic Edition (177 pp., 7 figs; 2013) • ISBN 978-92-0-638410-7 • STI/PUB/1570 • €44.00

Chinese Edition (164 pp., 7 figs; 2013) • ISBN 978-92-0-538110-7 • STI/PUB/1570 • €44.00

English Edition (168 pp., 7 figs; 2012) • ISBN 978-92-0-133310-0 • STI/PUB/1570 • €44.00

French Edition (174 pp., 7 figs; 2013) • ISBN 978-92-0-238910-6 • STI/PUB/1570 • €44.00

Russian Edition (183 pp., 7 figs; 2013) • ISBN 978-92-0-438510-6 • STI/PUB/1570 • €44.00

Spanish Edition (180 pp., 7 figs; 2013) • ISBN 978-92-0-337910-6 • STI/PUB/1570 • €44.00



#### Regulatory Control for the Safe Transport of Naturally Occurring Radioactive Material (NORM)

IAEA TECDOC Series No. 1728

This publication presents the outcome of an IAEA coordinated research project (CRP), which was organized to identify the types of NORM materials transported

and the resulting radiation doses to workers and the public as a result of transport. The CRP participants reviewed a wide range of materials from NORM industries, including those used for extraction of minerals, direct use materials, scales from oil and gas extraction industries, ores and waste material from uranium processing and other materials. They also conducted surveys of industries involved in the transport of NORM and assessed doses to workers and members of the public through modelling and by direct measurement. The results of the studies and several conclusions about regulatory provisions that should be more closely aligned with expected doses during transport were agreed upon by all participants, and are presented in this publication. Individual country reports are available for review in the accompanying CD-ROM.

(2013) • ISBN 978-92-0-114613-7 • IAEA-TECDOC-1728 • €18.00



## Schedules of Provisions of the IAEA Regulations for the Safe Transport of Radioactive Material (2009 Edition)

IAEA Safety Standards Series No. TS-G-1.6 (Rev. 1)

This Safety Guide is issued in support

#### Safety Guide

of Regulations for the Safe Transport of Radioactive Material (IAEA Safety Standards Series No. TS-R-1, 2009 Edition). It lists the paragraph numbers of the Transport Regulations that are relevant for specified types of consignment, classified according to their UN numbers. It does not provide additional recommendations. The intended users are consignors and consignees, carriers, shippers, regulators, and end users involved in the transport of radioactive material. A person or organization intending to transport a particular type of consignment of radioactive material must meet requirements in all sections of the Transport Regulations. This Safety Guide aids users by providing a listing of the relevant requirements of the Transport Regulations for each type of radioactive material, package or shipment. Once a consignor has classified the radioactive material to be shipped, the appropriate UN number can be assigned and the paragraph numbers of the

requirements that apply for the shipment can be found in the

(380 pp., 4 figs; 2014) • ISBN 978-92-0-192510-7 • STI/PUB/1614 • €40.00



corresponding schedule.

## Security in the Transport of Radioactive Material

IAEA Nuclear Security Series
No. 9

This publication addresses the vulnerability of radioactive material during transport. Given the international concern over acts of nuclear terrorism, it is imperative to have

a well-defined plan for the security of sensitive materials during transport. This publication provides guidance on implementing, maintaining or enhancing a State's nuclear security regime to protect radioactive material in transport against theft, sabotage

or other malicious acts. It will be of use to regulators and to operating personnel engaged in the transport of such material.

Chinese Edition (38 pp., 1 fig.; 2012) • ISBN 978-92-0-523410-6 • STI/PUB/1348 • €20.00

English Edition (39 pp., 1 fig.; 2008) • ISBN 978-92-0-107908-4 • STI/PUB/1348 • €20.00

French Edition (39 pp., 1 fig.; 2012) • ISBN 978-92-0-233210-2 • STI/PUB/1348 • €20.00

Spanish Edition (41 pp., 1 fig.; 2013) • ISBN 978-92-0-344410-1 • STI/PUB/1348 • €20.00

#### WASTE REPOSITORIES



#### Characterization of Swelling Clays as Components of the Engineered Barrier System for Geological Repositories

**IAEA TECDOC Series No. 1718** 

This publication presents the results of a coordinated research project (CRP) carried out between 2002 and 2007 on

the subject of swelling clays proposed for use as a component in the engineered barrier system (EBS) of the multi-barrier concept for disposal of radioactive waste. The structure of the book includes an overview of the repository concepts of the Member States involved in the CRP; a general description of key material properties and a means of assessing those properties of relevance to screening potentially suitable swelling clays for repository use; and a summary of the properties measured for the candidate materials selected by each of the participating Member States and a preliminary assessment of their potential suitability for use as a component of the EBS of a deep geological repository. The publication contributes to the process of swelling clay identification, characterization and evaluation for potential suitability for deep geological repository applications.

(2013) • ISBN 978-92-0-112410-4 • IAEA-TECDOC-1718 • €18.00

## Monitoring and Surveillance of Radioactive Waste Disposal Facilities

IAEA Safety Standards Series No. SSG-31

#### Specific Safety Guide

This Safety Guide provides recommendations and guidance on how to plan and perform monitoring and surveillance programmes for disposal facilities for radioactive waste. The Safety Guide considers monitoring and surveillance for near surface disposal facilities, for geological disposal facilities and for facilities for the disposal of waste from mining and from mineral processing. The publication provides recommendations on how to use results from the monitoring and surveillance of radioactive waste disposal facilities over their entire lifetime. It covers the different objectives of monitoring and surveillance for the different periods of the lifetime of disposal facilities, from the initiation of work on a candidate site to the period after closure of the disposal facility.

(Forthcoming 2014) • ISBN 978-92-0-115513-9 • STI/PUB/1640 • €40.00



## Near Surface Disposal Facilities for Radioactive Waste

IAEA Safety Standards Series No. SSG-29

#### Specific Safety Guide

This Safety Guide provides recommendations on how to meet safety requirements on the disposal of radioactive

waste. It is concerned with the disposal of solid radioactive waste by emplacement in designated facilities at or near the land surface. The Safety Guide provides guidance on the development, operation and closure of, and on the regulatory control of, near surface disposal facilities, which are suitable for the disposal of very low level waste and low level waste. The Safety Guide provides guidance on a range of disposal methods, including the emplacement of solid radioactive waste in earthen trenches, in above ground engineered structures, in engineered structures just below the ground surface and in rock caverns, silos and tunnels excavated at depths of up to a few tens of metres underground. It is intended for use primarily by those involved with policy development for, with the regulatory control of, and with the development and operation of near surface disposal facilities.

(103 pp., 5 figs; 2014) • ISBN 978-92-0-114313-6 • STI/PUB/1637 • €36.00



#### The Use of Numerical Models in Support of Site Characterization and Performance Assessment Studies of Geological Repositories

**IAEA TECDOC Series No. 1717** 

To build confidence in future applications of nuclear energy systems, and the

continuing use of existing ones, there has to be confidence that spent nuclear fuel and radioactive wastes can be securely stored and safely disposed. Numerical models play a key role in nuclear waste isolation projects. This publication presents the outcome of an IAEA coordinated research project in which numerical modelling is used to address the pertinent issue of site characterization and its impact on the safety, using data and information from a potential repository site.

(2013) • ISBN 978-92-0-112310-7 • IAEA-TECDOC-1717 • €18.00

#### RADIATION PROTECTION



## Implications for Occupational Radiation Protection of the New Dose Limit for the Lens of the Eye

**IAEA TECDOC Series No. 1731** 

This publication provides interim guidance on the implications of the new dose limit for the lens of the eye for occupational

radiation protection that is applicable to planned, exposure

situations. The new dose limit for the lens of the eye is included in GSR Part 3: Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards, Interim Edition (2011). In the longer term, the guidance provided in this publication will form the basis for the consensus guidance in relation to the new dose limit for the lens of the eye that is to be provided in two safety guides currently being developed.

(2013) • ISBN 978-92-0-115213-8 • IAEA-TECDOC-1731 • €18.00

## Justification of Practices, including Non-Medical Human Imaging

IAEA Safety Standards Series No. GSG-5

#### **General Safety Guide**

This Safety Guide was developed to assist governments and regulatory bodies with the assessment of particularly challenging proposals for the use of radiation; in particular, in human imaging for purposes other than medical diagnosis, medical treatment or biomedical research, such as for security screening at airports. It complements the guidance provided in the IAEA Safety Guide on the Regulatory Control of Radiation Sources. It provides guidance to governments and regulatory bodies on the elements that should be considered and the process that should be applied in determining whether the introduction of a particular type of practice is justified. It is intended to assist in the decision making process when confronted with a need or a request to authorize a novel type of practice or a need to review the justification of types of practice that are already established. The publication also provides some guidance to those wishing to demonstrate to the government or regulatory body that a particular type of practice is justified.

(Forthcoming 2014) • ISBN 978-92-0-102414-5 • STI/PUB/1650 • €32.00

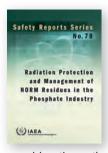
## Protection of the Public against Exposure Indoors due to Radon and Other Natural Sources of Radiation

IAEA Safety Standards Series No. SSG-32

#### Specific Safety Guide

This Safety Guide provides recommendations on meeting the requirements established in the IAEA Safety Requirements publication on Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards, for protection of the public against exposure indoors due to natural sources of radiation. Guidance is provided on the application of the requirements for justification and optimization of protection by national authorities in considering control of natural sources of radiation indoors such as radon and radionuclides of natural origin in materials used for the construction of dwellings, offices, industrial premises and other buildings. The Safety Guide provides recommendations and guidance to be followed by the regulatory body and by other authorities and organizations with responsibilities in relation to exposure to radiation from natural sources.

(Forthcoming 2014) • ISBN 978-92-0-102514-2 • STI/PUB/1651 • €45.00



#### Radiation Protection and Management of NORM Residues in the Phosphate Industry

Safety Reports Series No. 78

This Safety Report is a compilation of detailed information on the processes and materials associated with the phosphate industry and on the radiological

considerations that need to be taken into account by the regulatory body when determining the nature and extent of radiation protection measures. It has been developed as part of the IAEA's programme on the application of its safety standards in the field of radiation, transport and waste safety. The information provided will assist in the implementation of a graded approach to regulation, in terms of which the application of the requirements of the safety standards is commensurate with the characteristics of the practice or source and with the magnitude and likelihood of the exposures. The publication also provides information on expected radionuclide concentrations, exposure levels and the most appropriate regulatory approach in the phosphate industry, and covers the mining and beneficiation of phosphate ore, phosphoric acid production, phosphogypsum, and the manufacture and use of phosphatic fertilizers among others.

(288 pp., 90 figs; 2013) • ISBN 978-92-0-135810-3 • STI/PUB/1582 • €55.00



## Radiation Protection in Medicine: Setting the Scene for the Next Decade

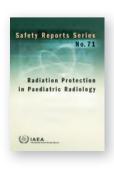
Proceedings of an International Conference held in Bonn, Germany, 3–7 December 2012

**Proceedings Series** 

This publication presents the proceedings

of the International Conference on Radiation Protection in Medicine — Setting the Scene for the Next Decade, held in Bonn, 3–7 December 2012. The aims were to indicate gaps in current approaches to radiation protection in medicine; identify tools for improving radiation protection in medicine; review advances, challenges and opportunities in the field; and assess the impact of the international action plan for the radiation protection of patients, in order to prepare new international recommendations.

(Forthcoming 2014) • ISBN 978-92-0-103914-9 • STI/PUB/1663 • €130.00



## Radiation Protection in Paediatric Radiology

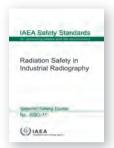
Safety Reports Series No. 71

This publication provides guidance to radiologists, other clinicians and radiographers/technologists involved in using ionizing radiation for diagnostic procedures with children and adolescents, and should also be of value to medical

physicists and regulators. It focuses on the measures necessary to provide protection from the effects of radiation using the

principles established in the IAEA's Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards (IAEA Safety Standards No. GSR Part 3 (Interim)) and the priority accorded to the area. The emphasis throughout is on the special requirements of paediatrics.

(111 pp., 2 figs; 2013) • ISBN 978-92-0-125710-9 • STI/PUB/1543 • €38.00



## Radiation Safety in Industrial Radiography

IAEA Safety Standards Series No. SSG-11

#### Specific Safety Guide

This Safety Guide provides recommendations for ensuring radiation safety in industrial radiography used in

non-destructive testing. This includes industrial radiography work that utilizes X ray and gamma sources, both in shielded facilities that have effective engineering controls and outside shielded facilities using mobile sources.

Arabic Edition (105 pp., 2 figs; 2012) • ISBN 978-92-0-633110-1 • STI/PUB/1466 • €33.00

English Edition (104 pp., 2 figs; 2011) • ISBN 978-92-0-107210-8 • STI/PUB/1466 • €33.00

French Edition (112 pp., 2 figs; 2013) • ISBN 978-92-0-236610-7 • STI/PUB/1466 • €33.00

Spanish Edition (112 pp., 2 figs; 2014) • ISBN 978-92-0-338710-1 • STI/PUB/1466 • €33.00



## The Information System on Occupational Exposure in Medicine, Industry and Research (ISEMIR): Interventional Cardiology

IAEA TECDOC Series No. 1735

This publication presents the results achieved by the Working Group on

Interventional Cardiology in assessing the status of occupational radiation protection in interventional cardiology (IC) throughout the world. It also reports on the main activities in developing an international database to be used by IC facilities as a tool for benchmarking and improving their implementation of occupational radiation protection.

(2014) • ISBN 978-92-0-100514-4 • IAEA-TECDOC-1735 • €18.00

#### **ACCIDENT RESPONSE**



#### Criteria for Use in Preparedness and Response for a Nuclear or Radiological Emergency

IAEA Safety Standards Series No. GSG-2

#### General Safety Guide

This Safety Guide presents a coherent set of generic criteria (expressed numerically

in terms of radiation dose) that form a basis for developing

the operational levels needed for decision making concerning protective and response actions. The set of generic criteria addresses the requirements established in IAEA Safety Standards Series No. GS-R-2 for emergency preparedness and response, including lessons learned from responses to past emergencies, and provides an internally consistent foundation for the application of principles of radiation protection. The publication also provides a basis for a plain language explanation of the criteria for the public and for public officials.

Arabic Edition (108 pp.; 2012) • ISBN 978-92-0-629410-9 • STI/PUB/1467 • €41.00
English Edition (91 pp.; 2011) • ISBN 978-92-0-107410-2 • STI/PUB/1467 • €41.00
French Edition (91 pp.; 2012) • ISBN 978-92-0-224210-4 • STI/PUB/1467 • €41.00
Russian Edition (108 pp.; 2012) • ISBN 978-92-0-424810-4 • STI/PUB/1467 • €41.00
Spanish Edition (104 pp.; 2013) • ISBN 978-92-0-336310-5 • STI/PUB/1467 • €41.00

#### The Radiological Accident in Lia, Georgia

Under the Convention on Assistance in Case of a Nuclear Accident or Radiological Emergency, the Georgian authorities requested assistance from the IAEA in relation to the 2001 radiological accident in Lia. This assistance related to advice on the dose assessment, source recovery and medical management of those involved in the accident. This report provides the detailed information on the accident and presents the findings and conclusions and lessons learned from the treatment of the overexposed victims. The aim is to help to avoid similar occurrences by improving safety, and to minimize the consequences of any such events that do occur.

(Forthcoming 2014) • ISBN 978-92-0-103614-8 • STI/PUB/1660 • €42.00

#### RADIOACTIVE WASTE MANAGEMENT

#### **Decommissioning of Facilities**

IAEA Safety Standards Series No. GSR Part 6
General Safety Requirements

Decommissioning is the last step in the lifetime management of a facility. It must also be considered during the design, construction, commissioning and operation of facilities. This publication establishes requirements for the safe decommissioning of a broad range of facilities: nuclear power plants, research reactors, nuclear fuel cycle facilities, facilities for processing naturally occurring radioactive material, former military sites, and relevant medical, industrial and research facilities. It addresses all the aspects of decommissioning that are required to ensure safety, aspects such as roles and responsibilities, strategy and planning for decommissioning, conduct of decommissioning actions and termination of the authorization for decommissioning. It is intended for use by those involved in policy development, regulatory control and implementation of decommissioning.

(Forthcoming 2014) • ISBN 978-92-0-102614-9 • STI/PUB/1652 • €25.00



## Model Regulations for the Use of Radiation Sources and for the Management of the Associated Radioactive Waste

IAEA TECDOC Series No. 1732

This publication provides advice on an appropriate set of regulations covering all aspects of the use of radiation sources

and the safe management of the associated radioactive waste. The publication provides the framework for the regulatory requirements and conditions to be incorporated into individual authorizations for the use of radiation sources in industry, medical facilities, research and education, and in agriculture. It also establishes criteria to be used for assessing compliance. The content allows States to appraise the adequacy of their existing regulations and regulatory guides, and to act as a reference for those States developing regulations for the first time. The publication is a supplement to the guidance in the IAEA Safety Guide GS-G-1.5, Regulatory Control of Radiation Sources.

(2013) • ISBN 978-92-0-115613-6 • IAEA-TECDOC-1732 • €18.00



## Safety Assessment for Decommissioning

Safety Reports Series No. 77

The international project on evaluation and demonstration of safety during decommissioning of facilities using radioactive material (DeSa), launched by the IAEA in 2004, helps to ensure that specific guidance on the safety

assessment in the context of the decommissioning of nuclear facilities is provided. This publication presents the outcomes of the work carried out in fulfilling the action plan through the DeSa Project. The main features of the process have been summarized and overall recommendations on producing, reviewing and implementing the safety assessment have been made. They are supported by specific recommendations contained in Annexes I–III.

(133 pp., 9 figs; 2013) • ISBN 978-92-0-141410-6 • STI/PUB/1604 • €44.00



#### The Safety Case and Safety Assessment for the Predisposal Management of Radioactive Waste

IAEA Safety Standards Series No. GSG-3

#### General Safety Guide

This Safety Guide provides recommendations and guidance for the development and regulatory review of the safety case and supporting safety assessment throughout the lifetime of a facility. The recommendations and guidance provided in this Safety Guide can be used irrespective of how the safety case and safety assessment processes are addressed within national regulatory

frameworks. It summarizes the most important considerations in assessing and demonstrating the safety of facilities and activities and recommends the steps that should be followed in developing the safety case and performing the safety assessment.

(151 pp., 11 figs; 2013) • ISBN 978-92-0-134810-4 • STI/PUB/1576 • €37.00

#### SAFETY ANALYSIS



Environmental Sensitivity in Nuclear Emergencies in Rural and Semi-natural Environments

Report of Working Group 8 Environmental Sensitivity of EMRAS II Topical Heading Approaches for Assessing Emergency Situations

IAEA TECDOC Series No. 1719

This publication describes the work and activities of the IAEA model test and comparison programme entitled Environmental Modelling for Radiation Safety (EMRAS II). The EMRAS II programme emphasized the comparison, testing and improvement of environmental transfer models for assessing exposures to the public and non-human species. The aim of the programme is to stimulate development and encourage the elaboration of internationally agreed and harmonized assessment models for planned, existing and emergency exposure situations and strengthen assessment capabilities in Member States. The work within the EMRAS II programme included an analysis of the influence of different climates, living habits and agricultural practices.

(2013) • ISBN 978-92-0-112610-8 • IAEA-TECDOC-1719 • €18.00



Evaluation of Advanced Thermohydraulic System Codes for Design and Safety Analysis of Integral Type Reactors

IAEA TECDOC Series No. 1733

The IAEA organizes International Collaborative Standard Problems (ICSPs) to facilitate the development and validation

of computer codes for design and safety analysis of nuclear power plants. The implementation of an ICSP usually includes an experimental investigation of interesting phenomena and simulation of the experiment with computer codes. This publication presents the outcome of an ICSP assessing the capability of system thermohydraulic computer codes for integral reactor system design and safety analysis. It took place at the experimental facility at the Oregon State University in the United States of America. The publication details the ICSP tests and results from all participants, provides a description of the computer codes used and the models developed, and includes some discussion by each participant concerning the results that were achieved during blind and open phases of the calculation

for their individual models. The publication concludes with lessons learned and recommendations for the future.

(2013) • ISBN 978-92-0-100314-0 • IAEA-TECDOC-1733 • €18.00



Safety Reassessment for Research Reactors in the Light of the Accident at the Fukushima Daiichi Nuclear Power Plant

Safety Reports Series No. 80

This publication provides guidance for all steps in performing safety reassessments

for research reactors in the light of the feedback from the Fukushima Daiichi accident. Although it primarily focuses on operating research reactors, the guidance provided by this publication also applies to research reactors that are in the design and construction phases or in an extended shutdown state. It is not intended to replace or supersede any of the requirements or guidance provided by the relevant IAEA Safety Standards, including those on safety analysis, evaluation of seismic and external hazards, and emergency preparedness and response for research reactors. However, this Safety Report should be used in close conjunction with these Safety Standards, whereby the main users will be operating organizations, regulatory bodies, design organizations and other entities involved in the safety of research reactors.

(33 pp.; 2014) • ISBN 978-92-0-100814-5 • STI/PUB/1615 • €20.00

#### **QUALITY MANAGEMENT**



Benchmarking Severe Accident Computer Codes for Heavy Water Reactor Applications

IAEA TECDOC Series No. 1727

This publication reports on the results of an IAEA coordinated research project (CRP) on benchmarking severe accident computer codes for heavy water reactor

applications. The CRP scope included the identification and selection of a severe accident sequence, selection of appropriate geometrical and boundary conditions, benchmark analyses, comparison of simulation results, evaluation of the computer code capabilities to predict important severe accident phenomena and core damage progression, and the proposal of code improvements and/or new experiments to reduce uncertainties. The summary report provides a comparison of key results for the selected Station Blackout scenario, obtained from five participating States and concludes with lessons learned and recommendations for future activities.

(2013) • ISBN 978-92-0-114413-3 • IAEA-TECDOC-1727 • €18.00

## LEGAL AND GOVERNMENTAL ASPECTS



#### Development of a Regulatory Inspection Programme for a New Nuclear Power Plant Project

Safety Reports Series No. 81

This Safety Report provides general principles, guidance and technical rationale for regulatory inspections related to new

nuclear power plant projects, and is based on the consideration of IAEA safety standards and experiences of Member States. The publication covers regulatory inspection during siting, design, construction and commissioning stages as well as the transition to operation. It takes into account approaches and practices of Member States recently involved in new nuclear facility projects, and it includes examples of Member States' regulatory inspection programmes and experiences.

(112 pp., 3 figs; 2014) • ISBN 978-92-0-113513-1 • STI/PUB/1636 • €35.00



#### Legal and Institutional Issues of Transportable Nuclear Power Plants: A Preliminary Study

IAEA Nuclear Energy Series No. NG-T-3.5

A transportable nuclear power plant (TNPP) is a factory manufactured, movable nuclear power plant, which when

fuelled is capable of producing final energy products such as electricity and heat. Transportable nuclear power plants are not designed to operate during transportation. This publication highlights the potential benefits of TNPPs, describes the legal and institutional issues for their deployment in countries other than the country of origin, reveals challenges that might be faced in their deployment, and outlines pathways for resolution of the identified issues and challenges in the short and long terms. It is addressed to senior legal, regulatory and technical officers in Member States planning to embark on a nuclear power programme or to expand an existing one by considering the introduction of a TNPP.

(95 pp., 6 figs; 2013) • ISBN 978-92-0-144710-4 • STI/PUB/1624 • €33.00



## Managing Regulatory Body Competence

Safety Reports Series No. 79

The ability of a regulatory body to fulfil its responsibilities depends largely on the competence of its staff. Building employees' skills and knowledge is an investment in each employee and in the future of the organization. This Safety

Report publication provides generic guidance on managing the competence of regulatory bodies within their management system. It can be used as an example for Member States on how to meet the requirements of systematically assessing competence needs, in the near and long term, and delivering training and other elements of competence development, as well as continually improving this part of the management system.

(96 pp., 2 figs; 2014) • ISBN 978-92-0-113413-4 • STI/PUB/1635 • €44.00



## Use of External Experts by the Regulatory Body

IAEA Safety Standards Series No. GSG-4

#### General Safety Guide

This Safety Guide provides recommendations and guidance on meeting the requirements of IAEA Safety

Standards Series No. GSR Part 1 on obtaining expert advice or services for the regulatory body. It informs the regulatory body on the process it should use to determine the need for external expert advice, and the processes and procedures for identifying a suitable support provider and making contractual arrangements for the work. It also provides recommendations and guidance on how the regulatory body should take the advice of external experts into account while still retaining responsibility in making its decisions.

(25 pp., 2 figs; 2013) • ISBN 978-92-0-135910-0 • STI/PUB/1583 • €25.00

### NuclearPower





#### Benchmark Analyses on the Natural Circulation Test Performed during the PHENIX End-of-Life Experiments

**IAEA TECDOC Series No. 1703** 

This publication is based on the experience of an IAEA coordinated research project on control rod withdrawal and sodium

natural circulation tests performed during the Phenix end-of-life experiments. Presented in this publication are the benchmark analyses of the natural circulation test performed before the definite shutdown of the reactor. The experimental data gathered during these tests represent a unique resource to carry out validation analyses and code to code comparisons. The benchmark analyses allowed participants to investigate and verify several system and safety codes currently used in the analyses of liquid metal thermalhydraulics phenomena in sodium fast reactors.

(2013) • ISBN 978-92-0-139610-5 • IAEA-TECDOC-1703 • €18.00



## Country Nuclear Power Profiles 2013 Edition

The Country Nuclear Power Profiles compile background information on the status and development of nuclear power programmes in Member States. The

CNPP summarizes organizational and industrial aspects of nuclear power programmes and provides information about the relevant legislative, regulatory and international framework in each State. Its descriptive and statistical overview of the overall economic, energy, and electricity situation in each State and its nuclear power framework is intended to serve as an integrated source of key background information about nuclear power programmes in the world. This 2013 edition, issued on CD-ROM and web pages, contains updated country information for 51 States.

CD Edition (2013) • ISBN 978-92-0-162010-1 • IAEA-CNPP/2013/CD • €95.00



Framework for Assessing Dynamic Nuclear Energy Systems for Sustainability:

Final Report of the INPRO Collaborative Project GAINS

IAEA Nuclear Energy Series
No. NP-T-1.14

As an integral part of the international project on innovative nuclear reactors and fuel cycles (INPRO), several collaborative projects were established by its members. The collaborative project on global architectures of innovative nuclear energy systems based on thermal and fast reactors including a closed fuel cycle was one of them. This publication

presents the study, its results and the conclusions drawn. A major achievement of the project is the development of a unique heterogeneous world model considering specific nuclear energy strategies of various States. This model simulates important realities of the global nuclear energy system thus enabling the assessment of resource, financial, and proliferation risks and identification of areas for beneficial multilateral cooperation. It shows that innovative nuclear technologies serve as a driving force for enhancing the sustainability features of nuclear energy supply, while a multilateral approach amplifies the positive effects of the technological innovations.

(253 pp., 233 figs; 2013) • ISBN 978-92-0-140410-7 • STI/PUB/1598 • €40.00



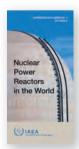
## International Safeguards in Nuclear Facility Design and Construction

IAEA Nuclear Energy Series No. NP-T-2.8

This IAEA publication provides guidance on the inclusion of safeguards considerations in nuclear facility design and construction.

This first volume introduces the basic principles of Safeguards by design and discusses the goals, costs and rewards, and places the information into the context of nuclear facility design and construction. Benefits and opportunities for all stakeholders are emphasized. The guidance is aimed at enhancing the understanding of nuclear facility vendors and designers regarding the safeguards obligations of both States and the IAEA, at improving the cooperation between all stakeholders in safeguards implementation, and at minimizing the cost of implementation for all stakeholders.

(22 pp., 1 fig.; 2013) • ISBN 978-92-0-140610-1 • STI/PUB/1600 • €19.00



## Nuclear Power Reactors in the World 2013 Edition

Reference Data Series No. 2

This is the 33rd edition of Reference Data Series No. 2, which presents the most recent reactor data available to the IAEA. It contains summarized information as of the end of 2012

on: power reactors operating, under construction, and shut down; and performance data on reactors operating in the IAEA Member States, as reported to the IAEA. The information is collected through designated national correspondents in the Member States and the data area used to maintain the IAEA's Power Reactor Information System (PRIS).

(80 pp., 6 figs; 2013) • ISBN 978-92-0-144110-2 • IAEA-RDS-2/33 • €15.00

## NUCLEAR POWER PLANNING AND ECONOMICS

## Ageing Management of Concrete Structures in Nuclear Power Plants

IAEA Nuclear Energy Series No. NP-T-3.5

This Publication is one in a series of reports on the assessment and management of ageing of major nuclear power plant components. Current practices for assessment of safety margins (fitness for service) and inspection, monitoring and mitigation of ageing degradation of selected concrete structures related to NPPs are documented. Implications for and differences in new reactor designs are discussed. This information is intended to help all involved directly and indirectly in ensuring the safe operation of NPPs; and also to provide a common technical basis for dialogue between plant operators and regulators when dealing with age related licensing issues.

(Forthcoming 2014) • ISBN 978-92-0-102914-0 • STI/PUB/1654 • €55.00



## Approaches for Assessing the Economic Competitiveness of Small and Medium Sized Reactors

IAEA Nuclear Energy Series
No. NP-T-3.7

This publication assists existing and potential stakeholders in the definition

of competitive approaches regarding design and deployment of small and medium sized reactors (SMRs). It provides a framework for assessment of the investment attractiveness of nuclear power plant projects that adopt small reactors to be deployed in multimodules and incorporate modularization construction technology. Main chapters detail past experience and future plans in several IAEA Member States and present the suite of models to assist designers and guide potential users on the economic performance and investment attractiveness of SMRs. A framework for the consolidated application of such models is also suggested. The annexes, contributed by Member States, provide in depth descriptions of different assessment models and give examples of their application.

(255 pp., 89 figs; 2013) • ISBN 978-92-0-144210-9 • STI/PUB/1619 • €42.00



## Cost Estimation for Research Reactor Decommissioning

IAEA Nuclear Energy Series
No. NW-T-2.4

The main aim of this publication is to disseminate experience in and guidance on cost estimates for research reactor decommissioning projects. It presents the

principles and background for a costing methodology based on the International Structure for Decommissioning Costing of Nuclear Installations. The methodology presented implements actual experience in decommissioning costing and is in line with IAEA efforts promoting harmonization in this field. The IAEA has

contributed to the development of software called CERREX (Cost Estimate for Research Reactors in Excel), a simpler version suitable for preliminary costing stages, which is included on the attached CD-ROM, together with a user manual. Several practical examples of software implementation and clarification of some details of available methodologies and models are also provided.

(95 pp., 23 figs; 2014) • ISBN 978-92-0-140210-3 • STI/PUB/1596 • €22.00



#### Energy, Electricity and Nuclear Power Estimates for the Period up to 2050

2013 Edition

Reference Data Series No. 1

The 33rd edition of the annual Reference Data Series No. 1 contains estimates of energy, electricity and nuclear power trends up to the

year 2050, using a variety of sources, such as the IAEA's Power Reactor Information System and data prepared by the United Nations.

(53 pp., 10 figs; 2013) • ISBN 978-92-0-111910-0 • IAEA-RD-1/33 • €18.00



#### INPRO Assessment of the Planned Nuclear Energy System of Belarus

**IAEA TECDOC Series No. 1716** 

INPRO is an international project to help ensure that nuclear energy is available to contribute in a sustainable manner to meeting the energy needs of the

twenty-first century. Between July 2009 and October 2011, Belarus used INPRO methodology to undertake a review of their planned nuclear energy system with regard to its long-range sustainability. This report comprises a description of the assessed nuclear energy system based on novel reactors of Russian design (AES-2006) and the results of assessment of that system using the INPRO methodology. The report identifies follow up actions for the further development and successful implementation of nuclear energy in Belarus. The publication may also serve as a model Nuclear Energy System Assessment for other Member States, as it covers all seven INPRO areas: Safety, Infrastructure, Proliferation Resistance, Physical Protection, Waste Management, Environment and Economics.

(2013) • ISBN 978-92-0-113013-6 • IAEA-TECDOC-1716 • €18.00

#### INPRO Methodology for Sustainability Assessment of Nuclear Energy Systems: Economics

IAEA Nuclear Energy Series No. NG-T-4.4

As part of the INPRO methodology this manual provides guidance on assessing a nuclear energy system in the area of economics. This is an independent assessment of the economic competitiveness of nuclear power, compared with available alternatives. The publication starts with a short description

of the goals and output of an energy system planning study, followed by general background information on performing an INPRO economic assessment and presents a discussion of the basic principle, the associated user requirements and criteria. In the appendices I–IV, additional background information on economic terms and support tools is provided.

(Forthcoming 2014) • ISBN 978-92-0-102714-6 • STI/PUB/1653 • €40.00



#### Managing Environmental Impact Assessment for Construction and Operation in New Nuclear Power Programmes

IAEA Nuclear Energy Series No. NG-T-3.11

This publication provides a holistic approach to environmental protection in

new nuclear power programmes. It describes the Environmental Impact Assessment (EIA) process, the subsequent utilization of the EIA, and the necessary infrastructure for such processes. The presumption is that a Member State embarking on such a programme already has an environmental regulatory framework in place, which may not be developed for nuclear power but for industrial projects, therefore the emphasis is on the environmental aspects that are unique to a nuclear power plant project. The publication is addressed to senior managers, project managers or coordinators and technical specialists of government authorities and agencies, including the regulatory body, operating organizations and supporting industries and other organizations involved in environmental issues.

(47 pp., 8 figs; 2014) • ISBN 978-92-0-144810-1 • STI/PUB/1625 • €29.00

## Preparation of a Feasibility Study for New Nuclear Power Projects

IAEA Nuclear Energy Series No. NG-T-3.3

A feasibility study represents an important step in the development of a new build nuclear power plant project. It is a complex but necessary step to determine whether a business opportunity is possible, practical and viable. Technical, economical, financial, regulatory, social, environmental aspects of a nuclear power plant programme need to be considered to allow authorities to make informed decisions regarding the possible implementation of the project This publication assists Member States in developing a feasibility study for nuclear power projects and provides guidance to users who are planning to perform such a study, with consideration of both the technical and process areas. These guidelines condense the experience of individuals involved in previous feasibility study efforts and provide industry best practices in order to maximize the usefulness of any results.

(Forthcoming 2014) • ISBN 978-92-0-145610-6 • STI/PUB/1633 • €39.00

## Technical Requirements in the Bidding Process for a New Research Reactor

IAEA Nuclear Energy Series No. NP-T-5.6

Interest in developing research reactor programmes has grown significantly in recent years. Currently, a significant number of Member States are in different stages of new research reactor projects. The majority of them are building their first research reactor as a key national installation for the development of their nuclear science and technology programmes. In this context, this publication has been developed to assist Member States in the preparation of the technical requirements for the bidding process of a new research reactor. The publication addresses the preparation phase of the bidding process and discusses criteria that may be used in the evaluation of the bids. The guidance applies to all reactor types and technologies and it does not recommend a specific reactor type or technology or a specific design. However, it is assumed that the publication will be used by a Member State that has made a commitment to build a safe, sustainable, robust design and easy maintainable research reactor. The guidance provided in the publication is primarily oriented to Member States building their first research reactor; however, such guidance could also be useful for the bidding process of subsequent reactors.

(Forthcoming 2014) • ISBN 978-92-0-103414-4 • STI/PUB/1659 • €21.00

#### **NUCLEAR POWER OPERATIONS**



Operating Experience with Nuclear Power Stations in Member States in 2012 2013 Edition (CD-ROM)

**Operating Experience** 

This CD-ROM contains the 44th edition

of the IAEA's series of annual reports on operating experience with nuclear power plants in Member States. It is a direct output from the IAEA's Power Reactor Information System (PRIS) and contains information on electricity production and overall performance of individual plants during 2012. In addition to annual information, the report contains a historical summary of performance during the lifetime of individual plants and figures illustrating worldwide performance of the nuclear industry. The CD-ROM contains also an overview of design characteristics and dashboards (not included into the web version) of all operating nuclear power plants worldwide.

CD Edition (2013) • ISBN 978-92-0-194310-1 • STI/PUB/1620 • €65.00



#### Operation and Licensing of Mixed Cores in Water Cooled Reactors

IAEA TECDOC Series No. 1720

The performance and operation of mixed cores is of interest to many nuclear power plants as new and improved fuel designs have been introduced or a different

fuel vendor has been chosen to supply fuel. Such decisions have generally been driven by economic considerations or by the expectation of improved fuel performance. The design and licensing of a fuel load in a reactor core are complex undertakings, even without the additional complication of the usage of different fuel types. The issues that need to be considered include simple geometric compatibility of different fuel types, their different thermohydraulic characteristics and nuclear behaviour. This publication presents the results of two meetings held on these topics and hosted by the IAEA. The meetings provided a forum to address the above mentioned issues and to review the accumulated experience and state of the art information on mixed core operation, as well as tools and techniques that are used to analyse the core operation and to demonstrate that there are no safety related issues.

(2013) • ISBN 978-92-0-113213-0 • IAEA-TECDOC-1720 • €18.00

## Plant Life Management Model for Long Term Operation of a Nuclear Power Plant

IAEA Nuclear Energy Series No. NP-T-3.18

When nuclear power plants reach the end of their nominal design life, they undergo a special safety review and an ageing assessment of their essential structures, systems and components for the purpose of validating or renewing their licence to operate for terms beyond the service period originally intended. Three different plant life management models have been used to qualify these nuclear power plants to operate beyond their original design life. This publication presents a collection of sample licensing practices for long term operation among IAEA Member States. The various plant life management models used to obtain long term operation authorizations are described and comparisons drawn against the standard periodic safety review model. Lessons learned and warning about possible complications and pitfalls are also described to minimize the licensing risk during operation and future long term operation applications. The main intention of this publication is to support nuclear power plant owners and operators planning an extension of their plant operation beyond its original design life, but it also serves as a useful guide for those interested in procuring from the beginning, the necessary tools to implement ageing management in their future plant with long term operation in mind.

(Forthcoming 2014) • ISBN 978-92-0-103014-6 • STI/PUB/1655 • €38.00



## Third International Conference on Nuclear Power Plant Life Management

Proceedings of an International Conference held in Salt Lake City, USA, 14–18 May 2012

#### **Proceedings Series**

There is current trend for the operational life of nuclear power plants to be extended beyond that of their original licence period. This publication is the proceedings of the third international conference on nuclear power plant life management which demonstrated the value of an open exchange of information between experts from different countries and organizations.

The presentations cover a wide range of subjects including: very specific solutions for reactor pressure vessel integrity; material degradation; ageing management and licensing renewal approaches; risk informed inspection; non-destructive examination methods; and tools to be used in various stages of plant life management programmes. The publication provides utilities, operators and regulators with a comprehensive state of the science and technology overview of the main issues concerning nuclear power plant life management.

(2014) • ISBN 978-92-0-162510-6 • STI/PUB/1634 • €20.00

#### REACTOR TECHNOLOGY



Advanced Surveillance,
Diagnostic and Prognostic
Techniques in Monitoring
Structures, Systems and
Components in Nuclear Power
Plants

IAEA Nuclear Energy Series No. NP-T-3.14

This publication reports on the work and findings of an IAEA coordinated research project. The technologies discussed are intended to establish the state of the art in surveillance, diagnostic and prognostic (SDP) technologies for equipment and process health monitoring in nuclear facilities. Technology gaps and research needs of the nuclear industry in the SDP area are also identified. The publication describes conventional SDP technologies as well as the latest tools, algorithms and techniques that have emerged over the past few years. These new tools have made it possible to identify problems earlier and with better resolution. The target audience of this publication is utility engineers, end users, researchers, managers and executives making decisions on implementation of the subject technologies in nuclear facilities, or determining the future direction of research and development in this area.

(128 pp., 78 figs; 2013) • ISBN 978-92-0-140510-4 • STI/PUB/1599 • €30.00



## Challenges Related to the Use of Liquid Metal and Molten Salt Coolants in Advanced Reactors

**IAEA TECDOC Series No. 1696** 

This publication documents the results of experimental investigations and computational fluid dynamics studies on thermohydraulics, specifically models and

correlations on pressure drop and heat transfer involving to liquid metal and molten salt coolants under different operating conditions, including the feedback on neutronics effects. It presents new data, or verifies existing data, on thermophysical properties of liquid metal and molten salt coolants, and describes tools for on-line monitoring and control of coolant chemistry. Methods to improve the corrosion resistance

between heavy liquid metal coolant and components, structure material and instrumentation are also examined.

(2013) • ISBN 978-92-0-139910-6 • IAEA-TECDOC-1696 • €18.00



#### Design Features and Operating Experience of Experimental Fast Reactors

IAEA Nuclear Energy Series
No. NP-T-1.9

Growing energy needs and concern for the environment drive the demand for large scale and low impact energy

Therefore, national and international research sources. on fast reactor technology is increasing. As a part of the IAEA efforts for knowledge preservation and data retrieval, this publication compiles and documents significant aspects of fast reactor engineering development and experience. Its focus is on research and development activities, experience with experimental facilities and properties, and criteria for comparison and choice of liquid metal coolants. The introductory part includes the history, the state of the art and an overview of fast reactor cooling, heat transport and heat conversion systems development. This is followed by basic information on liquid metal coolants and design features. The publication concludes with a summary which identifies the progress achieved and issues to be resolved in sodium and heavy metal coolant technology.

(128 pp., 54 figs; 2013) • ISBN 978-92-0-136410-4 • STI/PUB/1585 • €23.00



#### Evaluation of Advanced Thermohydraulic System Codes for Design and Safety Analysis of Integral Type Reactors

IAEA TECDOC Series No. 1733

The IAEA organizes International Collaborative Standard Problems (ICSPs) to facilitate the development and validation

of computer codes for design and safety analysis of nuclear power plants. The implementation of an ICSP usually includes an experimental investigation of interesting phenomena and simulation of the experiment with computer codes. This publication presents the outcome of an ICSP assessing the capability of system thermohydraulic computer codes for integral reactor system design and safety analysis. It took place at the experimental facility at the Oregon State University in the United States of America. The publication details the ICSP tests and results from all participants, provides a description of the computer codes used and the models developed, and includes some discussion by each participant concerning the results that were achieved during blind and open phases of the calculation for their individual models. The publication concludes with lessons learned and recommendations for the future.

(2013) • ISBN 978-92-0-100314-0 • IAEA-TECDOC-1733 • €18.00



#### Nuclear Reactor Technology Assessment for Near Term Deployment

IAEA Nuclear Energy Series No. NP-T-1.10

Given the increasing interest in the near term deployment of new nuclear power plants, IAEA Member States

have requested guidance on the process of evaluating and selecting available technology options. Reactor technology assessment enables the evaluation, selection, and deployment of the best technology to meet the objectives of a nuclear power programme. This publication demonstrates how reactor technology assessment is performed and how the process and results of this work enable decision making in nuclear power planning. The approach also provides decision makers with the documentation necessary to support their conclusions.

(94 pp., 3 figs; 2013) • ISBN 978-92-0-140310-0 • STI/PUB/1597 • €30.00



## Performance Assessment of Passive Gaseous Provisions (PGAP)

**IAEA TECDOC Series No. 1698** 

The International Project on Innovative Nuclear Reactors and Fuel Cycle (INPRO) initiated a collaborative project to contribute to an international consensus on

the definition of the reliability of passive systems that involves natural circulation, and a methodology to assess this reliability. Different reliability methodologies available in Member States were used to assess the performance and reliability of the passive decay heat removal system of the French gas cooled fast reactor (GFR) design for various transients. This publication is the final report of this project and summarizes the results of the participants' work concerning the evaluation of the performance and reliability of the passive decay heat removal system of the GFR design. The report also presents a unified definition of the reliability of thermohydraulic passive system, and the possibility of unifying the features of the methodologies in order to develop a generic methodology

(2013) • ISBN 978-92-0-139010-3 • IAEA-TECDOC-1698 • €18.00



## Status of Fast Reactor Research and Technology Development

IAEA TECDOC Series No. 1691

Based on a recommendation from the Technical Working Group on Fast Reactors, this publication is a regular update of previous publications on fast reactor technology. The publication provides comprehensive and detailed

information on the technology of fast neutron reactors. The focus is on practical issues that are useful to engineers, scientists, managers, university students and academics. The main issues discussed are experience in design, construction, operation and decommissioning, various areas of research

and development, engineering, safety and national strategies, and public acceptance of fast reactors. The summary includes national strategies, international initiatives on innovative (i.e. Generation IV) systems and an assessment of public acceptance of fast reactors.

(2013) • ISBN 978-92-0-130610-4 • IAEA-TECDOC-1691 • €35.00

#### **OUALITY ASSURANCE**



Evaluation of High Temperature Gas Cooled Reactor Performance: Benchmark Analysis Related to the PBMR-400, PBMM, GT-MHR, HTR-10 and the ASTRA Critical Facility

**IAEA TECDOC Series No. 1694** 

This publication presents the findings of an IAEA coordinated research project (CRP) focusing on validation of the safety and operational aspects of high temperature gas cooled reactors (HTGRs) under projected and actual operating conditions. Specifically, it documents the results of a benchmark analysis of the ASTRA critical facility at the Kurchatov Institute in the Russian Federation, with respect to the development of pebble bed high temperature modular reactor (PBMR-400). It also presents results of benchmark analyses performed for the HTR-10 experimental reactor in China, and the pebble bed micromodel test facility in South Africa. Such benchmarks include core height prediction for criticality, control rod worth and related differential reactivity and interference coefficients, and investigation of critical parameters for differing heights of the pebble bed high temperature modular reactor. Code to code comparison as well as comparison with actual experimental data make the information obtained from this CRP valuable for verification and validation of HTGR design and analysis codes for future developers of HTGR power plants. General results and conclusions as delineated by the participating Member States are described in the summary.

(2013) • ISBN 978-92-0-137610-7 • IAEA-TECDOC-1694 • €32.00

## QUALIFICATION AND TRAINING OF PERSONNEL



## Managing Human Performance to Improve Nuclear Facility Operation

IAEA Nuclear Energy Series No. NG-T-2.7

The contribution of human performance to the occurrence of significant events and consequently to overall performance

improvement in the nuclear field has been well documented. Nuclear industry experience shows that within nuclear power

plants, 80% of significant events can be attributed to human error. Monitoring and continually improving human performance has now become one of the key challenges in the management of human resources for a nuclear facility. This publication provides practical guidance in this area and will assist Member States to review and improve the systems and process for improving human performance as a major contribution to sustaining and improving the performance of nuclear facilities.

(24 pp., 2 figs; 2014) • ISBN 978-92-0-144610-7 • STI/PUB/1623 • €18.00

## Managing Organizational Change in Nuclear Organizations

IAEA Nuclear Energy Series No. NG-T-1.1

It is widely recognized that engineering changes, if not properly considered and controlled, can have potentially major safety implications; however, organizational changes can also have potentially major safety implications. This publication is intended to assist the management of nuclear organizations in identifying, planning and implementing organizational change. The driving force for the change may be internal or external. Based on the assumption that any change made within a facility applying nuclear technology has the potential to impact safety and effectiveness, the publication provides a description of the basic principles for managing and implementing the organizational change effectively while remaining focused on safe and reliable operation. The guidance contained in the publication is relevant to all organizational changes within nuclear organizations.

(Forthcoming 2014) • ISBN 978-92-0-140910-2 • STI/PUB/1603 • €45.00

## Nuclear Engineering Education: A Competence Based Approach to Curricula Development

IAEA Nuclear Energy Series No. NG-T-6.4

Maintaining nuclear competencies in the nuclear industry is a one of the most critical challenges in the near future. With the development of a number of nuclear engineering educational programmes in several States, this publication provides guidance to decision makers in Member States on a competence based approach to curricula development, presenting the established practices and associated requirements for educational programmes in this field. It is a consolidation of best practices that will ensure sustainable, effective nuclear engineering programmes, contributing to the safe, efficient and economic operation of nuclear power plants. The information presented is drawn from a variety of recognized nuclear engineering programmes around the world and contributes to the main areas that are needed to ensure a viable and robust nuclear industry.

(Forthcoming 2014) • ISBN 978-92-0-144910-8 • STI/PUB/1626 • €20.00



#### The Impact of Knowledge Management Practices on NPP Organizational Performance — Results of a Global Survey

IAEA TECDOC Series No. 1711

This publication summarizes the findings of research that was conducted to explore the link between knowledge management

practices and their impact on nuclear power plant organizational performance. The publication also includes findings on specific knowledge management practices that have proven effective in nuclear power plants and their benefits in terms of organizational effectiveness.

(2013) • ISBN 978-92-0-143110-3 • IAEA-TECDOC-1711 • €18.00

## NuclearFuelCycle andWasteManagement



#### Communication and Stakeholder Involvement in Environmental Remediation Projects

IAEA Nuclear Energy Series No. NW-T-3.5

This publication has been developed with the aim of translating the complex technical terminology and approaches embodied in the planning and implementation of environmental remediation programmes into a more accessible language. The objective is to help environmental remediation implementers and regulators to engage and sustain dialogue with different stakeholders while developing a decision making process regarding the implementation of environmental remediation programmes. The publication deals with the technical and nontechnical dimensions of environmental remediation and makes available experiences on how to proceed with communication and stakeholder engagement in environmental remediation programmes.

(Forthcoming 2014) • ISBN 978-92-0-145210-8 • STI/PUB/1629 • €28.00

## Experiences and Lessons Learned Worldwide in Cleanup and Decommissioning of Nuclear Facilities in the Aftermath of Accidents

IAEA Nuclear Energy Series No. NW-T-2.7

This publication reviews experiences in IAEA Member States relevant to the cleanup and decommissioning of nuclear facilities in the aftermath of accidents and provides an overview of lessons learned worldwide. It also updates information from earlier publications on this topic, according to the different phases of activity after the accident has been declared ended (site stabilization, post-accident cleanup, safe enclosure) and, in the longer term, final decommissioning and site remediation.

(Forthcoming 2014) • ISBN 978-92-0-101214-2 • STI/PUB/1644 • €31.00

#### Fast Reactors and Related Fuel Cycles Proceedings of an International Conference held in Paris, France, 4–7 March 2013

**Proceedings Series** 

This publication presents the proceedings of an international conference in the field of fast reactors and related fuel cycle technologies, organized by the IAEA every four years. The conference provided a unique forum to discuss national and international fast reactor programmes, analyse new experience and advances arising from research and development programmes, and identify needs to be addressed in relation to the industrial deployment of fast reactors. A CD-ROM with contributed papers accompanies the proceedings. All the scientific contributions included in these proceedings were peer reviewed by the International Scientific Programme Committee of the Conference.

(Forthcoming 2014) • ISBN 978-92-0-104114-2 • STI/PUB/1665 • €98.00



#### Hot Cell Post-irradiation Examination and Poolside Inspection of Nuclear Fuel

Proceedings of the IAEA– HOTLAB Technical Meeting held in Smolenice, Slovakia, 23–27 May 2011

#### **IAEA TECDOC Series No. 1693**

The growing operational demands in nuclear fuel, such as longer fuel cycles, higher burnups and use of transient regimes, call for more robust fuel designs and more radiation resistant materials. Implementation of new materials and fuel designs that are able to meet these more challenging conditions requires adequate operational feedback and practical verification of models for prediction of fuel behaviour. This CD-ROM publication presents the proceedings of a technical meeting jointly held by the IAEA and the HOTLAB association of hot laboratories with the aim of providing an overview of the current status, problems and perspectives of post-irradiation examination. The publication consists of the presentations, session summaries and conclusions of the meeting.

(2013) • ISBN 978-92-0-191210-7 • IAEA-TECDOC-CD-1693 • €18.00



#### Lessons Learned from Environmental Remediation Programmes

IAEA Nuclear Energy Series No. NW-T-3.6

Environmental remediation, in the context of legacy sites, is being carried out in IAEA Member States at different paces.

There is already significant experience and expertise present from around the world as nuclear and associated facilities are closed and move through the decommissioning and environmental remediation phases. Methodological approaches and remediation technologies have been developed to deal with different remediation situations and subsequently adapted to site specific conditions. They have also been further fine tuned as they have been rolled out either on relatively small or large scale projects. This publication is intended to capture part of this experience and make it available to IAEA Member States, so that they can benefit from the existing knowledge when planning and implementing their remediation programmes.

(51 pp.; 2014) • ISBN 978-92-0-145310-5 • STI/PUB/1630 • €27.00

## Management of Spent Fuel from Nuclear Power Reactors

### Proceedings of an International Conference held in Vienna, Austria, 31 May-4 June 2010

**Proceedings Series** 

This publication presents the proceedings of an international conference on spent fuel management organized by the IAEA in cooperation with the NEA of the OECD. The conference covered a broad range of topics from national strategies through safety and regulatory aspects, transport, technical innovation, fuel and material behaviour, operational experience with storage, new fuel and reprocessing developments, long term storage and disposal. The conference also featured two round table discussion sessions covering regulatory frameworks and stakeholder issues. The proceedings include the opening presentations and the President's summary and conclusions of the conference. A CD-ROM with contributed papers accompanies the publication.

(Forthcoming 2014) • ISBN 978-92-0-103714-5 • STI/PUB/1661 • €40.00

## Naturally Occurring Radioactive Material (NORM VII)

### Proceedings of an International Symposium held in Beijing, China, 22–26 April 2013

**Proceedings Series** 

This publication is the proceedings of the Seventh International Symposium on Naturally Occurring Radioactive Material (NORM), which was organized in cooperation with the IAEA as part of its programme to promote application of the safety standards to natural sources of radiation and to disseminate information to Member States. NORM VII provided an opportunity to review the many developments that had taken place over the past three years since the previous symposium in this series. This period was characterized by ongoing activities to revise international standards on radiation protection and safety and the further implementation of these standards in many countries. The proceedings contain 48 oral presentations and four rapporteur reports, as well as a summary that concludes with the main findings of the symposium. Text versions of 19 poster presentations are provided on the attached CD-ROM.

(Forthcoming 2014) • ISBN 978-92-0-104014-5 • STI/PUB/1664 • €95.00



#### **Nuclear Fuel Cycle Objectives**

IAEA Nuclear Energy Series
No. NF-O

The IAEA's Nuclear Energy Series is organized in a hierarchical structure: Nuclear Energy Basic Principles, Objectives in four key areas, Guides on specific topics and Technical Reports with detailed technical information. This

publication establishes the criteria that need to be fulfilled in the area of the nuclear fuel cycles in order to satisfy the Nuclear Energy Basic Principles for resources, fuel engineering and performance, spent fuel management and reprocessing, and

research reactor nuclear fuel cycles. The publication is written for fuel vendors, owners and operators of nuclear facilities, research and development organizations, nuclear regulators and politicians.

(34 pp.; 2013) • ISBN 978-92-0-144510-0 • STI/PUB/1622 • €21.00



#### Overcoming Barriers in the Implementation of Environmental Remediation Projects

IAEA Nuclear Energy Series No. NW-T-3.4

Environmental remediation has been in existence for decades, and a tremendous

body of practical and scientific knowledge has been developed in many areas. Responding to the needs of Member States, the IAEA has initiated an environmental remediation project to address radioactive contamination found in soils and waters. This publication discusses the drivers on environmental remediation as well as the major obstacles confronted by any remediation operation and how to overcome those obstacles. It includes a number of potential strategies that may provide effective remediation outcomes and that have been deemed to be cost effective by Member States. Implementers of an environmental remediation programme as well as regulators will benefit from the information and guidance provided in this publication.

(58 pp., 2 figs; 2013) • ISBN 978-92-0-140810-5 • STI/PUB/1602 • €24.00



## Planning, Management and Organizational Aspects of the Decommissioning of Nuclear Facilities

IAEA TECDOC Series No. 1702

This publication reflects the results of an IAEA coordinated research project on non-technical aspects of decommissioning.

Operating experience and lessons learned during full-scale applications, as well as national programmes and plans, are among the most significant achievements. The results help to improve understanding of specific characteristics of the decommissioning process that are important in the planning and implementation of decommissioning. The information provided will be particularly useful to Member States that are currently planning or implementing decommissioning of their nuclear facilities.

(2013) • ISBN 978-92-0-139510-8 • IAEA-TECDOC-1702 • €18.00



## Safety Assessment for Decommissioning

Safety Reports Series No. 77

The international project on evaluation and demonstration of safety during decommissioning of facilities using radioactive material (DeSa), launched by the IAEA in 2004, helps to ensure that specific guidance on the safety

assessment in the context of the decommissioning of nuclear facilities is provided. This publication presents the outcomes of the work carried out in fulfilling the action plan through the DeSa Project. The main features of the process have been summarized and overall recommendations on producing, reviewing and implementing the safety assessment have been made. They are supported by specific recommendations contained in Annexes I–III.

(133 pp., 9 figs; 2013) • ISBN 978-92-0-141410-6 • STI/PUB/1604 • €44.00



### Water Chemistry and Clad Corrosion/Deposition Including Fuel Failures

Proceedings of a Technical Meeting held in Kiev, Ukraine, 22–24 November 2010

#### **IAEA TECDOC Series No. 1692**

This CD-ROM publication presents the proceedings of a technical meeting on water chemistry and cladding corrosion/deposition including fuel failures, which was held in Kiev, Ukraine, in 2010. The outcome of the meeting is a summary report which provides state of the art information on the corrosion of reactor material, including fuel cladding, the causes of corrosion product deposition and the means in use to minimize the deleterious effects of these processes. The meeting was attended by 22 participants from 15 countries; papers were presented in three technical sessions, covering operational experience, corrosion and oxidation, and cladding deposition and its consequences.

(2013) • ISBN 978-92-0-187510-5 • IAEA-TECDOC-CD-1692 • €18.00

## FUEL FABRICATION AND PERFORMANCE



BN-600 MOX Core Benchmark Analysis: Results from Phases 4 and 6 of a Coordinated Research Project on Updated Codes and Methods to Reduce the Calculational Uncertainties of the LMFR Reactivity Effects

**IAEA TECDOC Series No. 1700** 

This publication presents the main results and achievements of an undertaking (part of a wider IAEA coordinated research

project) devoted to the benchmark analyses of two mixed oxide (MOX) fuelled BN-600 core designs. The studies conducted contributed to the progress in development, verification and validation of new codes and data libraries for fast reactor analyses; promoted deeper understanding of the influence of reactivity coefficients and their uncertainties on the results of experience and transient analyses in the initial phase of transients, such as unprotected loss of flow (ULOF); and facilitated exchange of opinions between specialists.

(2013) • ISBN 978-92-0-139210-7 • IAEA-TECDOC-1700 • €18.00



## Design, Manufacturing and Irradiation Behaviour of Fast Reactor Fuel

**IAEA TECDOC Series No. 1689** 

This CD-ROM publication presents the proceedings of a technical meeting

organized in order to share knowledge and practical experience on the improvement and innovation of fuels for fast reactors. The objective of the meeting was to provide an overview of the status of the design, manufacture and irradiation behaviour of fast reactor fuel. Scientists and engineers from different fields discussed critical issues, with the aim of supporting efforts relating to the design and manufacture of nuclear fuels for the existing and next generation of fast reactors, as well as the optimization of future irradiation experiments.

(2013) • ISBN 978-92-0-186510-6 • IAEA-TECDOC-CD-1689 • €18.00



### Fuel Behaviour and Modelling under Severe Transient and Loss of Coolant Accident (LOCA) Conditions

**IAEA TECDOC Series No. 1709** 

This CD-ROM publication is the proceedings of a technical meeting on fuel behaviour and modelling under severe transient and loss of coolant accident (LOCA) conditions. It was attended by nuclear fuel specialists representing fuel vendors, nuclear utilities, research and development institutions and regulatory bodies. Papers were presented in areas including analytical and experimental reactivity initiated accidents and power ramp and severe accident analysis. The proceedings highlight the key findings and recommendations based on the summaries of the session chairpersons.

(2013) • ISBN 978-92-0-192410-0 • IAEA-TECDOC-CD-1709 • €18.00

## **Guide on Nuclear Power Reactor Fuel Engineering**

IAEA Nuclear Energy Series No. NF-G-2.1

In order to decrease costs and increase competitiveness, nuclear utilities use more challenging operational conditions, longer fuel cycles and higher burnups, which require modifications in fuel designs and materials. Different aspects of quality assurance and control, as well as analysis of fuel performance have been considered in a number of specialized

publications. The present publication provides a concise but comprehensive overview of all interconnected quality and reliability issues in fuel fabrication, design and operation. It jointly tackles technical, safety and organizational aspects, and contains examples of state of the art developments and good practices of coordinated work of fuel designers, vendors and reactor operators.

(Forthcoming 2014) • ISBN 978-92-0-103114-3 • STI/PUB/1656 • €40.00



### Improvement of Computer Codes Used for Fuel Behaviour Simulation (FUMEX-III)

IAEA TECDOC Series No. 1697

The modelling of the performance of nuclear fuel is crucial to the operation of nuclear power plants and comprises a key component of the demonstration of

nuclear safety. As the demands on fuel performance increase, fuel modelling codes need to develop and cover a wider range of operational and transient conditions. This publication compares the predictions of current fuel modelling codes with data representing a wide range of fuel operational conditions. The results demonstrate both excellent performance and areas for further development of the codes to support advanced fuel operations.

(2013) • ISBN 978-92-0-138610-6 • IAEA-TECDOC-1697 • €18.00



### In-pile Testing and Instrumentation for Development of Generation-IV Fuels and Materials

IAEA TECDOC Series No. 1726

Generation IV reactors are being designed

as nuclear systems with revolutionary features, offering higher levels of safety, economy, non-proliferation and sustainability than the current generation. This CD-ROM publication presents the proceedings of a technical meeting providing an overview of the progress in methods and technologies used for the irradiation testing of nuclear fuel achieved in the last five years. Emphasis is given to advanced techniques applied for the understanding of high burn up fuel behaviour of water cooled power reactors, but testing techniques applied or to be developed specifically for new fuel and structural materials considered for Generation IV systems are also discussed.

(2013) • ISBN 978-92-0-164213-4 • IAEA-TECDOC-CD-1726 • €18.00

### SPENT FUEL MANAGEMENT



### Management and Storage of Research Reactor Spent Nuclear Fuel

Proceedings of a Technical Meeting held in Thurso, United Kingdom, 19–22 October 2009

**Proceedings Series** 

The intermediate storage of research reactor spent nuclear fuel is a real challenge for operators, as this period in some cases can extend for over 50 years until a final decision is made. This publication presents the proceedings of a technical meeting to discuss good practices for the management and storage of research reactor spent fuel. The information provided on these issues will be of interest to managers of research reactors and research reactor spent

(262 pp., 50 figs; 2013) • ISBN 978-92-0-138210-8 • STI/PUB/1592 • €49.00



nuclear fuel facilities.

## Spent Fuel Storage Operation — Lessons Learned

**IAEA TECDOC Series No. 1725** 

Past experience can usefully inform current practice and ensure the avoidance of known problems. Learning from such experience can also assist in maintaining an industry's reputation and the good will of stakeholders. This publication

collects Member State experiences in the design, construction and operation of spent fuel storage facilities. It collates the improvements which have been incorporated into the design of new storage facilities over the past fifty years, highlights good operating practices and designs and shares lessons learned. The information provided will assist those Member States that already have a developed storage capability and also those considering development of a spent nuclear fuel storage capability in making informed decisions when managing their spent nuclear fuel.

(2013) • ISBN 978-92-0-113813-2 • IAEA-TECDOC-1725 • €18.00

### WASTE MANAGEMENT



### Characterization of Swelling Clays as Components of the Engineered Barrier System for Geological Repositories

**IAEA TECDOC Series No. 1718** 

This publication presents the results of a coordinated research project (CRP) carried out between 2002 and 2007 on

the subject of swelling clays proposed for use as a component in the engineered barrier system (EBS) of the multibarrier

concept for disposal of radioactive waste. The structure of the book includes an overview of the repository concepts of the Member States involved in the CRP; a general description of key material properties and a means of assessing those properties of relevance to screening potentially suitable swelling clays for repository use; and a summary of the properties measured for the candidate materials selected by each of the participating Member States and a preliminary assessment of their potential suitability for use as a component of the EBS of a deep geological repository. The publication contributes to the process of swelling clay identification, characterization and evaluation for potential suitability for deep geological repository applications.

(2013) • ISBN 978-92-0-112410-4 • IAEA-TECDOC-1718 • €18.00



### Management of Discharge of Low Level Liquid Radioactive Waste Generated in Medical, Educational, Research and Industrial Facilities

IAEA TECDOC Series No. 1714

This publication is intended for decision makers in countries generating radioactive

effluents in the areas of medicine, education, research and industry. It provides guidance and information on how to implement and optimize radioactive effluent management practices and describes methodologies, criteria and options for the selection of appropriate technology for the discharge of liquid radioactive effluents into the sewer system. The publication reviews both technical and non-technical factors important for decision making and planning, and for the implementation of the most appropriate process design for effluent discharges at the country and facility levels. It also makes practical recommendations for the selection of decay storage arrangements for different scales of radioactive effluent generation

(2013) • ISBN 978-92-0-143510-1 • IAEA-TECDOC-1714 • €18.00

### Management of Disused Sealed Radioactive Sources

#### IAEA Nuclear Energy Series No. NW-T-1.3

This publication summarizes the reviewed information distributed in previous IAEA publications and provides an up to date, overall picture of the management of disused sealed radioactive sources (DSRSs) based upon the current status and trends in this field. It incorporates the most recent experience in source management, including newly developed techniques used for DSRS conditioning and storage. Problems encountered and lessons learned are also highlighted in the publication in order to help avoid the mistakes commonly made in the past in managing disused sources.

(Forthcoming 2014) • ISBN 978-92-0-103214-0 • STI/PUB/1657 • €46.00



### **Management of NORM Residues**

**IAEA TECDOC Series No. 1712** 

Naturally occurring radioactive material (NORM) may lead to exposures at some stage of its processing and in the use or reuse of products, residues or wastes. Several IAEA publications address NORM issues with a special focus on some of the more relevant industrial operations.

This publication addresses the management aspects of NORM residues, including their disposal as waste, in a wide range of industrial activities involving minerals and raw materials. It also addresses NORM residues at so-called legacy sites, that is, sites contaminated by past activities that were not regulated to present standards. The main intention of this publication is to provide guidance to Member States on good practice in the management of NORM residues, bearing in mind that there is no single approach that applies to all situations.

(2013) • ISBN 978-92-0-142710-6 • IAEA-TECDOC-1712 • €18.00



### Mobile Processing Systems for Radioactive Waste Management

IAEA Nuclear Energy Series No. NW-T-1.8

In recent years, mobile systems have increasingly been deployed for the processing of different types of radioactive waste. Such systems offer flexibility in

selection and application of the optimum technology for a specific waste stream by bringing the process to the point where the waste is generated, with the additional benefit that there can be equipment sharing among multiple generating sites. This publication provides the basic information on utilization of mobile systems for waste processing and introduces a methodology for the assessment required to determine the viability of mobile systems for specific applications. In addition, it informs the reader on the accurate assessment of mobile systems that employ one or more technologies. The target audience is professionals involved in the planning, selection, design, deployment and regulation of radioactive waste processing facilities.

(106 pp., 41 figs; 2014) • ISBN 978-92-0-141010-8 • STI/PUB/1621 • €38.00

### Modular Design of Processing and Storage Facilities for Small Volumes of Low and Intermediate Level Radioactive Waste including Disused Sealed Sources

IAEA Nuclear Energy Series No. NW-T-1.4

A number of IAEA Member States generate relatively small quantities of radioactive waste and/or disused sealed sources in research or in the application of nuclear techniques in medicine and industry. This publication presents a modular approach to the design of waste processing and storage facilities to address the needs of such Member States with a cost effective and flexible solution that allows easy adjustment to changing needs in terms of capacity and variety of waste streams. The key

feature of the publication is the provision of practical guidance to enable the users to determine their waste processing and storage requirements, specify those requirements to allow the procurement of the appropriate processing and storage modules and to install and eventually operate those modules.

(Forthcoming 2014) • ISBN 978-92-0-145110-1 • STI/PUB/1628 • €55.00

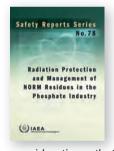


### Options for Management of Spent Fuel and Radioactive Waste for Countries Developing New Nuclear Power Programmes

IAEA Nuclear Energy Series
No. NW-T-1.24

States embarking upon a nuclear power programme should understand the importance of establishing an adequate radioactive waste and spent nuclear fuel management infrastructure. To assist in overcoming any challenges this might represent, this publication provides an overview of management practices in use in mature nuclear power programmes. Primarily addressing decision makers, it provides them with the level of strategic and technical information needed to understand overarching management issues of the various waste streams and spent fuel generated in nuclear power production. In addition, it examines the political, legal, societal, economic and technical challenges associated with each of the strategic options considered.

(54 pp., 7 figs; 2013) • ISBN 978-92-0-140710-8 • STI/PUB/1601 • €23.00



### Radiation Protection and Management of NORM Residues in the Phosphate Industry

Safety Reports Series No. 78

This Safety Report is a compilation of detailed information on the processes and materials associated with the phosphate industry and on the radiological

considerations that need to be taken into account by the regulatory body when determining the nature and extent of radiation protection measures. It has been developed as part of the IAEA's programme on the application of its safety standards in the field of radiation, transport and waste safety. The information provided will assist in the implementation of a graded approach to regulation, in terms of which the application of the requirements of the safety standards is commensurate with the characteristics of the practice or source and with the magnitude and likelihood of the exposures. The publication also provides information on expected radionuclide concentrations, exposure levels and the most appropriate regulatory approach in the phosphate industry, and covers the mining and beneficiation of phosphate ore, phosphoric acid production, phosphogypsum, and the manufacture and use of phosphatic fertilizers among others.

(288 pp., 90 figs; 2013) • ISBN 978-92-0-135810-3 • STI/PUB/1582 • €55.00



## Remediation of Land Affected by Radioactive Residues

Proceedings of an International Conference held in Astana, Kazakhstan, 18–22 May 2009

**Proceedings Series** 

This publication presents the proceedings of an international conference on

remediation of radioactive contaminated sites with a particular focus on the countries of central Asia. The conference provided a forum for all parties involved in remediation of such sites to gather and exchange ideas, review progress and new developments, compare technologies and methods, and thus disseminate information and experience. The key topical issues identified and discussed by the participants included regulatory and safety regimes, innovative and mature technologies, life cycle planning, technical experience exchange, stakeholder issues, and international cooperation and support. A series of case studies are presented to provide an overview of environmental remediation activities in different parts of the world. The publication summarizes the present status and outlines future trends in environmental remediation technologies and methods, and identifies possible areas for improvement.

(Forthcoming 2014) • ISBN 978-92-0-142310-8 • STI/PUB/1612 • €75.00



# The Behaviours of Cementitious Materials in Long Term Storage and Disposal of Radioactive Waste — Results of a Coordinated Research Project

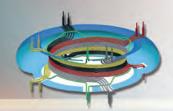
**IAEA TECDOC Series No. 1701** 

This publication presents the outcome of an IAEA coordinated research project that

investigated the behaviour and performance of cementitious materials used for an overall waste conditioning system. The publication is intended to assist the reader in comparing cementitious systems and technologies and in reaching an informed decision based on safety, technological maturity, economics, and other local needs. It highlights the active interchange of experiences among leading research groups, which enabled them to access valuable information on the underlying science and technology of cementitious materials used in radioactive waste management. The publication can be used as a screening tool to identify cementitious systems and technologies to meet specific waste management objectives in terms of the conditioning of waste generated, the technical complexity of waste streams, the environmental impact considerations and the desired end product.

(2014) • ISBN 978-92-0-139310-4 • IAEA-TECDOC-1701 • €18.00

## PlasmaPhysicsand NuclearFusion





### Applications of Research Reactors towards Research on Materials for Nuclear Fusion Technology

IAEA TECDOC Series No. 1724

Following their indispensable role in the qualification of materials for fission nuclear systems, research reactors can provide

numerous services for fusion research until the construction of dedicated fusion testing facilities, and afterwards to support complementary research related to fusion materials research, related nuclear data measurements and additional material qualification. Research reactors of all designs and power ratings can contribute in the advancement of fusion research. therefore this field promises enhanced research reactor utilization as well as long term cooperation with academia and the fusion community. This publication details the role of research reactors in fusion research from fundamental studies to collaborative efforts by fission and fusion communities. Focusing on materials science and engineering, within the larger scheme of fusion energy development, the publication then proceeds through the stages of testing and qualification. It also includes conclusions regarding the future of fusion research, synergy between fission and fusion technologies, and views on past and ongoing efforts.

(2013) • ISBN 978-92-0-113713-5 • IAEA-TECDOC-1724 • €18.00



## Atomic and Plasma–Material Interaction Data for Fusion Vol. 16

Atomic and Plasma–Material Interaction Data for Fusion

This publication, arising from a Coordinated Research Project on Atomic and Molecular Data for Plasma Modelling, provides

information on new data relevant to the edge region of plasmas in nuclear fusion energy devices. In this region, molecules and molecular ions are formed and react with electrons and with each other and fusion plasma modelling requires cross-sections and rate coefficients for such processes. This volume describes new data and data compilations for atomic and molecular processes that occur in edge plasma and provides data in forms that can be used in plasma modelling codes.

(190 pp., 134 figs; 2014) • ISBN 978-92-0-131510-6 • STI/PUB/023/APID/16 • €40.00



### **Dense Magnetized Plasmas**

**IAEA TECDOC Series No. 1699** 

This publication presents results achieved within an IAEA coordinated research project on dense magnetized plasmas (DMPs) with respect to the needs of plasma research in developed and developing IAEA Member States. Of specific interest is the improvement of experimental set-

ups for DMPs, including new ideas on drivers, chambers and targets, interface issues and plasma—wall interactions. Better understanding of discharge physics and control, improved theory and numerical modelling using various codes are reported. Important issues are diagnostics development, materials testing and development, and post-irradiation materials diagnostics and analysis. This publication illustrates the speed of progress in DMP applications facilitated by the sharing of knowledge, staffing and costs, and the promotion of technology transfer among Member States and issues relating to knowledge preservation. It also reports the main conclusions and recommendations from the experts' meeting and will serve as a useful resource for fusion scientists, fusion engineers, plasma physicists and material science physicists.

(2013) • ISBN 978-92-0-139110-0 • IAEA-TECDOC-1699 • €18.00



## Frontiers of Plasma Physics and Technology

Proceedings of an International Conference held in Singapore, 18–22 April 2011

IAEA TECDOC Series No. 1713

This CD-ROM publication is a collection of materials presented at the 5th International Conference on the Frontiers of Plasma Physics and Technology, which took place 18–22 April 2011 in Singapore. The materials describe the recent progress and future foreseen research topics in plasma physics. The aim is to disseminate information on current trends in research and development, technology and applications.

(2013) • ISBN 978-92-0-193410-9 • IAEA-TECDOC-CD-1713 • €18.00



### Integrated Approach to Dense Magnetized Plasmas Applications in Nuclear Fusion Technology

IAEA TECDOC Series No. 1708

This publication presents the results of an IAEA coordinated research project (CRP) on dense magnetized plasma (DMP)

applications in nuclear fusion technology. DMP devices are used in the testing of fusion relevant materials, diagnostics development and calibration and in developing technologies

and scaling to conceptual principles of larger devices. The specific research objectives of this CRP were to support mainstream fusion research and the development of dense magnetized plasma technology. The resulting publication is a compilation of the individual reports submitted by the 12 CRP participants, describing the research work undertaken as well as further expected, important spin-off applications of DMP devices.

(2013) • ISBN 978-92-0-142810-3 • IAEA-TECDOC-1708 • €18.00



## Pathways to Energy from Inertial Fusion: An Integrated Approach

IAEA TECDOC Series No. 1704

Nuclear energy from inertial fusion is clean, safe and abundant, and therefore has the potential to develop into a viable option in any given energy portfolio. This publication

presents the results and achievements of an IAEA coordinated research project on this topic. The project brought together experts from 16 institutions in 14 Member States to address issues relevant to advancing inertial fusion energy research and development towards practical applications. Key issues discussed include beam—plasma matter interactions, driver options and technology as well as target fabrication technology, and inertial fusion power plant and integration.

(2013) • ISBN 978-92-0-139710-2 • IAEA-TECDOC-1704 • €18.00

## Safeguards





## International Safeguards in Nuclear Facility Design and Construction

IAEA Nuclear Energy Series No. NP-T-2.8

This IAEA publication provides guidance on the inclusion of safeguards considerations in nuclear facility design and construction.

This first volume introduces the basic principles of safeguards by design and discusses the goals, costs and rewards, and places the information into the context of nuclear facility design and construction. Benefits and opportunities for all stakeholders are emphasized. The guidance is aimed at enhancing the understanding of nuclear facility vendors and designers regarding the safeguards obligations of both States and the IAEA, at improving the cooperation between all stakeholders in safeguards implementation, and at minimizing the cost of implementation for all stakeholders.

(22 pp., 1 fig.; 2013) • ISBN 978-92-0-140610-1 • STI/PUB/1600 • €19.00



## **Preparing for Future Verification Challenges**

Summary of an International Safeguards Symposium held in Vienna, Austria, 1–5 November 2010

**Proceedings Series** 

IAEA safeguards symposia are important

forums for substantive and detailed interaction between the Secretariat of the IAEA, its Member States and the international community on safeguards and verification issues. The 11th Symposium on International Safeguards, Preparing for Future Verification Challenges, was held in Vienna, Austria, from 1–5 November 2010. The aim of the symposium was to help the IAEA to prepare for future verification challenges by engaging in dialogue and information exchange with Member States, technical experts, the nuclear industry and members of the broader safeguards and nuclear non-proliferation community. This publication provides a summary of the symposium plenaries, technical sessions, panels and forums.

(63 pp.; 2013) • ISBN 978-92-0-142110-4 • STI/PUB/1611 • €82.00

## NuclearLaw





# The 1988 Joint Protocol Relating to the Application of the Vienna Convention and the Paris Convention — Explanatory Text

IAEA International Law Series No. 5

This publication complements IAEA International Law Series No. 3 and

reproduces the explanatory text on the 1988 Joint Protocol Relating to the Application of the Vienna Convention on Civil Liability for Nuclear Damage and the Paris Convention on Third Party Liability in the Field of Nuclear Energy. Finalized by the International Expert Group on Nuclear Liability (INLEX), this text constitutes a comprehensive study and authoritative interpretation of that instrument.

(37 pp.; 2013) • ISBN 978-92-0-139410-1 • STI/PUB/1593 • €38.00

### Environment





### Communication and Stakeholder Involvement in Environmental Remediation Projects

IAEA Nuclear Energy Series
No. NW-T-3.5

This publication has been developed with the aim of translating the complex

technical terminology and approaches embodied in the planning and implementation of environmental remediation programmes into a more accessible language. The objective is to help environmental remediation implementers and regulators to engage and sustain dialogue with different stakeholders while developing a decision making process regarding the implementation of environmental remediation programmes. The publication deals with the technical and nontechnical dimensions of environmental remediation and makes available experiences on how to proceed with communication and stakeholder engagement in environmental remediation programmes.

(43 pp., 2014) • ISBN 978-92-0-145210-8 • STI/PUB/1629 • €28.00



## Environmental Sensitivity in Nuclear Emergencies in Rural and Semi-natural Environments

Report of Working Group 8 Environmental Sensitivity of EMRAS II Topical Heading Approaches for Assessing Emergency Situations

IAEA TECDOC Series No. 1719

This publication describes the work and activities of the IAEA model test and comparison programme entitled Environmental Modelling for Radiation Safety (EMRAS II). The EMRAS II programme emphasized the comparison, testing and improvement of environmental transfer models for assessing exposures to the public and non-human species. The aim of the programme is to stimulate development and encourage the elaboration of internationally agreed and harmonized assessment models for planned, existing and emergency exposure situations and strengthen assessment capabilities in Member States. The work within the EMRAS II programme included an analysis of the influence of different climates, living habits and agricultural practices.

(2013) • ISBN 978-92-0-112610-8 • IAEA-TECDOC-1719 • €18.00



### Guidelines for Remediation Strategies to Reduce the Radiological Consequences of Environmental Contamination

Technical Reports Series No. 475

This publication addresses the remediation of non-urban terrestrial and freshwater

ecosystems including agricultural, forest and aquatic environments contaminated with radionuclides by radiation accidents, radiological incidents and other past activities. Associated social, ethical and economic considerations are also presented. The book describes modern decision aiding technologies and environmental decision support systems for remediation planning and optimization. Several case studies, demonstrating remediation success including radiation and radiological accidents and nuclear test sites are presented and evaluated. The publication considers only remediation strategies and management options that are relevant for existing exposure situations. Management options (countermeasures) for predeposition and early phases after emergencies are the subject of other IAEA publications.

(167 pp., 12 figs; 2013) • ISBN 978-92-0-134110-5 • STI/DOC/010/475 • €46.00

### Handbook of Parameter Values for the Prediction of Radionuclide Transfer to Wildlife

**Technical Reports Series No. 479** 

This handbook provides generic parameter values for estimating the transfer of radionuclides from environmental media to wildlife for the purpose of assessing potential radiation exposure under equilibrium conditions. These data are intended for use where site specific data are either not available or not required, and to parameterize generic assessment models. They are based on a comprehensive review of the available literature, including many Russian language publications that have not previously been available in English. The publication addresses the limitations of the parameter values and the applicability of data. Some general background information on the assessment of potential impacts of radioactive releases on wildlife is also included. It complements the existing handbook in the same IAEA series with parameter to assess the radiological impact to humans.

(Forthcoming 2014) • ISBN 978-92-0-100714-8 • STI/DOC/010/479 • €55.00



### Isotopes in Hydrology, Marine Ecosystems and Climate Change Studies

Proceedings of the International Symposium held in Monaco, 27 March–1 April 2011 (2 volumes)

**Proceedings Series** 

This publication presents the proceedings

of the latest IAEA symposium on isotopes in hydrology, marine ecosystems and climate change studies. At the symposium, five major topics were addressed through invited talks and oral presentations. These five sessions covered: the role of isotopes in understanding and modelling climate change, marine ecosystems and the water cycle; carbon dioxide sequestration and related aspects of the carbon cycle, such as ocean acidification; isotopes and radionuclides in the marine environment; groundwater assessments for large aquifers; and analytical methods and instrumentation for the application of isotopes in environmental, climate and hydrological studies. Leading scientists in the field of climate change and hydrology, as well as representatives from climate change and environmental bodies and organizations, exchanged their views and experience.

(1165 pp., 205 figs; 2013) • ISBN 978-92-0-135610-9 • STI/PUB/1580 • €90.00



### Lessons Learned from Environmental Remediation Programmes

IAEA Nuclear Energy Series
No. NW-T-3.6

Environmental remediation, in the context of legacy sites, is being carried out in IAEA Member States at different paces.

There is already significant experience and expertise present from around the world as nuclear and associated facilities are closed and move through the decommissioning and environmental remediation phases. Methodological approaches and remediation technologies have been developed to deal with different remediation situations and subsequently adapted to site specific conditions. They have also been further fine tuned as they have been rolled out either on relatively small or large scale projects. This publication is intended to capture part of this experience and make it available to IAEA Member States, so that they can benefit from the existing knowledge when planning and implementing their remediation programmes.

(51 pp.; 2014) • ISBN 978-92-0-145310-5 • STI/PUB/1630 • €27.00



### Managing Environmental Impact Assessment for Construction and Operation in New Nuclear Power Programmes

IAEA Nuclear Energy Series
No. NG-T-3.11

This publication provides a holistic approach to environmental protection in

new nuclear power programmes. It describes the Environmental Impact Assessment (EIA) process, the subsequent utilization of the EIA, and the necessary infrastructure for such process. The presumption is that a Member State embarking on such a programme already has an environmental regulatory framework, which may not be developed for nuclear power but for industrial projects, in place, therefore the emphasis is on the environmental aspects that are unique to a nuclear power plant project. The publication is addressed to senior managers, project managers or coordinators and technical specialists of government authorities and agencies, including regulatory body, operating organizations and supporting industries and other organizations involved in the environmental issues.

(47 pp., 8 figs; 2014) • ISBN 978-92-0-144810-1 • STI/PUB/1625 • €29.00

## Naturally Occurring Radioactive Material (NORM VII)

Proceedings of an International Symposium held in Beijing, China, 22–26 April 2013

**Proceedings Series** 

This publication is the proceedings of the Seventh International Symposium on Naturally Occurring Radioactive Material (NORM), which was organized in cooperation with the IAEA as part of its programme to promote application of the safety standards to natural sources of radiation and to disseminate information to Member States. NORM VII provided an opportunity to review the many developments that had taken place over the past three years since the previous symposium in this series. This period was characterized by ongoing activities to revise international standards on radiation protection and safety and the further implementation of these standards in many countries. The proceedings contain 48 oral presentations and four rapporteur reports, as well as a summary that concludes with the main findings of the symposium. Text versions of 19 poster presentations are provided on the attached CD-ROM.

(Forthcoming 2014) • ISBN 978-92-0-104014-5 • STI/PUB/1664 • €95.00



### Overcoming Barriers in the Implementation of Environmental Remediation Projects

IAEA Nuclear Energy Series No. NW-T-3.4

Environmental remediation has been in existence for decades, and a tremendous

body of practical and scientific knowledge has been developed in many areas. Responding to the needs of Member States, the IAEA has initiated an environmental remediation project to address radioactive contamination found in soils and waters. This publication discusses the drivers on environmental remediation as well as the major obstacles confronted by any remediation operation and how to overcome those obstacles. It includes a number of potential strategies that may provide effective remediation outcomes and that have been deemed to be cost effective by Member States. Implementers of an

environmental remediation programme as well as regulators will benefit from the information and guidance provided in this publication.

(58 pp., 2 figs; 2013) • ISBN 978-92-0-140810-5 • STI/PUB/1602 • €24.00

### Policy and Strategies for Environmental Remediation

IAEA Nuclear Energy Series No. NW-G-3.1

To assure the safe, technically optimal and cost effective management of remediation situations, appropriate policies and strategies are required. This publication describes the goals, time scales, efforts necessary for implementation, cost allocation and the different interests of concerned parties with regard to environmental remediation works. It clarifies the differences between a policy and a strategy, and provides advice to Member States on the typical composition and formulation of such documents. Along with previously published IAEA safety publications on environmental remediation, this publication will help national authorities to recognize the necessity for including environmental remediation as a required component in the planning and execution of nuclear related initiatives. Recent events have shown that the existence of an established policy and strategies on environmental remediation prior to nuclear and/or radiological accidents can be of fundamental importance, as it will among other things facilitate the dialogue to be established with different affected parties.

(Forthcoming 2014) • ISBN 978-92-0-103314-7 • STI/PUB/1658 • €20.00

### Remediation of Land Affected by Radioactive Residues

Proceedings of an International Conference held in Astana, Kazakhstan, 18–22 May 2009

**Proceedings Series** 

This publication presents the proceedings of an international conference on remediation of radioactive contaminated sites with a particular focus on the States of Central Asia.

The conference provided a forum for all parties involved in remediation of such sites to gather and exchange ideas, review progress and new developments, compare technologies and methods, and thus disseminate information and experience. The key topical issues identified and discussed by the participants included regulatory and safety regimes, innovative and mature technologies, life cycle planning, technical experience exchange, stakeholder issues, and international cooperation and support. A series of case studies are presented to provide an overview of environmental remediation activities in different parts of the world. The publication summarizes the present status, outlines future trends in environmental remediation technologies and methods, and identifies possible areas for improvement.

(Forthcoming 2014) • ISBN 978-92-0-142310-8 • STI/PUB/1612 • €75.00



## The Environmental Behaviour of Radium

#### Revised Edition

Technical Reports Series No. 476

This publication aims to provide IAEA Member States with information for use in the radiological assessment

of accidental releases and routine discharges of radium in the environment. It covers radium behaviour in the terrestrial, freshwater and marine environments. The information presented is relevant to the transfer of radionuclides through food chains to both humans and non-human biota. The corresponding remedial options and regulating aspects are also within the scope of this publication. Additionally, applications of radium isotopes to environmental issues are discussed in order to alert readers to studies that use radium isotopes as tracers of environmental processes. The information could also serve as a basis for remediation planning and identification of optimal remediation strategies in areas contaminated by radium.

(267 pp., 39 figs; 2014) • ISBN 978-92-0-143310-7 • STI/DOC/010/476 • €52.00

## NuclearSecurityandPhysical ProtectionofRadioactiveMaterial





### Application of Nuclear Forensics in Combating Illicit Trafficking of Nuclear and Other Radioactive Material

**IAEA TECDOC Series No. 1730** 

This publication presents the outcome of an IAEA coordinated research project (CRP), which served as a technical forum

for sharing international experiences in the field of nuclear forensics with a focus on improved procedures and techniques, optimization of nuclear forensic analysis, preservation of evidence, and provision of support to Member States. The CRP results address both technical needs to develop the discipline of nuclear forensics as well as to promote confidence in the application of analytical methods and understanding of the nuclear fuel cycle applied to nuclear forensics. Topics include instrumentation and field work for evidence collection, novel laboratory methods supporting a nuclear forensic examination, and modelling for interpretation of nuclear forensic results.

(2013) • ISBN 978-92-0-115113-1 • IAEA-TECDOC-1730 • €18.00



## Computer Security at Nuclear Facilities

IAEA Nuclear Security Series No. 17

This publication provides guidance specific to nuclear facilities on implementing a computer security programme and evaluating existing programmes. The use

of computer systems to cover an increasing range of functions at nuclear facilities introduces new vulnerabilities that could seriously endanger nuclear security if not addressed in a rigorous and balanced manner. Digital systems are increasingly being introduced in safety, safety related and security systems throughout facilities. Non-availability or malfunction of these systems can seriously impact nuclear safety and security, and potentially facilitate sabotage of the facility and/or theft of material. Computer security must, therefore, be a key component of overall facility security.

Arabic Edition (76 pp., 7 figs; 2013) • ISBN 978-92-0-642210-6 • STI/PUB/1527 • €33.00

Chinese Edition (62 pp., 7 figs; 2012) • ISBN 978-92-0-536110-9 • STI/PUB/1527 • €33.00

English Edition (69 pp., 7 figs; 2011) • ISBN 978-92-0-120110-2 • STI/PUB/1527 • €33.00

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### Nuclear Security: Enhancing Global Efforts

Proceedings of an International Conference held in Vienna, Austria, 1–5 July 2013

**Proceedings Series** 

This publication presents the proceedings of an international conference on nuclear

security, which was convened at the IAEA's headquarters in Vienna, 1–5 July 2013, the first such conference to include ministerial level participation. The conference adopted a ministerial declaration and provided a forum where experiences and lessons learned could be discussed. Ideas were exchanged to identify emerging trends and to consider medium and long term objectives for international nuclear security efforts, as well as to inform the development of the IAEA's Nuclear Security Plan 2014–2017. The President's summary highlights the main conclusions and key issues, drawing on the reports from the sessions. The conference attracted more than 1300 registered participants from 125 Member States, 34 of which were represented at ministerial level, and 21 intergovernmental and non-governmental organizations.

(119 pp.; 2014) • ISBN 978-92-0-101514-3 • STI/PUB/1643 • €90.00



### Nuclear Security Systems and Measures for Major Public Events

IAEA Nuclear Security Series
No. 18

This publication provides an overview, based on practical experience and lessons learned, for establishing nuclear security

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### Nuclear Security Systems and Measures for the Detection of Nuclear and Other Radioactive Material out of Regulatory Control

IAEA Nuclear Security Series
No. 21

This publication provides guidance to

Member States for the development, or improvement of, nuclear security systems and measures for the detection of criminal or unauthorized acts with nuclear security implications involving nuclear and other radioactive material out of regulatory control. It describes the elements of an effective nuclear security detection architecture which is comprised of

an integrated set of nuclear security systems and measures, and is based on an appropriate legal and regulatory framework for the implementation of the national detection strategy. The publication is an implementing guide within the IAEA Nuclear Security Series and is intended for use by national policy makers, legislative bodies, competent authorities, institutions, and individuals involved in the establishment, implementation, maintenance or sustainability of nuclear security systems and measures for the detection of nuclear and other radioactive material out of regulatory control.

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### Objective and Essential Elements of a State's Nuclear Security Regime

IAEA Nuclear Security Series No. 20

This IAEA Nuclear Security Series publication provides nuclear security fundamentals, recommendations, and

supporting guidance for Member States to assist them in implementing new nuclear security regimes, or in reviewing and, if necessary, strengthening existing ones. The publication is aimed at national policy makers, legislative bodies, competent authorities, institutions and individuals involved in the establishment, implementation, maintenance or sustainability of a State's nuclear security regime.

(15 pp.; 2013) • ISBN 978-92-0-137810-1 • STI/PUB/1590 • €20.00

## Options to Enhance Proliferation Resistance of Innovative Small and Medium Sized Reactors

IAEA Nuclear Energy Series No. NP-T-1.11

This publication addresses specific considerations for proliferation resistance and safeguards for small and medium sized reactors (SMRs). It describes the framework analysis through comparing and harmonizing the Generation IV International Forum and the International Project on Innovative Nuclear Reactors and Fuel Cycles methodologies, defines the proliferation resistance assessment and safeguards by design approach and presents the current implementation of proliferation resistance measures in innovative SMRs. The appendices include information on the example of a procedure to support a facility's analysis of the safeguarding situation in support of safeguards by design, and a template listing required proliferation resistance related design information. An overview of SMR design and development activities and States' perspectives is given in the annexes.

(68 pp., 2 figs; 2014) • ISBN 978-92-0-145510-9 • STI/PUB/1632 • €28.00



## Security in the Transport of Radioactive Material

IAEA Nuclear Security Series No. 9

This publication addresses the vulnerability of radioactive material during transport. Given the international concern over acts of nuclear terrorism, it is imperative to have

a well defined plan for the security of sensitive materials during transport. This publication provides guidance on implementing, maintaining or enhancing a State's nuclear security regime to protect radioactive material in transport against theft, sabotage or other malicious acts. It will be of use to regulators and to operating personnel engaged in the transport of such material.

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### **IAEA Safety Standards Series**

The IAEA Safety Standards Series comprises publications of a regulatory nature covering nuclear safety, radiation protection, radioactive waste management, the transport of radioactive material, the safety of nuclear fuel cycle facilities and management systems. These publications are issued under the terms of Article III of the IAEA's Statute, which authorizes the IAEA to establish "standards of safety for protection of health and minimization of danger to life and property". Safety standards are categorized into:

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Please note that this index does not detail all available safety standards. Only titles published in 2013 and 2014 and those forthcoming in 2014 and 2015 are shown. For a full list, please visit the IAEA books website: www.iaea.org/books or email: sales.publications@iaea.org.

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Reference Data Series No. 1	Energy, Electricity and Nuclear Power Estimates for the Period up to 2050 2011 Edition	Е	978-92-0-119410-7	IAEA-RDS-1/31	2011	9.00
Reference Data Series No. 1	Energy, Electricity and Nuclear Power Estimates for the Period up to 2050 2012 Edition	Е	978-92-0-133510-4	IAEA-RDS-1/32	2012	16.00
Reference Data Series No. 1	Energy, Electricity and Nuclear Power Estimates for the Period up to 2050 2013 Edition	Е	978-92-0-111910-0	IAEA-RDS-1/33	2013	18.00

Series & No.	Title	Language	ISBN	IAEA Reference	Published	PriceEuro
IAEA Nuclear Security Series No. 4	Engineering Safety Aspects of the Protection of Nuclear Power Plants Against Sabotage	С	978-92-0-523310-9	STI/PUB/1271	2012	30.00
IAEA TECDOC Series No. 1678	Environmental Modelling for Radiation Safety (EMRAS) — A Summary Report of the Results of the EMRAS Programme (2003-2007)	Е	978-92-0-129810-2	IAEA-TECDOC-1678	2012	18.00
IAEA TECDOC Series No. 1719	Environmental Sensitivity in Nuclear Emergencies in Rural and Semi-natural Environments: Report of Working Group 8 Environmental Sensitivity of EMRAS II Topical Heading Approaches for Assessing Emergency Situations	E	978-92-0-112610-8	IAEA-TECDOC-1719	2013	18.00
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IAEA Nuclear Security Series No. 19	Establishing the Nuclear Security Infrastructure for a Nuclear Power Programme	Е	978-92-0-138010-4	STI/PUB/1591	2013	29.00
IAEA Safety Standards Series No. SSG-16	Establishing the Safety Infrastructure for a Nuclear Power Programme Specific Safety Guide	Е	978-92-0-115310-4	STI/PUB/1507	2012	40.00
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IAEA Nuclear Energy Series No. NP-T-1.14	Framework for Assessing Dynamic Nuclear Energy Systems for Sustainability: Final Report of the INPRO Collaborative Project GAINS	Е	978-92-0-140410-7	STI/PUB/1598	2013	40.00

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IAEA TECDOC Series No. 1709	Fuel Behaviour and Modelling under Severe Transient and Loss of Coolant Accident (LOCA) Conditions	E	978-92-0-192410-0	IAEA-TECDOC- CD-1709	2013	18.00
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IAEA Human Health Series No. 12	Introduction to Body Composition Assessment Using the Deuterium Dilution Technique with Analysis of Saliva Samples by Fourier Transform Infrared Spectrometry	S	978-92-0-314013-3	STI/PUB/1450	2013	37.00
IAEA Human Health Series No. 13	Introduction to Body Composition Assessment Using the Deuterium Dilution Technique with Analysis of Urine Samples by Isotope Ratio Mass Spectrometry	Е	978-92-0-103310-9	STI/PUB/1451	2011	36.00
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Safety Reports Series No. 69	Management System Standards: Comparison between IAEA GS-R-3 and ISO 9001:2008	Е	978-92-0-120710-4	STI/PUB/1529	2012	29.00
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Series & No.	Title	Language	ISBN	IAEA Reference	Published	PriceEuro
IAEA TECDOC Series No. 1525	Notification and Authorization for the Use of Radiation Sources (Supplement to IAEA Safety Standards Series No. GS-G-1.5)	R	978-92-0-422810-6	IAEA-TECDOC-1525	2011	18.00
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Reference Data Series No. 2	Nuclear Power Reactors in the World 2012 Edition	Е	978-92-0-132310-1	IAEA-RDS-2/32	2012	12.00
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IAEA Nuclear Security Series No. 7	Nuclear Security Culture	С	978-92-0-526410-3	STI/PUB/1347	2012	30.00
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IAEA Nuclear Security Series No. 15	Nuclear Security Recommendations on Nuclear and Other Radioactive Material out of Regulatory Control	R	978-92-0-423010-9	STI/PUB/1488	2011	23.00
IAEA Nuclear Security Series No. 15	Nuclear Security Recommendations on Nuclear and Other Radioactive Material out of Regulatory Control	А	978-92-0-635210-6	STI/PUB/1488	2012	23.00
IAEA Nuclear Security Series No. 15	Nuclear Security Recommendations on Nuclear and Other Radioactive Material out of Regulatory Control	С	978-92-0-522910-2	STI/PUB/1488	2012	23.00
IAEA Nuclear Security Series No. 15	Nuclear Security Recommendations on Nuclear and Other Radioactive Material out of Regulatory Control	F	978-92-0-223710-0	STI/PUB/1488	2012	23.00

Series & No.	Title	Language	ISBN	IAEA Reference	Published	PriceEuro
IAEA Nuclear Security Series No. 15	Nuclear Security Recommendations on Nuclear and Other Radioactive Material out of Regulatory Control	S	978-92-0-324410-7	STI/PUB/1488	2012	23.00
IAEA Nuclear Security Series No. 13	Nuclear Security Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities (INFCIRC/225/Revision 5)	А	978-92-0-624510-1	STI/PUB/1481	2011	28.00
IAEA Nuclear Security Series No. 13	Nuclear Security Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities (INFCIRC/225/Revision 5)	E	978-92-0-111110-4	STI/PUB/1481	2011	28.00
IAEA Nuclear Security Series No. 13	Nuclear Security Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities (INFCIRC/225/Revision 5)	R	978-92-0-424110-5	STI/PUB/1481	2011	28.00
IAEA Nuclear Security Series No. 13	Nuclear Security Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities (INFCIRC/225/Revision 5)	С	978-92-0-526210-9	STI/PUB/1481	2012	28.00
IAEA Nuclear Security Series No. 13	Nuclear Security Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities (INFCIRC/225/Revision 5)	F	978-92-0-222110-9	STI/PUB/1481	2012	28.00
IAEA Nuclear Security Series No. 13	Nuclear Security Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities (INFCIRC/225/Revision 5)	S	978-92-0-324610-1	STI/PUB/1481	2012	28.00
IAEA Nuclear Security Series No. 14	Nuclear Security Recommendations on Radioactive Material and Associated Facilities	Α	978-92-0-624710-5	STI/PUB/1487	2011	22.00
IAEA Nuclear Security Series No. 14	Nuclear Security Recommendations on Radioactive Material and Associated Facilities	E	978-92-0-112110-3	STI/PUB/1487	2011	22.00
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Series & No.	Title	Language	ISBN	IAEA Reference	Published	PriceEuro
IAEA Nuclear Security Series No. 20	Objective and Essential Elements of a State's Nuclear Security Regime	Е	978-92-0-137810-1	STI/PUB/1590	2013	20.00
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Operating Experience	Operating Experience with Nuclear Power Stations in Member States in 2012 2013 Edition (CD-ROM)	E	978-92-0-194310-1	STI/PUB/1620	2013	55.00
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Proceedings CD Series	Opportunities and Challenges for Water Cooled Reactors in the 21st Century Proceedings of an International Conference Vienna, Austria, 27–30 October 2009	E	978-92-0-164210-3	STI/PUB/1500	2011	20.00
IAEA TECDOC Series No. 1666	Optimization of Water Chemistry to Ensure Reliable Water Reactor Fuel Performance at High Burnup and in Ageing Plant (FUWAC)	Е	978-92-0-120510-0	IAEA-TECDOC-1666	2011	18.00
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IAEA TECDOC Series No. 1721	Optimizing Productivity of Food Crop Genotypes in Low Nutrient Soils	Е	978-92-0-113113-3	IAEA-TECDOC-1721	2014	18.00
IAEA Nuclear Energy Series No. NW-T-1.24	Options for Management of Spent Fuel and Radioactive Waste for Countries Developing New Nuclear Power Programmes	E	978-92-0-140710-8	STI/PUB/1601	2013	23.00
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Series & No.	Title	Language	ISBN	IAEA Reference	Published	PriceEuro
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Series & No.	Title	Language	ISBN	IAEA Reference	Published	PriceEuro
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IAEA Safety Standards Series No. TS-G-1.3	Radiation Protection Programmes for the Transport of Radioactive Material Safety Guide	S	978-92-0-312310-5	STI/PUB/1269	2011	32.00
IAEA Safety Standards Series No. SSG-11	Radiation Safety in Industrial Radiography Specific Safety Guide	E	978-92-0-107210-8	STI/PUB/1466	2011	33.00
IAEA Safety Standards Series No. SSG-11	Radiation Safety in Industrial Radiography Specific Safety Guide	Α	978-92-0-633110-1	STI/PUB/1466	2012	33.00
IAEA Safety Standards Series No. SSG-11	Radiation Safety in Industrial Radiography Specific Safety Guide	F	978-92-0-236610-7	STI/PUB/1466	2013	33.00
IAEA Safety Standards Series No. SSG-11	Radiation Safety in Industrial Radiography Specific Safety Guide	S	978-92-0-338710-1	STI/PUB/1466	2014	33.00
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IAEA Safety Standards Series No. GS-G-1.5	Regulatory Control of Radiation Sources Safety Guide	А	978-92-0-633910-7	STI/PUB/1192	2012	25.00
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IAEA Safety Standards Series No. SSR-2/2	Safety of Nuclear Power Plants: Commissioning and Operation Specific Safety Requirements	F	978-92-0-221910-6	STI/PUB/1513	2012	31.00
IAEA Safety Standards Series No. SSR-2/2	Safety of Nuclear Power Plants: Commissioning and Operation Specific Safety Requirements	R	978-92-0-421710-0	STI/PUB/1513	2012	31.00
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IAEA Safety Standards Series No. SSR-2/1	Safety of Nuclear Power Plants: Design Specific Safety Requirements	С	978-92-0-529510-7	STI/PUB/1534	2012	32.00
IAEA Safety Standards Series No. SSR-2/1	Safety of Nuclear Power Plants: Design Specific Safety Requirements	Е	978-92-0-121510-9	STI/PUB/1534	2012	32.00
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Series & No.	Title	Language	ISBN	IAEA Reference	Published	PriceEuro
IAEA Safety Standards Series No. SSR-2/1	Safety of Nuclear Power Plants: Design Specific Safety Requirements	S	978-92-0-331310-0	STI/PUB/1534	2012	32.00
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