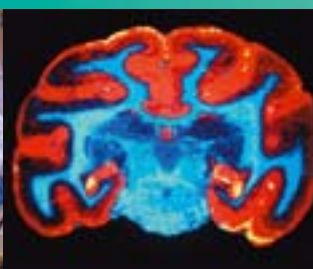


Publications Catalogue 2005



IAEA

International Atomic Energy Agency

www.iaea.org/books

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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.

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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 2005

**including full details of publications
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Radiological Protection for Medical Exposure to Ionizing Radiation

Safety Guide

Safety Standards Series No. RS-G-1.5

This Safety Guide provides recommendations on how safety requirements may be fulfilled for the

protection of patients and visitors against exposure to ionizing radiation in medical practice. Recommendations cover the establishment of guidance levels for diagnostic medical exposures, acceptance testing processes for radiation equipment, calibration of radiotherapy units and reporting of accidental medical exposures.

Contents: 1. Introduction; 2. Regulatory programme for radiological protection for medical exposure; 3. Specific aspects of radiological protection for medical exposure in diagnostic and interventional radiology; 4. Specific aspects of radiological protection for medical exposure in nuclear medicine; 5. Specific aspects of radiological protection for medical exposure in radiotherapy; Annex I: 1. General requirements; Annex II: Medical exposure; Annex III: Schedule II. Dose limits. Dose limitation for comforters and visitors of patients; Annex IV: Schedule III. Guidance levels of dose, dose rate and activity for medical exposure; Glossary.

Chinese Edition (65 pp.; 2005) • ISBN 92-0-516604-9 • STI/PUB/1117 • €14.50

English Edition (76 pp; 2002) • ISBN 92-0-111302-1 • STI/PUB/1117 • €14.50

French Edition (forthcoming 2005) • ISBN 92-0-202204-6 • STI/PUB/1117 • €14.50

Russian Edition (99 pp; 2004) • ISBN 92-0-402104-7 • STI/PUB/1117 • €14.50

NUCLEAR MEDICINE (INCLUDING RADIOPHARMACEUTICALS)

Development of Kits for ^{99m}Tc Radiopharmaceuticals for Infection Imaging **IAEA TECDOC Series No. 1414**

Development of Tc-99m labelling strategies can be useful in the preparation of infection imaging agents by laboratories in Member States. With techniques that were developed for the testing of label stability in vitro and in vivo, with the laboratories participating in the project becoming proficient in labelling the chosen molecules with Tc-99m using a variety of techniques, and with in vivo and in vitro quality assurance measurements standardized by all participants and applied, Tc-99m agents were viewed as reliably labelled. Additionally, with the identification of Tc-99m ubiquickidin peptide 29–41 as a radiolabelled agent with

potential clinical utility, the project has made a major contribution to nuclear medicine by providing the first convenient Tc-99m labelled 'specific' infection imaging agent.

(2004) • ISBN 92-0-111304-8 • IAEA-TECDOC-1414 • €15.00

Development of ^{99m}Tc Agents for Imaging Central Neural Systems Receptors

Technical Reports Series No. 426

Radiopharmaceuticals for imaging the receptors in the brain are of great interest in the management of several receptor related diseases such as epilepsy, Alzheimer's disease, Parkinson's disease and depression and other psychiatric disorders. Technetium-99m is the ideal radioisotope for imaging, due to its low cost, its easy and universal availability through commercially available generator systems, and its physical decay characteristics. The IAEA organized a coordinated research program (CRP) aimed at the development of Technetium-99m central neural system receptor imaging agents. This report summarizes the work carried out by different research groups during the CRP. The research projects presented by the participants include the development and evaluation of serotonin receptor ligands, benzodiazepinic receptor ligands, dopamine receptor ligands, and the study of novel cores for Technetium-99m labelling, as well as molecular modelling.

(198 pp., 88 figs; 2004) • ISBN 92-0-115303-1 • STI/DOC/010/426 • €33.00

Forthcoming

Radiation Safety in Nuclear Medicine **Safety Reports Series No. 40**

The International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources (BSS), jointly sponsored, inter alia, by the IAEA, the ILO, the WHO and the Pan American Health Organization, establish requirements on the legal persons responsible for designing, running and decommissioning practices involving ionizing radiation. These requirements are basic and general in nature. This book is intended to be of assistance to both regulators and users of radiation sources in nuclear medicine in applying the BSS to this practice. Regulators will find it useful for reviewing applications for authorization and for the inspection of the practice. Users of radiation in nuclear medicine may follow the guidance provided in order to comply with BSS requirements or equivalent national requirements. Experts recruited on IAEA missions to advise on the implementation of the BSS for the practice of nuclear medicine are expected to use the guidance given in this report rather than their own national regulations and guidance.

(Forthcoming 2005) • ISBN 92-0-111104-5 • STI/PUB/1207 • €28.00

IAEA Quality Control Atlas for Scintillation Camera Systems

Accurate interpretation of Nuclear medicine image data depends upon an understanding of image patterns and quantitative results. This publication presents numerous different examples which allow the reader to gain an understanding of the interpretation of quality control tests and to recognize artefacts. The examples are not limited to the quality control tests, but include clinical images obtained from unsuspected malfunctioning in the scintillation camera and/or computer system, sub optimal use of the system or operator error.

(293 pp.; 2003) • ISBN 92-0-101303-5 •
STI/PUB/1141 • €99.00
CD Edition (2003) • ISBN 92-0-113503-3 •
STI/PUB/1141/CD • €99.00

"The authors are to be congratulated on the publication of an important piece of work which represents a significant contribution to the field of nuclear medicine. It represents both an invaluable institutional reference and a significant advanced teaching resource to those formally studying the principles of operation of both older, analogue-based, and more contemporary gamma cameras relying predominantly on digital signal processing, and also of their interfaces, computer systems and associated devices for the generation of image hard copy."

"The practical value of this volume would also enhance the personal library collection of senior clinical nuclear medicine physicists, technologists or clinical nuclear medicine practitioner. Camera manufacturers should also explore its potential value as a teaching resource for field service personnel."

W.A. Waddington, London, UK
European Journal of Nuclear Medicine

"There are 2 features of the atlas that impressed me most. The first is the wide variety of manufacturers, generations, and models of γ -camera from which the illustrations are drawn, ... The second feature is the vast subsection on planar uniformity. I was amazed at just how many problems can be diagnosed through proper interpretation of a simple flood image, ... The atlas provides examples of at least 2 dozen types of detector or collimator problems and examples of diagnoses ..."

"Overall, I found the atlas to be organized well, easy to read, thorough, and very informative. Essentially every aspect and type of problem associated with γ -camera imaging is illustrated at least once. I highly recommend this atlas not only as an excellent reference guide for clinicians, and especially those responsible for performing and analyzing the results of γ -camera tests, but also as a tool in educational programs for nuclear medicine technologists and physicists. I plan to use it for both purposes."

William D. Erwin, MS
University of Texas M.D. Anderson Cancer Center Houston,
Texas, USA

RADIATION THERAPY

Commissioning and Quality Assurance of Computerized Planning Systems for Radiation Treatment of Cancer

Technical Reports Series No. 430

This report is intended to support hospitals in developing procedures for the commissioning and quality assurance (QA) of computerized treatment planning systems (TPSs). The relatively low cost of today's equipment has made TPSs widely available in industrialized and developing countries, but, with the exception of a few national recommendations for QA in North America and Western Europe, there are no publications available that professionals can follow to develop procedures to check their TPSs. The rationale for the multiple tests described in this report is related to the four major issues of a well structured QA programme in computerized treatment planning, namely education, verification, documentation and communication.

(281 pp., 27 figs; 2004) • ISBN 92-0-105304-5 •
STI/DOC/010/430 • €42.00

Labelling Techniques of Biomolecules for Targeted Radiotherapy

IAEA TECDOC Series No. 1359

This publication records the work carried out under the Coordinated Research Project (CRP) on Labelling Techniques of Biomolecules for Targeted Radiotherapy. Researchers from 15 laboratories from Asia, Europe and Latin America participated in the CRP, which aimed at developing and optimizing existing procedures for radiolabelling of monoclonal antibodies and small peptides with therapeutic radionuclides, such as ^{90}Y and ^{188}Re . This publication will be of interest to scientists worldwide who are working on the development of therapeutic radiopharmaceuticals.

(2003) • ISBN 92-0-107303-8 •
IAEA-TECDOC-1359 • €15.00

Radiation Oncology Physics: A Handbook for Teachers and Students

This publication is aimed at students and teachers involved in programmes that train professionals for work in radiation oncology. It provides a comprehensive overview of the basic medical physics knowledge required in the form of a syllabus for modern radiation oncology. It will be particularly useful to graduate students and residents in medical physics programmes, to residents in radiation oncology, as well as to students in dosimetry and radiotherapy technology programmes. It will assist those preparing for their professional certification examinations in radiation oncology, medical physics, dosimetry or radiotherapy technology. It has been endorsed by several international and national organizations and the material

presented has already been used to define the level of knowledge expected of medical physicists worldwide.

(Forthcoming 2005) • ISBN 92-0-107304-6 •
STI/PUB/1196 • €65.00

Radiation Protection in the Design of Radiotherapy Facilities

Safety Reports Series No. 47

This Safety Report provides practical guidance regarding the design and shielding of radiotherapy facilities. Methods for determining the necessary structural shielding for external beam units (cobalt-60 units, linear accelerators, superficial and orthovoltage units, and simulators) as well as brachytherapy units are described. Data used for determining the structural shielding necessary for all types of radiotherapy facilities are reproduced in this report and example calculations are provided for each type of facility. Also, specific design features that could be incorporated into radiotherapy facilities, including those related to the security of radioactive sources, are discussed in this book. It is intended to be used primarily by radiological physicists in the planning and design of new radiotherapy facilities and in the remodelling of existing facilities. Sections of the report will also be of interest to architects, civil engineers, hospital administrators and others who are concerned with the design of radiotherapy facilities. In addition, the guidance given in the report will be useful to regulatory personnel responsible for the licensing and inspection of these facilities.

(Forthcoming 2005) • ISBN 92-0-100505-9 •
STI/PUB/1223

Forthcoming

Radiation Safety in Radiotherapy

Safety Reports Series No. 38

The International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources (BSS), jointly sponsored, inter alia, by the IAEA, the ILO, the WHO and the Pan American Health Organization, establish requirements on the legal persons responsible for designing, running and decommissioning practices involving ionizing radiation. These requirements are basic and general in nature. This report is intended to be of assistance to both regulators and users of radiation sources in radiotherapy applying the BSS to radiotherapy. Regulators will find it useful for reviewing applications for authorization and for the inspection of the practice. Users of radiation in radiotherapy may follow the guidance provided in order to comply with BSS requirements or equivalent national requirements. Experts recruited on IAEA missions to advise on the implementation of the BSS for the practice of radiotherapy are expected to use this regulatory guidance report rather than their own national regulations and guidance.

(Forthcoming 2005) • ISBN 92-0-110904-0 •
STI/PUB/1205 • €28.00

RADIATION BIOLOGY

Accidental Overexposure of Radiotherapy Patients in Bialystok

An accidental overexposure occurred in the Bialystok Oncology Centre which affected five patients undergoing radiotherapy. This report gives an account of the event, the subsequent dose assessment and the clinical consequences to the patients. It also discusses the lessons learned and provides recommendations for preventing similar events from occurring. As such the report is likely to be of use to the manufacturers and users of accelerators and to national bodies.

(103 pp., 38 figs; 2004) • ISBN 92-0-114203-X •
STI/PUB/1180 • €24.00

The Radiological Accident in Cochabamba

In April 2002 an accident involving an industrial radiography source containing Ir-192 occurred in Cochabamba, Bolivia, some 500 km from the capital, La Paz. The source, in a remote exposure container, remained exposed within a guide tube, although this was not known at the time. The container, the guide tube and other equipment were transported from Cochabamba to La Paz as cargo on a passenger bus. This bus had a full load of passengers for most of the eight hour journey. The equipment was subsequently collected by employees of the company concerned and transferred by taxi to the company's shielded facility. This publication gives an account of the event, the doses received and the medical assessment. It also presents information relevant to national authorities and regulatory organizations, emergency planners and a broad range of specialists, including physicists, radiation protection officers and medical specialists. It is hoped that dissemination of the information contained in the report will help reduce the likelihood of similar accidents occurring or, if they do occur, help mitigate their consequences.

(55 pp., 20 figs; 2004) • ISBN 92-0-107604-5 •
STI/PUB/1199 • €19.00

MEDICAL PHYSICS

Absorbed Dose Determination in External Beam Radiotherapy – An International Code of Practice for Dosimetry Based on Standards of Absorbed Dose to Water

Technical Reports Series No. 398

This Code of Practice, which has also been endorsed by WHO, PAHO and ESTRO, fulfils the need for a systematic and internationally unified approach to the calibration of ionization chambers in terms of absorbed dose to water and to the use of these detectors in determining the absorbed dose to water for the radiation beams used in radiotherapy. It provides a methodology for the determination of absorbed dose to water in the low, medium and high energy photon beams, photon

beams, proton beams and heavy ion beams used for external radiation therapy.

Contents: 1. Introduction; 2. Framework; 3. ND,w based formalism; 4. Implementation; 5. Code of Practice for ^{60}Co gamma ray beams; 6. Code of Practice for high energy photon beams; 7. Code of Practice for high energy electron beams; 8. Code of Practice for low energy kilovoltage X ray beams; 9. Code of Practice for medium energy kilovoltage X ray beams; 10. Code of Practice for proton beams; 11. Code of Practice for heavy ion beams; Appendix I: Relation between NK and ND,w based Codes of Practice; Appendix II: Calculation of k_{Q,Q_0} and its uncertainty; Appendix III: Photon beam quality specification; Appendix IV: Expression of uncertainties.

English Edition (229 pp., 29 figs; 2000) • ISBN 92-0-102200-X • STI/DOC/010/398 • €51.00

Russian Edition (251 pp., 26 figs; 2004) • ISBN 92-0-404504-3 • STI/DOC/010/398 • €51.00

Intercalibration of In Vivo Counting Systems Using an Asian Phantom

IAEA TECDOC Series No. 1334

This report describes the development and results of an IAEA Coordinated Research Programme involving the use of the torso phantoms which facilitated the calibration and comparison of national detection systems for measurement of radionuclides in the human body. More specifically, it describes the use of the so-called Asian Phantom for intercalibrating in vivo counting systems.

(2003) • ISBN 92-0-100403-6 • IAEA-TECDOC-1334 • €15.00

Optimization of the Radiological Protection of Patients Undergoing Radiography, Fluoroscopy and Computed Tomography – Final Report of a Coordinated Research Project in Africa, Asia and Eastern Europe

IAEA TECDOC Series No. 1423

National surveys in the UK and USA have indicated that there are large variations in patient doses for routine radiographic examinations, sometimes as high as 20 times or even more. This indicates that variations in developing countries, where there are old machines and poor maintenance facilities, should be a matter of concern. This publication contains the results of a Coordinated Research Project carried out in some countries in Eastern Europe, Africa, and Asia. Considerable variations were observed in general radiography. The experience with optimization indicated significant reductions in patient dose with acceptable image quality consistent with the clinical purpose of the examination. The methodology, based on patient dose measurements, comparison with reference values, assessment of image quality, the introduction of quality control (QC) and corrective actions, wherever needed, and re-evaluation of patient

doses and image quality, has demonstrated its effectiveness for the optimization of radiation protection programmes. This publication also contains the results of a situation analysis on patient doses and QC status in fluoroscopy and in computed tomography.

(2004) • ISBN 92-0-113504-1 • IAEA-TECDOC-1423 • €15.00

Forthcoming

Radiation Safety in Diagnostic Radiology and Interventional Procedures Using X Rays

Safety Reports Series No. 39

The International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources (BSS), jointly sponsored, inter alia, by the IAEA, the ILO, the WHO and the Pan American Health Organization, establish requirements on the legal persons responsible for designing, running and decommissioning practices involving ionizing radiation. These requirements are basic and general in nature. This report is intended to be of assistance to both regulators and users of radiation sources in diagnostic radiology and interventional procedures using X rays in applying the BSS to this practice. Regulators will find it useful for reviewing applications for authorization and for the inspection of the practice. Users of radiation in radiology may follow the guidance provided in order to comply with BSS requirements or equivalent national requirements. Experts recruited on IAEA missions to advise on the implementation of the BSS for the practice of diagnostic radiology and interventional procedures using X rays are expected to use this regulatory guidance report rather than their own national regulations and guidance.

(Forthcoming 2005) • ISBN 92-0-111004-9 • STI/PUB/1206 • €28.00

Standards and Codes of Practice in Medical Radiation Dosimetry

Proceedings of an International Conference in Vienna, Austria, 25–28 November 2002

Proceedings Series

This proceedings presents a refereed selection of papers that were given at the symposium held in Vienna in November 2002. Emphasis was placed on dosimetry for therapeutic applications of radiation in medicine. However, some papers deal with dosimetry in diagnostic radiology and nuclear medicine. Although many dosimetry techniques are discussed, calorimetry is featured in one session exclusively. Many papers deal with dosimetry standards, protocols and comparisons. The need for accurate dosimetry for the treatment of cancer was a common thread throughout the symposium.

(984 pp., 196 figs; 2003) • ISBN 92-0-111403-6 • STI/PUB/1153 • €130.00

Food and Agriculture



Forthcoming

Determination of Human Pathogen Profiles in Food by Quality Assured Microbial Assays

IAEA TECDOC Series No. 1431

This publication includes the results of a Coordinated Research Project (CRP) on "Determination of Human Pathogen Profiles in Food by Quality Assured Microbial Assays". Major food microbial contaminants were identified in some of the main foods exported in the international food market. Thousands of samples in a wide variety of foods were selected to be studied during different points of the food chain: meat (chicken, beef and pork), seafood (shellfish such as shrimp, prawns, scampi, squid, and lobsters, and different types of fish such as salmon, cuttle fish, rohu, fin herring, catfish, milkfish, and tilapia), spices (pepper, paprika), frozen vegetables (asparagus, peas and corn) and other products (coconut and dairy products). The analysis included pathogenic bacteria such as *Salmonella* spp. (several serotypes), *Escherichia coli*, *E. coli* 0157:H7, *Staphylococcus aureus*, *Clostridium perfringens*, *Bacillus cereus*, *Vibrio cholerae*, *Vibrio parahaemolyticus* and *Yersinia enterocolitica*. This CRP produced useful data to conduct better risk assessments on food in importing as well as exporting countries.

(Forthcoming 2005) • ISBN 92-0-115704-5 •
IAEA-TECDOC-1431 • €15.00

FOOD IRRADIATION

Irradiation as a Phytosanitary Treatment of Food and Agricultural Commodities

IAEA TECDOC Series No. 1427

This publication includes the results of a Coordinated Research Project (CRP) on "Irradiation as a Phytosanitary Treatment of Food and Agricultural Commodities". The results contain data on the effect of low doses of irradiation at different stages of development of almost 30 different species of insects and mite which represent major trade problems. It is important to note that some of the projects resulted in the first approvals against a non-fruit fly pest (sweetpotato weevil and mango seed weevil). The document also includes information about tolerance to irradiation of some commodities, packaging materials, methodologies used and the effect of a few combined treatments. This CRP includes also a number of "firsts" such as the first large-scale confirmatory tests for several non-fruit fly pests, the first commercial shipment of cut flowers using irradiation as part of a quarantine treatment, and extensive studies on the response of mites to irradiation.

(2004) • ISBN 92-0-113804-0 •
IAEA-TECDOC-1427 • €15.00

Radiation Processing for Safe, Shelf-Stable and Ready-to-Eat Food

IAEA TECDOC Series No. 1337

The increasingly busy lifestyles of populations in many countries have driven the demand for safe, convenient and ready-to-eat food. Traditional food processes such as drying, canning or refrigeration offer a partial solution to this demand as the sensory quality of such food may be significantly affected or the products may be contaminated by bacteria during preparation. For developing countries, safe shelf-stable food without the need for refrigeration would offer advantages. Irradiation offers a potential to enhance microbiological safety and quality of food through shelf-life extension. A Coordinated Research Project (CRP) on the Development of Safe, Shelf-Stable and Ready-to-Eat Food through Radiation Processing therefore was implemented by the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture to evaluate the role of irradiation for such food. This publication presents the encouraging research results reported at the final research coordination meeting on this CRP.

(2003) • ISBN 92-0-100703-5 •
IAEA-TECDOC-1337 • €15.00

INSECT PEST CONTROL

Automation for Tsetse Mass Rearing for Use in Sterile Insect Technique Programmes

IAEA TECDOC Series No. 1353

This publication summarizes the results of a Coordinated Research Project which aimed to develop automation to enhance tsetse fly rearing for the application of the sterile insect technique. The purpose of the automation was both to increase the quality and quantity of flies produced and to reduce the labour required. It describes the development of the tsetse production unit (TPU) through three stages, from a highly automated system to a less sophisticated, hand operated system, TPU3. This last version holds the flies in cages on static frames, and brings the blood meal to the flies, minimizing the disturbance to them. Other components developed in the course of this work include day zero mating and selfstocking of the cages.

(2003) • ISBN 92-0-104303-1 •
IAEA-TECDOC-1353 • €15.00

Biology, History, Threat, Surveillance and Control of the Cactus Moth, *Cactoblastis cactorum*

Alien invasive insect pests are increasingly threatening agriculture and the environment. In the context of rapidly growing international travel and trade, the potential for moving

dangerous pest species to new geographical regions and locations has been drastically increasing. One such species is the cactus moth, *Cactoblastis cactorum* (Pylalidae). As a result of worldwide increases in opuntia cultivation and increased reliance on opuntia as a source of food and on income from its products, the invasion by *C. cactorum* has a potential impact on thousands of subsistence farmers in Central and South America, the Mediterranean countries, North Africa and other regions. Furthermore, *C. cactorum* is considered a serious threat to the high diversity of opuntia species in North America. The Sterile Insect Technique (SIT), being environment friendly and acting inversely density dependent and therefore optimally suited to deal with invasive pest populations up to the last individuals, is the ideal tool to complement efforts to eliminate beach-heads of alien insect invasions. An increased role is foreseen in the use of SIT for suppression of alien invasive species that will help FAO and IAEA Member States deal with the threat of outbreaks of such pests.

(2004) • ISBN 92-0-108304-1 •
IAEA/FAO-BSC/CM • €30.00

Improved Attractants for Enhancing Tsetse Fly Suppression

IAEA TECDOC Series No. 1373

This publication reports on the results of a Coordinated Research Project completed by the FAO and IAEA on the systematic screening and laboratory and field testing of known and new candidate attractant odours for use in the suppression or monitoring of tsetse populations and in barrier systems.

(2003) • ISBN 92-0-110403-0 •
IAEA-TECDOC-1373 • €15.00

MUTATION PLANT BREEDING

Genetic Improvement of Under-utilized and Neglected Crops in Low Income Food Deficit Countries Through Irradiation and Related Techniques

IAEA TECDOC Series No. 1426

This publication contains the results of an FAO/IAEA Coordinated Research Project (CRP) on "Genetic Improvement of Under-utilized and Neglected Crops in LIFDCs through Irradiation and Related techniques". It highlights the integration of radiation induced mutations in vitro culture and molecular genetics methods into the conventional breeding of neglected and under-utilized crops. The successful results included are: plant regeneration strategies in *Dioscorea* spp., grass pea and bambara ground nut, root rot disease tolerant putative mutants of cocoyam, and a genetic diversity bank of bambara ground nut, quinoa, narajilla, okra, *Amaranthus tricolor*, and *A. cruentus*. This publication would be of immense benefit for enhancing the genetic improvement of neglected and under-utilized crops and for further advancing international programmes for improving

food security, nutrition, socio-economic aspects, employment generation and sustainable food production.

(2004) • ISBN 92-0-113604-8 •
IAEA-TECDOC-1426 • €15.00

Improvement of New and Traditional Industrial Crops by Induced Mutations and Related Biotechnology

IAEA TECDOC Series No. 1369

A Coordinated Research Project was initiated in 1994 focusing on developing mutagenesis approaches for selected oilseeds and fibre plants, screening procedures for agricultural and industrial requirements and suitable genotypes of traditional industrial crops adapted to new areas and for new needs. An example of the results obtained were novel oil types developed in cuphea with potential use as a renewable, economical and safe energy source. This publication summarizes the results presented at the third and final research coordination meeting of the CRP.

(2003) • ISBN 92-0-101603-4 •
IAEA-TECDOC-1369 • €15.00

PLANT BIOTECHNOLOGY

Low Cost Options for Tissue Culture Technology in Developing Countries

IAEA TECDOC Series No. 1384

This publication describes options for reducing costs in the establishment and operation of plant tissue culture facilities and focuses primarily on plant micropropagation. It includes the basics of tissue culture technology, bioreactors, low-cost options in the design of laboratories, use of media and containers, energy and labour saving, integration and adoption of low cost options, increasing plant survival after propagation, and outreach of material to growers and farmers in developing countries. The publication will be of particular value to the micropropagation industry in developing countries for the enhancement of agricultural productivity to enable sustainable food production where infrastructure and facilities for tissue culture are not readily available and where there is a scarcity of financial support. The publication will also serve plant propagators, managers of tissue culture laboratories, scientists and organizations contemplating the establishment of new laboratories, and ongoing commercial concerns, which may incorporate low-cost options.

(2004) • ISBN 92-0-115903-X •
IAEA-TECDOC-1384 • €15.00

SOIL FERTILITY AND IRRIGATION

Management of Crop Residues for Sustainable Crop Production

IAEA TECDOC Series No. 1354

This publication reports on a Coordinated Research Project with the objective to increase crop production through better management of soil organic matter and nutrient inputs. There is a focus on countries where crop production and soil fertility can be sustained by the better management of crop residues. Ten contract and five agreement holders from Australia, Bangladesh, Belgium, Brazil, Chile, China, Egypt, India, Malaysia, Mexico, Morocco, Sri Lanka, the United Kingdom, the United States of America and Vietnam participated in the project.

(2003) • ISBN 92-0-104203-5 •

IAEA-TECDOC-1354 • €15.00

CD Edition (2003) • ISBN 92-0-107703-3 •

IAEA-TECDOC-CD-1354 • €15.00

ANIMAL PRODUCTION AND HEALTH

Guidelines and Recommendations for Improving Artificial Breeding of Cattle in Africa

IAEA-TECDOC Series No. 1437

This manual of protocols, procedures, guidelines and recommendations was produced under an IAEA Technical Cooperation Project, entitled "Improving and Increasing Milk and Meat production", that was implemented within the framework of the AFRA programme, with technical support of the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture. It is the result of interactive collaboration between the national project coordinators of the project, several experts in artificial insemination (AI) in the participating Member States, two IAEA experts who assisted with the project and the technical officer from the Joint FAO/IAEA Division. The manual is intended for livestock specialists involved in the provision of AI services to cattle farmers in Africa, including those in ministries of agriculture/livestock, departments of livestock and veterinary services, AI centres, semen distribution centres and field level AI service points. It is also a useful resource for teachers and students in faculties of veterinary and animal sciences, and those involved in the training of AI technicians.

(Forthcoming 2005) • ISBN 92-0-100705-1 •

IAEA-TECDOC-1437 • €15.00

Nuclear Measurements, Techniques and Instrumentation



PHYSICS

Forthcoming

Radioisotope Handling Facilities and Automation of Radioisotope Production

IAEA TECDOC Series No. 1430

Radioisotopes make important contributions in several sectors of economic significance including medicine, food processing, industry, agriculture and research. Member States continue to express interest in upgrading radioisotope handling facilities for production of radiopharmaceuticals, radioisotope generators and radioactive sources, and for medical and industrial applications. Handling of radioactivity needs special facilities to shield the radiation emitted and to prevent contamination of the environment, and radioisotopes for medical applications are special as they need to be complying with GMP requirements as well. The automation of radioisotope handling facilities for various operations in hot cells such as target handling, radiochemical processing, radiopharmaceuticals manufacturing, dispensing or autoclaving is crucial. Radioisotope handling facilities that can lead to a significant reduction of radiation dose and increased GMP compliance are elaborated upon in this publication.

(Forthcoming 2005) • ISBN 92-0-116104-2 •
IAEA-TECDOC-1430 • €15.00

Standardized High Current Solid Targets for Cyclotron Production of Diagnostic and Therapeutic Radionuclides

Technical Reports Series No. 432

Radionuclides continue to play an important role in diagnostic and therapeutic applications in modern nuclear medicine. Many of these radionuclides are produced using cyclotron accelerators, and the corresponding laboratory production methodologies and technologies are subject to constant improvements. This publication summarizes the laboratory protocols developed over a three year period for the production of radionuclides using solid target technology, in particular thallium-201, iodine-123, iodine-124 and palladium-103, which are important radioisotopes for use in medical diagnosis and therapy. This publication is a suitable guide for radioisotope laboratories, cyclotron and radiochemical production facilities, and will be of interest to those dealing with production and applications of radioisotopes and radiopharmaceuticals for nuclear medicine and industrial purposes. A CD-ROM is included.

(71 pp.; 2004) • ISBN 92-0-109304-7 •
STI/DOC/010/432 • €40.00

Utilization of Accelerators

Proceedings of an International Symposium in Sao Paulo, Brazil, 26–30 November 2001

C&S Papers CD Series No. 16

Particle accelerators, originally developed for basic research, have matured into versatile tools for important applications in other branches of science as well as in medicine and industry. The first IAEA International Symposium on Utilisation of Accelerators, 26-30 November 2001 in Sao Paulo, Brazil, brought together 135 international experts in the field and covered all aspects of accelerator technology and applications, with invited presentations on topics such as synchrotron radiation, environmental and industrial applications.

CD-ROM (2003) • ISBN 92-0-110003-5 •
IAEA-CSP-16/CD • €15.00

DOSIMETRY (TECHNIQUES)

Calibration of Photon and Beta Ray Sources Used in Brachytherapy

IAEA TECDOC Series No. 1274

This publication discusses calibration techniques of the most commonly used gamma and beta ray brachytherapy sources. For Cs-137 low dose rate (LDR) source calibrations, the IAEA Dosimetry Laboratory maintains reference sources calibrated at a primary standards dosimetry laboratory. These sources can be used to calibrate well type ionization chambers maintained at the secondary standards dosimetry laboratories. In Section 7 of this report Cs-137 LDR calibrations are discussed in detail.

English Edition (2002) •
IAEA-TECDOC-1274 • €15.00
Spanish Edition (2004) • ISBN 92-0-300404-1 •
IAEA-TECDOC-1274/S • €15.00

NUCLEAR ANALYTICAL TECHNIQUES

Advances in Destructive and Non-Destructive Analysis for Environmental Monitoring and Nuclear Forensics

Proceedings of an International Conference in Karlsruhe, Germany, 21–23 October 2002

Proceedings Series

The illicit trafficking of nuclear material has been an issue of concern since the first seizures in the early 1990s, and has gained increased attention in the context of the recent discussions on the possibilities of nuclear terrorism. The aim of this conference was to promote the further development

of nuclear forensic methods and international cooperation among laboratories. Another aim was to facilitate access to such capabilities by national law enforcement authorities in investigating and prosecuting nuclear crimes, to enhance cooperation, and to bring nuclear forensic methodology to a broader audience. These proceedings include the keynote addresses, invited papers, panel discussions, session summaries and an executive summary.

(419 pp., 114 figs; 2003) • ISBN 92-0-110203-8 •
STI/PUB/1169 • €60.00

Analytical Applications of Nuclear Techniques

The contributions from some of the world's leading nuclear analysts included in this book describe a variety of nuclear techniques and applications, such as those in the fields of environment and health, industrial processes, non-destructive testing, forensic and archaeological investigations and cosmochemistry, and in method validation. The descriptive articles demonstrate the advantages of nuclear techniques in, for example, analysing trace elements in submilligram samples in a single strand of hair or in kilogram samples of municipal waste. Halogenated organic compounds as well as major and trace inorganic constituents are analysed in a variety of solid and liquid matrices. Several different techniques are applied to investigate the authenticity of art objects and the origin of extraterrestrial material. Many applications of nuclear analytical techniques in industrial process control or in the production of high-tech materials are described, highlighting the socioeconomic benefit of these techniques in our daily lives. The book is intended to stimulate students, teachers and non-nuclear scientists to take the 'nuclear' option into consideration when deciding on a new field of study or an alternative analytical technique.

(203 pp., 41 fig.; 2004) • ISBN 92-0-114703-1 •
STI/PUB/1181 • €25.00

Clean Laboratories and Clean Rooms for Analysis of Radionuclides and Trace Elements

IAEA TECDOC Series No. 1339

This publication summarizes the requirements of clean laboratory environments, for construction materials as well as for materials used during routine analysis, maintenance, and pitfalls in the analysis of radionuclides and elements at trace- and ultra trace levels. Included are papers contributed by experts from India, the Netherlands, the United States of America and the IAEA Laboratories, Seibersdorf.

(2003) • ISBN 92-0-100603-9 •
IAEA-TECDOC-1339 • €15.00

Collection and Preparation of Bottom Sediment Samples for Analysis of Radionuclides and Trace Elements

IAEA TECDOC Series No. 1360

(2003) • ISBN 92-0-109003-X •
IAEA-TECDOC-1360 • €15.00

Development and Use of Reference Materials and Quality Control Materials

IAEA TECDOC Series No. 1350

This publication is intended to assist analytical chemists in their efforts to maintain good quality results and to provide them with a tool to overcome situations where QA/QC cannot be easily implemented. The report is a contribution to improving quality system implementation and to encouraging nuclear analytical laboratories to prepare appropriate materials that can be used for quality control purposes.

(2003) • ISBN 92-0-103303-6 •
IAEA-TECDOC-1350 • €15.00

Intercomparison of PIXE Spectrometry Software Packages

IAEA TECDOC Series No. 1342

During the year 2000, an exercise was organized to make a similar intercomparison of widely available software packages for analysis of particle induced X ray emission (PIXE) spectra. This publication describes the method used in this intercomparison exercise and presents the results obtained. It also gives a general overview of the participating software packages. No recommendation for a particular software package or method for spectrum analysis is given. It is intended that the readers reach their own conclusions and make their own choices, according to their specific needs. This publication will be useful to anyone involved in PIXE spectrum analysis. It includes a companion CD with the complete set of test spectra used for intercomparison. The test spectra on this CD can be used to test any PIXE spectral analysis software package.

(2003) • ISBN 92-0-101203-9 •
IAEA-TECDOC-1342 • €15.00

Ion Beam Techniques for the Analysis of Light Elements in Thin Films, Including Depth Profiling

IAEA TECDOC Series No. 1409

This publication highlights the achievements of a Coordinated Research Project (CRP) to promote the potential of accelerator-based nuclear techniques of analysis for light elements in thin films. The objectives of this CRP were to develop a coordinated research effort between accelerator laboratories and materials science research groups in order to assist and promote the development of quality assurance methods, to evaluate databases of parameters needed for quantitative analysis, and to develop and apply techniques to selected problems concerning the surface modification of materials and production of thin films. Through various case studies, this publication assesses and demonstrates the effectiveness of accelerator-based nuclear techniques for analysis to provide valuable data and knowledge not readily accessible using other methods.

(2004) • ISBN 92-0-110404-9 •
IAEA-TECDOC-1409 • €15.00

Isotopic and Nuclear Analytical Techniques for Health and Environment

C&S Papers CD Series No. 22

The IAEA organized the International Conference on Isotopic and Nuclear Analytical Techniques for Health and Environment held on 10–13 June 2003 in Vienna, Austria, as a way of enhancing its support for isotopic techniques and nuclear analytical techniques (NATs). The conference brought together scientists, technologists and representatives of industry and regulatory authorities to exchange information and review the status of current applications of isotopic techniques and NATs. Future trends and developments of NATs were also discussed. Potential opportunities were identified for application of isotopic techniques and NATs in health and environmental studies in developing countries, and mechanisms were explored for promoting and transferring such technologies. The purpose of the conference was to address developments and trends in health care, nutrition and environmental monitoring, and to exchange information in an international forum to identify future fields of application for isotopic techniques and NATs. In a round-table discussion, the conference addressed possible means and mechanisms for knowledge management and knowledge preservation in areas where interest in nuclear energy and nuclear applications is discouraged and declining, and for building capacity in areas where development potential is still available. This publication is the CD-ROM proceedings of the conference.

**(2004) • ISBN 92-0-100504-0 •
IAEA-CSP-22/CD • €15.00**

Nuclear Analytical Techniques in Archaeological Investigations

Technical Reports Series No. 416

Pre-Hispanic pottery has long been a focal point of archaeological investigations in Latin American countries. Identification of the chemical composition of such materials can give information on production sites and techniques, trade habits, and provide insight into socio-economic relationships. This book details the results of the Coordinated Research Project initiated by the International Atomic Energy Agency, Vienna with the assistance of the Smithsonian Institution, Washington, USA to introduce the principles of archaeo-chemical fingerprinting and foster the application of nuclear analytical methods to archaeological investigations by application of validated Instrumental Neutron Activation Analysis (INAA) to pottery samples. Analytical scientists and archaeologists from Argentina, Brazil, Chile, Cuba, Mexico and Peru participated in the project and investigated materials from a number of their archaeological sites. The great potential of the combination of nuclear analysis and archaeological research is demonstrated and this publication will be of interest to researchers in pre-Columbian South American ceramics as well as scientists worldwide involved in interdisciplinary research using nuclear analytical

methods applied in the field of archaeology. The project provides a template for other groups wishing to establish similar cooperations. This publication will be of interest to researchers in pre-Columbian South American ceramics as well as scientists worldwide involved in interdisciplinary research using nuclear analytical methods applied in the field of archaeology. The project provides a template for other groups wishing to establish similar cooperations.

**(188 pp., 49 figs; 2003) • ISBN 92-0-106203-6 •
STI/DOC/010/416 • €44.00**

Quantifying Uncertainty in Nuclear Analytical Measurements

IAEA TECDOC Series No. 1401

Dedicated specifically to nuclear analytical techniques, this IAEA Guide is intended to assist scientists using alpha-, beta-, and gamma-spectrometries, neutron activation and XRF analyses, and other nuclear analytical methods in assessing and quantifying the sources of uncertainty of their daily measurements. It complements the 'Guide to the Expression of Uncertainty in Measurement' published by ISO and other organizations in 1993, and the EURACHEM Guide on 'Quantifying Uncertainty in Analytical Measurement', the second edition of which was published in 2000. Thirteen selected worked examples on quantification of measurement uncertainty covering a number of nuclear analytical techniques and different measurand/matrix combinations are elaborated in detail. This IAEA Guide may therefore be used as a course material as well as a guidance in the assessment of competence for accreditation and similar purposes for laboratories applying nuclear analytical techniques.

**(2004) • ISBN 92-0-108404-8 •
IAEA-TECDOC-1401 • €15.00**

RESEARCH REACTORS AND PARTICLE ACCELERATORS (APPLICATIONS)

Manual for Reactor Produced Radioisotopes

IAEA TECDOC Series No. 1340

Radioisotopes produced in research reactors have been widely used in a number of applications over the last four decades. This manual is a compilation of procedures for the production, processing and quality control of important reactor produced radioisotopes. Major radioisotope producers across the world have contributed the methodologies reflecting their practical experience gained over several years.

**(2003) • ISBN 92-0-101103-2 •
IAEA-TECDOC-1340 • €15.00**

Earth Sciences



URANIUM GEOLOGY, EXPLORATION AND MINING

Forthcoming

Guidebook on Environmental Impact Assessment for In Situ Leach Mining Projects

IAEA TECDOC Series No. 1428

Assessment of the potential environmental impact of an in situ leach (ISL) project is the first step in the permitting and licensing process. An Environmental Impact Assessment (EIA) serves as the basis for preparing an Environmental Impact Statement (EIS), which in turn identifies the potential environmental and socioeconomic impact of a proposed project and outlines measures to mitigate the impact. The EIS review process serves to inform the public about a proposed project as well as providing regulatory agencies with assurance that ISL technology will comply with environmental standards, and that project sites can be rehabilitated to pre-mining use. This publication provides a step-by-step description of project parameters that must be addressed in conducting an EIA and preparing an EIS. It also includes EIA/EIS case histories for current operations in Australia, the Czech Republic, Kazakhstan and the United States of America. The publication will be useful to companies considering developing ISL projects and to regulatory personnel who are responsible for writing environmental regulations and licensing ISL projects.

**(Forthcoming 2005) • ISBN 92-0-113004-X •
IAEA-TECDOC-1428 • €15.00**

Guidelines for Radioelement Mapping Using Gamma Ray Spectrometry Data

IAEA TECDOC Series No. 1363

This publication is one of a series of IAEA publications covering all aspects of the uranium mining industry, from exploration to exploitation, decommissioning and the application of techniques in other non-uranium resources areas.

**(2003) • ISBN 92-0-108303-3 •
IAEA-TECDOC-1363 • €15.00**

HYDROLOGY

Forthcoming

Guidebook on the Use of Chlorofluorocarbons in Hydrology: 2004 Edition

Technical Reports Series No. 438

**(Forthcoming 2005) • ISBN 92-0-100805-8 •
STI/DOC/010/438 • €52.00**

Isotope Hydrology and Integrated Water Resources Management

C&S Papers Series No. 23

Global efforts to overcome the growing challenge of freshwater availability have been at the forefront of the world development agenda for nearly three decades. For developing policies towards sustainable management of freshwater resources, an improved understanding of the Earth's water cycle has been widely recognized as one of the key elements of scientific information. The IAEA has played a crucial role in promoting and expanding the field of isotope hydrology. Starting in 1963, the IAEA's quadrennial symposia on isotope hydrology have played a central role in developing this scientific discipline. This publication contains 174 extended abstracts of papers presented during 11 technical sessions of the 11th symposium in the series that was convened during 19–23 May 2003 in Vienna. Nearly 275 participants from 69 countries participated in the symposium to discuss the past, present and future of isotope applications in hydrology and climate research.

**(2004) • ISBN 92-0-108604-0 •
IAEA-CSP-23/P • €15.00
CD Edition (2004) • ISBN 92-0-114204-8 •
IAEA-CSP-23/CD • €15.00**

Industrial Applications

Directory of Gamma Processing Facilities in Member States

It is estimated that several hundred gamma irradiators are in operation worldwide. They are mainly used for sterilization of medical products, food irradiation and modification of materials. Their role is very important both for national economies and for R&D activities. This directory of commercial radiation processing facilities using gamma rays from radioisotopes is the first such directory to be published by the IAEA; it is a compilation of technical, utilization and administrative data based on the information supplied to the IAEA as of 2002. This directory includes radiation facilities that process products for various applications for commercial purposes (including industrial and pilot scale facilities). Thus, research laboratories and facilities are not included in the directory. The data were collected through questionnaires distributed to the organizations involved in operating such facilities in Member States. This directory will be a valuable tool for managers, engineers and scientists working in the field and it will facilitate networking amongst regional and interregional facilities.

(2004) • ISBN 92-0-100204-1 •
IAEA-DGPF/CD • €15.00

Market Potential for Non-electric Applications of Nuclear Energy

Technical Reports Series No. 410

Nuclear energy has a much wider potential than being used solely for the generation of electricity. This publication concentrates on the market potential and economics of the nuclear option in district heating, the supply of process heat, water desalination, ship propulsion and outer space applications. In addition, there is an overview of innovative but promising areas for its use, such as fuel synthesis (including hydrogen production) and oil extraction.

(242 pp., 29 figs; 2003) • ISBN 92-0-115402-X •
STI/DOC/010/410 • €49.50

Status of Industrial Scale Radiation Treatment of Wastewater and Its Future

IAEA TECDOC Series No. 1407

Fundamental studies of the radiation process for wastewater treatment, its analogues and differences to other advanced oxidation technologies and of combined processes are presented in the report. Possible fields of application, technical solutions and economic factors concerning engineering and other applications are addressed as well. Developments concerning accelerator design engineering and construction as well as other features of radiation sources are reviewed. Further discussions include the design of under-beam systems. Such progress and developments are critical for further applications. A reduction in cost and an improvement of technical reliability are expected in particular high power accelerators are needed

for environmental applications. The book points out that such applications should be carefully revised in accordance with the existing regulations and state of the art knowledge. The results of the discussions summarized in the TECDOC may serve as the basis for the preparation of guidelines and feasibility studies for full-scale process implementation. Public awareness and technology acceptance are additional factors to be considered for further dissemination; therefore this publication is a valuable source providing necessary information for engineers, environmentalists and decision makers.

(2004) • ISBN 92-0-110104-X •
IAEA-TECDOC-1407 • €15.00

RADIATION PROCESSING

Advances in Radiation Chemistry of Polymers

IAEA TECDOC Series No. 1420

The radiation chemistry of polymers is one of the most important fields in the sciences concerning radiation induced chemical and physical changes in materials. Polymers are the most often irradiated materials, those most often modified and the main component of radiation sterilized medical products. The changes in their structure may be either beneficial or undesirable. This is the reason why the R&D concerning these materials is broad and most developments concerning radiation processing are foreseen in this area. Different aspects of basic research and R&D were presented during the meeting on "Advances in Radiation Chemistry of Polymers" held at the Notre Dame Radiation Laboratory, University of Notre Dame, Indiana, USA, and this TECDOC contains the proceedings of this meeting. The leading experts in the field participated at the meeting, and the present status of the subject and the foreseen trends in it were discussed. Therefore this publication is the most up to date available on the subject.

(2004) • ISBN 92-0-112504-6 •
IAEA-TECDOC-1420 • €15.00

Emerging Applications of Radiation Processing

IAEA TECDOC Series No. 1386

This publication contains reports on the most recent developments in the implementation of radiation technology. Recent R&D trends are also discussed. The reports were prepared by leading international experts in the field. Technical solutions concerning electron accelerators (low, medium and high energy) are reviewed, while newly developed e/X high power units open new possibilities for bulk material processing. All the classical fields of radiation technology applications such as sterilization, food irradiation, polymer processing and rubber processing play an important economic role. Examples based on the two biggest market economies, the USA and Japan, are presented. Breakthroughs in environmental applications

of radiation technology opening new horizons in process applications and solutions applied for flue gas treatment and wastewater treatment are reported. In the field of R&D the most promising fields are natural polymers and nanotechnology. This book will be of interest to scientists, engineers, managers and students working in the field of radiation processing.

(2004) • ISBN 92-0-115803-3 •
IAEA-TECDOC-1386 • €15.00

Radiation Processing of Polysaccharides

IAEA TECDOC Series No. 1422

Radiation processing is a very convenient tool for imparting desirable effects in polymeric materials and it has been an area of enormous interest in the last few decades. The success of radiation technology for processing of synthetic polymers can be attributed to two reasons namely, their ease of processing in various shapes and sizes, and secondly, most of these polymers undergo crosslinking reaction upon exposure to radiation. In recent years, natural polymers are being looked at with renewed interest because of their unique characteristics, such as inherent biocompatibility, biodegradability and easy availability. Traditionally, the commercial exploitation of natural polymers like carrageenans, alginates or starch etc. has been based, to a large extent, on empirical knowledge. But now, the applications of natural polymers are being sought in knowledge — demanding areas such as pharmacy and biotechnology, which is acting as a locomotive for further scientific research in their structure-function relationship. Selected success stories concerning radiation processed natural polymers and application of their derivatives in the health care products industries and agriculture are reported. This publication will be of interest to individuals at nuclear institutions worldwide that have programmes of R&D and applications in radiation processing technologies. New developments in radiation processing of polymers and other natural raw materials give insight into converting them into useful products for every day life, human health and environmental remediation. The book will also be of interest to other field specialists, readers including managers and decision makers in industry (health care, food and agriculture) helping them to understand the important role of radiation processing technology in polysaccharides.

(2004) • ISBN 92-0-114104-1 •
IAEA-TECDOC-1422 • €15.00

Radiation Synthesis and Modification of Polymers for Biomedical Applications

IAEA TECDOC Series No. 1324

Various aspects of hydro gel synthesis are presented in this report. The mechanism of polymerization and cross-linking is described and methods for gel properties evaluation are discussed as well. Results of the presented research may be applied for preparation of the materials for biomedical applications.

(2002) • ISBN 92-0-119702-0 •
IAEA-TECDOC-1324 • €15.00

Radiation Technology in Emerging Industrial Applications

Proceedings of a Symposium in Beijing, China, 6–10 November 2000

C&S Papers CD Series No. 18

This CD-ROM publication reports on the International Symposium on Radiation Technology in Emerging Industrial Applications. Topics covered include a wide range of different applications of radiation technology, such as radiation processing of synthetic polymers, and natural polymers, pharmaceutical applications, hydrogels and membranes, environmental applications, process control, facilities and international developments.

(2003) • ISBN 92-0-111603-9 •
IAEA-CSP-18/CD • €15.00

TRACERS

Integration of Tracing with Computational Fluid Dynamics for Industrial Process Investigation

IAEA TECDOC Series No. 1412

This publication can be used as basic course in tracer methodology in university curricula of chemical engineering, engineering processing, and oil and gas reservoir engineering faculties. The report is also of interest to industrial managers and decision-makers that are generally educated in areas outside of nuclear applications. The book seeks to inform both the specialist and non-specialist reader about the application and impact of radiotracer technology in modern industry. The report can also be used for the further promotion of radiotracer technology in developing IAEA Member States. It is likely to be of wider interest for the further development of skills and confidence to carry out field work. It facilitates the transfer of technology from developed to developing countries.

(2004) • ISBN 92-0-114504-7 •
IAEA-TECDOC-1412 • €15.00

Radiotracer Applications in Industry – A Guidebook

Technical Reports Series No. 423

This guidebook describes the principles and state of the art of radiotracer methodology and technology as applied to industrial engineering processing, wastewater purification systems, oil well interconnections and geothermal power characterization. Case studies of typical problems for process and recovery optimization are presented. The book will be of interest to both radioisotope practitioners and industrial end users.

(281 pp., 180 figs; 2004) • ISBN 92-0-114503-9 •
STI/DOC/010/423 • €45.00



URANIUM MINING AND MILLING

Occupational Radiation Protection in the Mining and Processing of Raw Materials

Safety Guide

Safety Standards Series No. RS-G-1.6

This Safety Guide, which is jointly sponsored by the IAEA and the ILO, supersedes Safety Series No. 26: Radiation Protection of Workers in the Mining and Milling of Radioactive Ores (1983 Edition). Safety Series No. 26 dealt mainly with activities involving uranium or thorium ores. The Safety Guide updates the previous guidance material and extends its coverage to include activities involving all raw materials for which radiation protection measures need to be considered, as well as including additional guidance on authorization of mining and processing activities, inspection and compliance. The main purpose of this Safety Guide is to provide practical guidance on meeting the requirements of the Basic Safety Standards as they relate to the radiation protection of workers in the mining and processing of raw materials, and thus to facilitate the preparation and adoption, by Member States, of national and local regulations, rules, and working procedures in this area of industrial activity. This Safety Guide is aimed at regulatory bodies, operators of mines and mineral processing facilities, health and safety committees, workers and their representatives, and health and safety professionals.

(95 pp.; 2004) • ISBN 92-0-115003-2 •
STI/PUB/1183 • €21.00

The Long-Term Stabilization of Uranium Mill Tailings

IAEA TECDOC Series No. 1403

Mining and milling of uranium ores has been undertaken in many places around the world, resulting in large volumes of mining/milling residues with low activity concentrations of long lived nuclides that often have been disposed of in a haphazard fashion. This report summarizes the current state of the art of uranium mill tailings disposal and the results from an IAEA Coordinated Research Project (CRP) on technologies and strategies for their long term stabilization. The aim of the CRP was to develop conceptual and technical solutions that render tailings more inert over prolonged time spans, that render impounded materials and engineered structures stable over prolonged time spans, that minimize the need for active maintenance, and that are technically and economically feasible. The emphasis was on solutions that can be applied retrospectively, i.e. in a restoration/remediation context. It was recognized, however, that these objectives cannot be met by engineering design only, but must also involve appropriate management and planning procedures.

(2004) • ISBN 92-0-108904-X •
IAEA-TECDOC-1403 • €15.00

FUEL FABRICATION AND STORAGE



Core Management and Fuel Handling for Nuclear Power Plants

Safety Guide

Safety Standards Series No. NS-G-2.5

This Safety Guide supplements and elaborates upon the safety requirements for core management and fuel handling established in Section 5 of Safety Standards Series No. NS-R-2, The Safety of Nuclear Power Plants: Operation (2000). It also relates to Safety Standards Series No. NS-G-2.4, The Operating Organization for Nuclear Power Plants (2001), which identifies fuel management as one of the functions to be performed by the operating organization. It supersedes Safety Series No. 50-SG-O10, Safety Aspects of Core Management and Fuel Handling (1985).

Contents: 1. Introduction; 2. Core management; 3. Handling and storage of fresh fuel; 4. Implementation of the refuelling programme; 5. Handling and storage of irradiated fuel; 6. Handling and storage of core components; 7. Preparation of fuel for dispatch; 8. Administrative and organizational aspects; 9. Documentation.

English Edition (43 pp.; 2002) • ISBN 92-0-111002-2 •
STI/PUB/1125 • €14.00

Russian Edition (55 pp.; 2004) • ISBN 92-0-404204-4 •
STI/PUB/1125 • €14.00



Design of Fuel Handling and Storage Systems in Nuclear Power Plants

Safety Guide

Safety Standards Series No. NS-G-1.4

This Safety Standards Series Guide supersedes Safety Series No. 50-SG-D10 with the same title issued in 1984.

The purpose of this Safety Guide is to provide detailed recommendations for the design of fuel handling and storage systems in nuclear power plants. This publication is intended for use by organizations designing, manufacturing, constructing and operating fuel handling and storage facilities in nuclear power plants, as well as by regulatory bodies.

(53 pp., 4 figs; 2003) • ISBN 92-0-107803-X •
STI/PUB/1156 • €16.50



Storage of Spent Fuel from Power Reactors
Proceedings of an International Conference, Vienna, Austria, 2–6 June 2003

C&S Papers CD Series No. 20

This CD-ROM publication reports on the International Conference on Storage of Spent Fuel from Power Reactors, which gave an opportunity for exchange of information on the state of the art and prospects of spent fuel storage, for discussion of the worldwide situation and the major factors influencing the national policies in this field, and for the identification of the most important directions that national efforts and international cooperation in this area should take.

(2003) • ISBN 92-0-109603-8 •
 IAEA-CSP-20/P • €15.00
 CD Edition (2003) • ISBN 92-0-109803-0 •
 IAEA-CSP-20/CD • €15.00

NUCLEAR POWER PLANTS

Analysis of Differences in Fuel Safety Criteria for WWER and Western PWR Nuclear Power Plants

IAEA TECDOC Series No. 1381

This report captures the common features and differences between Western PWR and WWER fuel, and may serve as a general basis for the safety evaluation of these fuels. Therefore, it should be very beneficial for PWR and WWER licensing activities, as it focuses on the issues of importance for the review of fuel safety cases.

(2003) • ISBN 92-0-112903-3 •
 IAEA-TECDOC-1381 • €15.00

Assessment and Management of Ageing of Major Nuclear Power Plant Components Important to Safety – Primary Piping in PWRs

IAEA TECDOC Series No. 1361

This publication is one in a series of reports on the assessment and management of ageing of the major nuclear power plant (NPP) components important to safety. These reports are based on the experience and practices of NPP operators, regulators, designers, manufacturers, and technical support organizations and a widely accepted methodology for the management of ageing of NPP components important to safety, which was issued by the IAEA in 1992.

(2003) • ISBN 92-0-108003-4 •
 IAEA-TECDOC-1361 • €15.00

Forthcoming

Assessment of Defence in Depth for Nuclear Power Plants

Safety Reports Series No. 46

The publication provides specific technical information on implementation of the concept in the siting, design, construction and operation of nuclear power plants (NPPs). It describes a method for verifying capabilities for implementation of defence in depth in existing NPPs. For given objectives of each level of defence, a set of challenges to achieve these objectives is identified as well as several constitutive mechanisms leading to these challenges, and a list of possible safety provisions which contribute to prevention of these mechanisms is provided. This book is intended to serve as a reference primarily for self-assessment of the comprehensiveness and quality of defence in depth provisions by NPP operators, but it can be also used by regulators or independent reviewers. It offers a complementary tool for evaluation of the strengths and weaknesses of defence in depth in a specific NPP.

(Forthcoming 2005) • ISBN 92-0-114004-5 •
 STI/PUB/1218 • €28.00

Considerations in the Development of Safety Requirements for Innovative Reactors: Application to Modular High Temperature Gas Cooled Reactors

IAEA TECDOC Series No. 1366

This publication describes a general approach for assessing the safety of the design of advanced and innovative reactors, and of reactors in general including research reactors with characteristics that differ from those of light water reactors. A method is put forward for safety assessment that is based on the well established and accepted principle of defence in depth. The modular high temperature gas cooled reactor has been selected as a case study to demonstrate the viability of the method proposed.

(2003) • ISBN 92-0-107203-1 •
 IAEA-TECDOC-1366 • €15.00



Design of Emergency Power Systems for Nuclear Power Plants

Safety Guide

Safety Standards Series No. NS-G-1.8

This Safety Guide was prepared under the IAEA safety standards programme for nuclear power plants (NPPs). The basic requirements for the design of safety systems for NPPs are provided in Safety Standards Series No. NS-R-1: Safety of NPPs: Design. The Safety Guide describes how the revised basic requirements should be met for the design of emergency power supply systems for NPPs.

This publication is a revision of Safety Series No. 50-SG-D7, Emergency Power Systems at NPPs. It takes account of

developments in the design of emergency power supply systems in NPPs since 1991 and includes recommendations and guidance on non-electrical power sources. This Safety Guide was prepared through three technical meetings and extensive review of experts from 21 countries over a period of four years.

(61 pp., 5 figs; 2004) • ISBN 92-0-103504-7 •
STI/PUB/1188 • €20.00



Design of Reactor Containment Systems for Nuclear Power Plants

Safety Guide

Safety Standards Series No. NS-G-1.10

This Safety Guide supersedes Safety Series No. 50-SG-D12, Design of the Reactor Containment Systems in Nuclear

Power Plants, issued in 1985. The purpose of this Safety Guide is to provide recommendations for the design of the containment systems in nuclear power plants in compliance with the safety objectives and requirements established in Safety Standard Series No. NS-R-1, Safety of Nuclear Power Plants: Design. Management of energy, radionuclides and combustible gases is considered. This publication is intended for use by organizations designing, manufacturing, constructing and operating nuclear power plants, as well as by regulatory bodies.

(127 pp., 11 fig.; 2004) • ISBN 92-0-103604-3 •
STI/PUB/1189 • €18.00



Design of the Reactor Coolant System and Associated Systems in Nuclear Power Plants

Safety Guide

Safety Standards Series No. NS-G-1.9

This publication is a revision and combination of two previous Safety Guides: Safety Series No. 50-SG-D6, Ultimate

Heat Sink and Directly Associated Heat Transport Systems for Nuclear Power Plants (1981), and Safety Series No. 50-SG-D13, Reactor Coolant and Associated Systems in Nuclear Power Plants (1986). The revision takes account of developments in the design of the reactor coolant and associated systems in nuclear power plants since the earlier Safety Guides were published. The other objectives of the revision are to ensure consistency with the Requirements for Design, issued in 2000, and to update the technical content. In addition, an appendix on pressurized heavy water reactors has been included.

(79 pp., 4 figs; 2004) • ISBN 92-0-103404-0 •
STI/PUB/1187 • €18.00

Forthcoming

Design of the Reactor Core for Nuclear Power Plants

Safety Guide

Safety Standards Series No. NS-G-1.12

(Forthcoming 2005) • ISBN 92-0-116004-6 •
STI/PUB/1221 • €23.00

Earthquake Experience and Seismic Qualification by Indirect Methods in Nuclear Installations

IAEA TECDOC Series No. 1333

The objective of this TECDOC is to provide a technical background to help regulators, plant owners and designers in the definition, implementation and review of seismic qualification procedures for components and equipment, mainly for existing plants, consistent with the IAEA safety standards. Many engineering companies and utilities have developed their own methodologies for these purposes. A common feature of these approaches is that they rely to a large extent on engineering judgement and therefore the review and assessment of the qualification processes are sometimes rather difficult. This publication intends to provide information and recommendations for the improvement of the reliability of these procedures, for the understanding of their limitations and applicability, and for their optimal use.

(2003) • ISBN 92-0-100303-X •
IAEA-TECDOC-1333 • €15.00

Evaluation of Seismic Hazards for Nuclear Power Plants

Safety Guide

Safety Standards Series No. NS-G-3.3

This Safety Guide provides guidelines and recommends procedures for the evaluation of seismic hazards for nuclear power plants. Specifically, it provides recommendations on how to determine the ground motion hazards for a plant at a particular site and the potential for surface faulting, which could affect the feasibility of construction and safe operation of a plant at that site. The Safety Guide supersedes IAEA Safety Series No. 50-SG-S1 (Rev.1), Earthquakes and Associated Topics in Relation to Nuclear Power Plant Siting, that was issued in 1991.

(31 pp; 2002) • ISBN 92-0-117302-4 •
STI/PUB/1144 • €14.50

Experience Gained from Fires in Nuclear Power Plants: Lessons Learned

IAEA TECDOC Series No. 1421

This publication includes a detailed analysis of the most recent events collected through the IAEA databases and other bibliographic sources. It provides the technical background for the recently revised IAEA Safety Guide on Fire Protection for new and existing plants and also a collection of lessons learnt

that are useful for practical fire safety enhancement in operating plants. It aims at providing a comprehensive summary of the experience in Member States, with special emphasis on the development of a unified approach to management of the feedback experience, also in view of an improvement of the available methodologies for fire hazard evaluation.

(2004) • ISBN 92-0-112604-2 •
IAEA-TECDOC-1421 • €15.00



External Events Excluding Earthquakes in the Design of Nuclear Power Plants

Safety Guide

Safety Standards Series No. NS-G-1.5

This Safety Guide provides recommendations and guidance on design for the protection of nuclear power plants

from the effects of external events (excluding earthquakes), i.e. events that originate either off the site or within the boundaries of the site but from sources that are not directly involved in the operational states of the nuclear power plant units. In addition, it provides recommendations on engineering related matters in order to comply with the safety objectives and requirements established in the IAEA Safety Requirements publication on Safety of Nuclear Power Plants: Design. It is also applicable to the design and safety assessment of items important to the safety of land based stationary nuclear power plants with water cooled reactors.

(105 pp., 14 figs; 2003) • ISBN 92-0-113603-X •
STI/PUB/1159 • €27.00



External Human Induced Events in Site Evaluation for Nuclear Power Plants

Safety Guide

Safety Standards Series No. NS-G-3.1

This Safety Guide recommends actions, conditions and procedures and provides guidance for fulfilling the requirements of

Safety Standards Series No. NS-R-3, Site Evaluation for Nuclear Installations, in relation to external human induced events when conducting a site evaluation for a nuclear power plant. The Safety Guide supersedes Safety Series No. 50-SG-S5, External Man-induced Events in Relation to Nuclear Power Plant Siting (1981).

Contents: 1. Introduction; 2. General approach to site evaluation in relation to external human induced events; 3. Data collection and investigations; 4. Screening and evaluation procedures; 5. Aircraft crashes; 6. Release of hazardous fluids; 7. Explosions; 8. Other external human induced events; 9. Administrative aspects.

English Edition (49 pp., 1 fig.; 2004) • ISBN 92-0-111202-5 •
STI/PUB/1126 • €14.50

Russian Edition (61 pp., 1 fig.; 2004) • ISBN 92-0-402304-X •
STI/PUB/1126 • €14.50

Extreme External Events in the Design and Assessment of Nuclear Power Plants

IAEA TECDOC Series No. 1341

The objective of this publication is to provide a technical background to assist regulators, plant owners and designers in the definition of a consistent strategy in selected safety issues on site evaluation, design and operation in relation to extreme external events. The publication is also of assistance to the IAEA in the development of the Safety Series programme, where many safety guides dealing with related topics are under periodic review. Emphasis is given to the generally accepted "risk based" context, where the probability of event occurrence is analysed together with the probability of an induced radiological consequence. The publication intends to solve the pending issues that prevent a full scope application of the approach in relation to the external events. The relevant differences among the practices in Member States are analysed through a questionnaire. Many proposals for a consensus on the main safety issues are developed and presented in detail.

(2003) • ISBN 92-0-102003-1 •
IAEA-TECDOC-1341 • €15.00

Flood Hazard for Nuclear Power Plants on Coastal and River Sites

Safety Guide

Safety Standards Series No. NS-G-3.5

This Safety Guide discusses the phenomena, both natural and human induced, that may cause floods or droughts at coastal and river sites, and gives an outline of the methods that can be used for, and the critical factors involved in, the evaluation of such events and of their associated effects. Possible combinations of two or more phenomena that can give rise to flooding at a site are also discussed.

(83 pp.; 2003) • ISBN 92-0-112803-7 •
STI/PUB/1170 • €20.00

Forthcoming

Geotechnical Aspects of Site Evaluation and Foundations for Nuclear Power Plants

Safety Guide

Safety Standards Series No. NS-G-3.6

This publication is a revision of the former safety standards of the IAEA Safety Series No. 50-SG-S8. The scope has been extended to cover not only foundations but also design questions related to geotechnical science and engineering, such as the bearing capacity of foundations, design of earth structures and design of buried structures.

(Forthcoming 2005) • ISBN 92-0-107204-X •
STI/PUB/1195 • €19.00

Implementation of Accident Management Programmes in Nuclear Power Plants

Safety Reports Series No. 32

This publication provides a description of the elements which should be addressed by the team responsible for the preparation, development and implementation of a plant specific accident management programme at a nuclear power plant. The issues addressed include formation of the team, selection of accident management strategies, safety analyses required, evaluation of the performance of plant systems, development of accident management procedures and guidelines, staffing and qualification of accident management personnel, and training needs. The report is intended to facilitate the work to be done by NPP operators, utilities and their technical support organizations, but it can also be used for the preparation of relevant national regulatory requirements.

(121 pp., 16 figs; 2004) • ISBN 92-0-113803-2 • STI/PUB/1167 • €28.00

Implications of Power Uprates on Safety Margins of Nuclear Power Plants

IAEA TECDOC Series No. 1418

This publication addresses the specific topics relating to the utilization of safety margins for nuclear power plant (NPP) uprates. Progress made in the development and application of modern computer codes for safety analysis and better understanding of phenomena involved in plant design and operation enable analysts to determine licensing margins with higher precision. There is a general tendency for utilities to take advantage of unnecessarily large conservatism in safety analyses and to utilize them for reactor power uprates, better utilization of nuclear fuel, higher operational flexibility and justification of lifetime extension. The present publication sets forth the results of a Technical Meeting on the Implications of Power Uprates for the Safety Margins of NPPs, which was organized in cooperation with the OECD Nuclear Energy Agency and was held in Vienna from 13 to 15 October 2003.

(2004) • ISBN 92-0-112004-4 • IAEA-TECDOC-1418 • €15.00

Improvement of In-Service Inspection in Nuclear Power Plants

IAEA TECDOC Series No. 1400

This publication describes strategies for improving the effectiveness of in-service inspection (ISI). The role of ISI in maintaining or improving safety and the relationship of ISI improvement to cost are examined. The strategies for improving ISI effectiveness discussed in this publication consider the entire framework of ISI, including effective selection of the proper inspection scope and effectiveness of non-destructive examination as demonstrated through inspection qualification programmes. Improving the effectiveness of ISI in an economical and organized way requires adoption of a strategy that meets

specific objectives for each plant owner. Several such strategies are considered.

(2004) • ISBN 92-0-108104-9 • IAEA-TECDOC-1400 • €15.00

Meteorological Events in Site Evaluation for Nuclear Power Plants

Safety Guide

Safety Standards Series No. NS-G-3.4

This Safety Guide makes recommendations and provides guidance on conducting hazard assessments of extreme and rare meteorological phenomena. It is will be of interest to safety assessors and regulators involved in the licensing process as well as to designers of nuclear power plants.

(34 pp.; 2003) • ISBN 92-0-102103-8 • STI/PUB/1148 • €12.50

Methodology for the Assessment of Innovative Nuclear Reactors and Fuel Cycles

IAEA TECDOC Series No. 1434

Following a resolution of the General Conference of the IAEA in the year 2000 an International Project on Innovative Nuclear Reactors and Fuel Cycles, referred to as INPRO, was initiated.

The main objectives of INPRO are to:

Help to ensure that nuclear energy is available to contribute towards fulfilling energy needs in the 21st century in a sustainable manner; and

Bring together both technology holders and technology users to consider jointly the international and national actions required to achieve desired innovations in nuclear reactors and fuel cycles.

Within INPRO the future energy demand and supply was explored and several scenarios identified. The following requirement for energy supply will play a crucial role: sustainability of the way the energy supply will be realized. Fulfilling the growing need for energy in developing countries is also an important issue. On the basis of on scenarios for the next fifty years, requirements for the different aspects of the future of nuclear energy systems, such as economics, environment, safety, waste, proliferation resistance and infrastructure have been identified as well as a methodology developed to assess innovative nuclear systems and fuel cycles. On the basis of this assessment, the need for innovations in existing nuclear technology, to be achieved via research, development and demonstration, can be defined. To facilitate the deployment of innovative nuclear systems also different aspects of the infrastructure, technical as well as institutional, have also been reviewed, and recommendations for changes are made to anticipate the main developments in the world such as ongoing globalization.

(2004) • ISBN 92-0-116304-5 • IAEA-TECDOC-1434 • €15.00

Modifications to Nuclear Power Plants

Safety Guide

Safety Standards Series No. NS-G-2.3

This Safety Guide provides recommendations and guidance on controlling activities relating to modifications to nuclear power plants so as to reduce risk and to ensure that the configuration of the plant is under control at all times, and that the modified configuration conforms to the approved basis for granting an operation licence. The recommendations cover the whole process from conception to completion for modifications to structures, systems and components, operational limits and conditions, procedures and software, and the management systems and tools for plant operation. The Safety Guide recommends how to meet the requirements established in Safety Standards Series No. NS-R-2, The Safety of Nuclear Power Plants: Operation (2000).

Contents: 1. Introduction; 2. General; 3. Roles and responsibilities; 4. Modifications relating to plant configuration; 5. Modifications to management systems; 6. Temporary modifications; 7. Implementation of organizational changes; 8. Implementation of organizational changes; 9. Quality assurance; 10. Training; 11. Management of documentation.

Chinese Edition (27 pp.; 1 fig.; 2005) • ISBN 92-0-516904-8 • STI/PUB/1111 • €12.50

English Edition (33 pp., 1 fig.; 2001) • ISBN 92-0-101501-1 • STI/PUB/1111 • €12.50

Russian Edition (41 pp., 1 fig.; 2004) • ISBN 92-0-402904-8 • STI/PUB/1111 • €12.50

Operational Limits and Conditions and Operating Procedures for Nuclear Power Plants

Safety Guide

Safety Standards Series No. NS-G-2.2

This Safety Guide provides guidance on the development, content and use of operational limits and conditions (limits on plant operating parameters) and operating procedures that effect them. It recommends how to meet the requirements established in Safety Standards Series No. NS-R-2, Safety of Nuclear Power Plants: Operation (2000), setting out the responsibilities of the operating organization in setting, modifying and documenting operational limits and conditions and ensuring compliance with them. It supersedes Safety Series No. 50-SG-O3, Operational Limits and Conditions for Nuclear Power Plants (1979).

Contents: 1. Introduction; 2. Safety objective; 3. The concept of operational limits and conditions and their development; 4. Safety limits; 5. Limiting safety system settings; 5. Limits and conditions for normal operation; 7. Surveillance requirements; 8. Operating procedures; 9. Development of operating procedures; 10. Compliance with operational limits and conditions and operating procedures; Appendix I: Selection of limits and conditions for normal operation; Appendix II: Development of operating procedures (outlines); Annex: Example to explain some terms used; Glossary.

English Edition (41 pp., 2 figs; 2000) • ISBN 92-0-102000-7 • STI/PUB/1100 • €14.50

Russian Edition (45 pp., 2 figs; 2004) • ISBN 92-0-401704-X • STI/PUB/1100 • €14.50



Periodic Safety Review of Nuclear Power Plants

Safety Guide

Safety Standards Series No. NS-G-2.10

The purpose of this Safety Guide is to provide recommendations and guidance on the conduct of a periodic safety review (PSR) for an existing nuclear power plant. A

PSR is a comprehensive safety review of all important aspects of safety, carried out at regular intervals, typically of ten years. The Safety Guide is directed at plant operating organizations and regulatory bodies. The review process described in this Safety Guide is valid for nuclear power plants of any age, but may have a wider applicability, for example, to research reactors and radioactive waste management facilities.

(52 pp., 5 figs; 2003) • ISBN 92-0-108503-6 • STI/PUB/1157 • €15.50

Planning, Managing and Organizing the Decommissioning of Nuclear Facilities: Lessons Learned

IAEA TECDOC Series No. 1394

This publication is intended to encourage the development and improvement of decommissioning planning and management techniques with the focus on organizational aspects, reduce the duplication of efforts by different parties by transfer of experience and know-how, and provide useful results for those Member States planning or implementing decommissioning projects. In general it can be stated that any decommissioning project can be completed without any deleterious effects on the safety of the workforce and the public or any identifiable impact on the environment. However, timeliness and cost-effectiveness are not always optimal. It has been noted on several occasions that the major weakness in decommissioning projects (as well as in other industrial projects) is often not the lack of technologies, but rather poor planning and management. This publication intends to stimulate awareness of the need for early and efficient planning and to foster developments in management and organization in association with planned or ongoing decommissioning projects. A companion report on Organization and Management for Decommissioning of Large Nuclear Facilities was published by the IAEA in 2000 (Technical Reports Series No. 399), which provides generic guidance on organizational and management aspects. This TECDOC is complementary to the existing publication in that it highlights practical experience – in particular, typical issues, evidence of poor management, undue delays, and lack of timely funding – and distils lessons learned from this experience.

(2004) • ISBN 92-0-104404-6 • IAEA-TECDOC-1394 • €15.00

Precursor Analyses – The Use of Deterministic and PSA Based Methods in the Event Investigation Process at Nuclear Power Plants

IAEA TECDOC Series No. 1417

This publication outlines the methodology that is used for evaluation of the safety significance of unusual events in nuclear power plants. It describes a synergistic process that makes more effective use of operating experience event information by combining the insights and knowledge gained from two approaches, traditional deterministic root cause event investigation and PSA-based event analysis. The precursor analysis described in this publication enables better determination of the safety significance of events, so that adequate corrective measures can be better planned and utilized.

(2004) • ISBN 92-0-111604-7 •
IAEA-TECDOC-1417 • €15.00



Protection Against Internal Fires and Explosions in the Design of Nuclear Power Plants

Safety Guide

**Safety Standards Series
No. NS-G-1.7**

Safety Guide NS-G-1.7 is a revision of an earlier Safety Guide, Safety Series No. 50-SG-D2. This and other new Safety

Guides recommend how to meet the design requirements established in Safety Standards Series No. NS-R-1, Safety of Nuclear Power Plants: Design. Its technical content is based on the most recent operational experience and has been extended to cover the design of plants in relation to internal explosions. The appendices provide guidance for the design and upgrading of fire detection and suppression systems.

(63 pp., 2 figs; 2004) • ISBN 92-0-103304-4 •
STI/PUB/1186 • €15.00



Protection against Internal Hazards other than Fires and Explosions in the Design of Nuclear Power Plants

Safety Guide

**Safety Standards Series
No. NS-G-1.11**

The publication is a revision of the former safety standards given in Safety Series

No. 50-SG-D4, dealing with protection against missiles and their consequences on the safety of nuclear power plants. This revised publication also includes other internal hazards: collapses and falling objects, pipe whips, jet effects and flooding.

(43 pp.; 2004) • ISBN 92-0-104904-8 •
STI/PUB/1191 • €20.00



Safety Assessment and Verification for Nuclear Power Plants

Safety Guide

**Safety Standards Series
No. NS-G-1.2**

This Safety Guide provides recommendations to the designers of a nuclear power plant for a comprehensive

safety assessment in the initial design process and for modifications to the design, as well as recommendations to the operating organization for independent verification of the safety assessment for new nuclear power plants. The guidance can also be applied to safety reviews for existing plants. The methods and recommendations can be used by regulatory bodies for the conduct of the regulatory review and assessment. The Safety Guide recommends how to meet the requirements established in Safety Standards Series No. NS-R-1, The Safety of Nuclear Power Plants: Design (2000). It supersedes Safety Series No. 50-SG-D11 (1986). Guidance is also provided for Contracting Parties to the Convention on Nuclear Safety in meeting their obligations under Article 14 on Assessment and Verification of Safety.

Contents: 1. Introduction; 2. Safety assessment, safety analysis and independent verification; 3. Engineering aspects important to safety; 4. Safety analysis; 5. Independent verification.

English Edition (83 pp., 1 fig.; 2002) • ISBN 92-0-101601-8 •
STI/PUB/1112 • €14.50

Russian Edition (99 pp., 1 fig.; 2004) • ISBN 92-0-403004-6 •
STI/PUB/1112 • €14.50

Safety Considerations in the Transition from Operation to Decommissioning of Nuclear Facilities

Safety Reports Series No. 36

The decommissioning of nuclear facilities is a topic of great interest to many Member States of the International Atomic Energy Agency. A growing number of nuclear facilities around the world are being shut down for various reasons. The transition period between operations and the implementation of the decommissioning strategy includes some routine operations and others that may be specific to the transition stage. These transitional operations are undertaken following procedures authorized by the regulatory body. In this period, a number of modifications, both technical and organizational, are required to adjust the facility to new objectives and requirements. This Safety Report provides information regarding the safety concerns associated with the transition period and suggests solutions for managing them. It addresses issues that are generically applicable to any nuclear facility and those that are specific to various types of nuclear facility.

(38 pp., 1 fig.; 2004) • ISBN 92-0-115103-9 •
STI/PUB/1184 • €16.00

Forthcoming

Safety Culture in the Maintenance of Nuclear Power Plants

Safety Reports Series No. 42

Building upon earlier IAEA publications on this topic, this Safety Report reviews how challenges to the maintenance of nuclear power plants can affect safety culture. It also highlights indications of a weakening safety culture. The challenges described are in areas such as maintenance management; human resources management; plant condition assessment and the business environment. The steps that some Member States have taken to address safety culture aspects are detailed and singled out as good practices, with a view to disseminating and exchanging experiences and lessons learned.

(Forthcoming 2005) • ISBN 92-0-112404-X •
STI/PUB/1210 • €22.00

Safety Margins of Operating Reactors - Analysis of Uncertainties and Implications for Decision Making

IAEA TECDOC Series No. 1332

This publication deals with the basic concept of safety margins and their role in assuring safety of nuclear installations. It describes capabilities of thermal hydraulic computer codes used to determine safety margins, evaluation of uncertainties, methods for safety margin evaluation and utilization of safety margins in operation and modifications of nuclear power plants.

(2003) • ISBN 92-0-118102-7 •
IAEA-TECDOC-1332 • €15.00



Safety of Nuclear Power Plants: Design

Safety Requirements

Safety Standards Series No. NS-R-1

This Safety Requirements publication establishes design requirements for safety functions and associated structures, systems and components important to

the safe operation of a nuclear power plant. It also establishes requirements for a comprehensive safety assessment to identify the potential hazards that may arise in the operation of a plant. In relation to the design process, preventive and mitigatory features for severe accidents, the management of safety, design management, plant ageing and wearing out effects, computer based safety systems, external and internal hazards, human factors, feedback of operational experience, and safety assessment and verification are considered. It supersedes Safety Series No. 50-C-D (Rev.1), Code on the Safety of Nuclear Power Plants: Design (1988).

Contents: 1. Introduction; 2. Safety objectives; 3. Requirements for management of safety; 4. Principal technical requirements; 5. Requirements for plant design; 6. Requirements for design of plant systems; Appendix I: Postulated initiating events; Appendix II: Redundancy, diversity and independence; Annex:

Safety functions for boiling water reactors, pressurized water reactors and pressure tube reactors; Glossary.

Chinese Edition (forthcoming 2005) • ISBN 92-0-517504-8 •
STI/PUB/1099 • €14.50

English Edition (67 pp.; 2000) • ISBN 92-0-101900-9 •
STI/PUB/1099 • €14.50

Russian Edition (83 pp.; 2003) • ISBN 92-0-405003-9 •
STI/PUB/1099 • €14.50

Spanish Edition (71 pp.; 2004) • ISBN 92-0-307004-4 •
STI/PUB/1099 • €14.50



Safety of Nuclear Power Plants: Operation

Safety Requirements

Safety Standards Series No. NS-R-2

This Safety Requirements publication establishes the requirements to be met to ensure the safe operation of nuclear power plants. This publication supersedes

Safety Series No. 50-C-O (Rev. 1), Code on the Safety of Nuclear Power Plants: Operations (1988). It restructures the Code in the light of the Safety Fundamentals publication, Safety Series No. 110, The Safety of Nuclear Installations (1993) and Safety Series No. 115, International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources (1996). It introduces new topics to reflect current international practices and new concepts and technical developments.

Contents: 1. Introduction; 2. Operating organization; 3. Qualification and training of personnel; 4. Commissioning programme for the plant; 5. Plant operations; 6. Maintenance, testing, surveillance and inspection of structures, systems and components important to safety; 7. Plant modifications; 8. Radiation protection and radioactive waste management; 9. Records and reports; 10. Periodic safety review; 11. Decommissioning; Glossary.

Chinese Edition (forthcoming 2005) • ISBN 92-0-517604-4 •
STI/PUB/1096 • €11.50

English Edition (31 pp; 2000) • ISBN 92-0-100700-0 •
STI/PUB/1096 • €11.50

French Edition (37 pp.; 2004) • ISBN 92-0-215204-7 •
STI/PUB/1096 • €11.50

Russian Edition (41 pp; 2003) • ISBN 92-0-404903-0 •
STI/PUB/1096 • €11.50

Spanish Edition (35 pp; 2004) • ISBN 92-0-309504-7 •
STI/PUB/1096 • €11.50

Seismic Design and Qualification for Nuclear Power Plants

Safety Guide

Safety Standards Series No. NS-G-1.6

This Safety Guide provides recommendations on a generally accepted way to design a nuclear power plant so that an earthquake motion at the site will not jeopardize the safety of the plant. It also gives guidance on a consistent application of methods and procedures for analysis, testing and qualification of structures and equipment so that they meet the safety requirements covering the design of nuclear power plants,

safety assessments for the design and the regulatory issues concerned with the licensing of plants.

(59 pp., 3 figs; 2003) • ISBN 92-0-110703-X • STI/PUB/1158 • €17.50

Seismic Evaluation of Existing Nuclear Power Plants

Safety Reports Series No. 28

This report provides guidance for conducting seismic safety evaluation programmes for existing nuclear power plants in a manner consistent with internationally recognized practice. It will be useful for regulatory organizations and other organizations responsible for the implementation of seismic safety evaluation programmes.

(60 pp., 3 figs; 2003) • ISBN 92-0-101803-7 • STI/PUB/1149 • €18.00

Site Evaluation for Nuclear Installations

Safety Requirements

Safety Standards Series No. NS-R-3

This Safety Requirements publication was prepared under the IAEA programme on Safety Standards for Nuclear Installations. It establishes requirements and provides criteria for ensuring safety in site evaluation for nuclear installations. The Safety Guides on site evaluation listed in the references provide recommendations on how to meet the requirements established in this Safety Requirements publication.

(28 pp; 2003) • ISBN 92-0-112403-1 • STI/PUB/1177 • €15.00



Software for Computer Based Systems Important to Safety in Nuclear Power Plants

Safety Guide

Safety Standards Series No. NS-G-1.1

This Safety Guide provides guidance on the collection of evidence and preparation of documentation to be used

in the demonstration of safety and reliability of the software for computer based systems important to safety in nuclear power plants for all phases of the system life cycle. It recommends how to meet the requirements established in Safety Standards Series No. NS-R-1, The Safety of Nuclear Power Plants: Design: Safety Requirements (2000).

Contents: 1. Introduction; 2. Technical considerations for computer based systems; 3. Application of requirements for management of safety to computer based systems; 4. Project planning; 5. Computer system requirements; 6. Computer system design; 7. Software requirements; 8. Software design; 9. Software implementation; 10. Verification and analysis; 11. Computer system integration; 12. Validation of computer systems; 13. Installation and commissioning; 14. Operation;

15. Post-delivery modifications; Annex: Use and validation of pre-existing software; Glossary

English Edition (89 pp., 2 figs; 2000) • ISBN 92-0-101800-2 • STI/PUB/1095 • €14.50

French Edition (95 pp., 2 figs; 2004) • ISBN 92-0-202004-3 • STI/PUB/1095 • €14.50



The Operating Organization for Nuclear Power Plants

Safety Guide

Safety Standards Series No. NS-G-2.4

This Safety Guide provides recommendations on setting up an operating organization for nuclear power plants so as to facilitate their safe operation, and on the

organizational elements necessary for a strong safety culture and an international level of performance. The Safety Guide highlights the important elements of effective management in relation to nuclear safety, quality assurance, the management of radioactive waste and radiological protection, and in meeting the associated national regulatory requirements. It recommends how to meet the requirements established in Safety Standards Series No. NS-R-2, The Safety of Nuclear Power Plants: Operation (2000). It supersedes Safety Series No. 50-SG-O9 (1984).

Contents: 1. Introduction; 2. Organizational structure; 3. Functions and responsibilities; 4. Interfaces with external organizations; 5. Safety management; 6. Plant operation management programmes; 7. Supporting functions; 8. Communication and liaison.

English Edition (53 pp; 2002) • ISBN 92-0-102301-4 • STI/PUB/1115 • €14.50

Russian Edition (69 pp; 2004) • ISBN 92-0-401604-3 • STI/PUB/1115 • €14.50

RESEARCH REACTORS

Safety Assessment of Research Reactors and Preparation of the Safety Analysis Report

Safety Guide

Safety Series No. 35-G1

This Safety Guide, a companion document to Safety Series Nos 35-S1 and 35-S2, is part of a set of publications in the IAEA Safety Series dealing with all the important areas of research reactor safety which includes Safety Standards, Safety Guides and Safety Practices. This guide presents guidelines, approved by international consensus, for the preparation, review and assessment of the safety documentation (Safety Series No. 35-S1) and for the preparation of the Safety Analysis Report (SAR) (Safety Series No. 35-S2). In addition, it is most applicable during the design and construction stage of research reactors, as well as during relicensing or reassessment of already existing reactors.

Contents: 1. Introduction; 2. Requirements for safety assessment in the licensing process for a research reactor; 3. Preparation of the safety analysis report; 4. Performance of the review and assessment; Appendix: Contents of a Safety Analysis Report; Annex I: Safety analysis approach and methods; Annex II: Examples of input parameters and initial conditions; Annex III: Examples of items to be considered in the reactor description; Annex IV: Typical sources of radioactive material or radiation fields in a research reactor.

English Edition (103 pp; 1994) • ISBN 92-0-104594-8 • STI/PUB/960 • €29.00
French Edition (111 pp; 2004) • ISBN 92-0-201004-8 • STI/PUB/960 • €29.00
Russian Edition (129 pp; 2003) • ISBN 92-0-404503-5 • STI/PUB/960 • €29.00

Safety Considerations for Research Reactors in Extended Shutdown

IAEA TECDOC Series No. 1387

According to the IAEA Research Reactor Database, 258 research reactors that no longer operate are in some form of shutdown. Many others are facing problems of obsolescence of equipment, lack of experimental programmes, lack of funding for operation and maintenance, loss of expertise, equipment ageing and retirement of staff. The unclear future of these facilities gives rise to safety concerns. The objective of this publication is to state the problem of extended shutdown and its safety implications, such as the ageing and resignation of the operating and support staff; review the implications of extended shutdown on reactor components and systems; provide guidance aimed at assisting operating organizations in planning and implementing extended shutdown, and especially the maintenance or replacement of affected systems; assist the regulatory body in determining the requirements that are to be satisfied by an organization that is responsible for a reactor in extended shutdown and for the relicensing of a reactor previously in extended shutdown, and provide guidance for decision makers to assist in the determination of the future of the reactor.

(2004) • ISBN 92-0-100104-5 • IAEA-TECDOC-1387 • €15.00

Forthcoming

Safety of New and Existing Research Reactor Facilities in Relation to External Events

Safety Reports Series No. 41

This report provides insights, guidance and a framework for Member States to conduct realistic safety assessments for research reactors in terms of external events. A graded approach to the safety of research reactors is presented based on the radiological hazard that a facility poses to the environment, the public and workers. This report supports the development of site specific guidelines for the actual design and safety assessment. It can also be used as background for the preparation of training material for research reactor staff for a self-assessment of the vulnerability of existing structures to external events.

(Forthcoming 2005) • ISBN 92-0-111704-3 • STI/PUB/1209 • €25.00

RADIATION SOURCES AND ACCELERATORS

Categorization of Radioactive Sources

IAEA TECDOC Series No. 1344

The objective of this publication is to provide a simple, logical system for ranking radioactive sources based on their potential to cause harm to human health and for grouping the practices in which these sources are used into discrete categories. While the categorization focuses on sealed sources, the methodology can also be used to categorize unsealed radioactive sources.

(2003) • ISBN 92-0-105903-5 • IAEA-TECDOC-1344 • €15.00

Forthcoming

Radioisotope Handling Facilities and Automation of Radioisotope Production

IAEA TECDOC Series No. 1430

Radioisotopes make important contributions in several sectors of economic significance including medicine, food processing, industry, agriculture and research. Member States continue to express interest in upgrading radioisotope handling facilities for production of radiopharmaceuticals, radioisotope generators and radioactive sources, and for medical and industrial applications. Handling of radioactivity needs special facilities to shield the radiation emitted and to prevent contamination of the environment, and radioisotopes for medical applications are special as they need to be complying with GMP requirements as well. The automation of radioisotope handling facilities for various operations in hot cells such as target handling, radiochemical processing, radiopharmaceuticals manufacturing, dispensing or autoclaving is crucial. Radioisotope handling facilities that can lead to a significant reduction of radiation dose and increased GMP compliance are elaborated upon in this publication.

(Forthcoming 2005) • ISBN 92-0-116104-2 • IAEA-TECDOC-1430 • €15.00

Forthcoming

Regulatory Control of Radiation Sources

Safety Guide

Safety Standards Series No. GS-G-1.5

This Safety Guide is intended to assist States in implementing the requirements established in "Legal and Governmental Infrastructure for Nuclear, Radiation, Radioactive Waste and Transport Safety" Safety Standards Series No. GS-R-1 for a national regulatory infrastructure to regulate any practice involving radiation sources in medicine, industry, research, agriculture and education. The Safety Guide provides advice on the legislative basis for establishing regulatory bodies, including the effective independence of the regulatory body. The Safety Guide provides guidance on implementing the functions and activities of regulatory bodies: the development of regulations and guides on radiation safety; implementation

of a system for notification and authorization; carrying out regulatory inspections; taking necessary enforcement actions; and investigating accidents and circumstances potentially giving rise to accidents. The various aspects relating to the regulatory control of consumer products is explained, including justification, optimization of exposure, safety assessment and authorization. Guidance is also provided on the organization and staffing of regulatory bodies.

(Forthcoming 2005) • ISBN 92-0-105004-6 •
STI/PUB/1192 • €25.00

TRANSPORT OF RADIOACTIVE MATERIAL



Appraisal for Brazil of the Safety of the Transport of Radioactive Material

IAEA Safety Standards Applications – TranSAS 2

The IAEA has the specific statutory function within the United Nations system of establishing standards of safety for the protection of health against exposure to

ionizing radiation. As part of this mandate, the IAEA has issued Regulations for the Safe Transport of Radioactive Material, and has also established the Transport Safety Appraisal Service (TranSAS) to carry out, at the request of States, appraisals of the implementation of these regulations. The IAEA carried out such an appraisal in Brazil from 15 to 26 April 2002. The appraisal addressed all relevant transport activities in Brazil, both domestic and international, for all modes of transport. This report summarizes the findings of the five independent experts who participated in the appraisal.

(78 pp., 10 figs; 2003) • ISBN 92-0-108903-1 •
STI/PUB/1166 • €15.00

Appraisal for France of the Safety of the Transport of Radioactive Material

IAEA Safety Standards Applications - TranSAS 6

The IAEA has the specific statutory function within the United Nations system of establishing standards of safety for the protection of health against exposure to ionizing radiation. As part of this mandate, the IAEA has issued Regulations for the Safe Transport of Radioactive Material, and has also established the Transport Safety Appraisal Service (TranSAS) to carry out, at the request of States, appraisals of the implementation of these regulations. The IAEA carried out such an appraisal in France from 27 March to 8 April 2004. The appraisal addressed all relevant transport activities in France, both national and international, for all modes of transport, with special emphasis on the maritime transport and air transport of

radioactive material. This report summarizes the findings of the 13 independent experts who participated in the appraisal.

(120 pp., 17 figs; 2004) • ISBN 92-0-111204-1 •
STI/PUB/1208 • €23.00

Appraisal for Panama of the Safety of the Transport of Radioactive Material

IAEA Safety Standards Applications – TranSAS 5

The IAEA has the specific statutory function within the United Nations system of establishing standards of safety for the protection of health against exposure to ionizing radiation. As part of this mandate, the IAEA has issued Regulations for the Safe Transport of Radioactive Material, and has also established the Transport Safety Appraisal Service (TranSAS) to carry out, at the request of States, appraisals of the implementation of these regulations. The IAEA carried out such an appraisal in Panama from 9 to 20 June 2003. The appraisal addressed all relevant transport activities in Panama, both national and international, for all modes of transport, with special emphasis on the regulations and procedures applicable to the Panama Canal Authority with regard to the transport of radioactive material through the Panama Canal. This report summarizes the findings of the ten independent experts who participated in the appraisal.

(86 pp., 3 figs; 2004) • ISBN 92-0-109904-5 •
STI/PUB/1204 • €20.00

Appraisal for Turkey of the Safety of the Transport of Radioactive Material

IAEA Safety Standards Applications – TranSAS 4

The IAEA has the specific statutory function within the United Nations system of establishing standards of safety for the protection of health against exposure to ionizing radiation. As part of this mandate, the IAEA has issued Regulations for the Safe Transport of Radioactive Material, and has also established the Transport Safety Appraisal Service (TranSAS) to carry out, at the request of States, appraisals of the implementation of these regulations. The IAEA carried out such an appraisal in Turkey from 3 to 14 March 2003. The appraisal addressed all relevant transport activities in Turkey, both national and international, for all modes of transport. This report summarizes the findings of the four independent experts who participated in the appraisal.

(58 pp., 1 fig.; 2004) • ISBN 92-0-109804-9 •
STI/PUB/1203 • €18.00

Directory of National Competent Authorities' Approval Certificates for Package Design, Special Form Material and Shipment of Radioactive Material – 2004 Edition

IAEA TECDOC Series No. 1424

The PACKTRAM database contains administrative and technical information provided annually by the issuing competent authority about package approval certificates. Such data are used mainly

by national competent authorities and port and customs officials to assist in regulating radioactive material movements in their country, and also by manufacturers and shippers of radioactive material. The database carries information on extant certificates and those that expired within the last complete calendar year. This is the fifteenth PACKTRAM annual report to being published by the IAEA. It is distributed worldwide mainly to designated competent authorities, as well as to registered interested parties. The database itself is maintained at www.packtram.org and can be accessed by the general public.

(2004) • ISBN 92-0-114404-0 •
IAEA-TECDOC-1424 • €15.00

Input Data for Quantifying Risks Associated with the Transport of Radioactive Material

IAEA TECDOC Series No. 1346

The worldwide production and use of radioactive materials (RAM) and radiation sources in various facets of modern life (e.g. energy production, industry, medicine, science and technology) involves, inevitably, their transport in the public domain. The hazards of RAM transport may be characterized by two distinct conditions of transport and the subsequent risks associated with such transport, i.e. risks associated with incident-free transport as well as those resulting from possible incidents and accidents and the potential to affect people, property and the environment. Transport risk assessments require many different and complex subjects to be addressed, including (a) shipment information, (b) the radiological characteristics of the packages and their conveyances, (c) exposure parameters for the transport workers, (d) routing data and population characteristics, (e) frequency and severity of accidents for a given mode of transport, (f) package response and release behaviour, and (g) estimation of the dose to members of the public and transport workers. This publication has been prepared within the framework of the IAEA's Coordinated Research Project (CRP) on Development of Relevant Accident Data for Quantifying Risks Associated with the Transport of Radioactive Materials. This CRP was established as a continuation of the CRP on The Probabilistic Safety Techniques Related to the Safe Transport of Radioactive Material. Within that CRP, a computerized package for risk assessment on transport of RAM was developed. This package contains computer codes and some advisory documentation, called the INTERTRAN2 package. The primary objective of this publication is to assist the risk analyst by providing support on assessment techniques and potentially relevant information resources available internationally that may be employed in addressing the complex tasks involved in transport risk assessment.

(2003) • ISBN 92-0-101403-1 •
IAEA-TECDOC-1346 • €15.00



Regulations for the Safe Transport of Radioactive Material – 1996 Edition (as amended 2003)

Safety Requirements

Safety Standards Series No. TS-R-1

The transport regulations, first published in 1961, establish standards of safety to provide an acceptable level of control of radiation, criticality and thermal hazards to persons, property and the environment that are associated with the transport of radioactive material. Very high levels of safety have been achieved through the worldwide adoption of these Regulations. The regulations apply to the transport of radioactive material by all modes on land, in water, or in the air, including transport that is incidental to the use of the radioactive material. Transport comprises 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 all previous editions, and its requirements will take effect on 1 January 2005.

Contents: Section I. Introduction; Section II. Definitions; Section III. General provisions; Section IV. Activity limits and material restrictions; Section V. Requirements and controls for transport; Section VI. Requirements for radioactive materials and for packagings and packages; Section VII. Test procedures; Section VIII. Approval and administrative requirements; Schedules of requirements for the transport of specified types of radioactive material consignments; Annex I. Summary of approval and prior notification requirements; Annex II. Conversion factors and prefixes.

(228 pp., 7 figs; 2004) • ISBN 92-0-105704-0 •
STI/PUB/1194 • €28.00

Forthcoming

Safety of Transport of Radioactive Material

Proceedings of an International Conference in Vienna, Austria, 7–11 July 2003

Proceedings Series

Radioactive material is used throughout the world for many applications that benefit mankind encompassing agriculture, industry, medicine, electric power generation, and research. The transport of this material places it outside of controlled facilities, in the public domain, and often entails movement between countries. The IAEA was assigned the task of developing, maintaining, and providing the application of safety standards for the transport of radioactive material. This conference was convened to discuss the safety of the international transport of radioactive material. It was held in Vienna in July 2003 and was co-sponsored by ICAO, IMO and the UPU. These proceedings contain the opening addresses, papers from the background session and other papers presented at the conference, summaries of all discussions, and the summary and findings of

the conference president. Contributed papers are provided in a CD-ROM that accompanies this volume.

(Forthcoming 2005) • ISBN 92-0-108504-4 •
STI/PUB/1200 • €138.00

WASTE REPOSITORIES

Derivation of Activity Limits for the Disposal of Radioactive Waste in Near Surface Disposal Facilities

IAEA TECDOC Series No. 1380

This publication describes the application of the methodology developed in the ISAM Coordinated Research Project for the purpose of deriving radioactivity limits for low and intermediate level waste in near surface disposal facilities and provides illustrative values that can be used for reference purposes, for example at the preliminary planning stage of a disposal facility development.

(2003) • ISBN 92-0-113003-1 •
IAEA-TECDOC-1380 • €15.00

Developing Multinational Radioactive Waste Repositories: Infrastructural Framework and Scenarios of Cooperation

IAEA TECDOC Series No. 1413

The present publication reviews the possibilities for the realization of multinational repositories and is intended to serve as a reference for Member States potentially interested in multinational repository concepts as hosting, partner or third party countries. The report updates work done in a previous study in 1998 (IAEA-TECDOC-1021) and attempts to define the concepts involved in the creation of multinational repositories, to explore the likely scenarios, to examine the conditions for successful implementation, and to point out the benefits and challenges inherent to multinational repositories. The report also provides an overview of the past history and current status of multinational cooperations on repositories and related activities.

(2004) • ISBN 92-0-112204-7 •
IAEA-TECDOC-1413 • €15.00

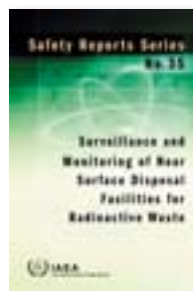
Safety Assessment Methodologies for Near Surface Disposal Facilities

(2004) • ISBN 92-0-104004-0 •
IAEA-ISAM-1 • €45.00

Safety Considerations in the Disposal of Disused Sealed Radioactive Sources in Borehole Facilities

IAEA TECDOC Series No. 1368

(2003) • ISBN 92-0-106403-9 •
IAEA-TECDOC-1368 • €15.00



Surveillance and Monitoring of Near Surface Disposal Facilities for Radioactive Waste

Safety Reports Series No. 35

The publication deals with surveillance and monitoring activities for the purposes of demonstrating the safety of near surface radioactive waste disposal facilities. It covers all phases of facility development from siting through construction and operation to closure. It identifies the activities over which surveillance needs to be exercised and the parameters to be monitored, and provides examples of such programmes for present-day facilities. It also addresses programmes that may be necessary for older facilities which were not built to present-day standards and for which surveillance and monitoring may have to be carried out to identify remedial measures to be taken.

(75 pp., 4 figs; 2004) • ISBN 92-0-114903-4 •
STI/PUB/1182 • €17.50

RADIATION PROTECTION



Application of the Concepts of Exclusion, Exemption and Clearance

Safety Guide

Safety Standards Series
No. RS-G-1.7

This Safety Guide provides guidance on the application of the concepts of exclusion, exemption and clearance as established in the "International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources". The Safety Guide includes specific values for activity concentrations for both radionuclides of natural origin and those of artificial origin that may be used for bulk amounts of material for the purposes of applying the concepts of exclusion and exemption.

(29 pp; 2004) • ISBN 92-0-109404-3 •
STI/PUB/1202 • €16.00



Assessing Radiation Doses to the Public From Radionuclides in Timber and Wood Products

IAEA TECDOC Series No. 1376

In this publication, a generic methodology has been developed which can be used for both screening and specific level assessments of the dose to the public caused by industrial treatment and/or domestic use of wood contaminated with long lived radionuclides in natural conditions of areas historically affected by major radioactive releases. The methodology can be also applied to

determine the long lived radionuclide activity concentrations in wood which would not result in public exposure exceeding appropriate radiological standards.

(2003) • ISBN 92-0-110903-2 •
IAEA-TECDOC-1376 • €15.00

Assessment of Occupational Exposure Due to External Sources of Radiation

Safety Guide

Safety Standards Series No. RS-G-1.3

The Safety Guide addresses the assessment of exposure to external sources of radiation in the workplace and the monitoring of workers and the workplace in such situations. It also reflects the major changes over the past decade in international practice in external dose assessment. It further provides the necessary guidance to meet the requirements as laid down in Safety Series No. 115, International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources (1996).

Contents: 1. Introduction; 2. Dosimetric quantities; 3. Monitoring programmes; 4. Dosimetric specifications; 5. Type testing; 6. Pre-use and periodic testing; 7. Performance testing; 8. Dose record keeping and reporting; 9. Quality assurance; Appendix: Monitoring for skin contamination and assessment of skin dose; References; Annex I: Summary of recommended radiation weighting factors and Q-L relationships; Annex II: Instrumentation for individual monitoring; Annex III: Instrumentation for workplace monitoring; Annex IV: Reference conditions and standard test conditions; Annex V: Data relevant to type testing of personal dosimeters and area monitors in terms of the operational quantities; Annex VI: Examples of IEC standards on radiation monitoring equipment.

English Edition (89 pp., 5 figs; 1999) • ISBN 92-0-101799-5 •
STI/PUB/1076 • €14.50

French Edition (95 pp., 5 figs; 2004) • ISBN 92-0-215503-8 •
STI/PUB/1076 • €14.50

Spanish Edition (95 pp., 5 figs; 2004) • ISBN 92-0-300704-0 •
STI/PUB/1076 • €14.50

"This volume ... is a comprehensive, concise guide to an external dosimetry program that would be in accord with the International Commission on Radiation Protection (ICRP) Publication 60 and guidelines from other international organizations."

Richard Reciniello

Brookhaven National Laboratory, Upton, New York

Assessment of Occupational Exposure Due to Intakes of Radionuclides

Safety Guide

Safety Standards Series No. RS-G-1.2

The Safety Guide addresses the assessment of exposure due to intakes of radionuclides in the workplace and reflects the major changes which have occurred in international practice in internal dose assessment over the past decade. The report further provides the necessary guidance to meet the requirements as laid down in Safety Series No. 115, International Basic Safety

Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources (1996).

Contents: 1. Introduction; 2. Dosimetric quantities; 3. Monitoring programmes; 4. Direct methods; 5. Indirect methods; 6. Biokinetic models for internal dosimetry; 7. Interpretation of measurements; 8. Dose record keeping and reporting; 9. Quality assurance; Appendix I: Suggested criteria for individual monitoring; Appendix II: Detection limits for measurement methods; References; Annex I: Basic data.

English Edition (85 pp., 7 figs; 1999) • ISBN 92-0-101999-8 •
STI/PUB/1077 • €14.50

French Edition (95 pp., 7 figs; 2004) • ISBN 92-0-202404-9 •
STI/PUB/1077 • €14.50

Spanish Edition (91 pp., 7 figs; 2004) • ISBN 92-0-306704-3 •
STI/PUB/1077 • €14.50



Building Competence in Radiation Protection and the Safe Use of Radiation Sources

Safety Guide

Safety Standards Series No. RS-G-1.4

The Safety Guide makes recommendations concerning the building of competence in protection and safety within a national radiation protection infrastructure and provides guidance for setting up the structure for a national strategy. It relates to the training and assessment of qualification of new personnel and the retraining of existing personnel in order to develop and maintain appropriate levels of competence. It provides the necessary guidance to meet the requirements as laid down in Safety Series No. 115, International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources (1996).

Chinese Edition (31pp.; 1 fig.; 2005) • ISBN 92-0-516704-5 •
STI/PUB/1108 • €13.00

English Edition (48 pp.; 1 fig.; 2001) • ISBN 92-0-100701-9 •
STI/PUB/1108 • €13.00

French Edition (forthcoming 2005) • ISBN 92-0-212003-X •
STI/PUB/1108 • €13.00

Forthcoming

Derivation of Activity Concentration Values for Exclusion, Exemption and Clearance

Safety Reports Series No. 44

This Safety Report provides the information that was used to derive the Safety Guide on the application of the concepts of exclusion, exemption and clearance.

(Forthcoming 2005) • ISBN 92-0-113104-6 •
STI/PUB/1213 • €34.00



International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources

Safety Series No. 115

These Standards are based on assessments of the biological effects of irradiation made by the United Nations Scientific Committee on the Effects of Atomic Radiation, and on the recommendations of the International Commission on Radiological Protection and the International Nuclear Safety Advisory Group. The Standards represent an international consensus on qualitative and quantitative requirements for protection and safety for: planned practices such as nuclear power generation and the use of radiation and radioactive materials in medicine and industry; intervention in existing situations such as chronic exposure to natural sources of radiation or exposure following an accident; control of radiation sources, including notification and authorization, and criteria for exemption. Consensus guidance is also given on: occupational radiation protection; protection of patients in radiography, fluoroscopy, computer tomography, mammography and nuclear medicine; protection of members of the public from exposure to radioactive materials released to the environment; prevention of incidents giving rise to potential exposures; and intervention in a radiological emergency.

Contents: Preamble: Principles and fundamental objectives; Principal requirements: 1. General requirements; 2. Requirements for practices; 3. Requirements for intervention. Appendices: Detailed requirements: Occupational exposure; Medical exposure; Public exposure; Potential exposure: Safety of sources; Emergency exposure situations; Chronic exposure situations; Schedules: Exemptions; Dose limits; Guidance levels of dose, dose rate and activity for medical exposure; Dose levels at which intervention is expected to be undertaken under any circumstances; Guidelines for intervention levels and action levels in emergency exposure situations; Guidelines for action levels in chronic exposure situations; Glossary; Index.

Arabic Edition (352 pp.; 1996) •

STI/PUB/996 • €78.50

Chinese Edition (329 pp.; 1997) • ISBN 92-0-505196-9 •

STI/PUB/996 • €78.50

English Edition (353 pp.; 1996) • ISBN 92-0-104295-7 •

STI/PUB/996 • €78.50

English CD Edition (2003) • ISBN 92-0-106003-3 •

STI/PUB/996/CD • €78.50

French Edition (382 pp.; 1997) • ISBN 92-0-202797-8 •

STI/PUB/996 • €78.50

Russian Edition (382 pp.; 1997) • ISBN 92-0-401497-0 •

STI/PUB/996 • €78.50

Spanish Edition (366 pp.; 1997) • ISBN 92-0-300397-5 •

STI/PUB/996 • €78.50

Spanish CD Edition (2004) •

STI/PUB/996/CD • €78.50

Methods for Assessing Occupational Radiation Doses due to Intakes of Radionuclides

Safety Reports Series No. 37

Radioactive material is used in many human activities, and whenever unsealed radioactive sources are present intakes of radionuclides by workers can occur. Intakes can occur by

a number of routes, and the monitoring of workers and the workplace is an integral part of any occupational radiation protection programme. This report contains practical advice on the interpretation of such monitoring results and the assessment of committed effective doses to workers. A CD-ROM of tables is included.

(115 pp., 5 figs; 2004) • ISBN 92-0-103904-2 •

STI/PUB/1190 • €28.00

Modelling the Environmental Transport of Tritium in the Vicinity of Long Term Atmospheric and Sub-Surface Sources

IAEA-BIOMASS-3

This document is part of the outcome of the IAEA's BIOMASS research coordination programme and describes the work carried out during a four year period from 1996 to 2000 by the BIOMASS Tritium Working Group (TWG). The objective of this work was to improve models for tritium environmental transport in situations of long-term release of tritium from primary or secondary sources. These situations had not been widely considered before at international level. The TWG developed and analysed six model test exercises and carried out a specifically commissioned field sampling and analysis programme in order to study and understand more fully the behaviour of long-term releases of tritium in the environment. As a result of the work undertaken in the modelling exercises and field sampling programme a number of recommendations are made for modelling tritium behaviour in the environment, data acquisition methods and further work. Appended to this document are summary descriptions of the individual models which participated in the TWG modelling studies, as well as detailed descriptions of each of the modelling scenarios addressed by the Tritium WG. The document is primarily intended for use by experts in environmental modelling worldwide, operators of the nuclear fuel cycle facilities, Regulatory Bodies of the IAEA Member States.

(2003) • ISBN 92-0-102303-0 •

IAEA-BIOMASS-3 • €15.00

Modelling the Transfer of Radionuclides to Fruit

IAEA-BIOMASS-5

This document is part of the outcome of the IAEA's BIOMASS research coordination programme and describes the work carried out during a three year period from 1997 to 2000 by the BIOMASS Fruits Working Group (WG). The document presents the main results such as conceptual advances, quantitative data and models on the transfer of radionuclides to fruit and covers the following particular issues:

- a review of experimental, field and modelling information on the transfer of radionuclides to fruit;
- the development of a conceptual model for a fruit tree subject to a deposit from atmosphere;
- description of an electronic database RADFLUX, which represents a substantial collection (34 fruit crops, from temperate, tropical and subtropical climate) of transfer parameters for use in models of soil–plant–animal systems;

- description and results of two model intercomparison studies and a validation study where the models were tested against an independent data set.

The document is primarily intended for use by experts in environmental modelling worldwide, operators of the nuclear fuel cycle facilities, Regulatory Bodies of the IAEA Member States.

(2003) • ISBN 92-0-106503-5 •
IAEA-BIOMASS-5 • €15.00

Occupational Radiation Protection

Safety Guide

Safety Standards Series No. RS-G-1.1

The Safety Guide provides general guidance on the establishment of an effective radiation protection programme for occupational exposure, appropriate for the sources of radiation likely to be encountered in a range of industries, medical institutions, educational and research establishments and nuclear fuel cycle facilities. The report further provides the necessary guidance to meet the requirements as laid down in Safety Series No. 115, International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources (1996).

Contents: 1. Introduction; 2. Framework for occupational radiation protection; 3. Dose limitation; 4. Optimization of radiation protection for practices; 5. Radiation protection programmes; 6. Intervention in emergencies; 7. Health surveillance.

English Edition (73 pp., 2 figs; 1999) • ISBN 92-0-102299-9 •
STI/PUB/1081 • €14.50

French Edition (81 pp., 2 figs; 2004) • ISBN 92-0-200804-3 •
STI/PUB/1081 • €14.50

Spanish Edition (79 pp., 2 figs; 2004) • ISBN 92-0-300604-4 •
STI/PUB/1081 • €14.50

Occupational Radiation Protection in the Mining and Processing of Raw Materials

Safety Guide

Safety Standards Series No. RS-G-1.6

This Safety Guide, which is jointly sponsored by the IAEA and the ILO, supersedes Safety Series No. 26: Radiation Protection of Workers in the Mining and Milling of Radioactive Ores (1983 Edition). Safety Series No. 26 dealt mainly with activities involving uranium or thorium ores. The Safety Guide updates the previous guidance material and extends its coverage to include activities involving all raw materials for which radiation protection measures need to be considered, as well as including additional guidance on authorization of mining and processing activities, inspection and compliance. The main purpose of this Safety Guide is to provide practical guidance on meeting the requirements of the Basic Safety Standards as they relate to the radiation protection of workers in the mining and processing of raw materials, and thus to facilitate the preparation and adoption, by Member States, of national and local regulations, rules, and working procedures in this area of industrial activity. This Safety Guide is aimed at regulatory bodies, operators of mines and mineral processing facilities, health and safety

committees, workers and their representatives, and health and safety professionals.

(95 pp; 2004) • ISBN 92-0-115003-2 •
STI/PUB/1183 • €21.00

Occupational Radiation Protection: Protecting Workers Against Exposure to Ionizing Radiation *Proceedings of an International Conference in Geneva, Switzerland, 26–30 August 2002*

Proceedings Series

The International Conference on Occupational Radiation Protection, held in Geneva in August 2002, was the first international conference covering the whole area of occupational radiation protection. A number of specific recommendations emerged from the Conference, which noted that, in general terms, occupational radiation protection over the past few decades has been a success story for the international radiation protection community. Consistently improving trends are found in many key performance indicators, but the picture is not so clear or encouraging for exposures in medicine and industry, nor for exposures to natural sources, especially in the mining of ores other than uranium. This is important, as these are the principal types of exposure encountered globally. A CD-ROM of contributed papers is included.

(515 pp., 54 figs; 2003) • ISBN 92-0-105603-6 •
STI/PUB/1145 • €120.00

Optimization of Radiation Protection in the Control of Occupational Exposure

Safety Reports Series No. 21

This Safety Report provides practical information on the application of the principle of the optimization of radiation protection in the workplace. It emphasizes the importance of integrating radiation protection into the work management system and of the involvement of management and workers alike in setting up and implementing a radiation protection system.

Contents: 1. Introduction; 2. Optimization process; 3. Assessment of exposure situations; 4. Means of reducing exposure; 5. Defining and implementing an ALARA plan; 6. Conclusions; Annex I: Decision aiding techniques; Annex II: ALARA checklists; Annex III: Monetary value of the unit collective dose.

English Edition (66 pp., 3 figs; 2002) • ISBN 92-0-110302-6 •
STI/PUB/1118 • €19.00

French Edition (71 pp., 3 figs; 2003) • ISBN 92-0-216303-0 •
STI/PUB/1118 • €19.00

Russian Edition (82 pp., 3 figs; 2003) • ISBN 92-0-415603-1 •
STI/PUB/1118 • €19.00

Spanish Edition (forthcoming 2005) • ISBN 92-0-302504-9 •
STI/PUB/1118 • €19.00

Optimization of the Radiological Protection of Patients Undergoing Radiography, Fluoroscopy and Computed Tomography – Final Report of a Coordinated Research Project in Africa, Asia and Eastern Europe

IAEA TECDOC Series No. 1423

National surveys in the UK and USA have indicated that there are large variations in patient doses for routine radiographic examinations, sometimes as high as 20 times or even more. This indicates that variations in developing countries, where there are old machines and poor maintenance facilities, should be a matter of concern. This publication contains the results of a Coordinated Research Project carried out in some countries in Eastern Europe, Africa, and Asia. Considerable variations were observed in general radiography. The experience with optimization indicated significant reductions in patient dose with acceptable image quality consistent with the clinical purpose of the examination. The methodology, based on patient dose measurements, comparison with reference values, assessment of image quality, the introduction of quality control (QC) and corrective actions, wherever needed, and re-evaluation of patient doses and image quality, has demonstrated its effectiveness for the optimization of radiation protection programmes. This publication also contains the results of a situation analysis on patient doses and QC status in fluoroscopy and in computed tomography.

(2004) • ISBN 92-0-113504-1 •
IAEA-TECDOC-1423 • €15.00

Practice Specific Model Regulations: Radiation Safety of Non-Medical Irradiation Facilities

IAEA TECDOC Series No. 1367

This publication provides organizations intending to purchase and operate industrial irradiation facilities with information and guidance regarding the design and safe operation of such facilities. It is not intended to repeat basic requirements such as those detailed in the Safety Standards. The set of model regulations is intended for use by both users and regulators. Registrants/licensees may choose to follow the guidance or may propose alternative measures that provide an equivalent level of protection and safety. Regulators can use the guidance for reviewing applications for authorization and during the inspection of facilities.

(2003) • ISBN 92-0-106903-0 •
IAEA-TECDOC-1367 • €15.00

Protection of the Environment from Ionising Radiation

Proceedings of the Third International Symposium in Darwin, Australia, 22–26 July 2002

C&S Papers Series No. 17

This publication reports on the Third International Symposium on Protection of the Environment from Ionising Radiation, which focused on issues related to the development and application of a system of radiation protection for the environment. Topics

covered include ongoing research on the effects, responses and mechanisms of the interactions of ionizing radiation with biota; policy and ethical dimensions of the development of a framework for environmental radiation protection; and the development and use of methods and models for evaluating radiation as a stressor to the environment.

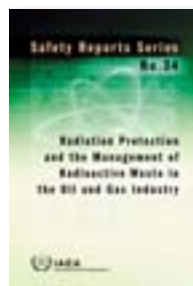
(102 figs; 2003) • ISBN 92-0-103603-5 •
IAEA-CSP-17/P • €15.00

Radiation Protection against Radon in Workplaces other than Mines

Safety Reports Series No. 33

This report deals with radon and thoron and their decay products in workplaces other than mines. It is intended for use in the application of radiation protection principles in those workplaces where employers may not have an extensive background in radiation protection. It provides practical information on action levels for workplaces, on monitoring techniques and on actions aimed at reducing exposures to radon and thoron and their decay products when necessary. It is also intended to assist regulatory bodies in establishing their own national policies in controlling high radon and thoron exposures of non-mining workforces.

(74 pp., 1 fig.; 2003) • ISBN 92-0-113903-9 •
STI/PUB/1168 • €19.00



Radiation Protection and the Management of Radioactive Waste in the Oil and Gas Industry

Safety Reports Series No. 34

This Safety Report documents the practical radiation protection and radioactive waste safety measures that are taken in the oil and gas industry in order to implement the

requirements of the International Basic Safety Standards and the guidance provided in various Safety Guides. It also includes detailed information on training and supervision, radiation monitoring, decontamination methods and radioactive waste characterization. The Safety Report is aimed at regulatory bodies; oil and gas field operators and service companies; workers and their representatives; health, safety and environmental protection professionals and health and safety training officers.

(130 pp., 37 figs; 2003) • ISBN 92-0-114003-7 •
STI/PUB/1171 • €21.00

Forthcoming

Radiation Protection in the Design of Radiotherapy Facilities

Safety Reports Series No. 47

This Safety Report provides practical guidance regarding the design and shielding of radiotherapy facilities. Methods for determining the necessary structural shielding for external beam units (cobalt-60 units, linear accelerators, superficial and

orthovoltage units, and simulators) as well as brachytherapy units are described. Data used for determining the structural shielding necessary for all types of radiotherapy facilities are reproduced in this report and example calculations are provided for each type of facility. Also, specific design features that could be incorporated into radiotherapy facilities, including those related to the security of radioactive sources, are discussed in this book. It is intended to be used primarily by radiological physicists in the planning and design of new radiotherapy facilities and in the remodelling of existing facilities. Sections of the report will also be of interest to architects, civil engineers, hospital administrators and others who are concerned with the design of radiotherapy facilities. In addition, the guidance given in the report will be useful to regulatory personnel responsible for the licensing and inspection of these facilities.

(Forthcoming 2005) • ISBN 92-0-100505-9 • STI/PUB/1223

Forthcoming

Radiation Safety in Nuclear Medicine

Safety Reports Series No. 40

The International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources (BSS), jointly sponsored, inter alia, by the IAEA, the International Labour Organization, the WHO and the Pan American Health Organization, establish requirements on the legal persons responsible for designing, running and decommissioning practices involving ionizing radiation. These requirements are basic and general in nature.

This report is intended to be of assistance to both regulators and users of radiation sources in nuclear medicine in applying the BSS to this practice. Regulators will find it useful for reviewing applications for authorization and for the inspection of the practice. Users of radiation in nuclear medicine may follow the guidance provided in order to comply with BSS requirements or equivalent national requirements. Experts recruited on IAEA missions to advise on the implementation of the BSS for the practice of nuclear medicine are expected to use the guidance given in this report rather than their own national regulations and guidance.

(Forthcoming 2005) • ISBN 92-0-111104-5 • STI/PUB/1207 • €28.00

Forthcoming

Radiation Safety in Radiotherapy

Safety Reports Series No. 38

The International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources (BSS), jointly sponsored, inter alia, by the IAEA, the ILO, the WHO and the Pan American Health Organization, establish requirements on the legal persons responsible for designing, running and decommissioning practices involving ionizing radiation. These requirements are basic and general in nature. This report is intended to be of assistance to both regulators and users of radiation sources in radiotherapy applying the BSS to radiotherapy. Regulators will find it useful for reviewing

applications for authorization and for the inspection of the practice. Users of radiation in radiotherapy may follow the guidance provided in order to comply with BSS requirements or equivalent national requirements. Experts recruited on IAEA missions to advise on the implementation of the BSS for the practice of radiotherapy are expected to use this regulatory guidance report rather than their own national regulations and guidance.

(Forthcoming 2005) • ISBN 92-0-110904-0 • STI/PUB/1205 • €28.00



Radiological Conditions in Areas of Kuwait with Residues of Depleted Uranium

Radiological Assessment Reports

An assessment was requested by the Government of Kuwait in relation to the residues of depleted uranium munitions from the 1991 Gulf War that exist on its

territory; for this purpose, the IAEA assembled an international group of experts. This report, prepared by the international group of experts, constitutes the first comprehensive radiological assessment of compliance with international radiation protection criteria and standards for areas with residues of depleted uranium munitions carried out under the auspices of the IAEA. It provides a detailed description of the IAEA's investigation of the radiological conditions in areas of Kuwait with residues of depleted uranium, the results of the radiological assessment, the overall and site specific findings and conclusions of the assessment, and the recommendations of the expert group.

Arabic Edition (88 pp., 12 figs; 2003) • ISBN 92-0-615703-5 • STI/PUB/1164 • €25.00

English Edition (73 pp., 12 figs; 2003) • ISBN 92-0-106603-1 • STI/PUB/1164 • €25.00

Radiological Protection for Medical Exposure to Ionizing Radiation

Safety Guide

Safety Standards Series No. RS-G-1.5

This Safety Guide provides recommendations on how safety requirements may be fulfilled for the protection of patients and visitors against exposure to ionizing radiation in medical practice. Recommendations cover the establishment of guidance levels for diagnostic medical exposures, acceptance testing processes for radiation equipment, calibration of radiotherapy units and reporting of accidental medical exposures.

Contents: 1. Introduction; 2. Regulatory programme for radiological protection for medical exposure; 3. Specific aspects of radiological protection for medical exposure in diagnostic and interventional radiology; 4. Specific aspects of radiological protection for medical exposure in nuclear medicine; 5. Specific aspects of radiological protection for medical exposure in radiotherapy; Annex I: 1. General requirements; Annex II: Medical exposure; Annex III: Schedule II. Dose limits. Dose limitation for comforters and visitors of patients; Annex IV:

Schedule III. Guidance levels of dose, dose rate and activity for medical exposure; Glossary.

Chinese Edition (65 pp.; 2005) • ISBN 92-0-516604-9 • STI/PUB/1117 • €14.50
English Edition (76 pp; 2002) • ISBN 92-0-111302-1 • STI/PUB/1117 • €14.50
French Edition (forthcoming 2005) • ISBN 92-0-202204-6 • STI/PUB/1117 • €14.50
Russian Edition (99 pp; 2004) • ISBN 92-0-402104-7 • STI/PUB/1117 • €14.50



“Reference Biospheres” for Solid Radioactive Waste Disposal

IAEA-BIOMASS-6

Theme 1 of the BIOMASS project was established with the objective of developing the concept of ‘reference biospheres’ into a practical system for application to the assessment of the long term safety of repositories for radioactive waste. The outcome is the BIOMASS methodology developed through the construction of a number of example reference biospheres. The examples illustrate the use of the methodology and are also intended to be useful in their own right by acting as standard (or reference), stylized biospheres.

(2003) • ISBN 92-0-106303-2 • IAEA-BIOMASS-6 • €15.00

Testing of Environmental Transfer Models Using Chernobyl Fallout From the Iput River Catchment Area, Bryansk Region, Russian Federation

IAEA-BIOMASS-4

This publication is part of the outcome of the IAEA's BIOMASS research coordination programme and it describes the work carried out during a four year period from 1996 to 2000 by the BIOMASS Dose Reconstruction Working Group. The objective of this work was to improve models for radiocaesium environmental transport through model testing and intercomparison. The input scenario modelling exercise described in this report provided an opportunity for model testing using post-Chernobyl measurement data. This scenario provided a challenging test in including: a variety of environments, the impact of countermeasures and a follow-up period of 10 years following the accident. Eight participants took part in this exercise and their experience, approaches and models are described. The information and the scenario itself are a valuable resource for other modellers to develop their methodologies further. This publication is primarily intended for use by experts in environmental modelling worldwide, operators of nuclear fuel cycle facilities and regulatory bodies of IAEA Member States.

(2003) • ISBN 92-0-104003-2 • IAEA-BIOMASS-4 • €15.00

Testing of Environmental Transfer Models Using Data from the Atmospheric Release of Iodine-131 from the Hanford site, USA, in 1963

IAEA-BIOMASS-2

This publication is part of the outcome of the IAEA's BIOMASS research coordination programme and it describes the work carried out during a four year period from 1996 to 2000 by the BIOMASS Dose Reconstruction Working Group. The objective of this work was to improve models for radioiodine environmental transport through model testing and intercomparison. The Hanford scenario modelling exercise described in this report provided an opportunity for model testing using measurement data from an acute release of I-131 to the environment from the Hanford plant in September 1963. This dose reconstruction exercise allowed model testing of atmospheric dispersion, environmental transport models and dose calculations. Six participants took part in this exercise and their experience, approaches and models are described. The information and the scenario itself are a valuable resource for other modellers to develop their methodologies further. This publication is primarily intended for use by experts in environmental modelling worldwide, operators of nuclear fuel cycle facilities, and regulatory bodies of IAEA Member States.

(2003) • ISBN 92-0-102603-X • IAEA-BIOMASS-2 • €15.00

Testing of Environmental Transfer Models Using Data from the Remediation of a Radium Extraction Site

IAEA-BIOMASS-7

The present report has been produced by the Remediation Working Group of the BIOMASS project. The main aim of this group was to test the accuracy of predictions of environmental assessment models that form part of the assessment of the radiological impact of remediation decisions. Two scenarios were constructed and applied based on the contamination around the site of a former radium extraction plant in Olen, Belgium, which arose due to the discharge of liquid effluents into a local brook — waste disposal practices and the use of waste material as a road surfacing material. This group considered the situation in an area of approximately 100 ha, contaminated as a result of the frequent flooding of a local river and the dredging of bed sediment out of the river onto the river banks. The scenarios were designed to allow modellers to consider the impact of possible future remediation actions, based on input data for a real site. Differences between model predictions were mainly due to differences in user interpretation of the scenario description. The main sources of uncertainty were the radium distribution in the root zone before deep ploughing and the effectiveness of deep ploughing. The report is intended for use by experts in environmental remediation assessment.

(2004) • ISBN 92-0-109103-6 • IAEA-BIOMASS-7 • €15.00

ACCIDENT RESPONSE

Accidental Overexposure of Radiotherapy Patients in Bialystok

An accidental overexposure occurred in the Bialystok Oncology Centre which affected five patients undergoing radiotherapy. This report gives an account of the event, the subsequent dose assessment and the clinical consequences to the patients. It also discusses the lessons learned and provides recommendations for preventing similar events from occurring. As such the report is likely to be of use to the manufacturers and users of accelerators and to national bodies.

(103 pp., 38 figs; 2004) • ISBN 92-0-114203-X • STI/PUB/1180 • €24.00

Forthcoming

Accident Analysis for Nuclear Power Plants with Graphite Moderated Boiling Water RBMK Reactors

Safety Reports Series No. 43

Accident analysis is an important tool for confirming the adequacy and efficiency of provisions within the defence in depth concept for the safety of nuclear power plants. In 2002, the IAEA published Safety Reports Series No. 23 on Accident Analysis for Nuclear Power Plants, containing general rules and practical guidance for performing accident analysis applicable to any reactor design. The specific features of individual reactor types are taken into account in separate Safety Reports. The current report provides additional guidance with respect to the specific design features of the graphite moderated boiling water reactors with pressurized channels known as RBMKs. In particular, guidance is provided regarding categorization of initiating events, selection of acceptance criteria, and initial and boundary conditions. Specific suggestions are offered for analysis of different groups of initiating events. The report is intended primarily for analysts coordinating, performing or reviewing computational analyses of transients and accidents for nuclear power plants with RBMKs, on both the utility and regulatory sides.

(Forthcoming 2005) • ISBN 92-0-112804-5 • STI/PUB/1211 • €38.00

Consideration of External Events in the Design of Nuclear Facilities other than Nuclear Power Plants, with Emphasis on Earthquakes

IAEA TECDOC Series No. 1347

This publication aims to provide guidelines for the assessment of the safety of nuclear facilities other than NPPs in relation to external events through the application of simplified methods and procedures for their siting and design. The approach adopted is both simplified and conservative compared with that used for power reactors. It seeks to provide a rational balance for a suitable combination of sustainable effort in site investigations and refinement in design procedures, compatible with the assigned safety objectives, graded from those of

NPPs. This publication is the successor to IAEA TECDOC 348 (1985), which focused on the seismic design of nuclear facilities with limited radioactive inventory. After some 17 years, new operational data have become available, sophisticated design methodologies are now more easily obtainable, and experts felt that the trade-off between sustainable investment in the facilities and design conservatism had to be redefined. The publication has been mainly developed for engineers, constructors and utilities, but it can be effectively applied also by regulatory bodies as a quick and conservative review tool.

(2003) • ISBN 92-0-102803-2 • IAEA-TECDOC-1347 • €15.00

Generic Procedures for Assessment and Response during a Radiological Emergency

IAEA TECDOC Series No. 1162

This manual provides the tools, generic procedures and data needed for initial response to different types of radiological emergency, including emergencies involving sealed and unsealed radioactive materials and radiation generators, and transport emergencies. It is intended for use by persons or groups who are responding to a radiological emergency. It explains the roles and responsibilities of the members of the generic response organization. The intention is that users of the manual will develop a better understanding of steps to be taken in a radiological emergency, in order to effectively achieve the goals of emergency response.

English Edition (2000) • IAEA-TECDOC-1162 • €15.00
Russian Edition (2004) • ISBN 92-0-405104-3 • IAEA-TECDOC-1162 • €15.00

Method for Developing Arrangements for Response to a Nuclear or Radiological Emergency – EPR-METHOD (2003)

Emergency Preparedness and Response

This publication provides a practical resource for emergency planning and fulfils, in part, functions assigned to the IAEA in the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency. If used effectively, it will help users to develop a capability to adequately respond to a nuclear or radiological emergency.

(269 pp.; 2003) • ISBN 92-0-111503-2 • EPR-METHOD (2003) • €28.00



Preparedness and Response for a Nuclear or Radiological Emergency

Safety Requirements Safety Standards Series No. GS-R-2

This Safety Requirements publication establishes the requirements for preparedness and response for a nuclear or radiological emergency. It expands on, complements and

organizes the requirements relating to emergency management established in Safety Series No. 120, Radiation Protection and the Safety of Radiation Sources (1996), and No. 115, International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources (1996).

Contents: 1. Introduction; 2. Principles and objectives; 3. General requirements; 4. Functional requirements; 5. Requirements for infrastructure; References; Annex I: Requirements on protection for workers undertaking an intervention; Annex II: Dose levels at which intervention is expected to be undertaken under any circumstances; Annex III: Guidelines for intervention levels and action levels in emergency exposure situations.

English Edition (22 pp; 2002) • ISBN 92-0-116702-4 • STI/PUB/1133 • €20.50

French Edition (84 pp; 2004) • ISBN 92-0-200904-X • STI/PUB/1133 • €20.50

Russian Edition (92 pp; 2004) • ISBN 92-0-410204-7 • STI/PUB/1133 • €20.50

Spanish Edition (86 pp; 2004) • ISBN 92-0-311904-3 • STI/PUB/1133 • €20.50

The Radiological Accident in Cochabamba

In April 2002 an accident involving an industrial radiography source containing Ir-192 occurred in Cochabamba, Bolivia, some 500 km from the capital, La Paz. The source, in a remote exposure container, remained exposed within a guide tube, although this was not known at the time. The container, the guide tube and other equipment were transported from Cochabamba to La Paz as cargo on a passenger bus. This bus had a full load of passengers for most of the eight hour journey. The equipment was subsequently collected by employees of the company concerned and transferred by taxi to the company's shielded facility. This publication gives an account of the event, the doses received and the medical assessment. It also presents information relevant to national authorities and regulatory organizations, emergency planners and a broad range of specialists, including physicists, radiation protection officers and medical specialists. It is hoped that dissemination of the information contained in the report will help reduce the likelihood of similar accidents occurring or, if they do occur, help mitigate their consequences.

(55 pp., 20 figs; 2004) • ISBN 92-0-107604-5 • STI/PUB/1199 • €19.00

RADIOACTIVE WASTE MANAGEMENT

Decommissioning of Medical, Industrial and Research Facilities

Safety Guide

Safety Standards Series No. WS-G-2.2

This Safety Guide addresses the subject of how to meet the requirements for the decommissioning of medical, industrial and research facilities where radioactive materials and sources are produced, received, used and stored, as laid down in the Safety Requirements publication, Safety Standards Series

No. WS-R-2, Predisposal Management of Radioactive Waste, Including Decommissioning. It provides guidance to national authorities and operating organizations, particularly to those in developing countries (as such facilities are predominant in these countries), on the planning and safe management of the decommissioning of such facilities.

Contents: 1. Introduction; 2. Key issues specific to decommissioning; 3. Decommissioning options; 4. Facilitating decommissioning; 5. Planning and safety assessment for decommissioning; 6. Critical tasks of decommissioning; 7. Management during decommissioning; 8. Completion of decommissioning; References; Annex I: Example of the contents of a decommissioning plan; Annex II: Safety assessment specific for decommissioning; Annex III: Example of the contents of a final radiation survey report.

Chinese Edition (forthcoming 2005) • ISBN 92-0-516504-2 • STI/PUB/1078 • €13.00

English Edition (37 pp.; 2 figs; 1999) • ISBN 92-0-102099-6 • STI/PUB/1078 • €13.00

French Edition (37 pp., 2 figs; 2004) • ISBN 92-0-215404-X • STI/PUB/1078 • €13.00



Decommissioning of Nuclear Fuel Cycle Facilities

Safety Guide

Safety Standards Series

No. WS-G-2.4

This Safety Guide sets out recommendations relating to the decommissioning of nuclear fuel cycle facilities. The guidance provided is derived

from the basic principles for radioactive waste management set out in the Safety Requirements publication, Safety Standards Series No. WS-R-2, Predisposal Management of Radioactive Waste, Including Decommissioning (2000), and in Safety Series No. 111-F, The Principles of Radioactive Waste Management: A Safety Fundamental (1995).

Contents: 1. Introduction; 2. Key issues specific to decommissioning; 3. Selection of a decommissioning option; 4. Facilitating decommissioning; 5. Planning and safety assessment for decommissioning; 6. Critical decommissioning tasks; 7. Management during decommissioning; 8. Completion of decommissioning; Annex: Example of the contents of the final radiological survey report.

Chinese Edition (forthcoming 2005) • ISBN 92-0-517304-5 • STI/PUB/1110 • €15.00

English Edition (37 pp.; 2001) • ISBN 92-0-101001-X • STI/PUB/1110 • €15.00

French Edition (41 pp.; 2004) • ISBN 92-0-215604-2 • STI/PUB/1110 • €15.00

Decommissioning of Nuclear Power Plants and Research Reactors

Safety Guide

Safety Standards Series No. WS-G-2.1

This Safety Guide addresses the subject of how to meet the requirements for decommissioning of nuclear power plants and research reactors laid down in the Safety Requirements

publication, Safety Standards Series No. WS-R-2, Predisposal Management of Radioactive Waste, Including Decommissioning. It provides guidance to national authorities and operating organizations on the planning and safe management of the decommissioning of such installations.

Contents: 1. Introduction; 2. Key issues specific to decommissioning; 3. Selection of a decommissioning option; 4. Facilitating decommissioning; 5. Planning and safety assessment for decommissioning; 6. Critical tasks of decommissioning; 7. Management during decommissioning; 8. Completion of decommissioning; References; Annex I: Example of the contents of a final radiological survey report; Annex II: Example of documented plans and management systems for implementation of decommissioning.

English Edition (41 pp.; 1999) • ISBN 92-0-102599-8 • STI/PUB/1079 • €14.50

French Edition (46 pp.; 2004) • ISBN 92-0-211903-1 • STI/PUB/1079 • €14.50



Management of Radioactive Waste from the Mining and Milling of Ores

Safety Guide

Safety Standards Series No. WS-G-1.2

This Safety Guide provides recommendations and guidance on the safe management of radioactive waste resulting from the mining and milling of ores, with the purpose of protecting workers, the public and the environment from the consequences of these activities. It supplements Safety Standards Series No. WS-R-1, Near Surface Disposal of Radioactive Waste (1999), and supersedes Safety Series No. 85, Safe Management of Wastes from the Mining and Milling of Uranium and Thorium Ores (1987).

Contents: 1. Introduction; 2. Administrative, legal and regulatory framework; 3. Protection of human health and the environment; 4. Strategy for waste management; 5. Safety considerations in different phases of operations; 6. Safety assessment; 7. Quality assurance; 8. Monitoring and surveillance; 9. Institutional control for the post-closure phase.

English Edition (39 pp., 2 figs; 2002) • ISBN 92-0-115802-5 • STI/PUB/1134 • €13.50

Russian Edition (forthcoming 2005) • ISBN 92-0-404104-8 • STI/PUB/1134 • €13.50



Near Surface Disposal of Radioactive Waste

Safety Requirements

Safety Standards Series No. WS-R-1

This Safety Requirements publication sets out the basic safety requirements related to the disposal of radioactive wastes in near surface repositories. As a Safety Requirements publication it is supported by a number of associated Safety Guides which provide guidance on the

implementation of the requirements. Its principles are derived from the Safety Fundamentals publication, Safety Series No. 111-F, The Principles of Radioactive Waste Management. It includes requirements for the protection of human health, requirements for the assessment procedures needed to ensure that safety is achieved, and technical requirements for waste acceptance and for siting, design, construction, operation and closure of the repository as well as for the post-closure phase. Contents: 1. Introduction; 2. Requirements for the protection of human health and the environment; 3. Safety assessment and compliance with safety requirements; 4. Organizational and technical safety requirements; 5. Waste acceptance requirements; 6. Characteristics of an acceptable site; 7. Design of disposal facilities; 8. Construction; 9. Operation; 10. Closure; 11. Post-closure phase; 12. Quality assurance; Annex: Dose and risk criteria for the post-closure phase.

Chinese Edition (25 pp.; 2005) • ISBN 92-0-517404-1 • STI/PUB/1073 • €12.50

English Edition (29 pp; 1999) • ISBN 92-0-101099-0 • STI/PUB/1073 • €12.50

Russian Edition (38 pp; 2003) • ISBN 92-0-404603-1 • STI/PUB/1073 • €12.50

Spanish Edition (34 pp; 2004) • ISBN 92-0-308004-X • STI/PUB/1073 • €12.50



Predisposal Management of High Level Radioactive Waste

Safety Guide

Safety Standards Series No. WS-G-2.6

This Safety Guide provides regulatory bodies and the operators that generate and manage radioactive waste with recommendations on how to meet the principles and requirements established for the predisposal management of high level waste.

(59 pp; 2003) • ISBN 92-0-102503-3 • STI/PUB/1151 • €17.50



Predisposal Management of Low and Intermediate Level Radioactive Waste

Safety Guide

Safety Standards Series No. WS-G-2.5

The objective of this Safety Guide is to provide regulatory bodies and the operators that generate and manage radioactive waste with recommendations on how to meet the principles and requirements established for the predisposal management of low and intermediate level waste.

(55 pp; 2003) • ISBN 92-0-102403-7 • STI/PUB/1150 • €16.50

Predisposal Management of Radioactive Waste, Including Decommissioning

Safety Requirements

Safety Standards Series No. WS-R-2

This publication establishes safety requirements relating to the predisposal management of radioactive waste arising from: the operation and decommissioning of nuclear facilities; the application of radionuclides in industry, medicine and research; the processing of raw materials containing naturally occurring radionuclides; and the cleanup of contaminated sites. Safety requirements for the relevant aspects of the decommissioning of nuclear facilities are established. The book includes provisions required to bring radioactive waste into a state suitable for storage or disposal in designated facilities and to ensure the safety of the facilities. Relevant requirements and associated responsibilities for the protection of human health and the environment are included. The safety requirements are established on the basis of principles set out in the Safety Fundamentals publication *The Principles of Radioactive Waste Management* (Safety Series No. 111-F, 1995).

Contents: 1. Introduction; 2. Protection of human health and the environment; 3. Responsibilities associated with predisposal management of radioactive waste, including decommissioning; 4. Interdependence; 5. Elements of predisposal management of radioactive waste; 6. Decommissioning; 7. Safety of facilities; Glossary.

English Edition (26 pp.; 2000) • ISBN 92-0-100300-5 • STI/PUB/1089 • €11.00

French Edition (33 pp.; 2004) • ISBN 92-0-202704-8 • STI/PUB/1089 • €11.00

Russian Edition (33 pp.; 2003) • ISBN 92-0-404703-8 • STI/PUB/1089 • €11.00

Spanish Edition (29 pp.; 2004) • ISBN 92-0-310804-1 • STI/PUB/1089 • €11.00

Regulatory Control of Radioactive Discharges to the Environment

Safety Guide

Safety Standards Series No. WS-G-2.3

This Safety Guide makes recommendations concerning the regulatory process for controlling the discharge of liquid and gaseous effluents to the environment from normal controlled operations of practices in which radioactive material is used. It provides guidance on how to meet the requirements established in the Safety Requirements publication, Safety Standards Series No. WS-R-2, *Predisposal Management of Radioactive Waste, Including Decommissioning* (2000). It expands on and interprets the principles stated in the Safety Fundamentals publications: Safety Series No. 111-F, *The Principles of Radioactive Waste Management* (1995) and Safety Series No. 120, *Radiation Protection and the Safety of Radiation Sources* (1996). It also elaborates on how to fulfil the requirements established in Safety Series No. 115, *International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources* (1996) and Safety Standards No. GS-R-1,

Legal and Governmental Infrastructure for Nuclear, Radiation, Radioactive Waste and Transport Safety (2000).

Contents: 1. Introduction; 2. General responsibilities; 3. Authorization of discharges for a new practice or source; 4. Responsibilities in operation; 5. Existing practices; Appendix: Generic upper value for a dose constraint for members of the public; Annex: Basic radiological protection concepts relevant to this Safety Guide.

English Edition (43 pp., 3 figs; 2000) • ISBN 92-0-101000-1 • STI/PUB/1088 • €14.50

French Edition (forthcoming 2005) • ISBN 92-0-215004-4 • STI/PUB/1088 • €14.50



Remediation of Areas Contaminated by Past Activities and Accidents

Safety Requirements

Safety Standards Series No. WS-R-3

This Safety Standard provides requirements for the intervention of areas, including land and industrial sites, that have been

contaminated as a result of human activities and could cause the prolonged exposure to radiation of workers and members of the public. This publication establishes requirements in relation to protective and remedial actions intended to reduce actual prolonged exposure, to avert potential prolonged exposure or to reduce the likelihood of the occurrence of such exposure. This document does not apply to situations arising from normal operation of appropriately controlled practices.

(21 pp; 2003) • ISBN 92-0-112303-5 • STI/PUB/1176 • €15.00



Safe Decommissioning for Nuclear Activities

Proceedings of an International Conference in Berlin, Germany, 14–18 October 2002

Proceedings Series

When a facility has reached the end of its useful life, action has to be taken to ensure safe shutdown and allow the removal of

regulatory controls. Some countries have put in place regulatory infrastructures and have developed programmes to manage the associated decommissioning and remediation activities. Other countries are at the stage of assessing what is involved in terminating such practices. This publication, arising from a conference held in Berlin, covers: the overall magnitude of the problem; regulatory approaches and safety strategies; status and development of decommissioning technologies; planning and implementation; funding approaches and strategies; consideration of social issues; and criteria for the removal of regulatory controls. A CD-ROM of contributed papers is included.

(583 pp., 78 figs; 2003) • ISBN 92-0-109703-4 • STI/PUB/1154 • €120.00

Safety Assessment for Near Surface Disposal of Radioactive Waste

Safety Guide

Safety Standards Series No. WS-G-1.1

This Safety Guide provides recommendations on how to meet the requirements related to safety assessment in the Safety Requirements publication, Safety Standards Series No. WS-R-1, Near Surface Disposal of Radioactive Waste (1999). It addresses the subject of safety assessment for near surface disposal of radioactive waste and provides guidance on approaches to performing safety assessments in the context of near surface repositories.

Contents: 1. Introduction; 2. General considerations for safety assessment; 3. Guidelines for safety assessment; 4. Confidence building.

English Edition (28 pp., 1 fig.; 1999) • ISBN 92-0-101299-3 • STI/PUB/1075 • €11.50

French Edition (39 pp., 1 fig.; 2004) • ISBN 92-0-201104-4 • STI/PUB/1075 • €11.50

Spanish Edition (37 pp., 1 fig.; 2004) • ISBN 92-0-302604-5 • STI/PUB/1075 • €11.50

Safety Considerations in the Transition from Operation to Decommissioning of Nuclear Facilities

Safety Reports Series No. 36

The decommissioning of nuclear facilities is a topic of great interest to many Member States of the International Atomic Energy Agency. A growing number of nuclear facilities around the world are being shut down for various reasons. The transition period between operations and the implementation of the decommissioning strategy includes some routine operations and others that may be specific to the transition stage. These transitional operations are undertaken following procedures authorized by the regulatory body. In this period, a number of modifications, both technical and organizational, are required to adjust the facility to new objectives and requirements. This Safety Report provides information regarding the safety concerns associated with the transition period and suggests solutions for managing them. It addresses issues that are generically applicable to any nuclear facility and those that are specific to various types of nuclear facility.

(38 pp., 1 fig.; 2004) • ISBN 92-0-115103-9 • STI/PUB/1184 • €16.00

Safety Indicators for the Safety Assessment of Radioactive Waste Disposal

IAEA TECDOC Series No. 1372

Plans for disposing of radioactive waste have raised a number of unique and mostly philosophical problems, mainly due to the very long time-scales which have to be considered. While there is general agreement on disposal concepts and on the approach to establishing that disposal facilities are safe, consensus on a number of issues remains to be achieved. To assist in promoting discussion amongst international experts and in developing consensus, the IAEA established a Working Group under the International Radioactive Waste Management

Advisory Committee (INWAC). This publication is the sixth report of this working group.

(2003) • ISBN 92-0-108703-9 • IAEA-TECDOC-1372 • €15.00

Status of the Decommissioning of Nuclear Facilities around the World

This book reviews and summarizes the decommissioning activities that have been performed to date, those that are currently under way and those that will need to be performed in the future. The aim of the book is to quantify the level of effort that will be required on the part of the industry in order to safely perform the necessary decommissioning activities. The book will be of interest to regulators, engineers and planners as a basis for developing a regulatory infrastructure and implementing a decommissioning programme. A CD-ROM is included which details on the location, type and status of nuclear power plants, research reactors, fuel cycle facilities and particle accelerators along with relevant associated data.

(27 pp., 1 fig.; 2004) • ISBN 92-0-108704-7 • STI/PUB/1201 • €32.00

SAFETY ANALYSIS

Accident Analysis for Nuclear Power Plants with Pressurized Heavy Water Reactors

Safety Reports Series No. 29

Deterministic safety analysis (henceforth referred to as accident analysis) is an important tool for confirming the adequacy and efficiency of provisions within the defence in depth concept for the safety of nuclear power plants (NPPs). Due to the close interrelation between accident analysis and safety, an analysis that lacks consistency, is incomplete or of poor quality is considered a safety issue for a given NPP. This Safety Report provides practical guidance for performing accident analysis for NPPs with pressurized heavy water reactors, based on present good practice worldwide. It covers all steps required to perform such analyses, including selection of initiating events, acceptance criteria, computer codes, modelling assumptions, the preparation of input, qualification of users, presentation of results and quality assurance.

(47 pp., 1 fig.; 2003) • ISBN 92-0-110503-7 • STI/PUB/1161 • €17.00

Accident Analysis for Nuclear Power Plants with Pressurized Water Reactors

Safety Reports Series No. 30

The objective of this publication is to provide specific guidance for accident analysis for nuclear power plants with pressurized water reactors, taking into account the specific design features of these reactors. This guidance covers all steps required to perform such analyses, including selection of initiating events, acceptance criteria, computer codes, modelling assumptions,

preparation of input, qualification of users, presentation of results and quality assurance.

(2003) • ISBN 92-0-110603-3 •
STI/PUB/1162 • €17.00



Dispersion of Radioactive Material in Air and Water and Consideration of Population Distribution in Site Evaluation for Nuclear Power Plants

Safety Guide

**Safety Standards Series
No. NS-G-3.2**

This Safety Guide deals with consideration of the potential effects of a nuclear power plant on the environment and of the population distribution in the surrounding area in site evaluation for a nuclear power plant. It supplements Safety Standard No. NS-R-3, Site Evaluation for Nuclear Installations, which supersedes Safety Series No. 50-C-S (Rev. 1), Code on the Safety of Nuclear Power Plants: Siting (1988). The Safety Guide supersedes Safety Series: No. 50-SG-S3, Atmospheric Dispersion in Nuclear Power Plant Siting (1980); No. 50-SG-S4, Site Selection and Evaluation for Nuclear Power Plants with Respect to Population Distribution (1980); No. 50-SG-S-6, Hydrological Dispersion of Radioactive Material in Relation to Nuclear Power Plant Siting (1985); and No. 50-SG-S7, Nuclear Power Plant Siting: Hydrogeological Aspects (1984).

Contents: 1. Introduction; 2. Transport and diffusion of effluents discharged into the atmosphere; 3. Transport and diffusion of effluents discharged into the hydrosphere; 4. Uses of land and water in the region of the site; 5. Population distribution; 6. Consideration of the feasibility of an emergency plan; 7. Quality assurance programme.

**English Edition (32 pp; 2002) • ISBN 92-0-110102-3 •
STI/PUB/1122 • €11.50**
**Russian Edition (41 pp; 2004) • ISBN 92-0-404304-0 •
STI/PUB/1122 • €11.50**

Evaluation of Seismic Hazards for Nuclear Power Plants

Safety Guide

Safety Standards Series No. NS-G-3.3

This Safety Guide provides guidelines and recommends procedures for the evaluation of seismic hazards for nuclear power plants. Specifically, it provides recommendations on how to determine the ground motion hazards for a plant at a particular site and the potential for surface faulting, which could affect the feasibility of construction and safe operation of a plant at that site. The Safety Guide supersedes IAEA Safety Series No. 50-SG-S1 (Rev.1), Earthquakes and Associated Topics in Relation to Nuclear Power Plant Siting, that was issued in 1991.

**(31 pp; 2002) • ISBN 92-0-117302-4 •
STI/PUB/1144 • €14.50**



External Human Induced Events in Site Evaluation for Nuclear Power Plants

Safety Guide

**Safety Standards Series
No. NS-G-3.1**

This Safety Guide recommends actions, conditions and procedures and provides guidance for fulfilling the requirements of Safety Standards Series No. NS-R-3, Site Evaluation for Nuclear Installations, in relation to external human induced events when conducting a site evaluation for a nuclear power plant. The Safety Guide supersedes Safety Series No. 50-SG-S5, External Man-induced Events in Relation to Nuclear Power Plant Siting (1981).

Contents: 1. Introduction; 2. General approach to site evaluation in relation to external human induced events; 3. Data collection and investigations; 4. Screening and evaluation procedures; 5. Aircraft crashes; 6. Release of hazardous fluids; 7. Explosions; 8. Other external human induced events; 9. Administrative aspects.

**English Edition (49 pp., 1 fig.; 2004) • ISBN 92-0-111202-5 •
STI/PUB/1126 • €14.50**
**Russian Edition (61 pp., 1 fig.; 2004) • ISBN 92-0-402304-X •
STI/PUB/1126 • €14.50**



Format and Content of the Safety Analysis Report for Nuclear Power Plants

Safety Guide

**Safety Standards Series
No. GS-G-4.1**

This Safety Guide provides recommendations and guidance on the possible format and content of Safety Analyses Reports (SARs) to be developed in support of requests to regulatory bodies for authorization to construct and/or to operate a nuclear power plant. As such, this Safety Guide recommends how to meet the requirements for preparation of adequate safety demonstrations as established in Safety Standards Series No. GS-R-1, Safety Requirements on Legal and Governmental Infrastructure for Nuclear, Radiation, Radioactive Waste and Transport Safety, and complements Safety Guide No. NS-G-1.2, Safety Assessment and Verification of Nuclear Power Plants.

**(81 pp; 2004) • ISBN 92-0-115203-5 •
STI/PUB/1185 • €22.00**

Incorporation of Advanced Accident Analysis Methodology into Safety Analysis Reports

IAEA TECDOC Series No. 1351

This publication complements Safety Report No. 23, Accident Analysis for Nuclear Power Plants, and presents additional guidance for specific application of advanced computer codes in accident analysis needed for the safety analysis reports. It

provides an overview of available advanced computer codes for various technical disciplines relevant to reactor accidents and discusses the application of such codes for various categories of accidents.

(2003) • ISBN 92-0-103803-8 •
IAEA-TECDOC-1351 • €15.00

Intercomparison and Validation of Computer Codes for Thermohydraulics – Safety Analysis of Heavy Water Reactors

IAEA TECDOC Series No. 1395

Intercomparison and validation of computer codes used in different countries for thermal hydraulics safety analysis of heavy water reactors (HWRs) enhances the confidence in the predictions made by these codes. A set of reliable experimental data is necessary for conducting such intercomparison and validation exercises. Experimental results from a large-loss of coolant accident (LOCA) test simulating HWR LOCA behaviour that was conducted by Atomic Energy of Canada Ltd. (AECL) was selected for this validation project. This report provides a comparison of the results obtained from six participating countries, utilizing four different computer codes. General conclusions are reached and recommendations made.

(2004) • ISBN 92-0-106004-1 •
IAEA-TECDOC-1395 • €15.00

Precursor Analyses – The Use of Deterministic and PSA Based Methods in the Event Investigation Process at Nuclear Power Plants

IAEA TECDOC Series No. 1417

This publication outlines the methodology that is used for evaluation of the safety significance of unusual events in nuclear power plants. It describes a synergistic process that makes more effective use of operating experience event information by combining the insights and knowledge gained from two approaches, traditional deterministic root cause event investigation and PSA-based event analysis. The precursor analysis described in this publication enables better determination of the safety significance of events, so that adequate corrective measures can be better planned and utilized.

(2004) • ISBN 92-0-111604-7 •
IAEA-TECDOC-1417 • €15.00

Use of Computational Fluid Dynamics Codes for Safety Analysis of Nuclear Reactor Systems

IAEA TECDOC Series No. 1379

With further progress in safety analysis techniques, the increasing use of three dimensional computational fluid dynamics (CFD) codes for nuclear applications is expected. The present publication constitutes the report of the joint IAEA and OECD/NEA technical meeting on the Use of CFD Codes for Safety Analysis of Reactor Systems, including Containment, held in Pisa, Italy, from 11 to 14 November 2002. It includes summaries of the presentations and of the discussions as

well as conclusions and recommendations for further work. A CD containing the entire collection of papers is provided as a supplement to this report. CFD codes provide a unique tool for analysis of local phenomena and have a broad potential for qualitative assessment in areas in which traditional methods (lumped parameter or 1-D simulations) are inadequate. They contribute to a deeper understanding of flow physics, and thus lead to better designs at reduced cost and/or to more precisely quantified safety margins. In nuclear safety, CFD codes have a complementary role to play in combination with traditional system codes, particularly in those areas where multidimensional aspects are important. Combined applications, supported by proper experiments, may guarantee a more precise evaluation of safety margins.

(2003) • ISBN 92-0-111003-0 •
IAEA-TECDOC-1379 • €15.00

QUALITY MANAGEMENT

Independence in Regulatory Decision Making

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(17 pp., 1 fig.; 2003) • ISBN 92-0-113303-0 •
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Maintaining Knowledge, Training and Infrastructure for Research and Development in Nuclear Safety

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This INSAG report, which was previously issued as INSAG Note No. 4, discusses the role that safety research has played, the present declining trend and the circumstances that are critical in maintaining a research infrastructure. The report describes new and emerging challenges that necessitate continued support of research and education opportunities and provides recommendations on how sufficient research capacity and competence can be maintained. The report is written for decision makers in government, industry and international organizations who have responsibility for research activities and educational facilities.

(13 pp; 2003) • ISBN 92-0-113203-4 •
STI/PUB/1179 • €9.00

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INSAG Series No. 19

This INSAG report discusses the problem of maintaining the integrity of the design of a nuclear power plant over its entire lifetime in order to achieve a continuous high level of safety. The purpose of this report is to identify the issues and some of the principles that should be addressed, discuss some of the solutions to the problem and define the specific responsibilities of designers, operators and regulators.

(12 pp., 1 fig.; 2003) • ISBN 92-0-112603-4 •
STI/PUB/1178 • €9.00

LEGAL AND GOVERNMENTAL ASPECTS



Documentation for Use in Regulating Nuclear Facilities

Safety Guide

Safety Standards Series No. GS-G-1.4

This Safety Guide provides recommendations for regulatory bodies and operators on how to meet the requirements in respect of documentation for use in

regulating nuclear facilities established in Safety Standards Series No. GS-R-1, Legal and Governmental Infrastructure for Nuclear, Radiation, Radioactive Waste and Transport Safety (2000). It supersedes Safety Series No. 50-SG-G8, Licences for Nuclear Power Plants: Content, Format and Legal Considerations: Safety Guide (1982), and Safety Series No. 50-SG-G9, Regulations and Guides for Nuclear Power Plants: Safety Guide (1984).

Contents: 1. Introduction; 2. Overview of documentation; 3. Regulations and guides; 4. Documents to be produced by the operator; 5. Documents produced for a particular facility by the regulatory body; Appendix: The authorization process.

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Russian Edition (54 pp.; 2004) • ISBN 92-0-401304-4 •
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and followed up by systematic quality management of regulatory processes and activities.

(17 pp., 1 fig.; 2003) • ISBN 92-0-113303-0 •
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Legal and Governmental Infrastructure for Nuclear, Radiation, Radioactive Waste and Transport Safety

Safety Requirements

Safety Standards Series No. GS-R-1

This Safety Requirements publication establishes the requirements for the legal and governmental infrastructure in respect of a range of facilities and activities, including nuclear facilities, sources of ionizing radiation, the management of radioactive waste and the transport of radioactive material. It covers development of the legal framework for establishing a regulatory body and other actions to achieve effective regulatory control. The publication addresses all phases of the life cycle of facilities or the duration of activities and any subsequent period of institutional control until there is no significant residual radiation hazard. For a facility, these phases usually include siting, design, construction, commissioning, operation and decommissioning (or close-out or closure). Other responsibilities are also covered, such as those for developing the necessary support for safety, involvement in securing third party liability and emergency preparedness. It accompanies Safety Series No. 115, International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources (1996) and Safety Standards Series No. TS-R-1 (ST-1, Revised), Regulations for the Safe Transport of Radioactive Material – 1996 Edition (Revised): Safety Requirements. It supersedes both Safety Series No 50-C-G (Rev.1), Code on the Safety of Nuclear Power Plants: Governmental Organization (1988) and Safety Series No. 111-S-1, Establishing a National System for Radioactive Waste Management (1995).

Contents: 1. Introduction; 2. Legislative and governmental responsibilities; 3. Responsibilities and functions of the regulatory body; 4. Organization of the regulatory body; 5. Activities of the regulatory body; 6. Specific infrastructure; Appendix: Review and assessment during the life cycle of a nuclear power plant; Glossary.

Chinese Edition (26 pp.; 2002) • ISBN 92-0-513402-3 •
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Russian Edition (36 pp.; 2003) • ISBN 92-0-404803-4 •
STI/PUB/1093 • €11.50

Spanish Edition (32 pp.; 2004) • ISBN 92-0-311804-7 •
STI/PUB/1093 • €11.50

Managing Change in the Nuclear Industry: The Effects on Safety

INSAG Series No. 18

This INSAG report is written for members of boards of directors and senior executives who are responsible for the overall safety of an installation, who make decisions for change, and who

implement those decisions. It is also written for senior regulators who, on behalf of the public, ensure that boards of directors and executives meet their responsibilities for safety. The report discusses how and why change can challenge the maintenance of a high level of safety, and what can be done to control that challenge and hence reap all the benefits of change. It draws an analogy between the well established principles for managing engineering changes safely and the need to put in place similar approaches to manage organizational changes. The report also identifies issues that regulators should review when licensees propose changes to the organization and management of their enterprise.

(12 pp; 2003) • ISBN 92-0-113403-7 •
STI/PUB/1173 • €9.00

National Infrastructures for Radiation Safety: Towards Effective and Sustainable Systems

*Proceedings of an International Conference in
Rabat, Morocco, 1–5 September 2003*

Proceedings Series

This conference reviewed the overall situation with respect to the development of radiation safety and security infrastructures both in IAEA Member States and in countries that are not IAEA Member States. It highlighted the need for complete and effective radiation safety and security infrastructures that are sustainable. The conference findings and recommendations are included in these proceedings, along with the keynote speeches, rapporteurs' summaries of contributed papers and the discussions. The contributed papers and oral presentations are available on a CD that is attached to the back this volume.

(449 pp., 14 figs; 2004) • ISBN 92-0-105404-1 •
STI/PUB/1193 • €120.00



Organization and Staffing of the Regulatory Body for Nuclear Facilities

Safety Guide

**Safety Standards Series
No. GS-G-1.1**

This Safety Guide provides recommendations on the appropriate management system, organization and

staffing of the regulatory body responsible for the regulation of nuclear facilities in order to comply with the requirements of Safety Standards Series No. GS-R-1, Legal and Governmental Infrastructure for Nuclear, Radiation, Radioactive Waste and Transport Safety (2000). It supersedes Safety Series No. 50-SG-G1, Qualifications and Training of Staff of the Regulatory Body for Nuclear Power Plants: A Safety Guide (1979).

Contents: 1. Introduction; 2. Regulatory independence and funding of the regulatory body; 3. Organization of the regulatory body; 4. Staffing; 5. Training of staff; Appendix: Basic elements of a regulatory training programme.

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Regulatory Inspection of Nuclear Facilities and Enforcement by the Regulatory Body

Safety Guide

**Safety Standards Series
No. GS-G-1.3**

This Safety Guide provides recommendations for regulatory bodies on

how to meet the requirements in respect of the inspection of nuclear facilities, regulatory enforcement and related matters established in Safety Standards Series No. GS-R-1, Legal and Governmental Infrastructure for Nuclear, Radiation, Radioactive Waste and Transport Safety (2000). It supersedes Safety Series No. 50-SG-G4 (Rev. 1), Inspection and Enforcement by the Regulatory Body for Nuclear Power Plants: Safety Guide (1996).

Contents: 1. Introduction; 2. Objectives of regulatory inspection and enforcement; 3. Management of inspection; 4. Performance of regulatory inspections; 5. Regulatory enforcement; 6. Assessment of inspection and enforcement activities; Appendix: Inspection areas for nuclear facilities.

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STI/PUB/1130 • €15.00
French Edition (53 pp.; 2004) • ISBN 92-0-215504-6 •
STI/PUB/1130 • €15.00
Russian Edition (60 pp; 2004) • ISBN 92-0-401204-8 •
STI/PUB/1130 • €15.00



Review and Assessment of Nuclear Facilities by the Regulatory Body

Safety Guide

**Safety Standards Series
No. GS-G-1.2**

This Safety Guide provides recommendations on how to satisfy the requirements established in Safety

Standards Series No. GS-R-1, Legal and Governmental Infrastructure for Nuclear, Radiation, Radioactive Waste and Transport Safety (2000) concerning the responsibilities and functions of the regulatory body in the regulation of nuclear facilities. It provides recommendations on regulatory review and assessment of the various safety related submissions (on siting, design, construction, commissioning, operation and decommissioning or closure of a nuclear facility) to determine whether a facility complies with the applicable safety objectives and requirements. This Safety Guide supersedes Safety Series No. 50-SG-G3, Conduct of a Regulatory Review and

Assessment During the Licensing Process for Nuclear Power Plants: Safety Guide (1980).

Contents: 1. Introduction; 2. Review and assessment process; 3. Performance of the review and assessment process; 4. Monitoring of the review and assessment process; Appendix: Topics to be covered by review and assessment.

Chinese Edition (forthcoming 2005) • ISBN 92-0-517004-6 • STI/PUB/1128 • €15.00

English Edition (46 pp; 2002) • ISBN 92-0-111702-7 • STI/PUB/1128 • €15.00

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Russian Edition (60 pp; 2004) • ISBN 92-0-405103-5 • STI/PUB/1128 • €15.00

Nuclear Power



Country Nuclear Power Profiles – 2003 Edition

This publication's main objectives are to consolidate information about the nuclear power infrastructure in participating countries and to present factors related to effective planning, decision making and implementation of nuclear power programmes that together lead to safe and economic operations. This is the fifth edition of the Country Nuclear Power Profiles, issued on CD-ROM and in hard copy, which updates the country by country information, in general, to the end of 2002. It reviews the organizational and industrial aspects of nuclear power programmes in the 36 countries which participated, and provides information about the relevant legislative, regulatory and international framework in each country. It compiles the current issues in the new environment of the electricity and the nuclear sector, i.e. energy policy, privatization and deregulation of these sectors, role of government, nuclear energy and climate change, and safety and waste management, which differ from country to country.

(2004) • ISBN 92-0-106904-9 •
IAEA-CNPP/2003/P • €95.00
CD Edition (2004) • ISBN 92-0-104604-9 •
IAEA-CNPP/2003/CD • €95.00

Forthcoming

Energy Indicators for Sustainable Development: Guidelines and Methodologies

Countries need to assess periodically their energy systems and to plan energy programmes and strategies keeping in perspective sustainable development goals and objectives. This publication presents a set of energy indicators for sustainable development that represents a versatile analytical tool for countries to track their progress towards more sustainable energy futures. The thematic framework, guidelines, methodologies and energy indicators set out in this publication reflect the expertise and consensus of five international agencies (the IAEA, the European Environment Agency, Eurostat, the International Energy Agency and the United Nations Department of Economic and Social Affairs) recognized worldwide as leaders in energy and environmental statistics and analysis. General guidelines and specific methodology sheets for 30 energy indicators are outlined in this report for statisticians, analysts, policy makers and academics to use in their efforts to monitor the effects of energy policies in the social, economic and environmental dimensions of sustainable development.

(Forthcoming 2005) • ISBN 92-0-116204-9 •
STI/PUB/1222 • €35.00

Nuclear Power Reactors in the World – April 2004

Reference Data Series No. 2

This is the twenty-fourth 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 2003 on: (1) power reactors operating or under construction, and shut down; and (2) performance data on reactors operating in the IAEA Member States, as reported to the IAEA. The information is collected by the Agency through designated national correspondents in the Member States. The replies are used to maintain the IAEA's Power Reactor Information System (PRIS).

(77 pp., 6 figs; 2004) • ISBN 92-0-108204-5 •
IAEA-RDS-2/24 • €12.00
25th Edition (forthcoming 2005) •
IAEA-RDS-2/25 • €12.00

NUCLEAR POWER PLANNING AND ECONOMICS

Case Studies to Assess and Compare Different Energy Sources in Sustainable Energy and Electricity Supply Strategies

IAEA TECDOC Series No. 1370

This publication summarizes the results obtained and lessons learned from national case studies carried out under a Coordinated Research Project titled "Case studies to assess and compare different sources in sustainable energy and electricity supply strategies". It provides a comparison of the costs-benefits and environmental advantages/disadvantages of nuclear power and other electricity generation options in different countries. The report is intended primarily for managers and senior experts in government organizations, research institutes and power utilities who are involved in energy and environmental analysis, interpretation of model results and translation into decision and policy making.

(2003) • ISBN 92-0-109303-9 •
IAEA-TECDOC-1370 • €15.00

Forthcoming

Economic Performance Indicators for Nuclear Power Plants

Technical Reports Series No. 437

From a global perspective, it is clear that there is no single group of key economic and financial measures that are applicable and useful for all countries and regions. The extent to which deregulation and privatization is occurring varies considerably throughout the world, with some countries continuing to foster regulated monopolies or government subsidies for power generation, while in others, retail and wholesale electricity is sold in truly open market, competitive situations. Consequently, the requirement for key measures of financial and economic success for the nuclear power industry will continue to be diverse from one region or country to another. The primary purpose of this report is to identify and

define a number of economic performance measures for use at nuclear power plants operating in deregulated, competitive electricity markets. The report outlines recent changes in the regulatory environments surrounding the financial operation of electric utilities, and in particular discusses the implications of deregulation and competition on gauging the economic performance and financial health of a nuclear power enterprise. It presents and discusses a general definition and classification of nuclear economic indicators, within the context of regulation, competition and the economic requirements of constructing, operating and decommissioning nuclear power plants. The economic indicators selected are a reflection of the diversity of requirements and are intended to have application in different regions throughout the world. In using the indicators, individual countries and Member States should select from the list those economic measures that are best suited to their specific applications and financial requirements.

(Forthcoming 2005) • ISBN 92-0-100905-4 •
STI/DOC/010/437 • €40.00

Energy and Nuclear Power Planning Study for Armenia

IAEA TECDOC Series No. 1404

This report describes the outcome of a successfully completed National TC Project, ARM/0/004, entitled, Energy and Nuclear Power Planning Study (ENPP) for Armenia, covering the period up to 2020. The main objectives of the project were to contribute to the development of a national energy master plan and assess the future role of nuclear power in Armenia by providing proven methodologies and building institutional capacities for analysing different energy options; and to perform an ENPP study. Assisted by the IAEA, a team of local experts conducted the study over a period of two years. The national team conducted a very detailed analysis of the energy issues, and constructed and evaluated various scenarios for future development of the energy sector in Armenia, using the IAEA's energy planning models. Finally, recommendations on future energy projects and policy were prepared which were used by the national authorities in the formulation of the ENPP for Armenia.

(2004) • ISBN 92-0-109204-0 •
IAEA-TECDOC-1404 • €15.00

Energy, Electricity and Nuclear Power Estimates for the Period up to 2030

Reference Data Series No. 1

This annual publication contains estimates of energy, electricity and nuclear power trends up to the year 2030, 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; 2004) • ISBN 92-0-109004-8 •
IAEA-RDS-1/24 • €9.00
2005 Edition (forthcoming) •
IAEA-RDS-1/25 • €9.00

Energy Supply Options for Lithuania: Detailed Multi-Sector Integrated Energy Demand, Supply and Environment Analysis

IAEA TECDOC Series No. 1408

This publication reports on the comprehensive study of Lithuania's future energy supply strategies taking into consideration necessary measures being implemented in the energy sector in accordance with the accession to full membership of the European Union. Within this context, the study investigates the future development of the Lithuanian electricity/heat supply sector and the impacts on energy supply security and environmental performance of a closure of the Ignalina nuclear power plant by 2009, a condition stipulated by the European Union. The publication describes the application of the IAEA energy models: the Model for Analysis of Energy Demand (MAED) and the Model for Energy Supply Strategy Alternatives and their General Environmental Impacts (MESSAGE), in the context of the Lithuanian energy system, in order to assess the financial, economic and environmental implications of the various development scenarios during the period up to 2025. As a result, a set of future development strategies has been analysed, prioritized and ranked according to their performance indicators with respect to investment requirements, air emission burden and fuel import dependence. For each proposed strategy, a list of best candidate projects for future electricity/heat supply systems has been identified for consideration by policy makers.

(2004) • ISBN 92-0-110004-3 •
IAEA-TECDOC-1408 • €15.00

Management of Life Cycle and Ageing at Nuclear Power Plants: Improved I&C Maintenance

IAEA TECDOC Series No. 1402

The goal of this publication is to provide the latest information on ageing, obsolescence and performance monitoring of those items of I&C equipment that are classified as safety equipment and/or safety related equipment, are operated in harsh environments in NPPs, and are important in plant life extension not only for normal operation but also, and more importantly, for post-accident service. In achieving this goal, this publication identifies the key I&C components of interest that are expected to function well throughout the life of a plant including the extended life.

(2004) • ISBN 92-0-108804-3 •
IAEA-TECDOC-1402 • €15.00

Site Evaluation for Nuclear Installations

Safety Requirements

Safety Standards Series No. NS-R-3

This Safety Requirements publication was prepared under the IAEA programme on Safety Standards for Nuclear Installations. It establishes requirements and provides criteria for ensuring safety in site evaluation for nuclear installations. The Safety Guides on site evaluation listed in the references provide

recommendations on how to meet the requirements established in this Safety Requirements publication.

(28 pp; 2003) • ISBN 92-0-112403-1 •
STI/PUB/1177 • €15.00

Status of the Decommissioning of Nuclear Facilities around the World

This book reviews and summarizes the decommissioning activities that have been performed to date, those that are currently under way and those that will need to be performed in the future. The aim of the book is to quantify the level of effort that will be required on the part of the industry in order to safely perform the necessary decommissioning activities. The book will be of interest to regulators, engineers and planners as a basis for developing a regulatory infrastructure and implementing a decommissioning programme. A CD-ROM is included which details the location, type and status of nuclear power plants, research reactors, fuel cycle facilities and particle accelerators along with relevant associated data.

(27 pp., 1 fig.; 2004) • ISBN 92-0-108704-7 •
STI/PUB/1201 • €32.00

Forthcoming

The Power Reactor Information System (PRIS) and its Extension to Non-electrical Applications, Decommissioning and Delayed Projects Information

Technical Reports Series No. 428

The IAEA's Power Reactor Information System (PRIS) contains detailed information on nuclear power plants worldwide since their start of commercial operation. It covers a broad range of information, including reactor design characteristics, plant general specifications, operating experience data and non-electrical applications of nuclear power plants such as steam production and desalination. This report describes all the elements of PRIS and explains the rules, coding, terminology and definitions used in the system.

(Forthcoming 2005) • ISBN 92-0-104704-5 •
STI/DOC/010/428 • €28.00



Transition from Operation to Decommissioning of Nuclear Installations

Technical Reports Series No. 420

The transition period between operation of an installation and the implementation of the decommissioning strategy is a critical one. In this period, a number of modifications, both technical and organizational, are needed to adjust a plant to meet new objectives and requirements. It is essential that detailed planning for decommissioning begin in good time during plant operation and that preparatory actions for the implementation of the decommissioning strategy be initiated immediately after permanent shutdown. This ensures a

gradual transition and minimizes uncontrolled loss of resources. The purpose of this report is to highlight technical, management and organizational issues during the transition period, to provide guidance to minimize delays and undue costs, to optimize personnel and other resources, and to initiate preparatory activities for decommissioning in a planned, timely and cost-effective manner.

(221 pp., 54 figs; 2004) • ISBN 92-0-114103-3 •
STI/DOC/010/420 • €39.00

NUCLEAR POWER OPERATIONS



Commissioning for Nuclear Power Plants

Safety Guide

Safety Standards Series No. NS-G-2.9

This Safety Guide deals with the commissioning of land based stationary thermal nuclear power plants of all types.

It covers how to meet the requirements of the commissioning programme, organization and management, test and review procedures, and the interfaces between organizations involved in commissioning activities. It also deals with the control of changes in the commissioning programme and with the documentation required and produced in commissioning.

(71 pp; 2003) • ISBN 92-0-104103-9 •
STI/PUB/1152 • €20.00



Configuration Management in Nuclear Power Plants

IAEA TECDOC Series No. 1335

Currently, the nuclear industry and governmental organizations are showing an increasing interest in the implementation of Configuration Management (CM) processes as an effective way for limiting configuration errors and related risks. In this report the necessary attributes of a good operational CM are identified. It is recognized and emphasized that CM is one aspect of the overall management system. Nevertheless, this is an important part of managerial activity focused on the compliance of knowledge of the plant personnel, plant documentation and records with the state of the plant technology. The concepts developed in this report present a basic approach to CM, taking into consideration experience gained from organizations and utilities which have successfully implemented partial or full CM programmes and from discussions at meetings organized by the IAEA on the subject.

(2003) • ISBN 92-0-100503-2 •
IAEA-TECDOC-1335 • €15.00



Design of Emergency Power Systems for Nuclear Power Plants

Safety Guide

Safety Standards Series No. NS-G-1.8

This Safety Guide was prepared under the IAEA safety standards programme for nuclear power plants (NPPs). The basic requirements for the design of safety systems for NPPs are provided in Safety Standards Series No. NS-R-1: Safety of NPPs: Design. The Safety Guide describes how the revised basic requirements should be met for the design of emergency power supply systems for NPPs. This publication is a revision of Safety Series No. 50-SG-D7 (Rev. 1), Emergency Power Systems at NPPs. It takes account of developments in the design of emergency power supply systems in NPPs since 1991 and includes recommendations and guidance on non-electrical power sources. This Safety Guide was prepared through three technical meetings and extensive review of experts from 21 countries over a period of four years.

(61 pp., 5 figs; 2004) • ISBN 92-0-103504-7 •
STI/PUB/1188 • €20.00



Design of Fuel Handling and Storage Systems in Nuclear Power Plants

Safety Guide

Safety Standards Series No. NS-G-1.4

This Safety Guide supersedes Safety Series No. 50-SG-D10 with the same title issued in 1984. The purpose of this Safety Guide is to provide detailed recommendations for the design of fuel handling and storage systems in nuclear power plants. This publication is intended for use by organizations designing, manufacturing, constructing and operating fuel handling and storage facilities in nuclear power plants, as well as by regulatory bodies.

(53 pp., 4 figs; 2003) • ISBN 92-0-107803-X •
STI/PUB/1156 • €16.50



Design of the Reactor Coolant System and Associated Systems in Nuclear Power Plants

Safety Guide

Safety Standards Series No. NS-G-1.9

This publication is a revision and combination of two previous Safety Guides: Safety Series No. 50-SG-D6, Ultimate Heat Sink and Directly Associated Heat Transport Systems for Nuclear Power Plants (1981), and Safety Series No. 50-SG-D13, Reactor Coolant and Associated Systems in Nuclear Power Plants (1986), which are superseded by this

new Safety Guide. The revision takes account of developments in the design of the reactor coolant and associated systems in nuclear power plants since the earlier Safety Guides were published in 1981 and 1986, respectively. The other objectives of the revision are to ensure consistency with the Requirements for Design, issued in 2000, and to update the technical content. In addition, an appendix on pressurized heavy water reactors has been included.

(79 pp., 4 figs; 2004) • ISBN 92-0-103404-0 •
STI/PUB/1187 • €18.00



External Events Excluding Earthquakes in the Design of Nuclear Power Plants

Safety Guide

Safety Standards Series No. NS-G-1.5

This Safety Guide provides recommendations and guidance on design for the protection of nuclear power plants from the effects of external events (excluding earthquakes), i.e. events that originate either off the site or within the boundaries of the site but from sources that are not directly involved in the operational states of the nuclear power plant units. In addition, it provides recommendations on engineering related matters in order to comply with the safety objectives and requirements established in the IAEA Safety Requirements publication on Safety of Nuclear Power Plants: Design. It is also applicable to the design and safety assessment of items important to the safety of land based stationary nuclear power plants with water cooled reactors.

(105 pp., 14 figs; 2003) • ISBN 92-0-113603-X •
STI/PUB/1159 • €27.00

Fire Safety in the Operation of Nuclear Power Plants

Safety Guide

Safety Standards Series No. NS-G-2.1

This Safety Guide provides recommendations on how to meet the requirements for achieving and maintaining fire safety in the management and operation of a nuclear power plant throughout its lifetime, covering topics including fire prevention, control of combustible materials and ignition sources, manual fire fighting, training and quality assurance. The requirements for fire safety are established in Safety Standards Series No. NS-R-2, Safety of Nuclear Power Plants: Operation (2000). The publication is intended for plant managers, operators, safety assessors and regulators. Recommendations are made concerning: organization and responsibilities; periodic updating of the fire hazard analysis; modifications relating to fire safety; inspection, maintenance and testing of fire safety features; records and documentation; the adoption of a formal policy for fire safety; and specific responsibilities and authorities of staff in relation to fire safety.

Contents: 1. Introduction; 2. Application of defence in depth; 3. Organization and responsibilities; 4. Periodic updating of the

fire hazard analysis; 5. Impacts of plant modifications on fire safety; 6. Control of combustible materials and ignition sources; 7. Inspection, maintenance and testing of fire protection measures; 8. Manual fire fighting capability; 9. Training of plant personnel; 10. Quality assurance for matters relating to fire safety; Annex: Fire protection measures for inclusion in the inspection, maintenance and testing programme; Glossary.

English Edition (34 pp.; 2000) • ISBN 92-0-100900-3 • STI/PUB/1091 • €12.50

French Edition (41 pp.; 2004) • ISBN 92-0-201904-5 • STI/PUB/1091 • €12.50

Russian Edition (43 pp.; 2004) • ISBN 92-0-401504-7 • STI/PUB/1091 • €12.50

Guidance for Optimizing Nuclear Power Plant Maintenance Programmes

IAEA TECDOC Series No. 1383

The objective of the project on Optimization of Nuclear Power Plant Overall Performance within the IAEA's subprogramme of Nuclear Power Planning, Implementation and Performance is to systematically improve the overall performance and competitiveness of nuclear power plants (NPPs) with due regard to safety through the application of technological and engineering best practices, including quality assurance/quality management, and the utilization of relevant databases. As an integrated part of this project, the Technical Working Group on Life Management of NPPs deals with the managerial and engineering aspects of NPP maintenance, its optimization process with special regard to the importance of condition monitoring in maintenance strategies and the contribution of maintenance to managing the lifetime of operating NPPs. This publication was developed in the above framework with the objective to collect and analyse proven maintenance optimization methods and techniques (engineering and organizational) in Member States.

(2003) • ISBN 92-0-112703-0 • IAEA-TECDOC-1383 • €15.00

Forthcoming

Guidelines for Application of the Master Curve Approach to Reactor Pressure Vessel Integrity in Nuclear Power Plants

Technical Reports Series No. 429

The master curve approach for assessing the fracture toughness of a sampled irradiated material has been gaining acceptance throughout the world. This direct measurement approach is preferred over the correlative and indirect methods used in the past to assess irradiated reactor pressure vessel (RPV) integrity. The master curve methodology already has been or is being assimilated into the ASME Boiler and Pressure Vessel Code, ASTM standards, USNRC regulations, German regulations (KTA 3203), IAEA PTS guidelines for WWER reactors as well as the VERLIFE "Unified Procedure for WWER Component Lifetime Assessment" and other industry guidance documents governing RPV integrity analysis. As this report was prepared using the results of many research projects and experiments,

these guidelines for application will be used for a long time to evaluate and assess the residual life of RPVs.

(Forthcoming 2005) • ISBN 92-0-112104-0 • STI/DOC/010/429 • €39.00

Implementation of Accident Management Programmes in Nuclear Power Plants

Safety Reports Series No. 32

This publication provides a description of the elements which should be addressed by the team responsible for the preparation, development and implementation of a plant specific accident management programme at a nuclear power plant. The issues addressed include formation of the team, selection of accident management strategies, safety analyses required, evaluation of the performance of plant systems, development of accident management procedures and guidelines, staffing and qualification of accident management personnel, and training needs. The report is intended to facilitate the work to be done by NPP operators, utilities and their technical support organizations, but it can also be used for the preparation of relevant national regulatory requirements.

(121 pp., 16 figs; 2004) • ISBN 92-0-113803-2 • STI/PUB/1167 • €28.00

International Outage Coding System for Nuclear Power Plants

IAEA TECDOC Series No. 1393

The experience obtained in each individual plant constitutes the most relevant source of information for improving its performance. However, experience of the level of the utility country- and worldwide is also extremely valuable, as there are limitations to what can be learned from in-house experience. Learning from the experience of others is difficult if the information is not harmonized. Therefore, such systems should be standardized and applicable to all types of reactors, satisfying the needs of the broad set of nuclear power plant operators worldwide and allowing experience to be shared internationally. To cope with the considerable amount of information gathered from nuclear power plants worldwide, it is necessary to codify the information facilitating the identification of causes of outages, systems or component failures. Therefore, the IAEA established a sponsored Coordinated Research Project (CRP) on the International Outage Coding System to develop a general, internationally applicable system of coding nuclear power plant outages, providing worldwide nuclear utilities with a standardized tool for reporting outage information. This publication summarizes the results of this CRP and provides information for transformation of the historical outage data into the new coding system, taking into consideration the existing systems for coding nuclear power plant events (WANO, IAEA-IRS and IAEA PRIS) but avoiding duplication of efforts.

(2004) • ISBN 92-0-116003-8 • IAEA-TECDOC-1393 • €15.00

Managing the Early Termination of Operation of Nuclear Power Plants

Safety Reports Series No. 31

When facing the decision of closing nuclear power plants (NPPs) before expiration of their operating licences, it is important that the same safety measures are applied to management concerns for strategic planning as are applied to technical reviews. These management and organizational issues are fundamental to any future decommissioning process. Managers at sites that decide to close early may be working to cope with management of change issues arising during the transition from operation to decommissioning as they monitor resource and competence needs, as well as staff morale and technical issues. If these issues are not treated satisfactorily, they can have significant safety consequences. The organization often must address all these challenges with little guidance or experience and with reduced resources. This Safety Report has been developed with the support of experts from regulatory, operating and engineering organizations and is intended for managers dealing with the decision to shut down plants prior to expiration of their licences. It provides guidance for senior managers in the area of strategies, personnel involvement, communications, interface with the regulatory body and experiences that may be used as States face challenges in managing the multiple tasks associated with early closure decisions.

(48 pp; 2003) • ISBN 92-0-108603-2 •
STI/PUB/1163 • €15.50

Modifications to Nuclear Power Plants

Safety Guide

Safety Standards Series No. NS-G-2.3

This Safety Guide provides recommendations and guidance on controlling activities relating to modifications to nuclear power plants so as to reduce risk and to ensure that the configuration of the plant is under control at all times, and that the modified configuration conforms to the approved basis for granting an operation licence. The recommendations cover the whole process from conception to completion for modifications to structures, systems and components, operational limits and conditions, procedures and software, and the management systems and tools for plant operation. The Safety Guide recommends how to meet the requirements established in Safety Standards Series No. NS-R-2, The Safety of Nuclear Power Plants: Operation (2000).

Contents: 1. Introduction; 2. General; 3. Roles and responsibilities; 4. Modifications relating to plant configuration; 5. Modifications to management systems; 6. Temporary modifications; 7. Implementation of organizational changes; 8. Implementation of organizational changes; 9. Quality assurance; 10. Training; 11. Management of documentation.

Chinese Edition (27 pp., 1 fig.; 2005) • ISBN 92-0-516904-8 •
STI/PUB/1111 • €12.50

English Edition (33 pp., 1 fig.; 2001) • ISBN 92-0-101501-1 •
STI/PUB/1111 • €12.50

Russian Edition (41 pp., 1 fig.; 2004) • ISBN 92-0-402904-8 •
STI/PUB/1111 • €12.50

Nuclear Power Plant Life Management

Proceedings of an International Symposium in Budapest, Hungary, 4–8 November 2002

C&S Papers CD Series No. 21

The objectives of the symposium were to emphasize the role of nuclear power plant (NPP) life management programmes in assuring a safe and reliable NPP operating cycle, to identify progress in methodological and technological developments for managing ageing processes and understanding degradation mechanisms, and to provide a forum for information exchange on national and international policies and strategies in NPP life management programme development. The proceedings are published on this CD-ROM.

(2003) • ISBN 92-0-116403-3 •
IAEA-CSP-21/CD • €15.00

Operational Limits and Conditions and Operating Procedures for Nuclear Power Plants

Safety Guide

Safety Standards Series No. NS-G-2.2

This Safety Guide provides guidance on the development, content and use of operational limits and conditions (limits on plant operating parameters) and operating procedures that effect them. It recommends how to meet the requirements established in Safety Standards Series No. NS-R-2, Safety of Nuclear Power Plants: Operation (2000), setting out the responsibilities of the operating organization in setting, modifying and documenting operational limits and conditions and ensuring compliance with them. It supersedes Safety Series No. 50-SG-O3, Operational Limits and Conditions for Nuclear Power Plants (1979).

Contents: 1. Introduction; 2. Safety objective; 3. The concept of operational limits and conditions and their development; 4. Safety limits; 5. Limiting safety system settings; 5. Limits and conditions for normal operation; 7. Surveillance requirements; 8. Operating procedures; 9. Development of operating procedures; 10. Compliance with operational limits and conditions and operating procedures; Appendix I: Selection of limits and conditions for normal operation; Appendix II: Development of operating procedures (outlines); Annex: Example to explain some terms used; Glossary.

English Edition (41 pp., 2 figs; 2000) • ISBN 92-0-102000-7 •
STI/PUB/1100 • €14.50

Russian Edition (45 pp., 2 figs; 2004) • ISBN 92-0-401704-X •
STI/PUB/1100 • €14.50

Operating Experience with Nuclear Power Stations in Member States in 2003

This report is the thirty-fifth in the Agency's series of annual reports on operating experience with nuclear power stations in Member States. It is a direct output from the Agency's Power Reactor Information System (PRIS) and contains data on electricity production, overall plant operating performance and plant outage during 2003 for individual plants. In addition to annual performance data and outage information, the report contains a historical summary of performance and outages

during the lifetime of individual plants and figures illustrating worldwide performance and statistical data.

(6 figs; 2004) • ISBN 92-0-114304-4 •
STI/PUB/1219 • €170.50

2004 Edition (forthcoming) • €170.50



Protection against Internal Hazards other than Fires and Explosions in the Design of Nuclear Power Plants

Safety Guide

Safety Standards Series No. NS-G-1.11

The publication is a revision of the former safety standards given in Safety Series No. 50-SG-D4, dealing with protection against missiles and their consequences on the safety of nuclear power plants. This revised publication also includes other internal hazards: collapses and falling objects, pipe whips, jet effects and flooding.

(43 pp; 2004) • ISBN 92-0-104904-8 •
STI/PUB/1191 • €20.00



Record Keeping for the Decommissioning of Nuclear Facilities: Guidelines and Experience

Technical Reports Series No. 411

The objective of this report is to provide information, based on experience gained so far, on how to identify, maintain and update the necessary records for the decommissioning of nuclear facilities. Record keeping has proven to be of vital importance, since its lack may result in the costly misallocation of resources and may cause safety problems.

Contents: 1. Introduction; 2. Scope and objectives; 3. Design and operational data requirements for decommissioning; 4. Process of selecting decommissioning records; 5. Retention of decommissioning records; 6. Quality assurance; 7. The records management system; 8. Management of new records; 9. Summary; Appendix: Options for record storage media and retrievability; Annex I: Examples of national experience; Annex II: Lessons learned.

(182 pp., 26 figs; 2002) • ISBN 92-0-119602-4 •
STI/DOC/010/411 • €42.50

Regulatory Inspection of Nuclear Facilities and Enforcement by the Regulatory Body

Safety Guide

Safety Standards Series No. GS-G-1.3

This Safety Guide provides recommendations for regulatory bodies on how to meet the requirements in respect of the inspection of nuclear facilities, regulatory enforcement and

related matters established in Safety Standards Series No. GS-R-1, Legal and Governmental Infrastructure for Nuclear, Radiation, Radioactive Waste and Transport Safety (2000). It supersedes Safety Series No. 50-SG-G4 (Rev. 1), Inspection and Enforcement by the Regulatory Body for Nuclear Power Plants: Safety Guide (1996).

Contents: 1. Introduction; 2. Objectives of regulatory inspection and enforcement; 3. Management of inspection; 4. Performance of regulatory inspections; 5. Regulatory enforcement; 6. Assessment of inspection and enforcement activities; Appendix: Inspection areas for nuclear facilities.

English Edition (46 pp; 2002) • ISBN 92-0-114102-5 •
STI/PUB/1130 • €15.00

French Edition (53 pp.; 2004) • ISBN 92-0-215504-6 •
STI/PUB/1130 • €15.00

Russian Edition (60 pp; 2004) • ISBN 92-0-401204-8 •
STI/PUB/1130 • €15.00



Safety Assessment and Verification for Nuclear Power Plants

Safety Guide

Safety Standards Series No. NS-G-1.2

This Safety Guide provides recommendations to the designers of a nuclear power plant for a comprehensive safety assessment in the initial design process and for modifications to the design, as well as recommendations to the operating organization for independent verification of the safety assessment for new nuclear power plants. The guidance can also be applied to safety reviews for existing plants. The methods and recommendations can be used by regulatory bodies for the conduct of the regulatory review and assessment. The Safety Guide recommends how to meet the requirements established in Safety Standards Series No. NS-R-1, The Safety of Nuclear Power Plants: Design (2000). It supersedes Safety Series No. 50-SG-D11 (1986). Guidance is also provided for Contracting Parties to the Convention on Nuclear Safety in meeting their obligations under Article 14 on Assessment and Verification of Safety.

Contents: 1. Introduction; 2. Safety assessment, safety analysis and independent verification; 3. Engineering aspects important to safety; 4. Safety analysis; 5. Independent verification.

English Edition (83 pp., 1 fig.; 2002) • ISBN 92-0-101601-8 •
STI/PUB/1112 • €14.50

Russian Edition (99 pp., 1 fig.; 2004) • ISBN 92-0-403004-6 •
STI/PUB/1112 • €14.50



Safety of Nuclear Power Plants: Operation

Safety Requirements

Safety Standards Series No. NS-R-2

This Safety Requirements publication establishes the requirements to be met to ensure the safe operation of nuclear power plants. This publication supersedes Safety Series No. 50-C-O (Rev. 1), Code on the Safety of Nuclear Power Plants: Operations (1988). It restructures the Code in the light of the Safety Fundamentals publication, Safety Series No. 110, The Safety of Nuclear Installations (1993) and Safety Series No. 115, International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources (1996). It introduces new topics to reflect current international practices and new concepts and technical developments.

Contents: 1. Introduction; 2. Operating organization; 3. Qualification and training of personnel; 4. Commissioning programme for the plant; 5. Plant operations; 6. Maintenance, testing, surveillance and inspection of structures, systems and components important to safety; 7. Plant modifications; 8. Radiation protection and radioactive waste management; 9. Records and reports; 10. Periodic safety review; 11. Decommissioning; Glossary.

Chinese Edition (forthcoming 2005) • ISBN 92-0-517604-4 • STI/PUB/1096 • €11.50

English Edition (31 pp; 2000) • ISBN 92-0-100700-0 • STI/PUB/1096 • €11.50

French Edition (37 pp.; 2004) • ISBN 92-0-215204-7 • STI/PUB/1096 • €11.50

Russian Edition (41 pp; 2003) • ISBN 92-0-404903-0 • STI/PUB/1096 • €11.50

Spanish Edition (35 pp; 2004) • ISBN 92-0-309504-7 • STI/PUB/1096 • €11.50



The Operating Organization for Nuclear Power Plants

Safety Guide

Safety Standards Series No. NS-G-2.4

This Safety Guide provides recommendations on setting up an operating organization for nuclear power plants so as to facilitate their safe operation, and on the organizational elements necessary for a strong safety culture and an international level of performance. The Safety Guide highlights the important elements of effective management in relation to nuclear safety, quality assurance, the management of radioactive waste and radiological protection, and in meeting the associated national regulatory requirements. It recommends how to meet the requirements established in Safety Standards Series No. NS-R-2, The Safety of Nuclear Power Plants: Operation (2000). It supersedes Safety Series No. 50-SG-O9 (1984).

Contents: 1. Introduction; 2. Organizational structure; 3. Functions and responsibilities; 4. Interfaces with external

organizations; 5. Safety management; 6. Plant operation management programmes; 7. Supporting functions; 8. Communication and liaison.

English Edition (53 pp; 2002) • ISBN 92-0-102301-4 • STI/PUB/1115 • €14.50

Russian Edition (69 pp; 2004) • ISBN 92-0-401604-3 • STI/PUB/1115 • €14.50

Forthcoming

The Power Reactor Information System (PRIS) and its Extension to Non-electrical Applications, Decommissioning and Delayed Projects Information

Technical Reports Series No. 428

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(Forthcoming 2005) • ISBN 92-0-104704-5 • STI/DOC/010/428 • €28.00



Transition from Operation to Decommissioning of Nuclear Installations

Technical Reports Series No. 420

The transition period between operation of an installation and the implementation of the decommissioning strategy is a critical one. In this period, a number of modifications, both technical and organizational, are needed to adjust a plant to meet new objectives and requirements. It is essential that detailed planning for decommissioning begin in good time during plant operation and that preparatory actions for the implementation of the decommissioning strategy be initiated immediately after permanent shutdown. This ensures a gradual transition and minimizes uncontrolled loss of resources. The purpose of this report is to highlight technical, management and organizational issues during the transition period, to provide guidance to minimize delays and undue costs, to optimize personnel and other resources, and to initiate preparatory activities for decommissioning in a planned, timely and cost-effective manner.

(221 pp., 54 figs; 2004) • ISBN 92-0-114103-3 • STI/DOC/010/420 • €39.00

Construction and Commissioning Experience of Evolutionary Water Cooled Nuclear Power Plants

IAEA TECDOC Series No. 1390

This publication is intended to provide an overview of the most advanced technologies, methods and processes used in the construction and commissioning of recent water cooled nuclear power plants. Information from the following recent nuclear projects has been collected and analysed: Qinshan III Units 1&2 and Lingao Units 1&2 in China, Kashiwazaki-Kariwa Units 6&7 in Japan, Yonggwang Units 5&6 in the Republic of Korea, and Tarapur Units 5&6 in India. To facilitate the readers' understanding, for each of the construction and commissioning activities reviewed, the publication presents background information, a brief description of the scope, generic good practices and specific examples selected from the collected data. The presentation is focused more on new developments than on providing a full review of all the issues related to construction and commissioning. The main focus of the publication is on-site construction, with only general considerations given to construction activities at manufacturers.

(2004) • ISBN 92-0-103804-6 •
IAEA-TECDOC-1390 • €15.00

Delayed Hydride Cracking in Zirconium Alloys in Pressure Tube Nuclear Reactors

IAEA TECDOC Series No. 1410

This report describes all of the research work undertaken as part of the IAEA coordinated research program on hydrogen and hydride induced degradation of the mechanical and physical properties of zirconium based alloys, and includes a review of the state of the art in understanding crack propagation by Delayed Hydride Cracking (DHC), and details of the experimental procedures that have produced the most consistent set of DHC rates reported in an international round-robin exercise to this date.

(2004) • ISBN 92-0-110504-5 •
IAEA-TECDOC-1410 • €15.00

Forthcoming

Design of the Reactor Core for Nuclear Power Plants

Safety Guide

Safety Standards Series No. NS-G-1.12

(Forthcoming 2005) • ISBN 92-0-116004-6 •
STI/PUB/1221 • €23.00



Emerging Nuclear Energy and Transmutation Systems: Core Physics and Engineering Aspects

IAEA TECDOC Series No. 1356

This publication reports on the results of a Technical Committee Meeting, of which the objectives were: to review the status of R&D activities in the area of hybrid systems for energy generation and transmutation, to discuss specific scientific and technical issues covering the different R&D topics of these systems; and to identify activities that would resolve open R&D issues in this field.

(2003) • ISBN 92-0-108103-0 •
IAEA-TECDOC-1356 • €15.00

Evaluation of High Temperature Gas Cooled Reactor Performance: Benchmark Analysis Related to Initial Testing of the HTTR and HTR-10

IAEA TECDOC Series No. 1382

High-temperature gas cooled reactor (HTGR) designs present special computational challenges related to their core physics and thermal-hydraulic characteristics. Neutron streaming and double heterogeneities are examples of the core physics challenges, while porous gas flow in a high-temperature ceramic core with the interaction of conduction, convection and radiation regimes characterize thermal-hydraulic challenges. In an effort to address such potential calculation uncertainties, computational results made by various international institutes are reported and code-to-code and code-to-experiment comparisons are made. The experimental data are mainly related to the initial testing of the Japanese HTTR and the Chinese HTR-10. Both are high-temperature gas cooled test reactors. The work is part of an IAEA Coordinated Research Project (CRP) with the participation of ten international institutes.

(2003) • ISBN 92-0-116203-0 •
IAEA-TECDOC-1382 • €15.00

Guidance for the Evaluation of Innovative Nuclear Reactors and Fuel Cycles

IAEA TECDOC Series No. 1362

This publication reports on the International Project on Innovative Nuclear Reactors and Fuel Cycles, referred to as INPRO, which was initiated by the IAEA in 2000. The main objectives of INPRO are: to help to ensure that nuclear energy is available to contribute to fulfilling energy needs in the 21st century in a sustainable manner; and to bring together both technology holders and technology users to consider jointly the international and national actions required to achieve desired innovations in nuclear reactors and fuel cycles.

(2003) • ISBN 92-0-105503-X •
IAEA-TECDOC-1362 • €15.00

Managing Modernization of Nuclear Power Plant Instrumentation and Control Systems

IAEA TECDOC Series No. 1389

The scope of this publication covers all of the management activities related to modernization of I&C systems in nuclear power plants, including the evaluation of all I&C systems to determine which can be successfully maintained and which need to be modernized. It also includes large, comprehensive modernization programmes that will modernize a large number of I&C systems, small modernization programmes that will modernize a very few I&C systems, and all of the possibilities in-between. The scope covers highly integrated systems and projects as well as stand-alone systems and projects.

**(2004) • ISBN 92-0-116103-4 •
IAEA-TECDOC-1389 • €15.00**

Operational and Decommissioning Experience with Fast Reactors

IAEA TECDOC Series No. 1405

Given the present slowdown in many Member States of fast reactor technology development, and the concomitant retirement of many of the developers of this technology, data retrieval and knowledge preservation efforts in this area are particularly important. Operational experience constitutes an important aspect of any fast reactor knowledge base. It is within this context that the IAEA convened a Topical Technical Meeting on Feedback from Operational and Decommissioning Experience with Fast Reactors. The present publication presents the proceedings of this meeting which was held from 11 to 15 March 2002 at CE Cadarache, France.

**(2004) • ISBN 92-0-107804-8 •
IAEA-TECDOC-1405 • €15.00**

Primary Coolant Pipe Rupture Event in Liquid Metal Cooled Reactors

IAEA TECDOC Series No. 1406

The objectives of this publication are to review the safety philosophy for the primary coolant pipe (PCP) rupture event in pool type liquid metal fast reactors (LMFRs), to assess the structural reliability of the PCP and the probability of rupture under different conditions (with/without in-service inspection), to review the classification of the PCP rupture event in the design basis/beyond design basis categories and discuss the applicable design safety limits, to assess the need for consequential analysis such as pipe whip effects, primary pump seizure and multiple pipe rupture, and, last but not least, to present the results of analyses of the event per se for flows and/or temperatures and improved design concepts for minimizing the consequences to the core.

**(2004) • ISBN 92-0-109104-4 •
IAEA-TECDOC-1406 • €15.00**

Review of National Accelerator Driven System Programmes for Partitioning and Transmutation

IAEA TECDOC Series No. 1365

One of the current important issues of nuclear power is the long lived waste toxicity problem. A possible way to contribute towards solving this issue is given by the utilization and transmutation of minor actinides and long lived fission products. To this end, the combination of external intensive neutron sources with facilities containing nuclear fuel, so-called hybrid systems, is under investigation in several Member States. The surplus of neutrons in such systems may be used to convert most of the long lived radioactive nuclides into isotopes having a shorter lifetime. There clearly is a need for coordinating the efforts of the various groups involved in this R&D, and also for the exchange of information from nationally or internationally coordinated activities. Consideration of the advantages of hybrid systems, and the wide field of interdisciplinary areas of research involved, clearly shows the need for an international cooperation in this novel R&D area. This publication contains the proceedings of the Advisory Group Meeting on "Review of National Accelerator Driven System (ADS) Programmes". The scope of the meeting included review of the current R&D programmes in the Member States, and the assessment of the progress in the development of hybrid concepts.

**(2003) • ISBN 92-0-106803-4 •
IAEA-TECDOC-1365 • €15.00**

Status of Advanced Light Water Reactor Designs – 2004

IAEA TECDOC No. 1391

The report is intended to be a source of reference information for interested organizations and individuals. Among them are decision makers of countries considering implementation of nuclear power programmes. Further, the report is addressed to government officials with an appropriate technical background and to research institutes of countries with existing nuclear programmes that wish to be informed on the global status in order to plan their nuclear power programmes including both research and development efforts and means for meeting future energy needs. The report is also intended to provide the public with unbiased information on nuclear power.

**(2004) • ISBN 92-0-104804-1 •
IAEA-TECDOC-1391 • €15.00
CD Edition (2004) • ISBN 92-0-109704-2 •
IAEA-TECDOC-CD-1391 • €15.00**

Validation of Fast Reactor Thermomechanical and Thermohydraulic Codes

IAEA TECDOC CD Series No. 1318

This publication, arising from a Coordinated Research Project (CRP), describes the main results and recommendations. The work carried out by the research groups at the participating institutes within the CRP on harmonization and validation of fast reactor thermomechanical and thermohydraulic codes and relations is also included.

**CD Edition (2003) • ISBN 92-0-109903-7 •
IAEA-TECDOC-1318 • €15.00
(2002) • ISBN 92-0-118302-X •
IAEA-TECDOC-1318 • €15.00**

QUALITY ASSURANCE

Improvement of In-Service Inspection in Nuclear Power Plants

IAEA TECDOC Series No. 1400

This publication describes strategies for improving the effectiveness of in-service inspection (ISI). The role of ISI in maintaining or improving safety and the relationship of ISI improvement to cost are examined. The strategies for improving ISI effectiveness discussed in this publication consider the entire framework of ISI, including effective selection of the proper inspection scope and effectiveness of non-destructive examination as demonstrated through inspection qualification programmes. Improving the effectiveness of ISI in an economical and organized way requires adoption of a strategy that meets specific objectives for each plant owner. Several such strategies are considered.

(2004) • ISBN 92-0-108104-9 •
IAEA-TECDOC-1400 • €15.00

Forthcoming

Safety Culture in the Maintenance of Nuclear Power Plants

Safety Reports Series No. 42

Building upon earlier IAEA publications on this topic, this Safety Report reviews how challenges to the maintenance of nuclear power plants can affect safety culture. It also highlights indications of a weakening safety culture. The challenges described are in areas such as maintenance management; human resources management; plant condition assessment and the business environment. The steps that some Member States have taken to address safety culture aspects are detailed and singled out as good practices, with a view to disseminating and exchanging experiences and lessons learned.

(Forthcoming 2005) • ISBN 92-0-112404-X •
STI/PUB/1210 • €22.00

QUALIFICATION AND TRAINING OF PERSONNEL

Application of Simulation Techniques for Accident Management Training in Nuclear Power Plants

IAEA TECDOC Series No. 1352

This report describes simulation techniques used in the training of personnel involved in accident management of nuclear power plants (NPPs). This concerns both the plant personnel and the persons involved in the management of off-site releases. The report pertains to light water reactors and pressurized heavy water reactors, but it can equally be applied to power reactors of other types. The report is intended for use by experts responsible for planning, developing, executing or supervising

the training of personnel involved in the implementation of accident management programmes in NPPs.

(2003) • ISBN 92-0-103903-4 •
IAEA-TECDOC-1352 • €15.00

Development of Instructors for Nuclear Power Plant Personnel Training

IAEA TECDOC Series No. 1392

The quality of nuclear power plant (NPP) personnel training is strongly dependent upon the availability of competent instructors. In 1996 the IAEA published a technical report Nuclear Power Plant Personnel Training and its Evaluation, A Guidebook, Technical Reports Series No. 380, that provided guidance with respect to development, implementation and evaluation of training programmes, including major requirements for the NPP instructors' competence. Later, the IAEA Technical Working Group on Training and Qualification of Nuclear Power Plant Personnel recommended that an additional publication be prepared to provide further details concerning the development of instructors for NPP personnel training. This publication has been developed and published to provide practical guidance on various aspects of instructor selection, development and deployment, by quoting actual examples from various countries and operating organizations.

(2004) • ISBN 92-0-105204-9 •
IAEA-TECDOC-1392 • €15.00



Maintaining Knowledge, Training and Infrastructure for Research and Development in Nuclear Safety

INSAG Series No. 16

This INSAG report, which was previously issued as INSAG Note No. 4, discusses the role that safety research has played, the present declining trend and the circumstances that are critical in maintaining a research infrastructure. The report describes new and emerging challenges that necessitate continued support of research and education opportunities and provides recommendations on how sufficient research capacity and competence can be maintained. The report is written for decision makers in government, industry and international organizations who have responsibility for research activities and educational facilities.

(13 pp; 2003) • ISBN 92-0-113203-4 •
STI/PUB/1179 • €9.00

Managing Human Resources in the Nuclear Power Industry: Lessons Learned

IAEA TECDOC Series No. 1364

This publication is directed at senior and middle level managers in nuclear operating organizations. Its objectives are to facilitate the recognition of priority issues with respect to managing human resources, and to provide pragmatic ideas regarding improvements. If not managed effectively, the human resource

issues addressed in this publication can result in significant performance problems at nuclear power plants.

(2003) • ISBN 92-0-105803-9 •
IAEA-TECDOC-1364 • €15.00



Means of Evaluating and Improving the Effectiveness of Training of Nuclear Power Plant Personnel

IAEA TECDOC Series No. 1358

This publication provides information on methods and practices for evaluating and improving the effectiveness of training and assistance to help nuclear facility managers establish and maintain effective training programmes for nuclear power plant personnel. The principles of effective training provide the overall structure needed to ensure that nuclear training programmes have processes in place to provide significant added value to nuclear power plant operations by improved safety, quality and production.

(2003) • ISBN 92-0-108203-7 •
IAEA-TECDOC-1358 • €15.00



Organization and Staffing of the Regulatory Body for Nuclear Facilities

Safety Guide

Safety Standards Series No. GS-G-1.1

This Safety Guide provides recommendations on the appropriate management system, organization and staffing of the regulatory body responsible for the regulation of nuclear facilities in order to comply with the requirements of Safety Standards Series No. GS-R-1, Legal and Governmental Infrastructure for Nuclear, Radiation, Radioactive Waste and Transport Safety (2000). It supersedes Safety Series No. 50-SG-G1, Qualifications and Training of Staff of the Regulatory Body for Nuclear Power Plants: A Safety Guide (1979).

Contents: 1. Introduction; 2. Regulatory independence and funding of the regulatory body; 3. Organization of the regulatory body; 4. Staffing; 5. Training of staff; Appendix: Basic elements of a regulatory training programme.

Chinese Edition (25 pp.; 2005) • ISBN 92-0-517104-2 •
STI/PUB/1129 • €11.50

English Edition (31 pp; 2002) • ISBN 92-0-114002-9 •
STI/PUB/1129 • €11.50

French Edition (37 pp.; 2004) • ISBN 92-0-215304-3 •
STI/PUB/1129 • €11.50

Russian Edition (42 pp; 2004) • ISBN 92-0-401404-0 •
STI/PUB/1129 • €11.50

The Nuclear Power Industry's Ageing Workforce: Transfer of Knowledge to the Next Generation

IAEA TECDOC Series No. 1399

This publication provides information on experiences gained in retaining the knowledge needed to design, operate and maintain nuclear power plants (NPPs) in IAEA Member States in the context of the ageing of the nuclear workforce. Information is provided on effective methods for transfer of knowledge in NPP operating organizations along with selected examples of proven management strategies and initiatives. Awareness and use of this information can assist NPP operating organizations in dealing with the challenges posed by retirement of the current NPP workforce and recruitment of new personnel.

(2004) • ISBN 92-0-107704-1 •
IAEA-TECDOC-1399 • €15.00

Use of Control Room Simulators for Training of Nuclear Power Plant Personnel

IAEA TECDOC Series No. 1411

In 1993 the IAEA published IAEA-TECDOC-685 Simulators for Training of Nuclear Power Plant Personnel, and in 1998, IAEA-TECDOC-995 Selection, Specification, Design and Use of Various Nuclear Power Plant Training Simulators. These TECDOCs, while providing some information on simulator training, focused primarily upon the characteristics of simulation devices for the training of nuclear power plant (NPP) personnel. Safety analysis and operational experience consistently indicate that human error is the greatest contributor to the risk of a severe accident in a NPP. Subsequent to the Three Mile Island accident, major changes were made internationally in reducing the potential for human error through improved procedures, information presentation and training of operators. The use of full scope simulators in the training of operators is an essential element of these efforts to reduce human error. In cases where a "replica" plant-referenced full scope simulator is not available, it may be necessary for operators to receive their training with a computer simulation or to travel to another plant that has a simulator that is similar to their plant. This TECDOC has been developed and published to provide information and practical guidance on various aspects of the use of control room simulators, by quoting actual examples from various Member States.

(2004) • ISBN 92-0-110604-1 •
IAEA-TECDOC-1411 • €15.00

Nuclear Fuel Cycle and Waste Management



Innovative Technologies for Nuclear Fuel Cycles and Nuclear Power

Proceedings of an International Conference, Vienna, 23–26 June 2003

C&S Papers Series No. 24

The International Atomic Energy Agency, in cooperation with the World Nuclear Association, the World Energy Council, the International Science and Technology Center and the Electric Utilities Cost Group, organized the International Conference on Innovative Technologies for Nuclear Fuel Cycles and Nuclear Power, held in Vienna from 23 to 26 June 2003. The main objectives of the Conference were to facilitate exchange of information between senior experts and policy makers from Member States and international organizations on important aspects of the development of innovative technologies for future generations of nuclear power reactors and fuel cycles; to create an understanding of the social, environmental and economic conditions that would facilitate innovative and sustainable nuclear technologies; and to identify opportunities for collaborative work between Member States and international organizations and programmes. In addition to 21 oral presentations and 26 poster presentations of accepted papers, talks on specific topics were given by 21 invited speakers from 11 Member States. All relevant aspects of innovative technologies for nuclear fuel cycles and nuclear power were discussed in an open, frank and objective manner. This publication includes an executive summary of the conference and the papers presented.

(2004) • ISBN 92-0-110704-8 •
IAEA-CSP-24/P • €15.00

in developing countries, as well as offering insight into future production plans and potential.

(Forthcoming 2005) • ISBN 92-0-112904-1 •
IAEA-TECDOC-1425 • €15.00



Management of Radioactive Waste from the Mining and Milling of Ores

Safety Guide

**Safety Standards Series
No. WS-G-1.2**

This Safety Guide provides recommendations and guidance on the safe management of radioactive waste resulting from the mining and milling of ores, with the purpose of protecting workers, the public and the environment from the consequences of these activities. It supplements Safety Standards Series No. WS-R-1, Near Surface Disposal of Radioactive Waste (1999), and supersedes Safety Series No. 85, Safe Management of Wastes from the Mining and Milling of Uranium and Thorium Ores (1987).

Contents: 1. Introduction; 2. Administrative, legal and regulatory framework; 3. Protection of human health and the environment; 4. Strategy for waste management; 5. Safety considerations in different phases of operations; 6. Safety assessment; 7. Quality assurance; 8. Monitoring and surveillance; 9. Institutional control for the post-closure phase.

English Edition (39 pp., 2 figs; 2002) • ISBN 92-0-115802-5 •
STI/PUB/1134 • €13.50

Russian Edition (forthcoming 2005) • ISBN 92-0-404104-8 •
STI/PUB/1134 • €13.50

URANIUM ORE PROCESSING

Forthcoming

Developments in Uranium Resources, Production, Demand and the Environment

IAEA TECDOC Series No. 1425

Globalization has led to the growing importance of the uranium production industries of the world's developing countries. Uranium supply from these countries could be increasingly important in satisfying worldwide reactor requirements over time. Along with their increasing contribution to worldwide uranium supply, the environmental impact of uranium production in developing countries has come under increasing scrutiny from the nuclear power industry, the end-users of this supply, and from communities impacted by uranium mining and processing. The papers presented at the meeting on "Developments in Uranium Resources, Production, Demand and the Environment" provide an important overview of uranium production operations and of their environmental consequences

Methodology for the Assessment of Innovative Nuclear Reactors and Fuel Cycles

IAEA TECDOC Series No. 1434

Following a resolution of the General Conference of the IAEA in the year 2000 an International Project on Innovative Nuclear Reactors and Fuel Cycles, referred to as INPRO, was initiated.

The main objectives of INPRO are to:

Help to ensure that nuclear energy is available to contribute towards fulfilling energy needs in the 21st century in a sustainable manner; and

Bring together both technology holders and technology users to consider jointly the international and national actions required to achieve desired innovations in nuclear reactors and fuel cycles.

Within INPRO the future energy demand and supply was explored and several scenarios identified. The following requirement for energy supply will play a crucial role: sustainability of the way the energy supply will be realized. Fulfilling the growing need for energy in developing countries is also an important issue. On the basis of on scenarios for the next fifty years, requirements

for the different aspects of the future of nuclear energy systems, such as economics, environment, safety, waste, proliferation resistance and infrastructure have been identified as well as a methodology developed to assess innovative nuclear systems and fuel cycles. On the basis of this assessment, the need for innovations in existing nuclear technology, to be achieved via research, development and demonstration, can be defined. To facilitate the deployment of innovative nuclear systems also different aspects of the infrastructure, technical as well as institutional, have also been reviewed, and recommendations for changes are made to anticipate the main developments in the world such as ongoing globalization.

(2004) • ISBN 92-0-116304-5 •
IAEA-TECDOC-1434 • €15.00

Recent Developments in Uranium Resources and Production with Emphasis on In Situ Leach Mining

IAEA TECDOC Series No. 1396

In situ leach (ISL) mining of uranium involves injecting mild acidic or alkaline chemicals through surface boreholes into permeable, uranium-bearing sandstones. The chemicals dissolve the uranium and the uranium-bearing solutions are pumped to the surface through a second set of boreholes. ISL mining of uranium totalled 6410 tonnes of uranium in 2002, and accounted for 18% of worldwide uranium production. Seven countries reported ISL production in 2002, and other countries are considering the potential for developing an ISL capability, as ISL has economic and environmental advantages for producing uranium from carefully selected deposits. This TECDOC contains 26 papers on various aspects of ISL mining including the geology of ISL-amenable sandstone deposits, case histories of ISL production using leaching solutions of varying chemistry and finally post-mining rehabilitation of ISL projects. The papers were presented at a meeting held in Beijing, China in 2002 attended by 59 scientists from 18 countries and one international organization (OECD/NEA). Attendees at the meeting also toured one of China's ISL operations, a description of which is included in this document.

(2004) • ISBN 92-0-103104-1 •
IAEA-TECDOC-1396 • €15.00



Treatment of Liquid Effluent from Uranium Mines and Mills

IAEA TECDOC Series No. 1419

Treatment and control of liquid effluents produced during uranium mining and milling operations is an integral part of environmental project management. Research has continued to add to the large body of science that has been built

up around the treatment of radioactive and non-radioactive effluents to minimize their long-term environmental impact. The objective of the meetings on which this publication is based was to exchange information on active effluent treatment technologies that have application during operations and passive treatment techniques such as constructed wetlands and use of

micro-organisms that are applicable during project reclamation and long-term care and maintenance. Papers included in this publication describe effluent treatment case histories from active uranium mining and processing operations. There are also papers that describe effluent treatment research on both active and passive systems that have potential application under a wide range of operating and post-operational conditions.

(2004) • ISBN 92-0-112304-3 •
IAEA-TECDOC-1419 • €15.00

FUEL FABRICATION AND PERFORMANCE

Advanced Fuel Pellet Materials and Designs for Water Cooled Reactors

IAEA TECDOC Series No. 1416

This report presents the proceedings of the Technical Meeting on "Improved Fuel Pellet Materials and Designs" held in Brussels, Belgium in October 2003. The Meeting focused on fabrication and design tools to influence, to some extent, and ensure desirable in-pile fuel properties. Emphasis was given to the analysis of fuel characteristics at high burnup including thermal behaviour, fission gas retention and release, pellet-cladding interaction and pellet-cladding mechanical interaction. Specific features of large grain size UO₂, MOX and uranium-gadolinia fuels with and without additives were considered in detail. A CD-ROM is also included.

(2004) • ISBN 92-0-111404-4 •
IAEA-TECDOC-1416 • €15.00



Corrosion of Research Reactor Aluminium Clad Spent Fuel in Water

Technical Reports Series No. 418

This report describes research performed in ten laboratories within the framework of the IAEA Coordinated Research Project on Corrosion of Research Reactor Aluminium Clad Spent Fuel in Water. The project consisted of exposure of standard racks of corrosion coupons in the spent fuel pools of the participating research reactor laboratories and the evaluation of the coupons after predetermined exposure times, along with periodic monitoring of the storage water. A group of experts in the field contributed a state-of-the-art review and provided technical supervision of the project. Localized corrosion mechanisms are notoriously difficult to understand, and it was clear from the outset that obtaining consistency in the results and their interpretation from laboratory to laboratory would depend on the development of an excellent set of experimental protocols. These experimental protocols are described in the report together with guidelines for the maintenance of optimum

water chemistry to minimize the corrosion of aluminium clad research reactor fuel in wet storage.

(209 pp., 81 fig.; 2003) • ISBN 92-0-113703-6 •
STI/DOC/010/418 • €42.00



Development Status of Metallic, Dispersion and Non-oxide Advanced and Alternative Fuels for Power and Research Reactors

IAEA TECDOC Series No. 1374

This publication summarizes knowledge accumulated in fuel research since the beginning of the 1960s. It concentrates on

the “advanced fuels” for the current different types of reactors, including metallic, carbide and nitride fuels for fast reactors, so-called “cold” fuels and fuels to burn excess ex-weapons plutonium in thermal power reactors. Emphasis is given to aspects of fabrication and irradiation behaviour of these fuels. Basic data on essential properties that help to understand the phenomena are also included.

(2003) • ISBN 92-0-110303-4 •
IAEA-TECDOC-1374 • €15.00



Fuel Failure in Water Reactors: Causes and Mitigation

IAEA TECDOC Series No. 1345

The report presents the proceedings of a Technical Meeting on Fuel Failure in Water Reactors: Causes and Mitigation, held in Bratislava, Slovakia in June 2002. Utility and fuel vendor experience in identification of fuel failure causes and on remedies

implemented to reduce the number of fuel failures and/or to mitigate fuel failure impact on nuclear power plant operation is analysed and discussed in the report. Emphasis is given to the fuel failure events most frequently observed during the last decade, including grid-to-rod fretting and axial offset anomaly failures in PWRs and severe secondary failures in BWRs. The report also includes information on fuel failure mechanisms and recommendations for fuel failure rate decrease in the near future.

(2003) • ISBN 92-0-101703-0 •
IAEA-TECDOC-1345 • €15.00
CD Edition (2003) • ISBN 92-0-102203-4 •
IAEA-TECDOC-CD-1345 • €15.00

Potential of Thorium Based Fuel Cycles to Constrain Plutonium and Reduce Long Lived Waste Toxicity

IAEA TECDOC Series No. 1349

This publication constitutes the final report of the Coordinated Research Project (CRP) on “Potential of Thorium-based Fuel Cycles to Constrain Plutonium and to Reduce Long-term Waste Toxicity” initiated by the IAEA in 1995. The Member States

participating in the CRP were: China, Germany, India, Israel, Japan, Republic of Korea, the Netherlands, Russian Federation, and the United States of America. The CRP examined the different fuel cycle options in which plutonium can be recycled with thorium to incinerate plutonium. The potential of the thorium matrix has been examined through computer simulations. Each participant had chosen their own cycle, and the different cycles are compared through certain predefined parameters (e.g., annual reduction of plutonium stockpiles). The radiotoxicity accumulation and the transmutation potential of thorium based cycles for current, advanced and innovative nuclear power reactors are investigated. The research programme was divided into three stages: (1) Benchmark calculations, (2) Optimization of the incineration of plutonium in various reactor types, (3) Assessment of the resulting impact on the waste radiotoxicity.

(2003) • ISBN 92-0-103203-X •
IAEA-TECDOC-1349 • €15.00



Status and Advances in MOX Fuel Technology

Technical Reports Series No. 415

This report gives an overview of the worldwide state of plutonium fuel development with an outline of future trends. The review was prepared by a group of experts in the field and supported

by information from specialists in plutonium fuel developments and related subjects. Information on the present status of, and development trends in, MOX fuel technology in the areas of design, fabrication, performance, in-core fuel management, transportation, spent MOX fuel management, decommissioning, waste treatment, safeguards and alternative approaches for plutonium recycling is provided. The report concentrates on MOX fuel for thermal power reactors; however, specific aspects of fast reactor MOX fuel are also considered.

(179 pp., 28 figs; 2003) • ISBN 92-0-103103-3 •
STI/DOC/010/415 • €39.50

SPENT FUEL MANAGEMENT

Practices and Developments in Spent Fuel Burnup Credit Applications

IAEA TECDOC Series No. 1378

Given a trend towards higher burnup power reactor fuel, the IAEA began an active programme in burnup credit (BUC) with major meetings in 1997 (TECDOC-1013) and 2000 (TECDOC-1241) exploring worldwide interest in using BUC in spent fuel management systems. This publication documents the proceedings of the IAEA's third major BUC meeting in Madrid in April 2002 on requirements, practices and developments in BUC applications. Fifty-four participants from 18 countries addressed validation of codes and methods, key issues, safety assessment and implementation, and future applications. This meeting encouraged the IAEA to continue its activities on burnup credit

including dissemination of related information, given the number of Member States having to deal with increased quantities of spent fuel and extended durations.

(2003) • ISBN 92-0-111203-3 •
IAEA-TECDOC-1378 • €15.00

Forthcoming

Remote Technology Applications in Spent Fuel Management

IAEA TECDOC Series No. 1433

Remote systems technology has been extensively applied to a variety of work in spent fuel management facilities with such benefits as dose reduction to workers, enhancement of operational performance or reliability and saving of labour costs. In recognition of the beneficial applications of remote technology in spent fuel management, the IAEA has provided information on the state-of-art developments and practices of remote technology in the area of spent fuel management. The first of this series, "Remote Technology Related to the Handling, Storage and Disposal of Spent Fuel" (IAEA-TECDOC-842) issued in 1994, was followed by another, "Remote Technology in Spent Fuel Management" (IAEA-TECDOC-1061) issued in 1999. The present publication intends to provide an overview of remote technology applications to spent fuel management within the scope of the fuel cycle back end by compiling the information collected from a series of consultancies held from 1998 to 2000 and other related information collected thereafter through other sources.

(Forthcoming 2005) • ISBN 92-0-101105-9 •
IAEA-TECDOC-1433 • €15.00

Spent Fuel Performance Assessment and Research

IAEA TECDOC Series No. 1343

(2003) • ISBN 92-0-102703-6 • IAEA-TECDOC-1343 • €15.00



Storage of Spent Fuel from Power Reactors

*Proceedings of an International
Conference, Vienna, Austria,
2–6 June 2003*

C&S Papers Series No. 20

This publication reports on the International Conference on Storage of Spent Fuel from Power Reactors, which gave an opportunity

for exchange of information on the state of the art and prospects for spent fuel storage, for discussion of the worldwide situation and the major factors influencing the national policies in this field, and for the identification of the most important directions that national efforts and international cooperation in this area should take.

(2003) • ISBN 92-0-109603-8 •
IAEA-CSP-20/P • €15.00
CD Edition (2003) • ISBN 92-0-109803-0 •
IAEA-CSP-20/CD • €15.00

WWER-440 Fuel Rod Experiments under Simulated Dry Storage Conditions

IAEA TECDOC Series No. 1385

There is significant interest in Member States operating WWER reactors in obtaining information about the highest allowable cladding temperatures for spent fuel assemblies in dry storage facilities. Therefore, special efforts have been made to simulate dry storage tests with WWER-440 fuel rods at the State Scientific Centre of the Russian Federation, Scientific Research Institute for Nuclear Reactors (RIIAR) in Dimitrovgrad using extra-budgetary funds supplied by the Government of Japan, leading to publication of the results in this publication. The aim is to provide an insight into the maximum spent fuel cladding temperature at the beginning of placement in a dry storage facility, in the context of the pre-cooling time. This TECDOC contains the results of pre-characterization of the rods, descriptions of the tests and the results of characterizations in the two principal temperature regimes.

(2004) • ISBN 92-0-103704-X •
IAEA-TECDOC-1385 • €15.00
CD Edition (2004) • ISBN 92-0-109604-6 •
IAEA-TECDOC-CD-1385 • €15.00

WASTE MANAGEMENT

Application of Membrane Technologies for Liquid Radioactive Waste Processing

Technical Reports Series No. 431

Membrane separation processes have made impressive progress since the first synthesis of membranes almost 40 years ago. This progress was driven by strong technological needs and commercial expectations. As a result the range of successful applications of membranes and membrane processes is continuously broadening. In addition, increasing application of membrane processes and technologies lies in the increasing variations of the nature and characteristics of commercial membranes and membrane apparatus.

The objective of the report is to review the information on application of membrane technologies in the processing of liquid radioactive waste. The report covers the various types of membranes, equipment design, range of applications, operational experience and the performance characteristics of different membrane processes. The report aims to provide Member States with basic information on the applicability and limitations of membrane separation technologies for processing liquid radioactive waste streams.

(145 pp., 53 figs; 2004) • ISBN 92-0-106804-2 •
STI/DOC/010/431 • €32.00

Combined Methods for Liquid Radioactive Waste Treatment

IAEA TECDOC Series No. 1336

This publication provides a summary report of a Coordinated Research Project and individual reports of the project

participants, compiling results of four years of investigation and development to identify and evaluate different options for combining treatment processes for liquid radioactive waste of complex compositions. The objective of the project was to identify, through the exchange of information and the results of experimental work, specific combined methods for liquid radioactive waste treatment and to define their applicability and efficiency for treatment of different waste streams.

(2003) • ISBN 92-0-100903-8 • IAEA-TECDOC-1336 • €15.00



Considerations in the Development of Near Surface Repositories for Radioactive Waste

Technical Reports Series No. 417

This report presents an integrated, stepwise approach for the development of near surface disposal facilities for low and intermediate level radioactive waste. The report is consistent with the current international requirements, principles, standards and guidance for the disposal of radioactive waste. The approach is designed to be flexible enough to be suitable for use in the various Member States, ranging from countries that have nuclear power plants to countries that have small inventories of radioactive waste from nuclear applications.

(75 pp., 10 figs; 2003) • ISBN 92-0-106103-X • STI/DOC/010/417 • €21.50



Decommissioning of Small Medical, Industrial and Research Facilities

Technical Reports Series No. 414

This publication provides information, experience and assistance on the decommissioning of small medical, industrial and research nuclear facilities in which radioactive material and radiation sources are produced, received, used and/or stored. This report is intended to promote timely and cost effective decommissioning and waste management at the end of the life of a small facility so as to render such a facility harmless.

(191 pp., 40 figs; 2003) • ISBN 92-0-101003-6 • STI/DOC/010/414 • €39.50

Determining the Suitability of Materials for Disposal at Sea Under the London Convention 1972: A Radiological Assessment Procedure

IAEA TECDOC Series No. 1375

Over the years the IAEA has provided advice to the Contracting Parties to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London Convention 1972) on the definition of de minimis levels of specific activity, below which materials can be regarded as 'non-radioactive' for

the purpose of this Convention. The IAEA has prepared several documents elaborating the concept of de minimis for the benefit of the Contracting Parties. In 1999, the IAEA provided advice on the application of the principles of exclusion and exemption to sea disposal, which was adopted at the Contracting Parties' Twenty-first Consultative Meeting. At the same meeting, the Contracting Parties adopted guidelines, which interpret the IAEA's advice further and incorporate a Stepwise Evaluation Procedure to determine if candidate material can be designated as de minimis under the Convention. The final step in the Stepwise Evaluation Procedure involves a specific assessment to determine whether candidate materials for sea disposal contain de minimis levels of radioactivity. This publication has been prepared in response to a request by the Contracting Parties to the IAEA to provide additional guidance on how such specific assessments should be performed.

(2003) • ISBN 92-0-110803-6 • IAEA-TECDOC-1375 • €15.00

Developing Multinational Radioactive Waste Repositories: Infrastructural Framework and Scenarios of Cooperation

IAEA TECDOC Series No. 1413

This publication reviews the possibilities for the realization of multinational repositories and is intended to serve as a reference for Member States potentially interested in multinational repository concepts as hosting, partner or third party countries. The report updates work done in a previous study in 1998 (IAEA-TECDOC-1021) and attempts to define the concepts involved in the creation of multinational repositories, to explore the likely scenarios, to examine the conditions for successful implementation, and to point out the benefits and challenges inherent to multinational repositories. The report also provides an overview of the past history and current status of multinational cooperations on repositories and related activities.

(2004) • ISBN 92-0-112204-7 • IAEA-TECDOC-1413 • €15.00

Forthcoming

Disposal Options for Disused Radioactive Sources

Technical Reports Series No. 436

This report presents a review of relevant information on the various technical factors and issues, as well as approaches and relevant technologies, leading to the identification of potential disposal options for disused radioactive sources. The report attempts to provide a logical "road map" for the disposal of disused radioactive sources, taking into consideration the high degree of variability in the radiological properties of such types of radioactive waste. The use of borehole or shaft type repositories is highlighted as a potential disposal option, particularly for those countries that have limited resources and are looking for a simple, safe and cost effective solution for the disposal of their radioactive source inventories. The information provided in the report could be adapted or adopted to identify and develop specific disposal options suitable for the type

and inventory of radioactive sources kept in storage in a given Member State.

(Forthcoming 2005) • ISBN 92-0-100305-6 •
STI/DOC/010/436 • €27.00



Extent of Environmental Contamination by Naturally Occurring Radioactive Material (NORM) and Technological Options for Mitigation

Technical Reports Series No. 419

The purpose of this report is to raise awareness of the residues arising from the processing of various naturally occurring radioactive materials and the possible environmental contamination arising from these. The various processes and their residues are analysed and the technical options for dealing with such contamination are discussed. The industries of interest include those related to fuel production, water use, metal ores and industrial minerals.

(198 pp., 45 figs; 2003) • ISBN 92-0-112503-8 •
STI/DOC/010/419 • €35.00

Implications of Partitioning and Transmutation in Radioactive Waste Management

Technical Reports Series No. 435

Partitioning and transmutation (P&T) is a potential complementary route in the management of the spent fuel resulting from the generation of nuclear power. It has the potential to open new avenues for long term waste management by eliminating longterm radionuclides and their thermal effects and thus reducing the necessity or capacities of disposal facilities. Recycling and reuse of nuclear material and other transuranic radioisotopes would have positive effects on the sustainability of nuclear energy and reduce proliferation concerns by burning nuclear material and other transuranic radionuclides. This report analyses, from an international perspective, the current status of P&T, the potential options for its implementation and its impact on waste management programmes and strategies.

(Forthcoming 2005) • ISBN 92-0-115104-7 •
STI/DOC/010/435 • €35.00



Issues and Trends in Radioactive Waste Management Proceedings of an International Conference in Vienna, Austria, 9–13 December 2002

Proceedings Series

This international conference addresses some of the current issues being debated in relation to radioactive waste management, including: control of radioactive discharges to the environment; long term storage of radioactive waste; geological disposal of radioactive waste; management of disused radioactive sources. In addition, issues such as waste from past activities and

events, public attitudes to radioactive waste, the involvement of stakeholders in decision making and the international regime for the safety of radioactive waste management are also addressed. A CD-ROM of contributed papers is included.

(616 pp.; 2003) • ISBN 92-0-113103-8 •
STI/PUB/1175 • €100.00

Long Term Behaviour of Low and Intermediate Level Waste Packages under Repository Conditions

IAEA TECDOC Series No. 1397

(2004) • ISBN 92-0-107904-4 • IAEA-TECDOC-1397 • €15.00

Management of Disused Long Lived Sealed Radioactive Sources (LLSRS)

IAEA TECDOC Series No. 1357

This publication provides advice and technical know-how on the management of disused and spent long lived sealed radioactive sources (LLSRS). It also provides background material for possible technical assistance to developing countries and serves as a reference for technical staff involved with IAEA programmes on the subject.

(2003) • ISBN 92-0-105403-3 • IAEA-TECDOC-1357 • €15.00



Management of Low and Intermediate Level Radioactive Wastes with Regard to their Chemical Toxicity

IAEA TECDOC Series No. 1325

This publication addresses the management of the chemical toxicity effects of low and intermediate level radioactive wastes.

Consideration of chemical toxicity requires an analysis of its impact on the disposal system performance, and the identification of pre-disposal management technologies that support protection of human health and the environment. The document identifies the nature of chemical toxicity contained in LILW, discusses technical options, performance requirements and regulatory aspects in dealing with chemical toxicity, and presents current technical information on applicable waste processing and disposal technologies.

(2002) • ISBN 92-0-119802-7 •
IAEA-TECDOC-1325 • €15.00



Management of Waste Containing Tritium and Carbon-14

Technical Reports Series No. 421

This publication reviews and analyses experience in the application of different organizational and technological approaches to the management of waste

containing C-14 and tritium, and reviews the different sources of such waste and the characteristics important in the selection of appropriate methods for its processing, storage, disposal and release.

(109 pp., 8 figs; 2004) • ISBN 92-0-114303-6 •
STI/DOC/010/421 • €20.00

Forthcoming

Management of Waste from the Use of Radioactive Materials in Medicine, Industry, Research, Agriculture and Education

Safety Standards Series No. WS-G-2.7

(Forthcoming 2005) • ISBN 92-0-113704-4 •
STI/PUB/1217 • €20.00

Methods for Maintaining a Record of Waste Packages During Waste Processing and Storage

Technical Reports Series No. 434

During processing, radioactive waste is converted into waste packages, sent for storage and ultimately for disposal. A principal condition for acceptance of a waste package for storage or disposal is its full compliance with waste acceptance criteria for disposal or storage. To declare compliance of a waste package with waste acceptance criteria, a system for generating and maintaining records should be established to record and track all relevant information, from raw waste characteristics, through changes related to waste processing, up to final checking and verification of waste package parameters. Records generated during waste processing are a constituent part of the more complex system of waste management record keeping, covering the entire life cycle of radioactive waste from generation to disposal and even the post-closure period of a disposal facility. The IAEA is systematically working on the preparation of a set of publications to assist its Member States in the development and implementation of such a system. This report covers all the principal aspects of the establishment and maintenance of records during waste processing and storage.

(Forthcoming 2005) • ISBN 92-0-114704-X •
STI/DOC/010/434 • €35.00



Modelling of the Radiological Impact of Radioactive Waste Dumping in the Arctic Seas

IAEA TECDOC Series No. 1330

The International Arctic Seas Assessment Project (IASAP) was launched by the IAEA in 1993 in response to widespread concern arising from reports that the former Soviet Union had dumped radioactive waste

in the Arctic Seas for more than thirty years. The objectives of IASAP were to assess the risk to human health and to the environment associated with the radioactive waste disposed of in the Kara and Barents Seas and to examine the possible remedial actions related to the dumped waste and to advise on

whether they are necessary and justified. Within the framework of IASAP, the Modelling and Dose Assessment Working group was established to develop a predictive model for the dispersal of radioactive contaminants both within and from the Arctic Ocean and to evaluate the contributions of dominating transfer mechanisms to the dispersal and hence the risks to human health and the environment. This publication summarises the work undertaken by the Modelling and Dose Assessment Working Group between 1994 and 1996.

(2003) • ISBN 92-0-100203-3 •
IAEA-TECDOC-1330 • €15.00



Near Surface Disposal of Radioactive Waste

Safety Requirements

Safety Standards Series No. WS-R-1

This Safety Requirements publication sets out the basic safety requirements related to the disposal of radioactive wastes in near surface repositories. As a

Safety Requirements publication it is supported by a number of associated Safety Guides which provide guidance on the implementation of the requirements. Its principles are derived from the Safety Fundamentals publication, Safety Series No. 111-F, The Principles of Radioactive Waste Management. It includes requirements for the protection of human health, requirements for the assessment procedures needed to ensure that safety is achieved, and technical requirements for waste acceptance and for siting, design, construction, operation and closure of the repository as well as for the post-closure phase.

Contents: 1. Introduction; 2. Requirements for the protection of human health and the environment; 3. Safety assessment and compliance with safety requirements; 4. Organizational and technical safety requirements; 5. Waste acceptance requirements; 6. Characteristics of an acceptable site; 7. Design of disposal facilities; 8. Construction; 9. Operation; 10. Closure; 11. Post-closure phase; 12. Quality assurance; Annex: Dose and risk criteria for the post-closure phase.

Chinese Edition (25 pp.; 2005) • ISBN 92-0-517404-1 •
STI/PUB/1073 • €12.50

English Edition (29 pp; 1999) • ISBN 92-0-101099-0 •
STI/PUB/1073 • €12.50

Russian Edition (38 pp; 2003) • ISBN 92-0-404603-1 •
STI/PUB/1073 • €12.50

Spanish Edition (34 pp; 2004) • ISBN 92-0-308004-X •
STI/PUB/1073 • €12.50



Predisposal Management of High Level Radioactive Waste

Safety Guide

Safety Standards Series No. WS-G-2.6

This Safety Guide provides regulatory bodies and the operators that generate and manage radioactive waste with recommendations on how to meet the

principles and requirements established for the predisposal management of high level waste.

(59 pp; 2003) • ISBN 92-0-102503-3 •
STI/PUB/1151 • €17.50



Predisposal Management of Low and Intermediate Level Radioactive Waste

Safety Guide

Safety Standards Series No. WS-G-2.5

The objective of this Safety Guide is to provide regulatory bodies and the operators that generate and manage radioactive waste with recommendations on how to meet the principles and requirements established for the predisposal management of low and intermediate level waste.

(55 pp; 2003) • ISBN 92-0-102403-7 •
STI/PUB/1150 • €16.50



Predisposal Management of Organic Radioactive Waste

Technical Reports Series No. 427

A wide variety of organic radioactive waste is generated at different nuclear fuel cycle facilities, as well as during different nuclear applications, including medicine, research, agriculture, industry, education and training. Processing of organic waste for storage and disposal requires specific approaches. In many cases application of special techniques to destroy organic components of waste or to provide reliable immobilization to isolate organic waste from the environment is required. The processing of organic waste is a rapidly developing field. Various treatment and conditioning options are being investigated, developed and widely applied in several IAEA Member States. This report revises and summarizes the information on different treatment and conditioning options applied for predisposal management of organic radioactive waste.

(87 pp., 10 figs; 2004) • ISBN 92-0-103204-8 •
STI/DOC/010/427 • €30.00

Predisposal Management of Radioactive Waste, Including Decommissioning

Safety Requirements

Safety Standards Series No. WS-R-2

This publication establishes safety requirements relating to the predisposal management of radioactive waste arising from: the operation and decommissioning of nuclear facilities; the application of radionuclides in industry, medicine and research; the processing of raw materials containing naturally occurring radionuclides; and the cleanup of contaminated sites. Safety requirements for the relevant aspects of the decommissioning

of nuclear facilities are established. The book includes provisions required to bring radioactive waste into a state suitable for storage or disposal in designated facilities and to ensure the safety of the facilities. Relevant requirements and associated responsibilities for the protection of human health and the environment are included. The safety requirements are established on the basis of principles set out in the Safety Fundamentals publication The Principles of Radioactive Waste Management (Safety Series No. 111-F, 1995).

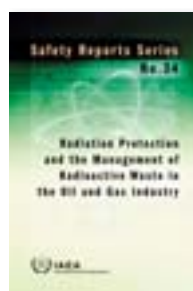
Contents: 1. Introduction; 2. Protection of human health and the environment; 3. Responsibilities associated with predisposal management of radioactive waste, including decommissioning; 4. Interdependence; 5. Elements of predisposal management of radioactive waste; 6. Decommissioning; 7. Safety of facilities; Glossary.

English Edition (26 pp.; 2000) • ISBN 92-0-100300-5 •
STI/PUB/1089 • €11.00

French Edition (33 pp.; 2004) • ISBN 92-0-202704-8 •
STI/PUB/1089 • €11.00

Russian Edition (33 pp.; 2003) • ISBN 92-0-404703-8 •
STI/PUB/1089 • €11.00

Spanish Edition (29 pp; 2004) • ISBN 92-0-310804-1 •
STI/PUB/1089 • €11.00



Radiation Protection and the Management of Radioactive Waste in the Oil and Gas Industry

Safety Reports Series No. 34

This Safety Report documents the practical radiation protection and radioactive waste safety measures that are taken in the oil and gas industry in order to implement the requirements of the International Basic Safety Standards and the guidance provided in various Safety Guides. It also includes detailed information on training and supervision, radiation monitoring, decontamination methods and radioactive waste characterization. The Safety Report is aimed at regulatory bodies; oil and gas field operators and service companies; workers and their representatives; health, safety and environmental protection professionals and health and safety training officers.

(130 pp., 37 figs; 2003) • ISBN 92-0-114003-7 •
STI/PUB/1171 • €21.00



Radioactive Waste Management Glossary – 2003 Edition

This updated glossary is intended to provide a source of terms that are commonly used or have special meanings in the field of radioactive waste management. The glossary includes new terms that have come into use in the past decade and terms whose meanings have changed. The terms that are included have all become part of accepted international usage.

(54 pp; 2003) • ISBN 92-0-105303-7 •
STI/PUB/1155 • €16.50



Record Keeping for the Decommissioning of Nuclear Facilities: Guidelines and Experience

**Technical Reports Series
No. 411**

The objective of this report is to provide information, based on experience gained so far, on how to identify, maintain and update the necessary records for the decommissioning of nuclear facilities. Record keeping has proven to be of vital importance, since its lack may result in the costly misallocation of resources and may cause safety problems.

Contents: 1. Introduction; 2. Scope and objectives; 3. Design and operational data requirements for decommissioning; 4. Process of selecting decommissioning records; 5. Retention of decommissioning records; 6. Quality assurance; 7. The records management system; 8. Management of new records; 9. Summary; Appendix: Options for record storage media and retrievability; Annex I: Examples of national experience; Annex II: Lessons learned.

(182 pp., 26 figs; 2002) • ISBN 92-0-119602-4 •
STI/DOC/010/411 • €42.50

Records for Radioactive Waste Management up to Repository Closure: Managing the Primary Level Information (PLI) Set

IAEA TECDOC Series No. 1398

The objective of this publication is to highlight the importance of the early establishment of a comprehensive records system to manage primary level information (PLI) as an integrated set of information, not merely as a collection of information, throughout all the phases of radioactive waste management. The information presented in this publication will assist Member States in ensuring that waste and repository records, relevant for retention after repository closure, are generated, identified, reviewed and actively managed during pre-closure phases so that they are available and useable at the appropriate time. This publication addresses the establishment and management of the PLI set up to the point of closure of a repository. Specifically, it (1) describes the importance of establishing a coordinated, integrated and well-managed PLI set, (2) provides a basic overview of the components of a PLI set, and (3) provides general guidance on the management of and responsibility for the PLI set.

(2004) • ISBN 92-0-107104-3 •
IAEA-TECDOC-1398 • €15.00



Remediation of Areas Contaminated by Past Activities and Accidents

Safety Requirements

**Safety Standards Series
No. WS-R-3**

This Safety Standard provides requirements for the intervention of areas, including land and industrial sites, that have been contaminated as a result of human activities and could cause the prolonged exposure to radiation of workers and members of the public. This publication establishes requirements in relation to protective and remedial actions intended to reduce actual prolonged exposure, to avert potential prolonged exposure or to reduce the likelihood of the occurrence of such exposure. This document does not apply to situations arising from normal operation of appropriately controlled practices.

(21 pp; 2003) • ISBN 92-0-112303-5 •
STI/PUB/1176 • €15.00



Remediation of Sites with Dispersed Radioactive Contamination

**Technical Reports Series
No. 424**

This report provides an overview of remediation technologies that are particularly suited to the remediation of dispersed contamination. Dispersed low level contamination poses a particular challenge. Many techniques are not efficient below certain concentration thresholds or entail more severe impacts on certain environmental compartments than the contamination itself. The technologies are outlined in brief, and their advantages and limitations are discussed. The need for a holistic design of the remedial action is stressed.

(117 pp., 23 figs; 2004) • ISBN 92-0-114603-5 •
STI/DOC/010/424 • €21.00



Safe Decommissioning for Nuclear Activities

**Proceedings of an International
Conference in Berlin, Germany,
14–18 October 2002**

Proceedings Series

When a facility has reached the end of its useful life, action has to be taken to ensure safe shutdown and allow the removal of regulatory controls. Some countries have put in place regulatory infrastructures and have developed programmes to manage the associated decommissioning and remediation activities. Other countries are at the stage of assessing what is involved in terminating such practices. This publication, arising from a conference held in Berlin, covers: the overall magnitude of the problem; regulatory approaches and safety strategies; status and development of decommissioning technologies; planning

and implementation; funding approaches and strategies; consideration of social issues; and criteria for the removal of regulatory controls. A CD-ROM of contributed papers is included.

(583 pp., 78 figs; 2003) • ISBN 92-0-109703-4 •
STI/PUB/1154 • €120.00

Safety Considerations in the Disposal of Disused Sealed Radioactive Sources in Borehole Facilities

IAEA TECDOC Series No. 1368

(2003) • ISBN 92-0-106403-9 •
IAEA-TECDOC-1368 • €15.00



Scientific and Technical Basis for the Geological Disposal of Radioactive Wastes

Technical Reports Series No. 413

This report focuses on the different functions of a repository within its life cycle and describes the processes relevant to the containment of long lived radioactive waste and other criteria influencing the long term integrity of the repository. It emphasizes the central role of safety and the importance of safety/performance assessments in the decision making process during repository development.

Contents: 1. Introduction; 2. The geological disposal concept; 3. Near field components and processes; 4. Far field barriers and processes; 5. Confidence in adequate isolation; 6. Summary and conclusions.

(80 pp., 2 figs; 2003) • ISBN 92-0-100103-7 •
STI/DOC/010/413 • €22.00



Selection of Efficient Options for Processing and Storage of Radioactive Waste in Countries with Small Amounts of Waste Generation

IAEA TECDOC Series No. 1371

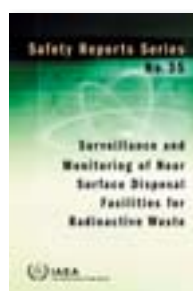
This publication will assist decision makers in countries using nuclear energy for non-power applications to organize their waste management practices. It describes methodologies, criteria and options for the selection of appropriate technologies for processing and storing radioactive waste generated by these applications. A review of both technical and non-technical factors important for decision making and planning, and for implementation of waste management activities at the country and facility levels are presented. Practical recommendations for the selection of particular technologies for different scales of waste generation are made.

(2003) • ISBN 92-0-108803-5 • IAEA-TECDOC-1371 • €15.00

Status of the Decommissioning of Nuclear Facilities around the World

This book reviews and summarizes the decommissioning activities that have been performed to date, those that are currently under way and those that will need to be performed in the future. The aim of the book is to quantify the level of effort that will be required on the part of the industry in order to safely perform the necessary decommissioning activities. The book will be of interest to regulators, engineers and planners as a basis for developing a regulatory infrastructure and implementing a decommissioning programme. A CD-ROM is included which details the location, type and status of nuclear power plants, research reactors, fuel cycle facilities and particle accelerators along with relevant associated data.

(27 pp., 1 fig.; 2004) • ISBN 92-0-108704-7 •
STI/PUB/1201 • €32.00



Surveillance and Monitoring of Near Surface Disposal Facilities for Radioactive Waste

Safety Reports Series No. 35

The publication deals with surveillance and monitoring activities for the purposes of demonstrating the safety of near surface radioactive waste disposal facilities. It covers all phases of facility development from siting through construction and operation to closure. It identifies the activities over which surveillance needs to be exercised and the parameters to be monitored, and provides examples of such programmes for present-day facilities. It also addresses programmes that may be necessary for older facilities which were not built to present-day standards and for which surveillance and monitoring may have to be carried out to identify remedial measures to be taken.

(75 pp., 4 figs; 2004) • ISBN 92-0-114903-4 •
STI/PUB/1182 • €17.50



Transition from Operation to Decommissioning of Nuclear Installations

Technical Reports Series No. 420

The transition period between operation of an installation and the implementation of the decommissioning strategy is a critical one. In this period, a number of modifications, both technical and organizational, are needed to adjust a plant to meet new objectives and requirements. It is essential that detailed planning for decommissioning begin in good time during plant operation and that preparatory actions for the implementation of the decommissioning strategy be initiated immediately after permanent shutdown. This ensures a gradual transition and minimizes uncontrolled loss of resources. The purpose of this report is to highlight technical, management and organizational issues during the transition period, to provide guidance to minimize delays and undue costs, to optimize

personnel and other resources, and to initiate preparatory activities for decommissioning in a planned, timely and cost-effective manner.

(221 pp., 54 figs; 2004) • ISBN 92-0-114103-3 •
STI/DOC/010/420 • €39.00

Upgrading of Near Surface Repositories for Radioactive Waste

Technical Reports Series No. 433

This report considers a variety of circumstances that may require corrective actions to be assessed or implemented at

near surface disposal facilities. The circumstances leading to the corrective actions, or the corrective actions themselves, may be of either a technical or non-technical nature. Methodologies that can be employed to implement effective solutions to problems are discussed, including assessment of alternative options prior to selecting corrective actions, and the planning, implementation and verification of the specific measures adopted. Examples are provided of approaches and technologies that may be used to improve repository performance and safety. Information is also provided in the Annex on experience in various Member States on upgrading of disposal facilities.

(Forthcoming 2005) • ISBN 92-0-112704-9 •
STI/DOC/010/433 • €38.00

Plasma Physics and Nuclear Fusion



Atomic and Plasma-Material Interaction Data for Fusion

Atomic and Plasma-Material Interaction Data for Fusion 11

This publication, arising from a Coordinated Research Project on Radiative Cooling Rates of Fusion plasma impurities provides information on radiative processes taking place in different regions of fusion plasmas.

This information is an important ingredient in many modelling and diagnostic studies of fusion plasmas.

Contents: 1. Comparison calculations of radiated power loss for silicon and iron; 2. Calculated radiated power loss for neon, silicon, argon, titanium and iron; 3. Effective rates for calculation of steady state and time dependent plasmas.

(65 pp., 58 figs; 2003) • ISBN 92-0-101205-5 •
STI/PUB/023/APID/11 • €30.00



Atomic and Plasma-Material Interaction Data for Fusion

Atomic and Plasma-Material Interaction Data for Fusion 12

The twelfth volume of Atomic and Plasma-Material Interaction Data for Fusion represents the result of a coordinated effort of leading theoretical groups within the IAEA Coordinated Research Project (CRP)

on Radiative Cooling Rates of Fusion Plasma Impurities. The contributions of the participants of this CRP, contained in the present volume, significantly enlarge information on radiative processes taking place in different regions of fusion plasmas. This information is an important ingredient in many modelling and diagnostic studies of fusion plasmas.

(2003) • ISBN 92-0-111803-1 •
STI/PUB/023/APID/12 • €30.00

Fusion Energy 2002

***Proceedings of an International Conference in
Lyon, France, 2002***

C&S Papers CD Series No. 19

This CD-ROM publication is the proceedings of the 19th International Conference on Fusion Energy 2002. It includes 399 contributions in plasma physics and controlled thermonuclear science.

CD Edition (2003) • ISBN 92-0-112203-9 •
IAEA-CSP-19/CD • €15.00
(2002) • ISBN 92-0-111902-X •
IAEA-CSP-19 • €15.00

Fusion Energy 2004

***Proceedings of an International Conference in
Vilamoura, Portugal, 2004***

C&S Papers CD Series No. 25

(Forthcoming 2005) • ISBN 92-0-100405-2 •
IAEA- IAEA-CSP-25/CD • €15.00



IAEA Safeguards Glossary **International Nuclear Verification** **Series No. 3**

The IAEA Safeguards Glossary 2001 Edition reflects recent advances in the strengthening of the IAEA safeguards system. It aims at facilitating the understanding of the specialized safeguards terminology within the international community. The glossary comprises 13 sections, each addressing a specific subject related to IAEA safeguards. The terms used have been translated into the official languages of the IAEA — Arabic, Chinese, French, Russian and Spanish — as well as into German and Japanese. The advanced search features of the CD-ROM version enable the user to access the Index and to easily search the document. The safeguards terms have been cross-indexed through the use of hyperlinks for ease of navigation through the document. Similarly, each term referenced in the Index can be accessed directly with a simple mouse click.

Contents: 1. Legal instruments and other documents related to IAEA safeguards; 2. IAEA safeguards: Purpose, objectives and scope; 3. Safeguards approaches, concepts and measures; 4. Nuclear and non-nuclear material; 5. Nuclear and nuclear related activities and installations; 6. Nuclear material accountancy; 7. Nuclear material measurement techniques and equipment; 8. Containment, surveillance and monitoring; 9. Environmental sampling; 10. Statistical concepts and techniques for nuclear material verification; 11. Visits, inspections and complementary access; 12. Safeguards information and evaluation; 13. Reporting on safeguards implementation; Translations of terms; Index. Also available in print.

(2003) • ISBN 92-0-138602-8 • IAEA/NVS/3/CD • €24.00

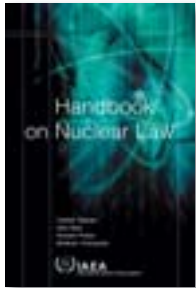
Safeguards Techniques and Equipment – **2003 Edition**

International Nuclear Verification Series No. 1 **(Revised)**

The IAEA has the task of providing continuing assurance to the international community that States that have entered into safeguards agreements with the IAEA are meeting their obligations. This requires, in particular, that any diversion of safeguarded nuclear material from civil use to a proscribed purpose would be detected. To this end, the IAEA must be able to verify the correctness and completeness of the statements it receives from States concerning the nuclear materials included in the State's safeguards agreements with the IAEA. Moreover, the IAEA must be able to confirm that there is no undeclared nuclear material and activity present in the State. Inspectors use equipment to make independent measurements to verify quantitatively the amounts of nuclear material presented in the State's accounts. This equipment can measure attributes of the items under control or can measure the amount of nuclear material with a relative uncertainty in the range of 1–10. Containment and surveillance (C/S) techniques are applied to reduce the safeguards inspection effort (e.g. by limiting the frequency of accountancy verification) and also to give assurance that nuclear material follows predetermined routes, that the integrity of its containment remains unimpaired, and that the material is accounted for at the correct measurement points. A variety of techniques are used, primarily optical surveillance and sealing. The present booklet provides an overview of the methods and technologies used by the IAEA inspectors in performing the verification activities.

(82 pp., 47 figs; 2003) • ISBN 92-0-109403-5 •
IAEA/NVS/1/2003 • €15.00

Nuclear Law



Handbook on Nuclear Law

This publication is a new resource for assessing the adequacy of national legal frameworks governing the peaceful uses of nuclear energy. It provides practical guidance for governments in enhancing their laws and regulations, in harmonizing them with internationally recognized standards, and in meeting their obligations under relevant international instruments. This handbook contains concise and authoritative information for teachers (lawyers, scientists, engineers, health and radiation protection workers and government administrators) on the basic elements of a framework for managing and regulating nuclear energy.

(168 pp; 2003) • ISBN 92-0-105703-2 •
STI/PUB/1160 • €80.00

"This excellent handbook [is] the first real co-handbook on civil nuclear law"

"... the most all-embracing handbook available to all practitioners in the field of nuclear law"

"...provides the nuclear community with a very good introduction to the field of Nuclear Law"

*Anders Nyström, Deputy Director,
International Law Department,
Swedish Ministry for Foreign Affairs*

"excellent and authoritative guide"

"... should be regarded as required reading material for all students of international nuclear law; it is a first-rate teaching tool."

Jeffrey Miller, U.S. Department of State

International Nuclear Information System



INIS: Authority List for Journal Titles

INIS Reference Series No. 11 (Rev. 30)

The 30th revision of this manual contains the names of 12980 journal titles covered by INIS. It is arranged in six parts. In Part I, all key journals are grouped under the name of the country or international organization responsible for their input to INIS, then sorted alphabetically under their title. In Part II, all key journals are sorted alphabetically under their title. In Part III, all journals that are regularly scanned by INIS Centres are grouped under the name of the country or international organization responsible for their input to INIS, then sorted alphabetically under their title. In Part IV, all journals that are regularly scanned by INIS Centres are sorted alphabetically under their title. In Part V, all journals are grouped under the name of the country or international organization responsible for their input to INIS, then sorted alphabetically under their title. In Part VI, all journals are sorted alphabetically under their title.

(652 pp; 2004) • ISBN 92-0-105504-8 •
IAEA-INIS-11 (Rev. 30) • €54.00

Joint Thesaurus Part I (A–L) and Part II (M–Z)

ETDE/INIS Joint Reference Series No. 1 (Rev. 1)

This is the first revision of the INIS/ETDE Joint Thesaurus. It contains 20 953 valid descriptors and 8600 forbidden terms, and was last updated in December 2003. The Joint Thesaurus contains the controlled terminology for indexing all information within the subject scope of both the INIS (International Nuclear Information System) and ETDE (Energy Technology Data Exchange) information systems. The terminology is intended for use in subject description for input of information to or retrieval of information from those systems. The original basis of the terminology found in this thesaurus was the 1969 edition of the Euratom Thesaurus. The structure subsequently given to that terminology was the result of a systematic study performed by subject specialists. Further expansion of the thesaurus terminology was done by ETDE to incorporate information on all forms of energy. The Joint Thesaurus is the result of continued editing carried out in parallel to the processing of the INIS and ETDE databases.

(1162 pp; 2004) • ISBN 92-0-105604-4 •
IAEA-ETDE/INIS-1 (Rev. 1) • €120.00



INIS: Database Manual

INIS Reference Series No. 22

This manual provides information for users of INIS output data on magnetic media. It gives a description of each data element including information on contents, structure and usage, and a historical overview of additions, deletions and changes of data elements and their contents that have

taken place over the years.

(42 pp; 2003) • ISBN 92-0-101903-3 •
IAEA-INIS-22 (Rev. 2) • €9.00



Biomonitoring of Atmospheric Pollution (with Emphasis on Trace Elements) – BioMAP II

IAEA TECDOC Series No. 1338

The publication contains papers presented at the Second International Workshop on Biomonitoring of Atmospheric Pollution (with emphasis on trace elements) – BioMAP II. There are 40 papers addressing

goals and quality assessment of biomonitoring surveys, the applicability of bio-organisms in both qualitative and quantitative senses, response modelling, the use of multi-element analytical techniques, interpretation of results for specific pollutants, and the use of appropriate statistical tools for detailed data interpretation.

(2003) • ISBN 92-0-100803-1 •
IAEA-TECDOC-1338 • €15.00

Forthcoming

Developments in Uranium Resources, Production, Demand and the Environment

IAEA TECDOC Series No. 1425

Globalization has led to the growing importance of the uranium production industries of the world's developing countries. Uranium supply from these countries could be increasingly important in satisfying worldwide reactor requirements over time. Along with their increasing contribution to worldwide uranium supply, the environmental impact of uranium production in developing countries has come under increasing scrutiny from the nuclear power industry, the end-users of this supply, and from communities impacted by uranium mining and processing. The papers presented at the meeting on "Developments in Uranium Resources, Production, Demand and the Environment" provide an important overview of uranium production operations and of their environmental consequences in developing countries, as well as offering insight into future production plans and potential.

(Forthcoming 2005) • ISBN 92-0-112904-1 •
IAEA-TECDOC-1425 • €15.00



Dispersion of Radioactive Material in Air and Water and Consideration of Population Distribution in Site Evaluation for Nuclear Power Plants

Safety Guide

**Safety Standards Series
No. NS-G-3.2**

This Safety Guide deals with consideration of the potential effects of a nuclear power plant on the environment and of the population distribution in the

surrounding area in site evaluation for a nuclear power plant. It supplements Safety Standard No. NS-R-3, Site Evaluation for Nuclear Installations, which supersedes Safety Series No. 50-C-S (Rev. 1), Code on the Safety of Nuclear Power Plants: Siting (1988). The Safety Guide supersedes Safety Series: No. 50-SG-S3, Atmospheric Dispersion in Nuclear Power Plant Siting (1980); No. 50-SG-S4, Site Selection and Evaluation for Nuclear Power Plants with Respect to Population Distribution (1980); No. 50-SG-S-6, Hydrological Dispersion of Radioactive Material in Relation to Nuclear Power Plant Siting (1985); and No. 50-SG-S7, Nuclear Power Plant Siting: Hydrogeological Aspects (1984).

Contents: 1. Introduction; 2. Transport and diffusion of effluents discharged into the atmosphere; 3. Transport and diffusion of effluents discharged into the hydrosphere; 4. Uses of land and water in the region of the site; 5. Population distribution; 6. Consideration of the feasibility of an emergency plan; 7. Quality assurance programme.

English Edition (32 pp; 2002) • ISBN 92-0-110102-3 •
STI/PUB/1122 • €11.50
Russian Edition (41 pp; 2004) • ISBN 92-0-404304-0 •
STI/PUB/1122 • €11.50

Extent of Environmental Contamination by Naturally Occurring Radioactive Material (NORM) and Technological Options for Mitigation

Technical Reports Series No. 419

The purpose of this report is to raise awareness of the residues arising from the processing of various naturally occurring radioactive materials and the possible environmental contamination arising from these. The various processes and their residues are analysed and the technical options for dealing with such contamination are discussed. The industries of interest include those related to fuel production, water use, metal ores and industrial minerals.

(198 pp., 45 figs; 2003) • ISBN 92-0-112503-8 •
STI/DOC/010/419 • €35.00

Forthcoming

Guidebook on Environmental Impact Assessment for In Situ Leach Mining Projects

IAEA TECDOC Series No. 1428

Assessment of the potential environmental impact of an in situ leach (ISL) project is the first step in the permitting and licensing process. An Environmental Impact Assessment (EIA) serves as the basis for preparing an Environmental Impact Statement (EIS), which in turn identifies the potential environmental and socioeconomic impact of a proposed project and outlines measures to mitigate the impact. The EIS review process serves to inform the public about a proposed project as well as providing regulatory agencies with assurance that ISL technology will

comply with environmental standards, and that project sites can be rehabilitated to pre-mining use. This publication provides a step-by-step description of project parameters that must be addressed in conducting an EIA and preparing an EIS. It also includes EIA/EIS case histories for current operations in Australia, the Czech Republic, Kazakhstan and the United States of America. The publication will be useful to companies considering developing ISL projects and to regulatory personnel who are responsible for writing environmental regulations and licensing ISL projects.

(Forthcoming 2005) • ISBN 92-0-113004-X •
IAEA-TECDOC-1428 • €15.00

Modelling the Environmental Transport of Tritium in the Vicinity of Long Term Atmospheric and Sub-Surface Sources

IAEA BIOMASS-3

This document is part of the outcome of the IAEA's BIOMASS research coordination programme and describes the work carried out during a four year period from 1996 to 2000 by the BIOMASS Tritium Working Group (TWG). The objective of this work was to improve models for tritium environmental transport in situations of long-term release of tritium from primary or secondary sources. These situations had not been widely considered before at international level. The TWG developed and analysed six model test exercises and carried out a specifically commissioned field sampling and analysis programme in order to study and understand more fully the behaviour of long-term releases of tritium in the environment. As a result of the work undertaken in the modelling exercises and field sampling programme a number of recommendations are made for modelling tritium behaviour in the environment, data acquisition methods and further work. Appended to this document are summary descriptions of the individual models which participated in the TWG modelling studies, as well as detailed descriptions of each of the modelling scenarios addressed by the Tritium WG. The document is primarily intended for use by experts in environmental modelling worldwide, operators of the nuclear fuel cycle facilities, Regulatory Bodies of the IAEA Member States.

(2003) • ISBN 92-0-102303-0 •
IAEA-BIOMASS-3 • €15.00

Modelling the Transfer of Radionuclides to Fruit

IAEA BIOMASS-5

This document is part of the outcome of the IAEA's BIOMASS research coordination programme and describes the work carried out during a three year period from 1997 to 2000 by the BIOMASS Fruits Working Group (WG). The document presents the main results such as conceptual advances, quantitative data and models on the transfer of radionuclides to fruit and covers the following particular issues:

- a review of experimental, field and modelling information on the transfer of radionuclides to fruit;
- the development of a conceptual model for a fruit tree subject to a deposit from atmosphere;

- description of an electronic database RADFLUX, which represents a substantial collection (34 fruit crops, from temperate, tropical and subtropical climate) of transfer parameters for use in models of soil–plant–animal systems;
- description and results of two model intercomparison studies and a validation study where the models were tested against an independent data set.

The document is primarily intended for use by experts in environmental modelling worldwide, operators of the nuclear fuel cycle facilities, Regulatory Bodies of the IAEA Member States.

(2003) • ISBN 92-0-106503-5 •
IAEA-BIOMASS-5 • €15.00

Protection of the Environment from Ionising Radiation

Proceedings of the Third International Symposium in Darwin, Australia, 22–26 July 2002

C&S Papers Series No. 17

This publication reports on the Third International Symposium on Protection of the Environment from Ionising Radiation, which focused on issues related to the development and application of a system of radiation protection for the environment. Topics covered include ongoing research on the effects, responses and mechanisms of the interactions of ionizing radiation with biota; policy and ethical dimensions of the development of a framework for environmental radiation protection; and the development and use of methods and models for evaluating radiation as a stressor to the environment.

(102 figs; 2003) • ISBN 92-0-103603-5 •
IAEA-CSP-17/P • €15.00



Radiological Conditions in Areas of Kuwait with Residues of Depleted Uranium

Radiological Assessment Reports

An assessment was requested by the Government of Kuwait in relation to the residues of depleted uranium munitions from the 1991 Gulf War that exist on its

territory; for this purpose, the IAEA assembled an international group of experts. This report, prepared by the international group of experts, constitutes the first comprehensive radiological assessment of compliance with international radiation protection criteria and standards for areas with residues of depleted uranium munitions carried out under the auspices of the IAEA. It provides a detailed description of the IAEA's investigation of the radiological conditions in areas of Kuwait with residues of depleted uranium, the results of the radiological assessment, the overall and site specific findings and conclusions of the assessment, and the recommendations of the expert group.

Arabic Edition (88 pp., 12 figs; 2003) • ISBN 92-0-615703-5 •
STI/PUB/1164 • €25.00
English Edition (73 pp., 12 figs; 2003) • ISBN 92-0-106603-1 •
STI/PUB/1164 • €25.00



“Reference Biospheres” for Solid Radioactive Waste Disposal

IAEA BIOMASS-6

Theme 1 of the BIOMASS project was established with the objective of developing the concept of ‘reference biospheres’ into a practical system for application to the assessment of the long term safety of repositories for radioactive waste. The outcome is the BIOMASS methodology developed through the construction of a number of example reference biospheres. The examples illustrate the use of the methodology and are also intended to be useful in their own right by acting as standard (or reference), stylized biospheres.

(2003) • ISBN 92-0-106303-2 •
IAEA-BIOMASS-6 • €15.00



Sediment Distribution Coefficients and Concentration Factors for Biota in the Marine Environment

Technical Reports Series No. 422

In 1985 the International Atomic Energy Agency published Technical Reports Series No. 247, entitled Sediment Kds and Concentration Factors for Radionuclides in the Marine Environment, containing sediment distribution coefficients and concentration factor data for marine biological material, which could be used in models simulating the dispersion of radioactive wastes disposed of in the sea. The report described an approach for calculation of sediment/water distribution coefficients using stable element geochemical data developed by J.M. Bewers, although emphasis was given to the use of field derived data whenever possible. Over the years TRS 247 has proved to be a valuable reference document for radioecologists, marine modellers and other scientists working in the field of assessment of the impact of radionuclides in the marine environment. In 2000 the IAEA initiated the revision of this publication to take account of the many new data that have been gathered. The sediment distribution coefficients and concentration factors provided in the revised publication were calculated using the same approach adopted in TRS 247. These values should, therefore, be used instead of the values published in TRS 247. In addition, the revised publication contains concentration factors for a limited number of elements for marine mammals, which were not included in the first version of the report.

(95 pp; 2004) • ISBN 92-0-114403-2 •
STI/DOC/010/422 • €19.00

Soil Sampling for Environmental Contaminants

IAEA TECDOC Series No. 1415

This report is a suitable guide for analytical and radioanalytical laboratories. The protocols described in the report help

specialists to improve the quality and reliability of their analysis. The report will help Member State laboratories in developing countries to assess environmental contamination of soils and develop strategies for remediation.

(2004) • ISBN 92-0-111504-0 • IAEA-TECDOC-1415 • €15.00

Status of Industrial Scale Radiation Treatment of Wastewater and Its Future

IAEA TECDOC Series No. 1407

Fundamental studies of the radiation process for wastewater treatment, its analogues and differences to other advanced oxidation technologies and of combined processes are presented in the report. Possible fields of application, technical solutions and economic factors concerning engineering and other applications are addressed. Developments concerning accelerator design engineering and construction as well as other features of radiation sources are reviewed in the papers. Further discussions include the design of under-beam systems. Such progress and developments are critical for further applications. A reduction in cost and improvement of technical reliability are expected, especially high power accelerators are needed for environmental applications. The papers point out that such applications should be carefully revised in accordance with the existing regulations and state of the art knowledge. The results of the discussions summarized in the TECDOC may serve as the basis for the preparation of guidelines and feasibility studies for full-scale process implementation. Public awareness and technology acceptance are additional factors to be considered for further dissemination; therefore this publication is a valuable source providing necessary information for engineers, environmentalists and decision makers.

(2004) • ISBN 92-0-110104-X •
IAEA-TECDOC-1407 • €15.00

Testing of Environmental Transfer Models Using Chernobyl Fallout From the Iput River Catchment Area, Bryansk Region, Russian Federation

IAEA BIOMASS-4

This publication is part of the outcome of the IAEA's BIOMASS research coordination programme and it describes the work carried out during a four year period from 1996 to 2000 by the BIOMASS Dose Reconstruction Working Group. The objective of this work was to improve models for radiocaesium environmental transport through model testing and intercomparison. The input scenario modelling exercise described in this report provided an opportunity for model testing using post-Chernobyl measurement data. This scenario provided a challenging test in including: a variety of environments, the impact of countermeasures and a follow-up period of 10 years following the accident. Eight participants took part in this exercise and their experience, approaches and models are described. The information and the scenario itself are a valuable resource for other modellers to develop their methodologies further. This publication is primarily intended for use by experts in environmental modelling worldwide, operators

of nuclear fuel cycle facilities and regulatory bodies of IAEA Member States.

(2003) • ISBN 92-0-104003-2 •
IAEA-BIOMASS-4 • €15.00

Testing of Environmental Transfer Models Using Data from the Atmospheric Release of Iodine-131 from the Hanford site, USA, in 1963

IAEA BIOMASS-2

This publication is part of the outcome of the IAEA's BIOMASS research coordination programme and it describes the work carried out during a four year period from 1996 to 2000 by the BIOMASS Dose Reconstruction Working Group. The objective of this work was to improve models for radioiodine environmental transport through model testing and intercomparison. The Hanford scenario modelling exercise described in this report provided an opportunity for model testing using measurement data from an acute release of I-131 to the environment from the Hanford plant in September 1963. This dose reconstruction exercise allowed model testing of atmospheric dispersion, environmental transport models and dose calculations. Six participants took part in this exercise and their experience, approaches and models are described. The information and the scenario itself are a valuable resource for other modellers to develop their methodologies further. This publication is primarily intended for use by experts in environmental modelling worldwide, operators of nuclear fuel cycle facilities, and regulatory bodies of IAEA Member States.

(2003) • ISBN 92-0-102603-X •
IAEA-BIOMASS-2 • €15.00

Testing of Environmental Transfer Models Using Data from the Remediation of a Radium Extraction Site

IAEA BIOMASS-7

This publication has been produced by the Remediation Working Group of the BIOMASS project. The main aim of this group was to test the accuracy of predictions of environmental assessment models that form part of the assessment of the radiological impact of remediation decisions. Two scenarios were constructed and applied based on the contamination around the site of a former radium extraction plant in Olen, Belgium, which arose due to the discharge of liquid effluents into

a local brook — waste disposal practices and the use of waste material as a road surfacing material. This group considered the situation in an area of approximately 100 ha, contaminated as a result of the frequent flooding of a local river and the dredging of bed sediment out of the river onto the river banks. The scenarios were designed to allow modellers to consider the impact of possible future remediation actions, based on input data for a real site. Differences between model predictions were mainly due to differences in user interpretation of the scenario description. The main sources of uncertainty were the radium distribution in the root zone before deep ploughing and the effectiveness of deep ploughing. The report is intended for use by experts in environmental remediation assessment.

(2004) • ISBN 92-0-109103-6 •
IAEA-BIOMASS-7 • €15.00

Forthcoming

Worldwide Marine Radioactivity Studies (WOMARS): Radionuclide Level in Oceans and Seas

IAEA TECDOC Series No. 1429

This publication summarizes the results of the Coordinated Research Project carried out by the IAEA's Marine Environment Laboratory in Monaco. The obtained results confirm that the dominant source of anthropogenic radionuclides in the marine environment is global fallout; however, important contributions have also been due to authorized releases of radionuclides to the marine environment from the Sellafield and Cap de la Hague reprocessing plants, as well as from the Chernobyl accident. Time trends in radionuclide concentrations in surface water were studied and radionuclide mean residence times in the world ocean were estimated. Similar mean residence times were obtained for ^{90}Sr and ^{137}Cs , 28 ± 3 years, and 13 ± 1 year for $^{239,240}\text{Pu}$. The results provide the most complete data set available to Member States on levels of anthropogenic radionuclides in the marine environment. They are used as the international reference source on the average levels of anthropogenic radionuclides in the marine environment so that any further contributions from nuclear reprocessing plants, radioactive waste disposal sites, nuclear bomb test sites and possible nuclear accidents can be identified.

(Forthcoming 2005) • ISBN 92-0-114904-2 •
IAEA-TECDOC-1429 • €15.00

Physical Protection of Radioactive Material



Advances in Destructive and Non-Destructive Analysis for Environmental Monitoring and Nuclear Forensics

Proceedings of an International Conference in Karlsruhe, Germany, 21–23 October 2002

Proceedings Series

The illicit trafficking of nuclear material has been an issue of concern since the first seizures in the early 1990s, and has gained increased attention in the context of the recent discussions on the possibilities of nuclear terrorism. The aim of this conference was to promote the further development of nuclear forensic methods and international cooperation among laboratories. Another aim was to facilitate access to such capabilities by national law enforcement authorities in investigating and prosecuting nuclear crimes, to enhance cooperation, and to bring nuclear forensic methodology to a broader audience. These proceedings include the keynote addresses, invited papers, panel discussions, session summaries and an executive summary.

(419 pp., 114 figs; 2003) • ISBN 92-0-110203-8 • STI/PUB/1169 • €60.00

Detection of Radioactive Materials at Borders

IAEA TECDOC Series No. 1312

The purpose of this publication is to provide guidance for Member States for use by customs, police or other law enforcement bodies on the radiation monitoring of vehicles, people and commodities at border crossing facilities as a countermeasure to illicit trafficking and also to find inadvertent movement of radioactive materials. Such monitoring may be one component of efforts towards finding radioactive materials that have been lost from control and which may enter a Member State.

Arabic Edition (2004) • ISBN 92-0-606404-5 • IAEA-TECDOC-1312 • €15.00
English Edition (2002) • ISBN 92-0-116102-6 • IAEA-TECDOC-1312 • €15.00
French Edition (2003) • ISBN 92-0-207903-X • IAEA-TECDOC-1312 • €15.00
Russian Edition (2003) • ISBN 92-0-407603-8 • IAEA-TECDOC-1312 • €15.00
Spanish Edition (2004) • ISBN 92-0-306304-8 • IAEA-TECDOC-1312 • €15.00

Prevention of the Inadvertent Movement and Illicit Trafficking of Radioactive Materials

IAEA TECDOC Series No. 1311

This publication will primarily be of interest to customs, border police and other law enforcement bodies. It outlines the typical regulatory framework so that customs, police and other law enforcement staff are aware of the measures being taken to prevent loss of control. It also deals with the roles of customs, border police and other law enforcement bodies in the

prevention of the inadvertent movement and illicit trafficking of radioactive materials.

Arabic Edition (2004) • ISBN 92-0-606104-6 • IAEA-TECDOC-1311 • €15.00
English Edition (2002) • ISBN 92-0-116002-X • IAEA-TECDOC-1311 • €15.00
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Russian Edition (2003) • ISBN 92-0-407503-1 • IAEA-TECDOC-1311 • €15.00
Spanish Edition (2004) • ISBN 92-0-306204-1 • IAEA-TECDOC-1311 • €15.00

Response to Events Involving the Inadvertent Movement or Illicit Trafficking of Radioactive Materials

IAEA TECDOC Series No. 1313

The prime objective of this TECDOC is to provide Member States with practical information for use by emergency response and law enforcement personnel involved in dealing with incidents of inadvertent movement or illicit trafficking of radioactive materials. The purpose of the response is to regain control of the relevant radioactive materials so that the risk of harm to people and the environment is mitigated.

Arabic Edition (forthcoming 2005) • ISBN 92-0-606604-8 • IAEA-TECDOC-1313 • €15.00
English Edition (2002) • ISBN 92-0-116202-2 • IAEA-TECDOC-1313 • €15.00
French Edition (2003) • ISBN 92-0-207003-2 • IAEA-TECDOC-1313 • €15.00
Russian Edition (2003) • ISBN 92-0-407103-6 • IAEA-TECDOC-1313 • €15.00
Spanish Edition (2004) • ISBN 92-0-306504-0 • IAEA-TECDOC-1313 • €15.00



Security of Radioactive Sources *Proceedings of an International Conference in Vienna, Austria, 10–13 March 2003*

Proceedings Series

Accidents involving radioactive sources and reports of illicit trafficking in radioactive materials have raised awareness of the safety and security risks created by sources that are outside effective control, and the attacks of 11 September 2001 have triggered international concern about the potential malevolent use of radioactive sources by terrorist groups. The International Conference on Security of Radioactive Sources was organized with the aims of promoting information exchange on, and raising awareness of, key issues relating to the security of high risk radioactive sources, and of fostering a better understanding of the measures necessary to improve the security of such sources and to enhance preparedness for radiological emergencies. These proceedings contain the

addresses and papers presented at the conference, as well as records of the discussions and the conference findings.

(617 pp., 33 figs; 2003) • ISBN 92-0-107403-4 •
STI/PUB/1165 • €120.00

Strengthening Control Over Radioactive Sources in Authorized Use and Regaining Control Over Orphan Sources: National Strategies

IAEA TECDOC Series No. 1388

The control of radioactive sources is a high visibility and high priority topic in contemporary society. Fatalities from orphan

radioactive sources and the possible use of radioactive sources in radiological dispersal devices make it more important than ever that governments know about and have good control over radioactive sources within their territories, especially Category 1, 2 and 3 sources. This TECDOC provides the necessary background and a systematic methodology for governments to evaluate how well they are controlling radioactive sources. Part I of the report details the applications of radioactive sources and Part II describes the process for gathering information, performing an evaluation and then developing a prioritized national strategic action plan. Many examples of events involving sources are given as illustrations of the points discussed.

(2004) • ISBN 92-0-100304-8 •
IAEA-TECDOC-1388 • €15.00

Publications 2001–2002

SeriesText	Title	Lang.	ISBN	Symbol	Published	Price Euro
Atomic and Plasma–Material Interaction Data for Fusion 7/B	Atomic and Plasma-Material Interaction Data for Fusion, Volume 7 (Part B)	E		STI/PUB/023/APID/07/B	2001	€25.50
Atomic and Plasma–Material Interaction Data for Fusion 9	Atomic and Plasma-Material Interaction Data for Fusion, Volume 9	E		STI/PUB/023/APID/09	2001	€29.00
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C&S Papers CD Series No. 8	Fusion Energy 2000 18th Conference Proceedings, Sorrento, Italy, 4–10 October 2000 and 17th Conference Proceedings, Yokohama, Japan, 19–24 October 1998	E		IAEA-CSP-8/CD	2001	€15.00
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ETDE/INIS Joint Reference Series No. 3	Manual for Subject Analysis	E	92-0-115102-0	IAEA-ETDE/INIS-3	2002	€10.00
ETDE/INIS Joint Reference Series No. 2	Subject Categories and Scope Descriptions	E	92-0-112902-5	IAEA-ETDE/INIS-2	2002	€15.00
IAEA Safety Standards Applications - TransSAS-3	Appraisal for the United Kingdom of the Safety of the Transport of Radioactive Material	E	92-0-116602-8	STI/PUB/1143	2002	€15.00
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IAEA TECDOC Series No. 1194 (Rev. 1)	Arrangements for Transition from the 1985 Edition (as amended 1990) to the 1996 Edition of the IAEA Transport Regulations	E		IAEA-TECDOC-1194 (Rev. 1)	2001	€15.00
IAEA TECDOC Series No. 1194	Arrangements for Transition from the 1985 Edition (as Amended 1990) to the 1996 Edition of the IAEA Transport Regulations	E		IAEA-TECDOC-1194	2001	€15.00
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IAEA TECDOC Series No. 1217	Assessment by Peer Review of the Effectiveness of a Regulatory Programme for Radiation Safety Interim Report for Comment	E		IAEA-TECDOC-1217	2001	€15.00
IAEA TECDOC Series No. 1272	Assessment of Soil Phosphorus Status and Management of Phosphatic Fertilisers to Optimise Crop Production	E E		IAEA-TECDOC-1272 IAEA-TECDOC-1272/CD	2002 2002	€15.00 €15.00
IAEA TECDOC Series No. 1258	Assessment of Uranium Deposit Types and Resources — A Worldwide Perspective	E		IAEA-TECDOC-1258	2001	€15.00
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IAEA TECDOC Series No. 1289	Comparative Assessment of Thermophysical and Thermohydraulic Characteristics of Lead, Lead-Bismuth and Sodium Coolants for Fast Reactors	E	92-0-113602-1	IAEA-TECDOC-1289	2002	€15.00
IAEA TECDOC Series No. 1304	Comparative Studies of Energy Supply Options in Poland for 1997–2020	E	92-0-112602-6	IAEA-TECDOC-1304	2002	€15.00
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IAEA TECDOC Series No. 1309	Cost Drivers for the Assessment of Nuclear Power Plant Life Extension	E	92-0-114402-4	IAEA-TECDOC-1309	2002	€15.00
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IAEA TECDOC Series No. 1294	Development and Field Evaluation of Animal Feed Supplementation Packages	E		IAEA-TECDOC-1294	2002	€15.00
IAEA TECDOC Series No. 1307	Development of Kits for Radioimmunoassay Assays for Tumour Markers	E	92-0-113502-5	IAEA-TECDOC-1307	2002	€15.00

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IAEA TECDOC Series No. 1237	Directory of National Competent Authorities' Approval Certificates for Package Design, Special Form Material and Shipment of Radioactive Material 2001 Edition	E		IAEA-TECDOC-1237	2001	€15.00
IAEA TECDOC Series No. 1302	Directory of National Competent Authorities' Approval Certificates for Package Design, Special Form Material and Shipment of Radioactive Material 2002 Edition (superseded by IAEA-TECDOC-1377)	E	92-0-112402-3	IAEA-TECDOC-1302	2002	€15.00
IAEA TECDOC Series No. 1265	Economic Evaluation of Three Alternative Methods for Control of the Mediterranean Fruit Fly (Diptera: Tephritidae) in Israel, Jordan, Lebanon, Syrian Arab Republic and Territories under the Jurisdiction of the Palestinian Authority	E		IAEA-TECDOC-1265	2001	€15.00
IAEA TECDOC Series No. 1316	Effects of Radiation and Environmental Factors on the Durability of Materials in Spent Fuel Storage and Disposal	E	92-0-113802-4	IAEA-TECDOC-1316	2002	€15.00
IAEA TECDOC Series No. 1306	Environmental Aspects Based on Operational Performance of Nuclear Fuel Fabrication Facilities	E	92-0-113102-X	IAEA-TECDOC-1306	2002	€15.00
IAEA TECDOC Series No. 1270	Ethical Considerations in Protecting the Environment from the Effects of Ionizing Radiation A Report for Discussion	E		IAEA-TECDOC-1270	2002	€15.00
IAEA TECDOC Series No. 1217/S	Evaluación Mediante Examen por Pares de la Efectividad de un Programa Regulador para la Seguridad Radiológica	S		IAEA-TECDOC-1217/S	2002	€15.00
IAEA TECDOC Series No. 1217/F	Evaluation au moyen d'un examen par des pairs de l'efficacité d'un programme réglementaire de sûreté radiologique Rapport intérimaire pour observations	F		IAEA-TECDOC-1217/F	2001	€15.00
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IAEA TECDOC Series No. 1238	Gas Turbine Power Conversion Systems for Modular HTGRs	E		IAEA-TECDOC-1238	2001	€15.00
IAEA TECDOC Series No. 1092	Generic Procedures for Monitoring in a Nuclear or Radiological Emergency	R		IAEA-TECDOC-1092/R	2002	€15.00
IAEA TECDOC Series No. 967 (Rev. 1)/A, C, F, R, S	Guidance and Considerations for the Implementation of INFCIRC/225/Rev. 4, The Physical Protection of Nuclear Material and Nuclear Facilities	A C F R S		IAEA-TECDOC-967 (Rev. 1)	2002 2002 2002 2002 2002	€15.00 €15.00 €15.00 €15.00 €15.00
IAEA TECDOC Series No. 1276	Handbook on the Physical Protection of Nuclear Materials and Facilities Restricted	E		IAEA-TECDOC-1276	2002	€15.00

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IAEA TECDOC Series No. 1327	Harmonization of the Licensing Process for Digital Instrumentation and Control Systems in Nuclear Power Plants	E	92-0-119302-5	IAEA-TECDOC-1327	2002	€15.00
IAEA TECDOC Series No. 1163	Heat Transport and Afterheat Removal for Gas Cooled Reactors under Accident Conditions	E		IAEA-TECDOC-1163	2001	€15.00
IAEA TECDOC Series No. 1303	High-Temperature On-Line Monitoring of Water Chemistry and Corrosion Control in Water Cooled Power Reactors	E	92-0-112702-2	IAEA-TECDOC-1303	2002	€15.00
IAEA TECDOC Series No. 1248	Impact of Long Term Pesticide Usage on Soil Properties Using Radiotracer Techniques	E		IAEA-TECDOC-1248	2001	€15.00
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IAEA TECDOC Series No. 1290	Improving Economics and Safety of Water Cooled Reactors: Proven Means and New Approaches	E		IAEA-TECDOC-1290	2002	€15.00
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IAEA TECDOC Series No. 1284	Information Technology Impact on Nuclear Power Plant Documentation	E		IAEA-TECDOC-1284	2002	€15.00
IAEA TECDOC Series No. 1323	Institutional Framework for Long Term Management of High Level Waste and/or Spent Nuclear Fuel	E	92-0-118202-3	IAEA-TECDOC-1323	2002	€15.00
IAEA TECDOC Series No. 1242	Inventory of Accidents and Losses at Sea Involving Radioactive Material	E	92-0-100201-7	IAEA-TECDOC-1242	2001	€15.00
IAEA TECDOC Series No. 1317	Irradiated Sewage Sludge for Application to Cropland	E	92-0-117102-1	IAEA-TECDOC-1317	2002	€15.00
		E	92-0-137202-7	IAEA-TECDOC-1317/CD	2002	€15.00
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IAEA TECDOC Series No. 1301	Management of Spent High Activity Radioactive Sources (SHARS)	E	92-0-114502-0	IAEA-TECDOC-1301	2002	€15.00
IAEA TECDOC Series No. 1226	Managing Change in Nuclear Utilities	E		IAEA-TECDOC-1226	2001	€15.00
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IAEA TECDOC Series No. 1259	Nuclear Power Programme Planning: An Integrated Approach	E		IAEA-TECDOC-1259	2001	€15.00
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IAEA TECDOC Series No. 1113/F	Plans d'évaluation de la sûreté pour l'autorisation et l'inspection des sources de rayonnements	F		IAEA-TECDOC-1113/F	2001	€15.00

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IAEA TECDOC Series No. 1297	Predictive Assays and Their Role in Selection of Radiation as the Therapeutic Modality	E		IAEA-TECDOC-1297	2002	€15.00
IAEA TECDOC Series No. 1240	Present and Future Environmental Impact of the Chernobyl Accident	E		IAEA-TECDOC-1240	2001	€15.00
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IAEA TECDOC Series No. 1260	Procedures and Techniques for Closure of Near Surface Disposal Facilities for Radioactive Waste	E		IAEA-TECDOC-1260	2001	€15.00
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IAEA TECDOC Series No. 1253	Radioactively Labelled DNA Probes for Crop Improvement	E		IAEA-TECDOC-1253	2001	€15.00
IAEA TECDOC Series No. 1220	Radioimmunoassay and Related Techniques to Improve Artificial Insemination Programmes for Cattle Reared under Tropical and Sub-Tropical Conditions	E		IAEA-TECDOC-1220	2001	€15.00
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IAEA TECDOC Series No. 1285	Reference Neutron Activation Library	E		IAEA-TECDOC-1285	2002	€15.00
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IAEA TECDOC Series No. 1264	Reliability Assurance Programme Guidebook for Advanced Light Water Reactors	E		IAEA-TECDOC-1264	2002	€15.00
IAEA TECDOC Series No. 1313	Response to Events Involving the Inadvertent Movement or Illicit Trafficking of Radioactive Materials	E	92-0-116202-2	IAEA-TECDOC-1313	2002	€15.00
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IAEA TECDOC Series No. 1235	Safety Aspects of Nuclear Plants Coupled with Seawater Desalination Units	E		IAEA-TECDOC-1235	2001	€15.00

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IAEA TECDOC Series No. 1329	Safety Culture in Nuclear Installations: Guidance for Use in the Enhancement of Safety Culture	E	92-0-119102-2	IAEA-TECDOC-1329	2002	€15.00
IAEA TECDOC Series No. 1221	Safety of and Regulations for Nuclear Fuel Cycle Facilities	E		IAEA-TECDOC-1221	2001	€15.00
IAEA TECDOC Series No. 1210	Safety Related Design and Economic Aspects of HTGRs	E		IAEA-TECDOC-1210	2001	€15.00
IAEA TECDOC Series No. 1250	Seismic Design Considerations of Nuclear Fuel Cycle Facilities	E		IAEA-TECDOC-1250	2001	€15.00
IAEA TECDOC Series No. 1202	Seismic Evaluation of Existing Nuclear Facilities	E		IAEA-TECDOC-1202	2001	€15.00
IAEA TECDOC Series No. 1321	Self-Assessment of Safety Culture in Nuclear Installations Highlights and Good Practices	E	92-0-117702-X	IAEA-TECDOC-1321	2002	€15.00
IAEA TECDOC Series No. 1195	Sesame Improvement by Induced Mutations	E		IAEA-TECDOC-1195	2001	€15.00
IAEA TECDOC Series No. 1231	Severity, Probability and Risk of Accidents during Maritime Transport of Radioactive Material	E	92-0-101801-0	IAEA-TECDOC-1231	2001	€15.00
IAEA TECDOC Series No. 1308	Socio-Economic and Other Non-Radiological Impacts of the Near Surface Disposal of Radioactive Waste	E	92-0-115302-3	IAEA-TECDOC-1308	2002	€15.00
IAEA TECDOC Series No. 1328	Solutions for Cost Effective Assessment of Software Based Instrumentation and Control Systems in Nuclear Power Plants	E	92-0-119902-3	IAEA-TECDOC-1328	2002	€15.00
IAEA TECDOC Series No. 1275	Specialised Software Utilities for Gamma Ray Spectrometry	E		IAEA-TECDOC-1275	2002	€15.00
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IAEA TECDOC CD Series No. 1268+1269	Stable Isotope Measurement Techniques for Atmospheric Greenhouse Gases (IAEA-TECDOC-1268) + Isotope-aided Studies of Atmospheric Carbon Dioxide and Other Greenhouse Gases - Phase II (IAEA-TECDOC-1269)	E		IAEA-TECDOC-1268+1269/CD	2002	€15.00
IAEA TECDOC Series No. 1193	Staffing Requirements for Future Small and Medium Reactors (SMRs) Based on Operating Experience and Projections	E		IAEA-TECDOC-1193	2001	€15.00
IAEA TECDOC Series No. 1201	Standardized Methods to Verify Absorbed Dose in Irradiated Food for Insect Control	E		IAEA-TECDOC-1201	2001	€15.00
IAEA TECDOC Series No. 1212	Strategic Planning for Research Reactors	E		IAEA-TECDOC-1212	2001	€15.00
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IAEA TECDOC Series No. 1299	Technical and Economic Limits to Fuel Burnup Extension	E	92-0-112802-9	IAEA-TECDOC-1299	2002	€15.00
IAEA TECDOC Series No. 1256	Technical Considerations in the Design of Near Surface Disposal Facilities for Radioactive Waste	E		IAEA-TECDOC-1256	2001	€15.00
IAEA TECDOC Series No. 1271	Technologically Enhanced Natural Radiation (TENR II) Proceedings of an International Symposium held in Rio de Janeiro, Brazil, 12–17 September 1999	E		IAEA-TECDOC-1271	2002	€15.00

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IAEA TECDOC Series No. 1296	Technologies for the Treatment of Effluents from Uranium Mines, Mills and Tailings	E		IAEA-TECDOC-1296	2002	€15.00
IAEA TECDOC Series No. 1298	The Application of Isotope Techniques to the Assessment of Aquifer Systems in Major Urban Areas	E		IAEA-TECDOC-1298	2002	€15.00
IAEA TECDOC Series No. 1234	The Applications of Research Reactors	E		IAEA-TECDOC-1234	2001	€15.00
IAEA TECDOC Series No. 1224	The Role of Radiotherapy in the Management of Cancer Patients Infected by Human Immunodeficiency Virus (HIV)	E		IAEA-TECDOC-1224	2001	€15.00
IAEA TECDOC Series No. 1243	The Use of Scientific and Technical Results from Underground Research Laboratory Investigations for the Geological Disposal of Radioactive Waste	E		IAEA-TECDOC-1243	2001	€15.00
IAEA TECDOC Series No. 1228	Therapeutic Applications of Radiopharmaceuticals	E		IAEA-TECDOC-1228	2001	€15.00
IAEA TECDOC Series No. 1203	Thermohydraulic Relationships for Advanced Water Cooled Reactors	E		IAEA-TECDOC-1203	2001	€15.00
IAEA TECDOC Series No. 1319	Thorium Fuel Utilization: Options and Trends	E	92-0-114202-1	IAEA-TECDOC-1319	2002	€15.00
IAEA TECDOC Series No. 628/ Rev. 1	Training Guidelines in Non-destructive Testing Techniques 2002 Edition	E		IAEA-TECDOC-628/Rev. 1	2002	€15.00
IAEA TECDOC Series No. 1254	Training the Staff of the Regulatory Body for Nuclear Facilities: A Competency Framework	E R	92-0-418002-1	IAEA-TECDOC-1254	2001 2002	€15.00 €15.00
IAEA TECDOC Series No. 1331	Use of Electron Paramagnetic Resonance Dosimetry with Tooth Enamel for Retrospective Dose Assessment	E	92-0-119402-1	IAEA-TECDOC-1331	2002	€15.00
IAEA TECDOC Series No. 1225	Use of Irradiation for Chemical and Microbial Decontamination of Water, Wastewater and Sludge	E		IAEA-TECDOC-1225	2001	€15.00
IAEA TECDOC Series No. 1206	Use of Isotope Techniques in Lake Dynamics Investigations	E		IAEA-TECDOC-1206	2001	€15.00
IAEA TECDOC Series No. 1215	Use of Research Reactors for Neutron Activation Analysis	E		IAEA-TECDOC-1215	2001	€15.00
IAEA TECDOC Series No. 1318	Validation of Fast Reactor Thermomechanical and Thermohydraulic Codes	E	92-0-118302-X	IAEA-TECDOC-1318	2002	€15.00
IAEA TECDOC Series No. 1288	Verification of Analysis Methods for Predicting the Behaviour of Seismically Isolated Nuclear Structures	E		IAEA-TECDOC-1288	2002	€15.00
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IAEA TECDOC Series No. 1266	Water Balance and Fertigation for Crop Improvement in West Asia	E		IAEA-TECDOC-1266	2002	€15.00
INIS Reference Series No. 11	INIS: Authority List for Journal Titles	E	92-0-110402-2	IAEA-INIS-11 (Rev. 28)	2002	€54.00
INSAG Series No. 15	Key Practical Issues in Strengthening Safety Culture (including booklet)	E	92-0-112202-0	STI/PUB/1137	2002	€12.50
International Nuclear Verification Series No. 3	IAEA Safeguards Glossary 2001 Edition	E	92-0-111902-X	IAEA/NVS/3	2002	€24.00

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Operating Experience 2000	Operating Experience with Nuclear Power Stations in Member States in 2000	E	92-0-102001-5	STI/PUB/1121	2001	
Operating Experience	Operating Experience with Nuclear Power Stations in Member States in 2001	E	92-0-118502-2	STI/PUB/1147	2002	
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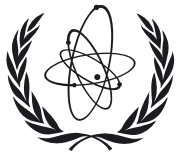
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