

SAVE THE DATE



iC&ND

International Conference on
Nuclear Decommissioning

13TH
EDITION

18. - 21. NOVEMBER 2024

VERANSTALTER **AiNT**



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IMPRINT



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DR.-ING. ANDREAS HAVENITH

† 14.02.2023

Wir trauern um unseren sehr geschätzten
Geschäftsführer, Gesellschafter und Teamleader

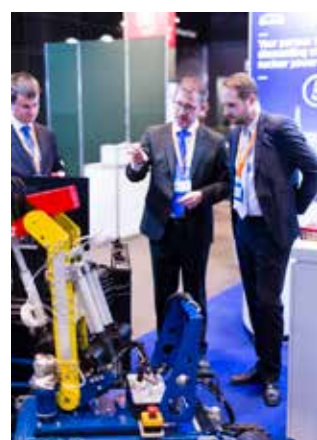
Dr.-Ing. Andreas Havenith

Völlig unerwartet und für uns alle unfassbar, verstarb Andreas während
seines Urlaubes am 14.02.2023 im frühen Alter von nur 40 Jahren.

We mourn the loss of our much appreciated
managing director, shareholder and teamleader

Dr.-Ing. Andreas Havenith

Completely unexpected and for us all inconceivable, Andreas passed away
during his vacation on February, 14th, 2023 at the early age of only 40 years.



HINTERGRUND

Die Stilllegung kerntechnischer Anlagen stellen alle Beteiligten vor hohe planerische und genehmigungstechnische Anforderungen. In der laufenden Dekade werden sowohl in Europa als auch weltweit zahlreiche Kernkraftwerke aufgrund ihrer Laufzeit und politischen Entscheidungen außer Betrieb genommen. Dieser Umstand erfordert optimierte bzw. zwischen allen Beteiligten abgestimmte Rückbaustrategien. Die Fachveranstaltung fokussiert den rechtlichen Rahmen in Deutschland, vergleicht Stilllegungsstrategien und nimmt die verschiedenen Teilaufgaben des Rückbaus in den Blick. Neben den unterschiedlichen Genehmigungs- und Finanzierungsstrategien spielt das Personalmanagement beim Übergang vom Kernkraftwerksbetrieb zum Rückbauprojekt eine wichtige Rolle. Ebenfalls wird die Zwischenlagerung und Entsorgung radioaktiver Abfälle thematisiert, die für den Rückbau eine wesentliche Randbedingung darstellt.

ZIELGRUPPE

Die Konferenz richtet sich an Betreiber von kerntechnischen Anlagen, die die Verantwortung für die Projektsteuerung und die Reststoffentsorgung von Rückbauprojekten haben. Weitere Zielgruppen sind Unternehmen, die mit der Planung und Durchführung von Rückbauprojekten beauftragt sind. Es werden Behörden und Sachverständigenorganisationen adressiert, die in Genehmigungs- sowie Aufsichtsverfahren und die Begutachtungen von Rückbauprojekten eingebunden sind. Ausgehend von Fachvorträgen diskutieren die Teilnehmer/-innen die Herausforderungen des Rückbaus sowie Planungsvarianten für individuelle Rückbaufgaben. Alle Beiträge werden simultan übersetzt (Deutsch/Englisch).

BACKGROUND

The decommissioning of nuclear power plants, particularly power reactors, present high demands regarding planning and authorization to all parties involved. In the ongoing decade several nuclear power plants will be shut down due to their operating life and political decisions, not only in Europe, but also worldwide. As a result, optimized decommissioning strategies will need to be well-coordinated among all participants.

The ICOND focuses on the relevant legal parameters in Germany and compares decommissioning strategies worldwide. This includes roles of authorization, financial planning, and change management in the transition from nuclear power plant to decommissioned project. Furthermore the different options for interim storage and disposal of radioactive waste are discussed.

AUDIENCE

ICOND addresses operators of nuclear plants and companies who are working on the planning, implementation and supervision of decommissioning projects; authorities and technical experts whose focus includes the approval and supervisions procedure of decommissioning projects; and research institutions which are responsible for the dismantling of research reactors and the storage and/or disposal of radioactive hazardous waste. ICOND will enable participants to proficiently discuss the challenges of the decommissioning of nuclear plants in a practical way, and to define optimal planning variants for decommissioning implementation. Simultaneous translation (German/English) will be available.



RÜCKBLICK

IC&ND 2022

REVIEW

AUSSTELLER

IC&ND 2023

EXHIBITORS

Im November 2022 fand die 11. ICOND erneut im Eurogress Aachen statt. Mit mehr als 460 internationalen Teilnehmenden und 51 Unternehmen, die ihre Produkte und Dienstleistungen in der Ausstellung präsentierten, war es die größte ICOND bisher. Der Pre-Conference Workshop widmete sich insbesondere innovativen Methoden und Technologien der radiologischen Abfall- und Anlagencharakterisierung sowie technischer Lösungen beim Materialtransport im Rückbau. Das modernste Beschichtungsverfahren, das Kaltgasspritzten, wurde ebenfalls präsentiert. Durch dieses Verfahren können korrosionsbeständige Beschichtungen mit hoher Enddichte, hoher thermischer und elektrischer Leitfähigkeit sowie Homogenität aufgebracht werden.

Nachdem Herr Dr. Cord-Heinrich Lefhalm, Leiter der Rückbausteuerung der RWE Nuclear GmbH, zum Thema „Innovationen für einen effizienten Rückbau“ die ICOND eröffnet und den Rückbaufortschritt in der RWE-Flotte skizziert hatte, erläuterte er an konkreten Projekten Optimierungspotenziale zur Effizienzsteigerung. Die besonderen Herausforderungen diese Optimierungen im industriellen kerntechnischen Umfeld zu implementieren, wurden durch ihn analysiert und aus dem Auditorium wurden hierzu zahlreiche Fragen gestellt. Peter Berben, Leiter des Bereichs für Stilllegung und Management radioaktiver Abfälle bei ENGIE, gab ein Statusupdate des belgischen Rückbauprogramms. Vorträge im Themenblock „Strategien und Marktentwicklungen“ stellten VR unterstützte Rückbauprojekte sowie ganzheitliche, KI-basierte Projektplanungstools vor, die Potenziale zur Effizienzsteigerung von Rückbauprojekten ermitteln. Anschließend wurden laufende Projekte und hieraus gewonnene Erfahrungen vorgestellt.

In November 2022 the 11th ICOND again took place at the Eurogress in Aachen. More than 460 participants and 51 companies presented their products and services in the accompanying exhibition. The biggest ICOND so far. The pre-conference workshop was dedicated to innovative methods and technologies of radioactive waste and plant characterization, as well as material transport during dismantling. The most modern coating process, cold gas spraying, was also presented. This coating process allows corrosion and wear resistant coatings with high final density, high thermal and electrical conductivity and homogeneity.

The keynote was given by Dr. Cord-Heinrich Lefhalm, Head of Decommissioning Management at RWE Nuclear GmbH with his talk about “Innovations for efficient dismantling “. After he had outlined the decommissioning progress in the RWE fleet, he explained the optimization potential for increasing efficiency on concrete projects. The particular challenges of implementing these optimizations in the industrial nuclear environment were analysed by him and numerous questions were asked from the audience. Peter Berben, Head of ENGIE’s Decision for Decommissioning and Management of Radioactive Waste, gave a status update on the Belgian decommissioning program. Presentations in the thematic block “Strategies and Market Developments” presented VR-supported decommissioning projects, as well as holistic AI-based project planning tools that enable efficiency improvements in decommissioning projects. Subsequently, ongoing projects and lessons learned were presented.



iCOND
ICOND PROGRAM



SPEAKER REFERENCE WALL

MONDAY - NOV. 13TH, 2023

PRE-CONFERENCE WORKSHOP

(Presentations are held in English)

11:30 REGISTRATION

12:00 QUICK LUNCH

13:00 Welcome

Prof. Dr. Bruno Thomaske – AiNT GmbH – DEU

DECOMMISSIONING SERVICES & PRODUCTS

13:15 Use Cases of a Non-Destructive Measurement System to Comply with Material Waste Acceptance Criteria for Final Disposal

Dr. Laurent Coquard – Framatome GmbH – DEU

13:40 Investigation of the Effects of Mass and Self-Absorption on Measurements of Copper Parts using Clearance Monitors at PSI

Federico Alejandro Geser – Paul Scherrer Institute – CHE

14:05 Radiation Instrumentation and Measurement Technologies for High Radiation Fields

Dr. Marina Sokic-Kostic – NUKEM Technologies Engineering Services – DEU

14:30 Development of Heavy Water Research Reactor Decommissioning Engineering Technology Supporting System

Zhang Yu – China Institute of Atomic Energy – CHN


14:55 COFFEE BREAK

15:30 Radioactive Waste Management of FiR1 Research Reactor Decommissioning

Matti Kaisanlahti – Fortum Power and Heat Oy – FIN

15:55 WaveBlast - Automated Decontamination System for Complex Geometry Metal and Other Non-porous Solid Waste

Brian Gihm – Hatch Ltd. – CAN



Beteiligen Sie die Mitarbeiter

16:20 In-situ Process Monitoring of Contact Arc Metal Grinding (CAMG) for Underwater Use in Nuclear Decommissioning

Christian Mills – Leibniz Universität Hannover – DEU

16:45 Decommissioning of the BR3 Biological Shield Using the dry Diamond Wire Cutting

Baart Geerkens – Interboring
Guido Mulier – SCKCEN – BEL

17:10 Responding to the Increased Demand for Metals Treatment Capacity from Decommissioning Projects

Arne Larsson – Cyclife Sweden AB

14:05 Disposal of high-dose rate Waste as a Fleet Project at PreussenElektra GmbH
Entsorgung von Hochdosisleistungsabfällen als Flottenprojekt bei der PreussenElektra GmbH

Georg Weiß – PreussenElektra GmbH – DEU

14:30 Konrad Repository – Construction and Retrieval Scheduling
Endlager Konrad – Errichtung und Abrufvorbereitung

Dr. Ben Samwer – BGE Bundesgesellschaft für Endlagerung mbH – DEU

14:55 EXHIBITOR ROAD SHOW

14:55 COFFEE BREAK

15:55 The Transition Gap: Decommissioning and Repurposing as a Critical Success Factor in the Energy Transition

The Transition Gap: Stilllegung und Umnutzung als kritischer Erfolgsfaktor der Energiewende

Rüdiger König – Jacobs Ltd. – DEU

16:20 Nuclear Decommissioning's Contribution to UN Sustainability Goals: Recycle Everything?

Der Beitrag der Stilllegung von Kernkraftwerken zu den UN-Nachhaltigkeitszielen: Alles recyceln?

Collin Austin – EnergySolutions LLC – US

16:45 An Update on the Decommissioning of ENGIE's Nuclear Power Plants.
Aktuelles zur Stilllegung belgischer Kernkraftwerke

Peter Berben – ENGIE – BEL

17:45 DEPARTURE OF BUSES TO SOCCER STADIUM TIVOLI

Abfahrt der Busse zum Stadion TIVOLI

18:15 CONFERENCE DINNER AT TIVOLI

Conference Dinner im TIVOLI

TUESDAY - NOV. 14TH, 2023

10:00 REGISTRATION

11:30 QUICK LUNCH

12:30 Welcome

Dr. Andreas Havenith – AiNT GmbH – DEU

STRATEGIES & MARKET DEVELOPMENT STRATEGIEN & MARKTENTWICKLUNGEN

13:15 Key Note
Keynote

Gerrit Niehaus – BMUV – DEU

13:40 Germany after the Shutdown: Transformation into a World Champion in Dismantling?
Deutschland nach der Abschaltung: Transformation zum Rückbau-Weltmeister?

Daniel Oehr – GNS Gesellschaft für Nuklear-Service mbH – DEU

TUESDAY - THURSDAY
DIENSTAG - DONNERSTAG





WEDNESDAY - NOV. 15TH, 2023

PROJECT STATUS & BEST PRACTICE PROJEKTSTATUS & BEWÄHRTE VERFAHREN

09:00 Achievements of Phase I decommissioning of China's first Research Reactor, HWRR, as well as the Main Contents and Challenges of Phase II Decommissioning
Errungenschaften der Phase-I-Stillegung von Chinas erstem Forschungsreaktor, HWRR, sowie die wichtigsten Inhalte und Herausforderungen der Phase-II-Stillegung

Ruizhi Li – China Institute of Atomic Energy – CHN

09:25 A Management Toolbox for Commercial Fleet Decommissioning Derived from US DOE Closure and Remediation Programmes

Eine Management-Toolbox für die Stillegung kommerzieller Flotten, abgeleitet aus US DOE Stilllegungs- und Sanierungsprogrammen

Douglas Kerr – Jacobs Ltd. – UK

09:50 COFFEE BREAK

09:50 EXHIBITOR ROAD SHOW

10:45 Waste from the Public Sector – Actor Diversity from the Perspective of a Waste Producer

Abfälle der öffentlichen Hand – Akteursvielfalt aus der Perspektive einer Ablieferungspflichtigen

Beate Kallenbach-Herbert – JEN mbH – DEU

11:10 The Swiss Model Inventory of Radioactive Materials as Basis for the General Licence Application for the Deep Geological Repository

Das modellhafte Inventar der radioaktiven Materialien der Schweiz als Basis des Rahmenbewilligungsgesuchs für ein Endlager radioaktiver Abfälle

Dr. Susanne Pudollek – Nationale Genossenschaft für die Lagerung radioaktiver Abfälle (Nagra) – CHE

DECOMMISSIONING TECHNOLOGIES RÜCKBAUTECHNOLOGIEN

11:35 Learnings from Grafenrheinfeld Radioactive Liquid Treatment Installations in Perspectives from a license Holder & Service Provider
Erkenntnisse aus Grafenrheinfeld - Anlagen zur Behandlung radioaktiver Flüssigkeiten aus der Perspektive eines Lizenznehmers & Dienstleisters

Martin Lerche – Fortum Power & Heat Oy – FIN

12:00 Fukushima Daiichi Primary Containment Vessel - Reaching the Heart of the Incident through Innovative Technologies

Der primäre Sicherheitsbehälter von Fukushima Daiichi - Mit innovativen Technologien zum Kern des Unfalls vordringen

Simon Delavalle – Veolia Nuclear Solutions – UK

12:25 LUNCH

13:30 MEET YOUR COMPANY

INNOVATION & DIGITALIZATION INNOVATION & DIGITALISIERUNG

13:30 Digitization in Nuclear Decommissioning: A view on Innovative Technologies, Potentials, and Use Cases during the Planning and Implementation Phases

Digitalisierung der nuklearen Stilllegung: Ein Blick auf innovative Technologien, Potenziale und Anwendungsfälle in der Planungs- und Umsetzungsphase

Dennis Gottschalk – Arthur D. Little Schweiz AG – CHE

13:55 AMORAC – Autonomous MOBILE Robot for Automated Clearance Solution for Radiological Characterization during Decommissioning

Lösung für die radiologische Charakterisierung bei der Stilllegung

Frank Querfurth – Framatome GmbH – DEU

14:20 Digital Future: Robotics and Sensors in Extreme Environments
Digitale Zukunft: Robotik und Sensoren in extremen Umgebungen

Neil Owen – Createc Ltd. – UK

14:45 COFFEE BREAK

TUESDAY - THURSDAY
DIENSTAG - DONNERSTAG





CHARACTERIZATION & WASTE MANAGEMENT CHARAKTERISIERUNG & ABFALLMANAGEMENT

- 15:15 Relocatable Radioactive Waste Characterization Systems**
Versetzbare Systeme zur Charakterisierung radioaktiver Abfälle
Dr. Cédric Carasco – CEA, DES, IRESNE, Nuclear Technology Department, Cadarache – FRA
- 15:40 Disposal Routes for Integrated Waste Treatment in the Dismantling of Nuclear Facilities**
Entsorgungswege bei integrierter Reststoffbehandlung im Rückbau kerntechnischer Anlagen
Dr. Anton Anthofer – DORNIER Nuclear Services GmbH – DEU
- 16:05 Sorting of High Level Waste**
Sortierung von hochaktiven Abfällen
Jacobco Segurado – EQUANS – BEL
- 16:30 Activation Calculations for Packaging Planning**
Aktivierungsberechnungen für die Verpackungsplanung
Dr. Henning Keller – WTI GmbH – DEU

17:00 - 18:15 BUSINESS SPEED NETWORKING

17:00 - 19:30 GET TOGETHER

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THURSDAY - NOV. 16TH, 2023

COMPETENCE & TRAINING KOMPETENZ & WEITERBILDUNG

- 09:00 Building Competences and Promoting Talents: Activities of the publicly funded Nuclear Safety and Decommissioning Research**
Kompetenzen aufbauen und Talente fördern: Aktivitäten im Rahmen der öffentlich geförderten nuklearen Sicherheits- und Rückbauforschung
Dr. Peter Ungelenk – GRS gGmbH – DEU

- 09:25 Educating the Next Generation: The Study Program at FH Aachen**
Nachwuchs ausbilden: Das Studium an der FH Aachen
Prof. Dr. Christoph Langer – FH Aachen – DEU

- 09:50 KernTrafo: Efficient Skill Management for Nuclear Power Plant in Decommissioning**
KernTrafo: Effizientes Skillmanagement für Kernkraftwerke im Rückbau
Angus Turpin – HRForecast – DEU

10:15 COFFEE BREAK

RESIDUE MANAGEMENT & CLEARANCE RESTSTOFFMANAGEMENT & -FREIGABE

- 10:45 Handling for Potentially Asbestos Containing Rubble**
Umgang für potenziell asbesthaltigen Bauschutt
Angelika Mettke – Brandenburgische Technische Universität Cottbus-Senftenberg – DEU
- 11:10 Challenges in Decommissioning of Concrete Shielding at PSI**
Herausforderungen bei der Stilllegung von Betonabschirmungen am PSI
Dr. Malgorzata Urszula Sliz – Paul Scherrer Institute – CHE
- 11:35 Software Assisted InSitu Clearance Measurements (SAIF/VEGAS)**
Software-Assistierte-InSitu-Freimessungen (SAIF/VEGAS)
Dr. Benjamin Brückner – Safetec GmbH – DEU
- 12:00 Derivation of Nuclide-Specific Surface-Clearance Levels for the normal Reuse of Objects leaving the Controlled Area of a Nuclear Facility**
Ableitung von nuklidspezifischen Oberflächenfreigabewerten für die normale Wiederverwendung von Gegenständen, die den Kontrollbereich einer kerntechnischen Anlage verlassen
Dr. Teun van Dillen – National Institute for Public Health and the Environment (RIVM) – NL
- 12:25 Challenges of Different Clearance Options within Clearance Procedures in Germany**
Herausforderungen verschiedener Freigabeoptionen bei Freigabeverfahren in Deutschland
Olaf Nitzsche – Brenk Systemplanung GmbH – DEU

12:50 FINAL STATEMENT AND OUTLOOK

13:00 QUICK LUNCH

SPEAKER ABSTRACTS
MONDAY



DR. LAURENT COQUARD

13:15

MONDAY

Framatome GmbH
Paul-Gossen-Str. 100
91052 Erlangen
Germany

www.framatome.com

USE CASES OF A NON-DESTRUCTIVE MEASUREMENT SYSTEM TO COMPLY WITH MATERIAL WASTE ACCEPTANCE CRITERIA FOR FINAL DISPOSAL

During the last decades, the nuclear and non-nuclear industry has produced a considerable amount of low and intermediate level radioactive wastes (LLW and ILW). In Germany, such waste will be finally disposed underground in the geological repository Konrad, which is planned to go into operation in 2029. The national licensing and supervisory authorities defined strict waste acceptance criteria (e.g. radiological characterization, material characterization) for these waste. The material characterization is a real challenge for waste producers especially for legacy waste.

The material characterization of waste packages can be performed on the basis of existing documentation or, if the documentation

is insufficient, on further destructive or non-destructive analysis. Non destructive methods are to be preferred to minimize radiation exposures of operating personnel as well as costs. The speaker presents an innovative non-destructive technology called QUANTOM® (QUantitative ANalysis of TOxic and non-toxic Materials) based on prompt and delayed gamma neutron activation analysis (P&DGNA) and some uses cases how the system can support concretely waste producers (plausibility check, waste classification, detection of some hazardous materials). Benefits and limitations of the system will be discussed.



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FEDERICO ALEJANDRO GESER

13:40

MONDAY

Paul Scherrer Institute
Forschungsstrasse 111
5232 Villigen PSI
Switzerland

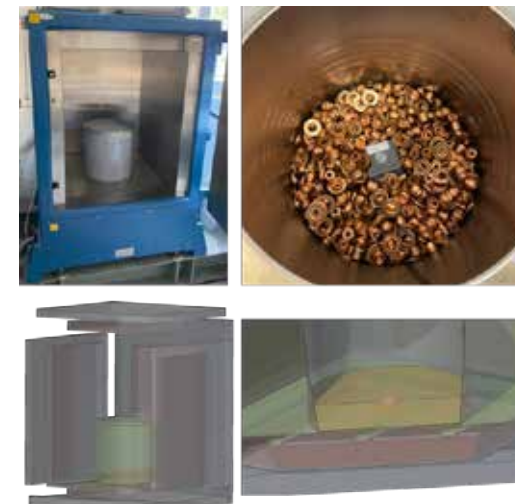
www.psi.ch

INVESTIGATION OF THE EFFECTS OF MASS AND SELF-ABSORPTION ON MEASUREMENTS OF COPPER PARTS USING CLEARANCE MONITORS AT PSI

The clearance measurements of the potentially radioactive wastes generated in the large scale research facilities at the Paul Scherrer Institute (PSI) are conducted with clearance monitors (CMs). CMs usually require a scenario dependent calibration which takes into account the possible different geometrical arrangements of the measured materials (density, shape, etc.). Typically, in commercial clearance monitors, there are different efficiency calibration techniques available for this purpose, whose result is a single sensitivity factor that relates the efficiency of a key (leading) radionuclide with the efficiency of other generic radionuclides.

The goal of this work is to define a general guideline on how to select the appropriate sensitivity factor for a given measurement scenario, and to determine if one single factor is sufficient to cover all possible scenarios in terms of geometry and radionuclide combinations. The dependence of CMs sensitivity

factors on the mass of the measured material was studied for a specific configuration: copper parts in a 30-liter drum with a variable mass from 10.0 kg to 40.0 kg. Monte Carlo (MC) simulations as well as experimental measurements with reference calibration sources were conducted. The results show that the use of a single fixed sensitivity factor makes sense in the case of radionuclides emitting gammas in a wide energy range (e.g. ^{152}Eu), where the mass dependence of these factors is low. In contrast, the use of a single sensitivity factor for monoenergetic radionuclides (e.g. ^{137}Cs), if not adequately selected, may lead to an over- or underestimation of the activity level of the measured materials. These findings contribute to improving the accuracy of calibration procedures and clearance measurements for the release of waste from the dismantling of large scale research facilities, with potential logistic and economic implications.



**DR. MARINA SOKCIC-KOSTIC**

14:05

MONDAY

NUKEM Technologies Engineering Services
Industriestrasse 13
63755 Alzenau
Germany



www.nukemtechnologies.de

RADIATION INSTRUMENTATION AND MEASUREMENT TECHNOLOGIES FOR HIGH RADIATION FIELDS

The radiation measurement devices for operation in high radiation fields have to meet high requirements in respect to:

- Dynamic measurement range
- Noise immunity against background radiation
- Construction materials resistant against radiation (i.e. alpha, neutron and gamma radiation)
- Possibility for remote operation

Using many years of NUKEM experience, solutions are presented for selected cases.

We start with dose rate meters for gamma radiation, based on Geiger-Mueller counters, describe the design of neutron counters for measurements of burn-up of fuel elements and finish with Plutonium measurements in the harsh environment of nuclear reprocessing plants.

Finally gamma cameras are presented using the technique of multi aperture pinhole detection to localize Hot Spots during working in hot cells.

The outstanding decommissioning projects for nuclear power plants requires a further development of the techniques to fulfill the challenges in respect to characterization and conditioning of high radioactive waste as produced during the dismantling of the plants.

**ZHANG YU**

14:30

MONDAY

China Institute of Atomic Energy
Sanqiang Road 1#, Fangshan District
102413 Beijing
China



derrick_zhangyu@outlook.com

DEVELOPMENT OF HEAVY WATER RESEARCH REACTOR DECOMMISSIONING ENGINEERING TECHNOLOGY SUPPORTING SYSTEM

The decommissioning of Heavy Water Research Reactor(HWRR) is comprehensive, which include dismantling, decontamination, waste management, radiation protection and so forth. As the development of computer graphics technologies, using simulation technology to verify decommissioning plan is more and more required. This presentation mainly introduce the development and construction plan of the technical support system for the decommissioning of HWRR, including the overall structure design, software development platform scheme, hardware development scheme and etc.

The 3D model of HWRR is built by 3D laser scanner and CAD software. Based on 3D virtual cutting algorithm, 3D radiation field computation algorithm, estimation of quantities algorithm simulation platform is developed. Based on Virtual Reality technology, the VR HWRR and operator training platform is developed.



MATTI KAISANLAHTI

15:30

MONDAY

Fortum Power and Heat Oy
Keilalahdentie 2-4
02150 Espoo
Finland

www.fortum.com



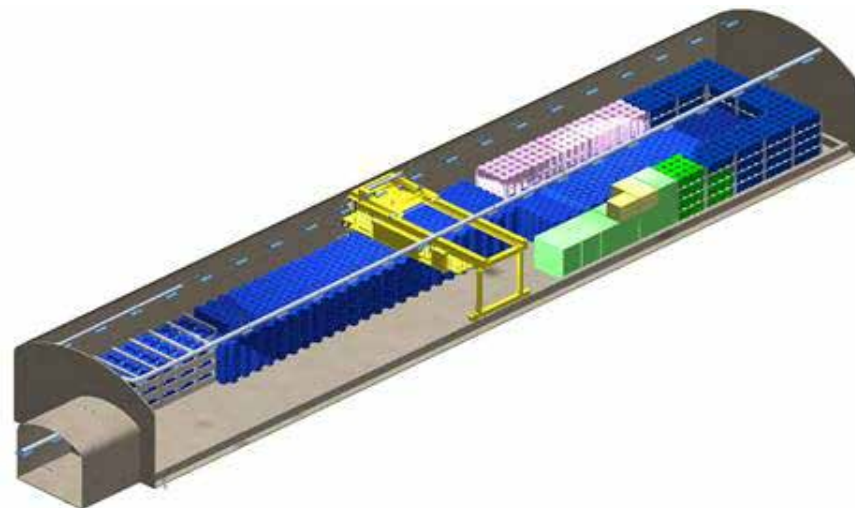
RADIOACTIVE WASTE MANAGEMENT OF FIR1 RESEARCH REACTOR DECOMMISSIONING

FIR 1 TRIGA Mark II research reactor which was operated in Espoo, Finland, in 1962–2015 is under decommissioning. Reactor is owned and operated by VTT Technical Research Centre of Finland Ltd and VTT is also the owner of the decommissioning project. After shutdown Fortum was elected as main contractor to plan and to dismantle all active systems and components. Contract also included whole waste management process from packing to disposal.

After shutdown planning of decommissioning was carried out to full fill all regulatory requirements for decommissioning license. The decommissioning license has been obtained from the Government of Finland at summer 2021. The waste handling process including packaging, characterization and transport has been planned to fulfil Loviisa NPP's requirements for waste handling and final disposal of the waste. The

license for dispose all the radioactive waste from FIR 1 research reactor has obtained from the Government of Finland at March 2023. The long-term safety case for disposal of the waste finalized in September and the permission to start waste transports is expected to be granted during November.

All waste generated from dismantling had predeterminate waste handling procedures. Depending on activity, nuclide vector and material, waste were sorted for three different final disposal package. After packing waste is characterized and transported to temporary storage area. After there is enough waste in storage for one transport, waste containers will be packed inside of the official public road transport container. Finally waste is transported to the Loviisa final disposal facility and ownership of waste is transferred from VTT to Fortum.



BRIAN GIHM

15:55

MONDAY

Hatch Ltd.
2800 Speakman Drive
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Canada

www.hatch.com



WAVEBLAST - AUTOMATED DECONTAMINATION SYSTEM FOR COMPLEX GEOMETRY METAL AND OTHER NON-POROUS SOLID WASTE

The nuclear industry generates substantial quantities of radioactive metallic waste, such as steam generators, heat exchangers, pipes, pumps, scaffolds, ducts and various small components. These metallic wastes come from nuclear power generation, uranium mining, refining, conversion and enrichment processes, fuel fabrication, and decommissioning and disposal processes as well. While some of the metals are activated and cannot be easily decontaminated, the majority of the metallic waste is only surface contaminated. These surface-contaminated metals can be decontaminated by removing the surface contaminants, and they are potentially free released and recycled.

Likewise, various low-level non-metallic radioactive wastes are only surface contaminated, and they can be decontaminated to the level of free release if all radioactive particulates from the surface can be effectively removed.

While there are several surface decontamination technologies that are currently used, including high-pressure jet washing, grit blasting, laser ablation, electropolishing, chemical decontamination and melting, the decontamination

process flow is complex and highly manual. The contaminated materials need to be characterized, inspected and sorted before processing, and they have to be handled multiple times by people during the decontamination and free-release process.

Furthermore, the majority of the waste exhibits complex geometry (e.g., small diameter pipes, bent or crushed metals, bolts and nuts with grooves, springs, etc.), and it is not possible to dislodge very fine radioactive particles from joints, cracks completely. Thus, complex geometry wastes are difficult to decontaminate to the free release level.

WaveBlast is a patent pending technology that is using ultrasound in a novel way that allows full decontamination of complex solid waste to the free release level. As the technology is not discriminant of the waste geometry, shape, size or the nature of contaminants, waste characterization, sort and segregation processes can be eliminated from the decontamination process. This will result in significant reduction in labour cost and improvement in decontamination efficiency and speed.



CHRISTIAN MILLS

16:20

MONDAY

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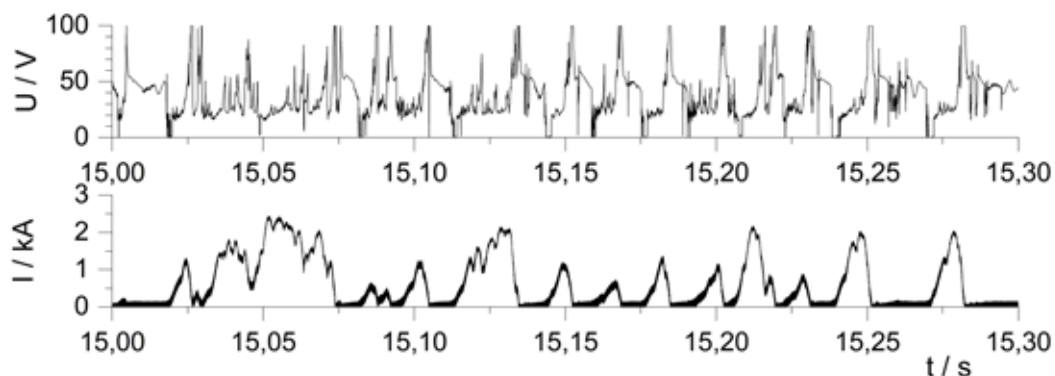


IN-SITU PROCESS MONITORING OF CONTACT ARC METAL GRINDING (CAMG) FOR UNDERWATER USE IN NUCLEAR DECOMMISSIONING

Decommissioning of contaminated and activated metal structures requires robust and fail-safe technologies that can be used remotely underwater. Contact Arc Metal Grinding (CAMG) is a thermal cutting process, which has the advantage of marginal restoring forces. The main removal mechanism is achieved by an arc which burns between a disc electrode and the workpiece. This occurs when a mechanical contact is initiated between the two, resulting in a high current flow in the form of a short circuit. The high current density generated, leads to local heating of the contact point results in the ignition of an arc. Due to the rotation of the electrode, this process occurs several times per second.

As known from welding technology, insight into the process can be obtained from the electrical voltage and current. These data are intended to enable in-situ control of the process like regulation of

the feed rate. As a result, the application of Contact Arc Metal Grinding in nuclear decommissioning could be simplified and the wear of the electrode be reduced. To achieve this, a better understanding of the signals is needed first. Through the rotation of the electrode, many arcs ignite and extinguish. Therefore the measurements were made with a high sampling rate of 50 kHz. The influence of different electrode geometries and materials on the formation of the arc and the process signal are still unknown. Within the scope of this investigation, different electrode geometries and their process signals were studied. Based on the results, it can be seen that the signals are influenced by external factors such as geometry. For future process control, it is necessary to identify and understand these factors.



BAART GEERKENS

16:45

MONDAY

Interboring bv
Industrieweg-Zuid 1354
3520 Zonhoven- Belgium

www.interboring.be



GUIDO MULIER

SCK CEN
Boeretang 200
2400 Mol - Belgium

www.sckcen.be



DECOMMISSIONING OF THE BR3 BIOLOGICAL SHIELD USING THE DRY DIAMOND WIRE CUTTING

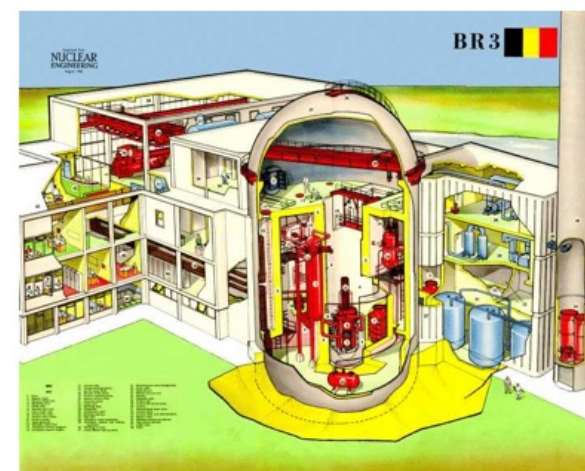
The Belgian Reactor 3 was a PWR (Pressurized Water Reactor) build as a pilot project for the construction of the other Belgian Reactors. The goal of this reactor was mainly to enhance the knowledge in Europe for the construction, operation and dismantling of a nuclear reactor (PWR).

The biological shield refers to the concrete walls surrounding the reactor pressure vessel which protects the external environment from radiation. The BR3 pilot PWR has reached the latest stages of its decommissioning, which includes the removal of the activated concrete of the biological shield. An extensive characterization through in-situ measurements, sampling combined with ex-situ measurements and 3D modelling supported the strategy aiming for release of the entire volume of concrete following the Belgian regulatory framework in terms of generic and specific clearance.

The on-going dismantling mainly uses two types of mechanical segmentation techniques, namely diamond drilling and diamond wire cutting. All techniques were used without the use of cooling water to prevent cross-contamination and to decrease secondary waste.

Aspects of stability, safety and radiological protection have been taken into account during planning and implementation of the subsequent phases.

After a brief introduction of SCK CEN and INTERBORING, the different phases of the project will be discussed as well as the used techniques. Return on experience on the use of dry diamond wire cutting and waste types and volumes will be explained and demonstrated visually by SCK CEN and INTERBORING together.



Cutaway and aerial view of BR3





ARNE LARSSON

17:10

MONDAY

Cyclife Sweden AB
Box 610
611 10 Nyköping
Sweden

www.cyclife-edf.com



RESPONDING TO THE INCREASED DEMAND FOR METALS TREATMENT CAPACITY FROM DECOMMISSIONING PROJECTS

Faced with the challenge of meeting the metal and waste management needs of current and planned decommissioning projects, Cyclife, the waste management and decommissioning specialist within the EDF Group, has taken a number of strategic decisions to expand its treatment capacity by upgrading existing facilities and building new ones in France, Sweden and the UK. For decades, Cyclife companies have been providing metal treatment services to national and international customers with the aim of qualifying the metal for clearance and recycling for the manufacture of new products outside and inside the nuclear industry. Both containerised scrap and large complex components have been treated. The savings in disposal volume, the avoidance of long-term interim storage, the value of the materials and, last but not least, the sustainability perspective make recovery through recycling and reuse the preferred choice. Free clearance for recycling turns liabilities into assets for society. Now that metal management concepts are well established and accepted, thanks to efforts to demonstrate that recycling such material is completely safe and beneficial to society, new

challenges are emerging. In particular, the shortage of production capacity, which threatens the schedules of decommissioning and life extension projects, and complicates logistics, which in turn affects the overall efficiency and cost of projects.

Demand for treatment services for scrap metal and contaminated large components is increasing and current facilities do not have the capacity to meet the demand, resulting in capacity being sold out several years in advance. To meet the market needs and the internal needs of the EDF group, which has 11 NPPs in decommissioning, Cyclife has taken several decisions in order to:

- Improve the treatment concepts, logistics and tools in the existing facilities
- Expand the facilities with new production lines
- Build new treatment facilities

Authors: Arne Larsson, Cyclife Sweden / Dr Bastian Schulz and Dr Tomasz Majchrowski



WWW.WORLD-NUCLEAR-EXHIBITION.COM

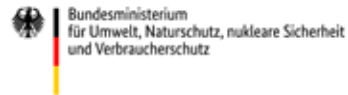
SPEAKER ABSTRACTS
TUESDAY

**GERRIT NIEHAUS**

13:15

TUESDAY

Bundesministerium für Umwelt,
Naturschutz, nukleare Sicherheit
und Verbraucherschutz
Robert-Schuman-Platz
63175 Bonn
Germany



www.bmu.de

KEY NOTE**DANIEL OEHR**

13:40

TUESDAY

GNS Gesellschaft für Nuklear-Service
mbH
Frohnhauser Straße 67
45127 Essen
Germany



www.gns.de

GERMANY AFTER THE SHUTDOWN: TRANSFORMATION INTO A WORLD CHAMPION IN DISMANTLING?

For decades, the German NPP fleet was renowned for its uniquely safe and reliable operation worldwide. Generations of operating staff and an entire industry were committed to these requirements. Countless times, German NPP were able to earn the title of world champion in generation as well as several top positions due to their high availability. In April 2023, nuclear generation was terminated due to political decisions in Germany. The former world champions in generation must now also prove themselves as ambitious decommissioners. This is a whole new game. But are operators, authorities and an entire nuclear industry already geared up for it? And what rules are being played by?

Germany's nuclear industry can already look back on a long track record of successful decommissioning and dismantling (D&D) projects of several smaller units. Consequently, there is already well-founded D&D know-how.

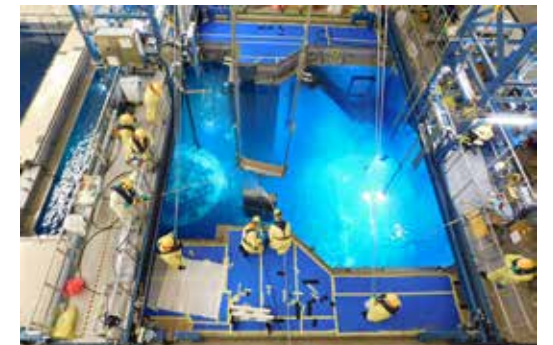
With the shutdown of the last three nuclear power plants, all sites have finally reached the decommissioning phase. The dismantling is supposed to take place immediately and almost simultaneously. All operators have set themselves high ambitions regarding dismantling times and project budgets. High expectations are transferred to all project partners. To make the overall D&D programme in Germany a success for all parties involved a few critical success factors need must be necessarily considered:

1. industrialisation of processes
2. availability of resources
3. innovations
4. professional project management
5. partnership-based cooperation

Related to that, an entire industry still has a far-reaching transformation ahead of it to successfully manage the socially responsible task of nuclear D&D in Germany together.

Even if German NPPs will no longer compete for the title of world champion in operation, the D&D programme will be visible worldwide. And perhaps the next world champion in dismantling will come from Germany with a regard to shortest dismantling times and lowest dismantling costs?

Sustainably filling the aforementioned success factors with life and proudly reporting on the jointly achieved project successes will collectively enable the nuclear industry to export many products and services with the label „D&D - Made in Germany“ worldwide.





GEORG WEISS

14:05

TUESDAY

PreussenElektra GmbH
Tresckowstr. 5
30457 Hannover
Germany

www.preussenelektra.de



DISPOSAL OF HIGH-DOSE RATE WASTE AS A FLEET PROJECT AT PREUSSENELEKTRA GMBH

High dose rate (HDR) waste includes diverse types of filter elements from operation and dismantling of nuclear power plants (NPPs), metals, sludge, and mixed waste. Activity levels are in the range E11-E12 Bq per drum and local dose rate at contact is up to the order of Sv/h.

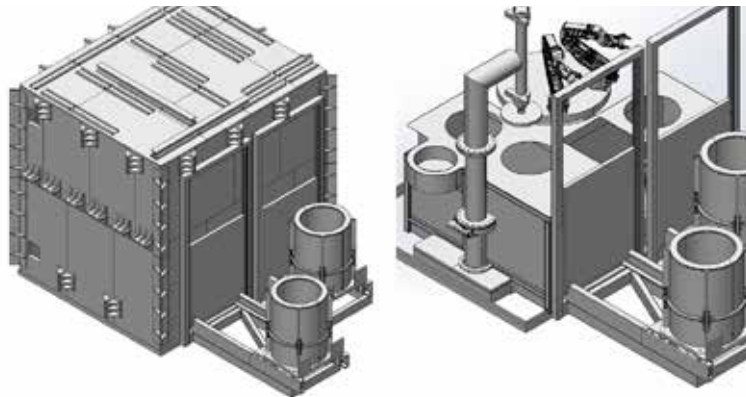
PreussenElektra GmbH (PEL) presents the disposal of HDR waste as a fleet project for its units KKG, KWG, KKK, KBR, KKI-1/2 aiming at the best possible use of synergy effects between the PEL sites with a total of approx. 550 HDR drums. This fleet approach defines the scope of the HDR campaigns at PEL and the associated challenges, both regarding aspects of hardware and campaigns:

A mobile sorting station is deployed for remote and heavily shielded handling and conditioning of HDR waste to reduce its volume and load it in 180 l and 200 l drums. Simultaneously, the sorting algorithm ensures that generated drums match activity levels for optimized packaging (accident-proof) in MOSAIK containers with 40 mm or 70

mm lead shielding, type II or IV Konrad containers. Furthermore, a mobile drum measuring system optimized for HDR waste is used for gamma spectrometric measurements ensuring a more realistic activity determination. Design and fabrication of both systems rely on PEL's specification for device technology, so that successive sites can credit the preliminary test and operational experience in the pilot unit.

Regarding the campaigns' aspects, the fleet approach is reflected in the use of standards (so-called product control specifications) for the essential conditioning steps of drying, sorting, sampling, activity determination, packaging, and material description.

Regarding implementation of the project PEL partners with Equans for the HDR sorting station, AiNT GmbH for the campaign applications and the standards, and AiNT GmbH and Mirion Technologies (Canberra) GmbH for the drum measuring system as experienced and competent partners to successfully run the first HDR campaign in the pilot plant in 2024/25.



DR. BEN SAMWER

14:30

TUESDAY

Bundesgesellschaft für Endlagerung mbH (BGE)
Eschenstraße 55
31224 Peine
Germany

www.bge.de



KONRAD REPOSITORY – CONSTRUCTION AND RETRIEVAL SCHEDULING

The Bundesgesellschaft für Endlagerung builds and operates the Konrad repository for low- and intermediate-level radioactive waste with negligible heat generation. We report on the progress of the construction work underground, the excavation of the necessary spaces and the expansion of the routes for underground transport and for the storage of radioactive waste in accordance with the requirements of the Konrad plan approval decision.

We also present the above-ground construction sites, the buildings and facilities that have already been completed, as well as the infrastructure and the extensive construction work on Konrad 2.

In preparation for the repository operation, the overall commissioning is planned in differentiated phases, the prescribed overall acceptance is being prepared with the regulator and the operational regulations and instructions are drawn up based on the planned procedures.

In cooperation with those obliged to deliver, BGE prepares the retrieval and acceptance of the waste containers for the Konrad final storage facility. Solutions to optimize sequencing and delivery have already been found and implemented. The data processing systems to record all the necessary container and location data are now being set up.





RÜDIGER KÖNIG

15:55

TUESDAY

Jacobs



www.jacobs.com/solutions

THE TRANSITION GAP: DECOMMISSIONING AND REPURPOSING AS A CRITICAL SUCCESS FACTOR IN THE ENERGY TRANSITION

Decommissioning the existing energy infrastructure, along its entire value chain, while building a sustainable new system, in the short period of 25 years to 2050 is a multi-trillion Euro undertaking, in a resource constrained environment, and a serious financial risk.

The nuclear industry has been addressing this challenge in a transparent and robust manner, but has yet to successfully execute the transition from operating NPPs to future uses of the sites on the large scale necessary. And in doing so it will need to compete for human resources, industrial capacities, and financial means against other sectors and corporate needs.

This "Transition Gap" can only be overcome by the fittest market players with an optimal, forward-thinking approach.

Our presentation begins with a short definition of the Transition Gap challenge, examines the

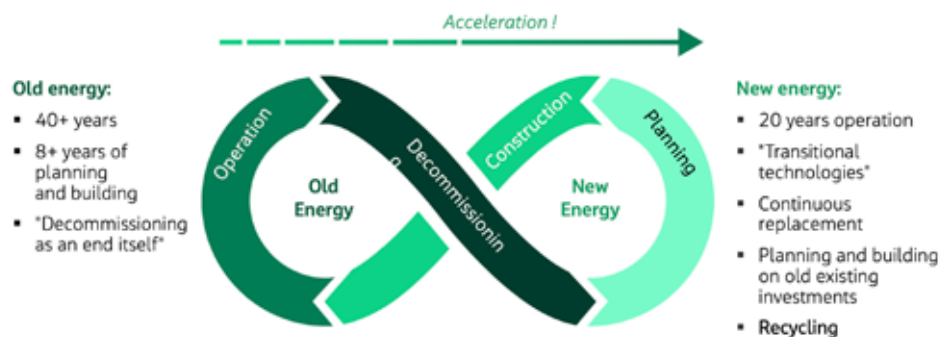
financial market risks and opportunities, and presents a holistic approach that can be taken, including strategic and programmatic pathways.

The presentation is aimed at decision makers in nuclear decommissioning as well as Asset Managers, Sustainability Officers, Finance and Strategy functions at energy companies with decommissioning / remediation / rehabilitation liabilities and a transition programme - and their investors and other stakeholders.



The Transition Gap paradigm

Decommissioning: not the end - but the beginning ...



COLLIN AUSTIN

16:20

TUESDAY

EnergySolutions
299 S. Main Street, Suite 1700
84111 Salt Lake City, UT
United States



www.energysolutions.com

NUCLEAR DECOMMISSIONING'S CONTRIBUTION TO UN SUSTAINABILITY GOALS: RECYCLE EVERYTHING?

Imagine a world where the stigma of the back end of the nuclear life cycle is gone. No longer considered a liability, but rather a mine of valuable resources.

Since its inception in the late 1950's nuclear has been a low carbon source of energy, The industry has employed vast amounts of metals in the construction of nuclear power plants and associated supporting plants and facilities. Currently much of this metal is deemed worthless.

Society has begun to realize the true value of reusing materials rather than considering single use. e.g. reusing Aluminum not only increases the availability of this important resource, one tonne of virgin aluminum produces 17 tonnes of CO2 but one tonne of recycled aluminum produces only 0.6 Tonnes.

The steel industry produces 3 tonnes of carbon dioxide for every tonne of steel and accounts for 8% of all greenhouse gases emitted annually. Recycling steel reduces the greenhouse gas emissions by 50% representing a global greenhouse gas emissions reduction of 4% per annum. In 2022 the USA imported \$4.5 billion worth of nickel mined from ore, 65% of which is used to produce stainless steel and 20% of that nickel will end up in disposal sites as scrap metal. Statistics that clearly demonstrate the material value trapped in the back end of the nuclear cycle.

Described in this paper is EnergySolutions new Sustainable Value Solutions (SuVa) International business approach to unleash the potential of the back end of the nuclear fuel cycle by recycling.





PETER BERBEN

16:45

TUESDAY

ENGIE
Av. Bolivar 36
1000 Brussels
Belgium

www.engie.com



atw

International Journal
for Nuclear Power

nucmag.com

AN UPDATE ON THE DECOMMISSIONING OF ENGIE'S NUCLEAR POWER PLANTS

ENGIE Electrabel has a strong local presence in Belgium for more than 100 years as operator. Its responsibility is the entire life cycle of its facilities: their construction, operations and decommissioning.

ENGIE Electrabel is focusing since the end of 2020 on the preparation of the decommissioning of the 7 Belgian nuclear plants. The decommissioning of a commercial nuclear power plant is a first in Belgium. The simultaneous decommissioning of 7 commercial nuclear power plants has never taken place anywhere else. It is an interesting and challenging project for which we will need specific expertise and innovative solutions.

After unit Doel 3 was permanently shut down on September 23rd in 2022, it was unit Tihange 2 which followed on 31st of January this year. Both units are in the post-operations phase now. At Doel 3, the chemical decontamination of the primary circuit took place and the team is clear-

ring out the turbine hall to equip it as a logistics center. The dismantling organization is growing as transition plans are being developed, strategic choices related to the dismantling scenarios and options are chosen, new infrastructures are being planned for, waste management treatment and evacuation routes are being developed, license processes are started, and the Final Decommissioning Plan is being developed.

On July 21st 2023, ENGIE and the Belgian government signed a framework agreement on the operation extension of the 2 youngest plants for 10 years. This framework agreement also provides clarification on long-term radioactive waste management. Both aspects have an impact on the industrial and resource planning of the program. An update of the decommissioning program, the impact of the agreement on the program and the upcoming changes of the law on nuclear phase out will be addressed during the presentation.



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**SPEAKER ABSTRACTS
WEDNESDAY**



RUIZHI LI

09:00

WEDNESDAY

China Institute of Atomic Energy
Sanqiang str.1
102413 Beijing
China

www.ciae.ac.cn



ACHIEVEMENTS OF PHASE I DECOMMISSIONING OF CHINA'S FIRST RESEARCH REACTOR, HWRR, AS WELL AS THE MAIN CONTENTS AND CHALLENGES OF PHASE II DECOMMISSIONING

CIAE is a part of China National Nuclear Corporation (CNNC) and it is a multidisciplinary institute. Heavy water research reactor is located in China institute of atomic energy and it was the first nuclear reactor of China. HWRR started to construct in 1956 and went first criticality in 1958. HWRR is a tank type reactor using heavy water as primary coolant and moderator. Its nominal power is 7MW, while strengthened thermal power is 10MW. Between 1978 and 1981, the reconstruction project was implemented and operational parameters upgraded after that. After 49 years of long term operation, HWRR permanently shut down at the end of 2007 for the termination of operational license.

HWRR is the first nuclear reactor to be decommissioned in China. Immediate dismantling is chosen as a preferred decommissioning strategy. Considering the difficulty of decommissioning the HWRR reactor, a phased strategy was adopted to implement the decommissioning.



The phase I of decommissioning was approved by the government in November 2019 and the main tasks include:

1. Renovation and construction of decommissioning service system
2. Decontamination and dismantling of experimental circuits
3. Detailed source item survey
4. All kinds of radioactive waste treatment and disposal

All tasks were completed in August 2023. This presentation describes the main results and accumulated experience of the phase I of the decommissioning project.

According to the government's requirements, the phase II will start in early 2024 and end in December 2028. We will face many challenges in this phase, including remote control cutting and dismantling of reactor internals. The presentation will give some introduction on HWRR decommissioning planning of phase II and key pending issues.



DOUGLAS KERR

09:25

WEDNESDAY

Jacobs
1999 Bryan Street Suite 3500
Dallas, TX 75201
United States

www.jacobs.com



A MANAGEMENT TOOLBOX FOR COMMERCIAL FLEET DECOMMISSIONING DERIVED FROM US DOE CLOSURE AND REMEDIATION PROGRAMMES

In the near future many organisations across the globe will be required to deal with the wave of nuclear facilities coming to the end of their operational life. In many countries this scenario will result in the need to develop, manage and deliver complex large programmes covering multiple sites and plant designs to progress decommissioning and remediation in a timely and cost effective manner.

Since 2001, Jacobs has successfully managed the delivery of large Department of Energy (DOE) decommissioning and remediation projects across the US. These projects were challenging due to the scale, age and diversity of these legacy cold war era nuclear sites.

- DOE Waste Challenges – One of the key challenges experienced during the execution of these programmes was the ability to manage and process large volumes of resultant wastes of different categories and regulatory compliance.

- DOE Sites – The presentation will outline learning from the Rocky Flats, Idaho, Hanford Plateau and Paducah programmes. This learning highlights the key issues associated with managing programmes of this scale and providing an environment to quickly address emergent technical and non-technical challenges.

This experience has enabled Jacobs to develop a toolbox of management initiatives forming a flexible delivery model to address the unique and complex challenges encountered when delivering large decommissioning and remediation programmes. As will be discussed, this flexible model has been applied to a diverse range of decommissioning projects and will be transferrable to the emergent wave of Nuclear Power Plant (NPP) fleet decommissioning and remediation programmes.





BEATE KALLENBACH-HERBERT

10:45

WEDNESDAY

JEN Jülicher Entsorgungsgesellschaft
für Nuklearanlagen
Wilhelm-Johnen-Straße
52428 Jülich

www.jen-juelich.de



WASTE FROM THE PUBLIC SECTOR – ACTOR DIVERSITY FROM THE PERSPECTIVE OF A WASTE PRODUCER

The dismantling of various nuclear facilities and a substantial part of the waste destined for the Konrad repository, approx. 40 %, is under the responsibility of the public sector (“ÖH”). The waste, which is transferred from the EVU to the responsibility of the BGZ with the issuance of the so-called interim decision, is not included.

The diversity of actors in the public sector is reminiscent of a Hindu deity with her many arms - between four and ten they usually have. Such a goddess for waste management in the public sector would rather have twenty arms, if one wanted to represent all those involved: various parties obliged to deliver waste, the federal ministries with technical and financial responsibilities, BGE, BGZ and various supervisory and licensing authorities.

The diversity of actors makes a coordinated approach difficult:

- There is no common strategy to provide the necessary interim storage capacities in case the delivery of waste to the Konrad repository is significantly delayed. While BMUV and BGZ are planning the “Logistics Center Konrad (LoK)” for the waste of the EVU, the storage of waste of the public sector is not planned there so far.
- The financing of the dismantling is carried out according to the requirements of the budgetary rhythm (cameralistics), which is only conditionally compatible with the requirements of project cost optimization.

In the Hindu deity, the many arms are a sign of superiority. They are always accompanied by another symbol: the third eye, which is called the spiritual eye or the eye of enlightenment. If such an eye would control the waste management of the public sector, this could be done in a more coordinated and efficient way:

- The coordination office at EWN for the preparation of the delivery to the Konrad repository is a positive example of how tasks are bundled for the EWN group and the research centers, resulting in a better representation of interests and an increase in efficiency.
- The Kenfo basically enables a decoupling of project costs from the cameralistic orientation towards „annual slices“.



DR. SUSANNE PUDOLLEK

11:10

WEDNESDAY

Nagra
Hardstrasse 73
5430 Wettingen
Switzerland

www.nagra.ch



THE SWISS MODEL INVENTORY OF RADIOACTIVE MATERIALS AS BASIS FOR THE GENERAL LICENCE APPLICATION FOR THE DEEP GEOLOGICAL REPOSITORY

MIRAM stands for “Model Inventory of Radioactive Materials” and is a database developed specifically for Nagra’s purposes for the management, radiological calculation and automated analysis of all of Switzerland’s radioactive waste that exists today and will be produced in the future, including spent fuel assemblies.

MIRAM is continuously developed and refined taking into account changes in boundary conditions and knowledge about already produced radioactive waste. The database is consolidated and documented for important project milestones. MIRAM-RBG is such a snapshot of the continuously evolving MIRAM and was specifically developed for the general licence application for the deep geological repository, specifically as a basis for long-term safety analyses.

MIRAM-RBG describes a realistic best-estimate waste volume and material and nuclide inventory. For the nuclide inventory, the uncertainty is also given. It compiles the inventory of radioactive waste actually produced (i.e. conditioned for deep geological disposal) in Switzerland as well as the forecast in which the waste is characterised and quantified as a model in accordance with the current state of knowledge.

An overview of methods used for characterizing the different waste streams, implemented calculation approaches and evaluations of uncertainties will be given. Specific examples will highlight the derived data and information.



MARTIN LERCHE

Fortum Power and Heat Oy
Keilalahdentie 2-4
02150 Espoo
Finland

www.fortum.com

11:35

WEDNESDAY



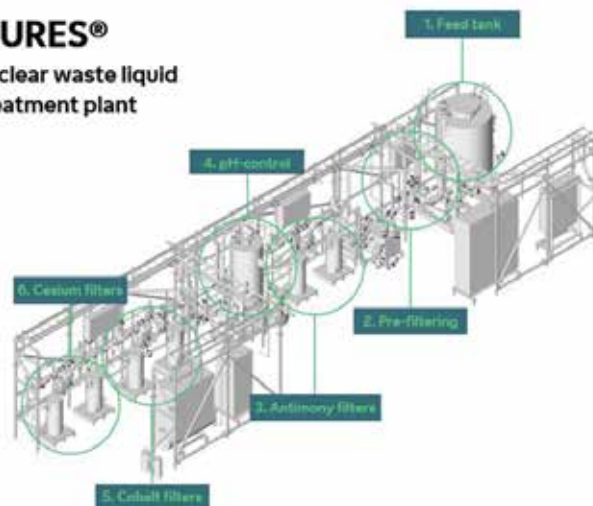
LEARNINGS FROM GRAFENRHEINFELD RADIOACTIVE LIQUID TREATMENT INSTALLATIONS IN PERSPECTIVES FROM A LICENSE HOLDER & SERVICE PROVIDER

Liquid waste is generated throughout the lifetime of any nuclear installations. Initiatives of a new nuclear liquid waste treatment installation can originate from nuclear new build, from renewal of aged facilities, from new treatment needs (e.g., when shifting towards decommissioning stage), and from technical upgrade for a safer and more cost-efficient process. Fortum Power and Heat Oy (Fortum) is the license holder of Loviisa nuclear power plant (VVER-440, Finland), where the liquid waste treatment system renewal is currently underway. In addition to being an operator and license holder, Fortum is an active service provider that design and implements liquid waste treatment projects internationally. In this presentation, we share several key lessons learned from our recently completed and ongoing projects with a deep understanding across the system delivery boundary. A feasibility study based on strategy is an entry point for any design and

implementation project. However, the focus of the feasibility study tends to be centred around finding a viable technical solution. Lesson learned #1 is that the emphases of the feasibility study shall be put on defining project lifecycles and boundary conditions, cost impact analysis which includes final disposal cost consequences, and technical feasibility with a wider range of solutions. When entering into the design and implementation phase, lesson learned #2 is that sufficient amount of resources are recommended to be reserved for piloting and design modifications. Open, customer-centric communications and project management is the #3 lessons learned, especially between the license holder organisation and the service provider organisation. The last lessons learned (#4) is that owner organisations are recommended to implement a holistic fleet level approach and to consider the deployment of mobile systems used in multiple sites over a longer period of time.

NURES®

nuclear waste liquid treatment plant



SIMON DELAVALLE

Veolia Nuclear Solutions
18 Nuffield Way
OX14 1RL Abingdon
United Kingdom

www.nuclearsolutions.veolia.com

12:00

WEDNESDAY

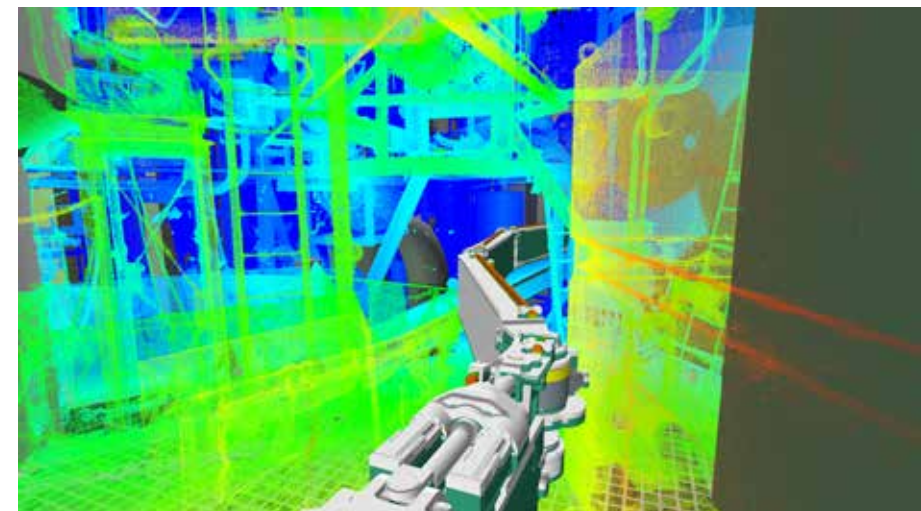


FUKUSHIMA DAIICHI PRIMARY CONTAINMENT VESSEL - REACHING THE HEART OF THE INCIDENT THROUGH INNOVATIVE TECHNOLOGIES

The ongoing cleanup of the Fukushima Daiichi Nuclear Power Plant site is a good example of how constantly evolving technology is driving significant change in the way operators are thinking about significant hazardous waste projects. Specifically, an ongoing challenge has been to investigate the Primary Containment Vessel at Fukushima reactor number 2 so that damaged fuel and other debris can eventually be removed. The challenges are immense: the environment is highly contaminated, doesn't permit human access, and is hard to navigate.

To tackle this challenge Veolia Nuclear Solutions has called on its technology expertise to design a unique and complex robotic system that can be stored in a restrictive volume, deployed through a long and narrow aperture and navigate the unknown obstructed environment of the stricken nuclear reactor.

In this presentation VNS will share how they faced this challenge, lift the lid on some of the obstacles that had to be overcome and demonstrate how, what started as a research project, as now become a state of the art complete system, including an 18 axis robot deployer and a dexterous force feedback robotic manipulator, ready to reach the heart of the Fukushima incident. It will explore how some of the key supporting technologies and tools have helped to de-risk the project and what learnings have been instrumental in driving innovative thinking and next generation solutions for the nuclear sector.





DENNIS GOTTSCHALK

13:30

WEDNESDAY

Arthur D. Little Schweiz AG
Sempacherstrasse 15
8032 Zürich
Switzerland

www.adlittle.com

DIGITIZATION IN NUCLEAR DECOMMISSIONING: A VIEW ON INNOVATIVE TECHNOLOGIES, POTENTIALS AND USE CASES DURING THE PLANNING AND IMPLEMENTATION PHASES

The nuclear industry has been undergoing a significant transformation in recent years, with an increasing focus on the decommissioning of aging facilities and the management of radioactive waste. Although the decommissioning phase is not in the core of the plant's lifecycle, it still is crucial for the overall profitability of the asset and, moreover, the political and social acceptance of nuclear technology. Digitization plays a major role in this game, having significant potential to enhance financial and process efficiency, safety, and sustainability throughout the process. Digitization, in this context, can be understood as the process of converting information or data into a digital format and as the use of new technologies to process information to enable simplification, acceleration, and automation of processes.

The adoption of digital technologies in nuclear decommissioning has been driven by the need to address complex challenges, such as accurate characterization of radioactive materials, remote

handling of hazardous substances, and long-term waste management. Besides widely known and piloted key technologies like robotics, virtual/augmented reality (VR/AR) and blockchain, recent developments in the field of artificial intelligence (AI) combined with remote sensing technologies (IOT) open up highly attractive use cases for plant operators, service providers as well as completely new market players.

However, digitization is not an end in itself. Vision and purpose should be clearly defined, and applicable framework conditions must be considered to support a smooth transformation and successful implementation.



FRANK QUERFURTH

13:55

WEDNESDAY

Framatome GmbH
Am Pestalozziring 18a
91058 Erlangen
Germany

www.framatome.com

AMORAC – AUTONOMOUS MOBILE ROBOT FOR AUTOMATED CLEARANCE SOLUTION FOR RADIOLOGICAL CHARACTERIZATION DURING DECOMMISSIONING

During decommissioning of nuclear power plants many tasks are still performed manually by a person on-site. One example is the clearance measurement of wall segments. This task requires placing a contamination monitor close to the surface precisely and repetitively by an operator over large areas.

In the AMORAC project, the focus is on further developing the mobile robot Spot to support human operators in their daily work, e.g. the integration of autonomous tasks with the automated measurement process to the existing system, with special emphasis on measurement rules and the resulting documentation. AMORAC is able to accomplish measurements of rooms or structures and transport equipment completely autonomously, of course in the range of its specifications. The goal is to automate the task while improving accuracy of the required measurements, resulting in reduced manual workload, improved project schedule and decreased radiation exposure of the workforce.

The development of AMORAC has been realized through agile project management moving quickly from idea to realization, incorporating customer feedback as early as possible, and resulting recently in its first applications as a commercial product. AMORAC's developed use cases mainly include radiological measurements with different purposes, e.g. for material release or radiological characterization of objects for interim and final disposal.

Object monitoring by AMORAC drives digital transformation by generating a variety of potentially useful data and converting them into digital databases, which in turn can serve as an interface for other operational-level platforms, such as building information models (BIM).

Within this framework, AMORAC is a solution that is constantly being extended with new functions and use cases, with the aim of meeting the current and future needs of Framatome's customers and supporting them in their daily work.





NEIL OWEN

14:20

WEDNESDAY

Createc
4 Derwent Mills Commercial Park
CA13 0HT Cockermouth
United Kingdom

www.createc.co.uk



DIGITAL FUTURE: ROBOTICS AND SENSORS IN EXTREME ENVIRONMENTS

Digital is set to play an essential and critical role in the future of nuclear decommissioning. From data collection and analysis for optimum decision-making to full digital twins, mapping the progress of items through the various waste streams to final storage.

Digital has powerful and compelling features and benefits. The challenge is deciding how and when to use the various tools in conjunction with the existing systems. Digital transformation has to be a strategic programme embraced by the whole organisation, but individual projects in that programme need to suit individual budgets, resources, timescales and workflows.

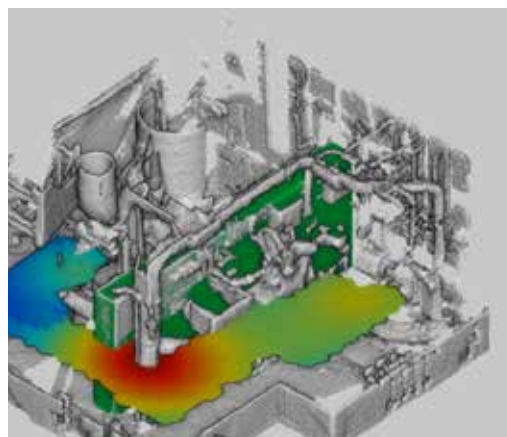
The key to it all is the data. How it is collected, analysed and managed? The other critical factor is that there are never two jobs the same. Digital nuclear decommissioning requires a flexible approach to data. This is achieved by selecting the right sensors for the hazardous environment and in most cases selecting the most appropriate way to remotely collect the data, using robots if needed.



This presentation will discuss collecting and using digital data in nuclear decommissioning, including Planning and Retrievals. Many of the technologies have been initially tested in active areas at Sellafield in UK.

In decommissioning there is always more uncertainty regarding the contamination in a specific area. Careful planning is essential and that requires a digital tool that can easily characterise an environment. Createc's N-Visage system fuses radiometric data with 3D data to provide a digital model showing dose planes and source terms.

For the retrieval of waste, robotics are a powerful tool but can become expensive in the cost/benefit analysis of a dedicated system. Createc's solution is a digital twin control system for robotic integration using commercial-off-the-shelf components that can be re-configured for other projects. A case study will be discussed that was quickly developed in the UK and deployed in Japan.



DR. CÉDRIC CARASCO

15:15

WEDNESDAY

CEA
Cadarache
13108 Saint Paul Lez Durance
France

www.cea.fr



RELOCATABLE RADIOACTIVE WASTE CHARACTERIZATION SYSTEMS

Authorisation for transporting a radioactive waste package can often be obtained after a radiological characterization based on gamma ray spectrometry to check compliance with safety rules. However, the non-destructive characterization of waste packages with a high activity, high attenuating matrix or with unknown physical or chemical characteristics requires more complex measurements. Because these problematic waste packages cannot be transported to facilities where such measurements are usually performed, it is necessary to bring the measurement systems to the place where the waste are stored.

This presentation will focus on several mobile non-destructive characterization systems that are developed or investigated by the Nuclear Measurement Laboratory of CEA Cadarache:

- A mobile passive neutron measurement cell is currently used at Cadarache to characterize historical waste packages. The coupling of this system with a transportable calorimeter capable of measuring 200 L waste drums developed by KEP tech-

nology was also tested to measure plutonium in a concrete mock-up radioactive waste drum.

- The low dose, multi-energy tomograph TOMIS is under deployment at Cadarache for radiographing and making 3D tomographic pictures with millimetre precision of large-volume concrete waste drums (up to 1 metre in diameter).

- The ANAIS mobile active neutron interrogation system is under development for declassifying long lived; medium activity wastes packages. It is designed to be operable in unrestricted areas or restricted areas (1.25 mSv/month maximum) and to provide a detection limit lesser than 1g 239Pu.

- Relocatable inspection systems based on the Associated Particle Technique (APT) have already been tested in different seaports for detecting contraband and NRBC-E threats. Simulations show that such systems can bring valuable information on radioactive waste packages matrices.



DR.-ING. ANTON ANTHOFER**15:40****WEDNESDAY**

Dornier Nuclear Services GmbH
Fritz-Reuter-Str. 32c
01097 Dresden
Germany

www.dornier-group.de



DISPOSAL ROUTES FOR INTEGRATED WASTE TREATMENT IN THE DISMANTLING OF NUCLEAR FACILITIES

The end of the operating life of a nuclear power plant (NPP) is the start of the planning and implementation of the dismantling process. The materials, which are obtained during this process have to be separated by basic material, radiologically evaluated, and measured for weight/size with the objective of release back into the conventional materials cycle or long-term deposition as radioactive waste.

To reduce the amount of waste, multiple steps of waste treatment can be performed. The different pathways needed for these conditioning processes must be planned out and executed with the limitations in treatment capabilities and amount of waste in mind. An integrated waste treatment center can "recycle" the current authorization for radiological treatment. Moreover, no new control areas must build up. On the other hand, an integrated treatment center has to be adapted to the site building situation and also to the dismantling concept. The result is a continuous planning and adapting of the integrated treatment. Different disposal routes are available depending on the amount, weight/size, and contamination of the materials. Great quantities can be processed with automated facilities. Large and complex compounds can be broken down with mechanical or thermal cutting methods. Contamination can be reduced or removed with wet and dry decontamination methods. After each process the materials are appraised considering if the requirements for disposal or release have been met. If necessary, additional treatment steps can be performed.

In the presentation, different disposal routes for integrated waste treatment are demonstrated.

- integrated or separated residue processing center
- continuous planning and adapting of the integrated treatment
- decontamination methods and usage of advanced technologies (robotics)
- fulfillment of the long-term storage requirements
- specific release of metals through waste melting, requirements, time, and cost savings
- education and training of the planning and operating staff for knowledge of the whole process

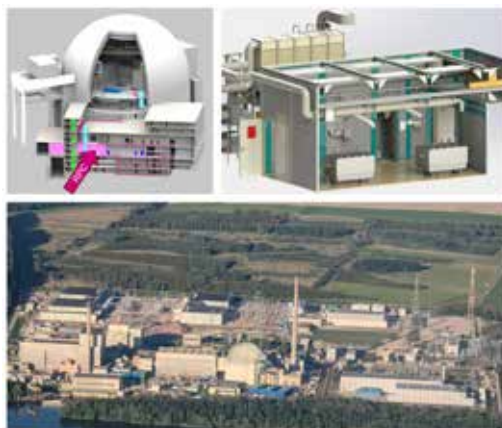


Figure 1: Examples of internal and external solutions for residue treatment and access for thermal processing

JACOBO SEGURADO**16:05****WEDNESDAY**

Equans Nuclear
19, Boulevard Roi Albert II
1210 Bruxelles
Belgium

www.equans.com



REMOTE MANIPULATION TECHNIQUES IN ON-SITE AND OFF-SITE MATERIAL TREATMENT

EQUANS Nuclear Services, from its Belux base, has two decades of experience in remote manipulation for onsite and offsite material treatment.

We will provide an overview of applications for the deployment of telemanipulation techniques for sampling, inspection, treatment, dismantling and decontamination both on-site and off-site at different environments.





DR. HENNING KELLER

16:30

WEDNESDAY

WTI GmbH
Karl-Heinz-Beckurts-Str. 8
52428 Jülich - Germany

www.wti-juelich.de

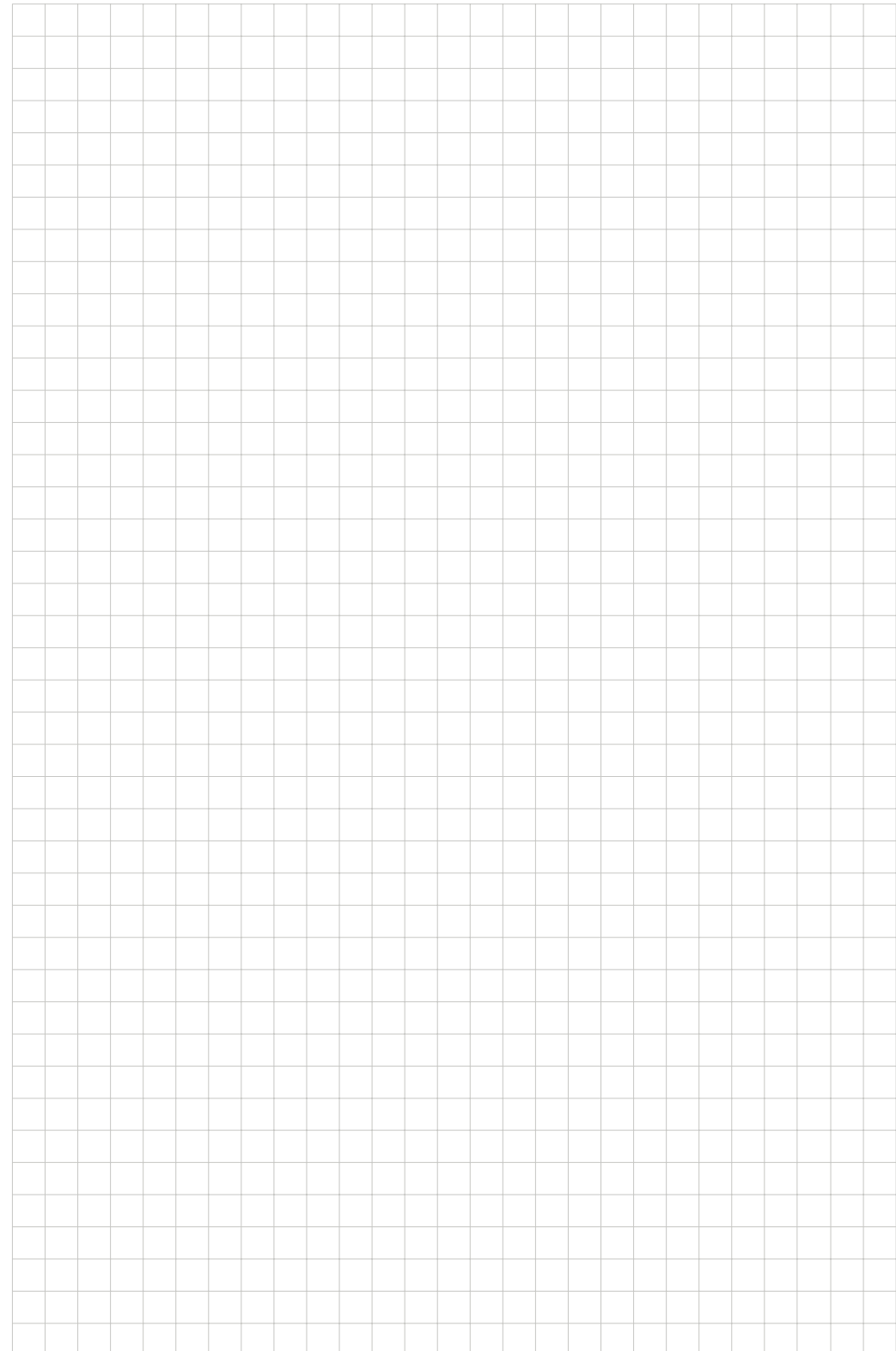
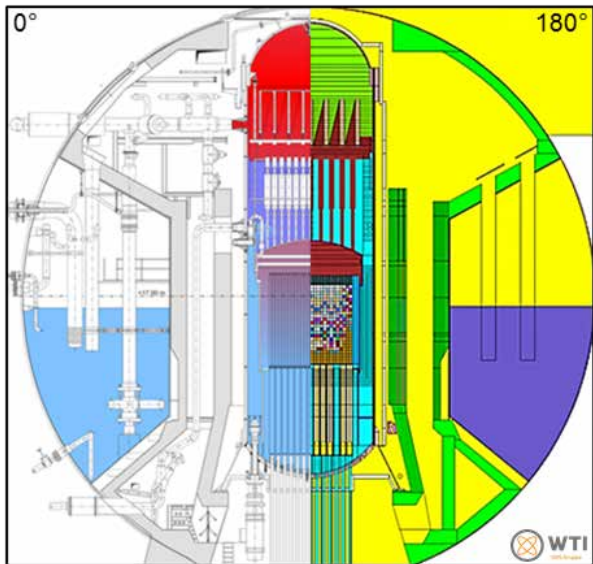


ACTIVATION CALCULATIONS FOR PACKAGING PLANNING

The decommissioning and dismantling (D&D) of light water reactors following the post-operational phase is currently the main task in the nuclear sector in Germany. With several countries deciding to phase out nuclear energy and additionally an increasing number of NPP - built in the 1970s and 1980s - facing the end of their operating time, the number of reactors in decommissioning will still increase world-wide in the next decades.

After removal of the irradiated fuel, the main nuclear inventory of a nuclear facility consists of activated radionuclides located in the structural components of the reactor pressure vessel. Knowledge of the activity distribution and nuclide vectors of those components as well as surrounding structures, which mainly consist of concrete materials, is of vital importance for an

optimized D&D planning. Neutron-induced activation calculations are carried out for the various structural components in order to develop a realistic prediction of the radioactivity of the components and to estimate the future costs for the conditioning of the radioactive waste or for the release of the components. In addition, the results of the activation calculations are used to develop a detailed radiation protection concept for the execution phase in order to fulfill the broad set of requirements of the comprehensive licensing procedure including possible effects on the environment.



SPEAKER ABSTRACTS
THURSDAY



DR. PETER UGELE

09:00

THURSDAY

GRS gGmbH
Schwertnergasse 1
50667 Köln
Germany

www.grs.de



BUILDING COMPETENCES AND PROMOTING TALENTS: ACTIVITIES OF THE PUBLICLY FUNDED NUCLEAR SAFETY AND DECOMMISSIONING RESEARCH

Germany will continue to need its extensive and widely recognised knowledge and experience in nuclear safety and decommissioning as well as highly trained and competent experts for the tasks ahead. These include decommissioning of nuclear power plants (NPPs) and other nuclear facilities, management of low/intermediate/high level waste, and continued operation of research reactors. In addition, it is in Germany's safety interest that independent and technically sound safety assessments of nuclear facilities abroad are conducted and to further participate in the elaboration of international safety standards, e.g. regarding new NPPs and waste treatment concepts.

To meet these goals, the funding programme for nuclear safety of the Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection (BMUV) supports application-oriented basic research in the areas of reactor safety, extended interim storage and treatment of high-level radioactive waste, final disposal, and cross-cutting issues. The Federal Ministry of Education and Research

(BMBF) funds application-oriented research projects related to nuclear decommissioning and management of the resulting waste through its funding programme FORKA. In addition, BMBF funds reactor safety, waste management, and radiation research projects with a focus on the promotion of young talent. Germany also supports a broad participation relating to nuclear safety research within the Euratom Research and Training Programme and other multilateral research such as OECD/NEA Joint Projects, thus enabling an intensive exchange with international experts, access to large research facilities, and valuable data generation/exchange.

This talk will provide information on the current funding programmes of BMUV and BMBF on nuclear safety and the status of national and international research and competence building activities implemented in recent years, and give an outlook on future activities and funding initiatives.



PROF. DR. CHRISTOPH LANGER

09:25

THURSDAY

FH Aachen University of Applied Sciences
Heinrich-Mußmann-Strasse 1
52428 Jülich
Germany

<https://www.fh-aachen.de/>



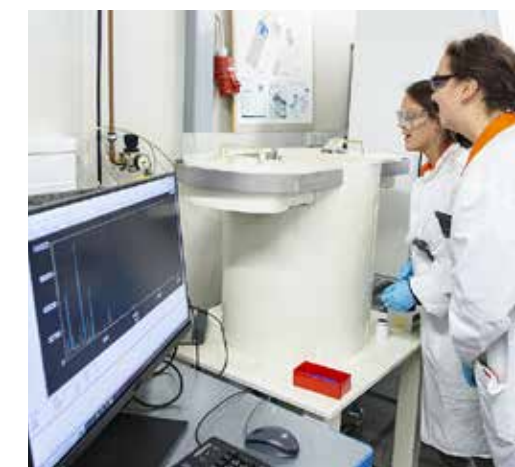
EDUCATING THE NEXT GENERATION: THE STUDY PROGRAM AT FH AACHEN

One of the major challenges in the field of decommissioning is to find and attract new employees to work in corresponding companies. This has many reasons and is also subject to educational and political discussions. As such, early education already in schools (and maybe even earlier) in topics related to natural sciences and engineering is important.

Also, universities should offer corresponding study programs to enable interested students to work in the nuclear field with close contact to the different companies. Here, an interaction between the universities and the companies is important. This allows, on the one hand, a close collaboration regarding the requirements of the companies for new employees and the curricula at the universities. On the other hand, the universi-

ties profit from this interaction by acquiring new experts providing lectures, exercises, practical trainings and possible positions for a project, a bachelor or master thesis.

In this talk, I will present different study opportunities, that are offered by the FH Aachen University of Applied Sciences. I will focus on existing study programs with bachelor and master degrees, and show, how they support the education of the next generation in the nuclear field – with a special focus on decommissioning. Also, some possibilities to support the educational program along with new ideas will be presented.





ANGUS TURPIN

09:50

THURSDAY

HR Forecast
Agnes -Pockels Bogen 1
80992 München
Germany

www.hrforecast.de



KERNTRAF0: EFFICIENT SKILLS MANAGEMENT FOR NUCLEAR POWER PLANTS DURING DECOMMISSIONING

The dismantling of nuclear power plants poses considerable challenges for operators and requires new approaches as well as innovative solutions.

In addition to issues surrounding the technical dismantling of the plants or the proper disposal of nuclear waste, the topic of „people and organisation“ is a central pillar of dismantling. The need to revolutionise skills management in the nuclear energy sector and enable operators to optimally manage the transformation process is critical. Locating the relevant new skills, hiring and up and cross-skilling to achieve the optimal desired approach.

Dismantling of nuclear power plants requires a new skill set, the dismantling process cannot be planned with the same precision as power operation; however, previously employees have neither been trained nor hired with this in mind. People are being asked to dismantle what they have at time spent their lives building and creating- and to work themselves out of a job. Moreover a workforce that has remained in some case with a static skillset must become nimble and agile, and the skills of the workforce and the new job profiles must be carefully matched.

This is where HRForecast with our innovative AI and Data Led approach can help. Key to the success of the dismantling program is the areas of People Analytics which deals with the development of data-driven software for human resource development. With our focus on solutions

in the areas of artificial intelligence, big data and people analytics, we are ideally suited to help you, adapting our AI-based skills approach to the needs of the nuclear energy industry.

We can identify which competences are necessary for which phase of the dismantling process, and match the existing skills of the workforce with the newly arising requirements. In this way, new positions that arise during the dismantling process can be quickly identified and employees can be assigned to them in the best possible way and upskilled with the minimal business interruption.

This needs to be a top down and bottom up approach. Understanding the skills required for effective leadership is vital. In dismantling, managers must constantly perform a cognitive balancing act between safety-relevant processes and innovative ideas. We can help managers expand their leadership skills and gain valuable competences in dealing confidently with conflicting demands. Moreover we can help with adaptation to a changing organisation. For this purpose, the situation in the respective power plants and areas is carefully considered and we work with you to ensure that the potential of the individual quickly becomes effective in the new organisation.

PROF. DR.-ING.
ANGELIKA METTKE

10:45

THURSDAY

Brandenburgische Technische Universität
Cottbus-Senftenberg
Siemens-Halske-Ring 8
03046 Cottbus
Germany

www.b-tu.de



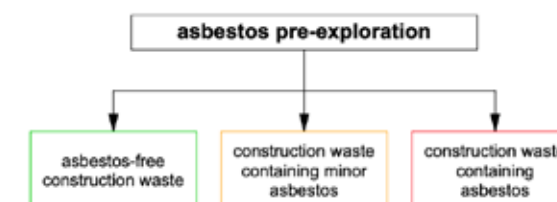
HANDLING FOR POTENTIONIALLY ASPESTOS CONTAINING RUBBLE

Buildings constructed before October 31, 1993 may contain asbestos-containing building materials and products. If these are not verifiably asbestos-remediated or their freedom from asbestos is not confirmed by an expert, they are to be classified as potentially containing asbestos. In this case, there is a duty of preliminary investigation for demolition, renovation or repair measures, which must be carried out in accordance with the state of the art.

When the new Hazardous Substances Ordinance comes into force - in 2023 - asbestos exploration and the implementation of risk-based action concepts for activities involving asbestos-containing building materials and products will be mandatory. At the same time, it is mandatory to prove that potentially containing asbestos construction waste is free of asbestos when it is being disposed of. LAGA M 23 of 29.11.2022, published on 08.05.2023, serves as an

implementation guide for the disposal of construction waste containing asbestos.

This presentation gives an overview of possible locations where asbestos may be found, the new requirements for handling construction waste containing asbestos, and the consequences of the results of the analyses for dismantling and disposal concepts and for practical implementation.





DR. MALGORZATA URSZULA SLIZ

11:10

THURSDAY

Paul Scherrer Institute
Forschungsstrasse 111
5232 Villigen
Switzerland

www.psi.ch



CHALLENGES IN DECOMMISSIONING OF CONCRETE SHIELDING AT PSI

Considerable amounts of waste materials are produced during dismantling of the large research facilities at the Paul Scherrer Institute (PSI), e.g. concrete shielding from a recently dismantled proton accelerator. If the concrete's specific activity (Bq/g), among other specifications, is below the Swiss Radiation Protection Ordinance exemption level, it will be released from regulatory control. PSI uses clearance monitors (CM) to measure material's specific activity. The concrete was measured using the HWM-1800 CM (Ludlum GmbH, Hamburg), whose calibration involves energy and geometry calibrations.

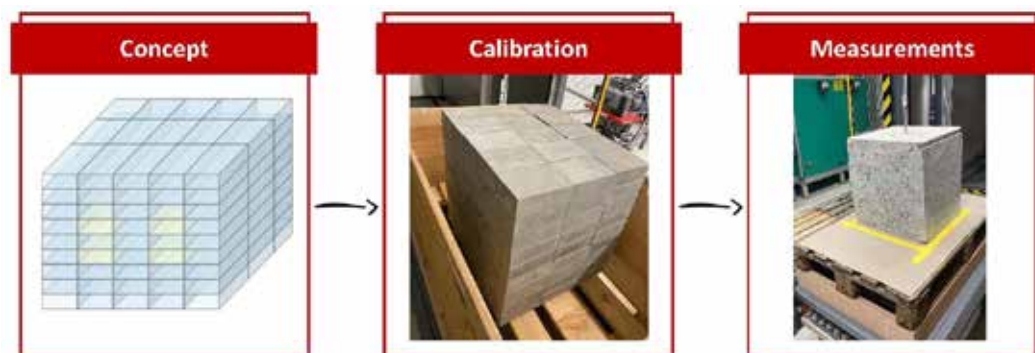
Calibrating the HWM-1800 presented some challenges:

- Instead of the usual practice of measuring the concrete as gravel, it was to be measured as blocks;
- The manufacturer's calibrations underestimate activities for the specific combination of geometry, nuclide vector (100% ^{152}Eu) and measurement position of the blocks;
- The calibration must consider steel reinforcement in blocks. Thereby, a novel

approach was necessary to calibrate HWM-1800 appropriately.

For this task, PSI designed a dedicated calibration phantom, consisting of bricks with inlets for certified ^{133}Ba , ^{137}Cs and ^{60}Co rod-shaped sources, which can be assembled in dimensions of up to $\sim 50 \times 50 \times 50$ cm³ and weight ranging from ~ 50 to ~ 350 kg. The phantom mimics the properties of the material to be cleared, allowing calibration for homogeneous and hotspot activity distributions. The calibration procedure was validated using certified ^{152}Eu sources. The results showed that the measured and known activities were in good agreement, with a 1-33% overestimation depending on the activity distribution.

The described customised phantom and novel calibration procedure help to keep radioactive waste to a minimum and reduce the risk of radioactive release into the environment. By enabling clearance measurements of unconventional geometries and eliminating material processing, the decommissioning is made more cost-effective and time-efficient.



DR. BENJAMIN BRÜCKNER

11:35

THURSDAY

Safetec GmbH
Dischingerstraße 8
69123 Heidelberg
Germany

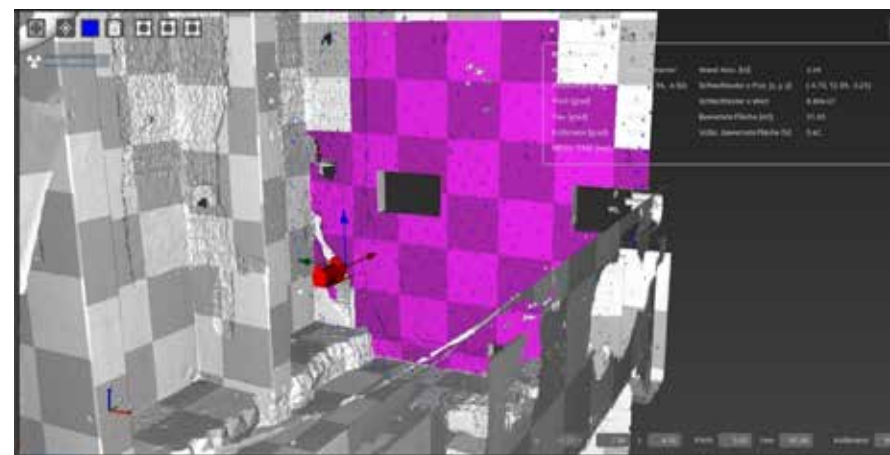
www.safetec-hd.de

SOFTWARE ASSISTED INSITU CLEARANCE MEASUREMENTS (SAIF/VEGAS)

Mit der Umsetzung der AtG Novelle, welche 2021 verabschiedet wurde, sind in den nächsten zwei Dekaden etwa 20 Leistungsreaktoren in Deutschland zurückzubauen. Ein wesentlicher Prozess des Rückbaus ist die Dekontamination und Freigabe (GeDuF) der Kontrollbereichsgebäude mit der schlussendlichen Entlassung der Gebäude aus dem Atomgesetz. Die Vielzahl an Anlagen, die hierbei in Deutschland parallel zurückgebaut werden, erfordern effiziente und prozesssichere Vorgehensweise. Hierbei kann die Digitalisierung helfen. Bisherige Erkenntnisse in den Rückbauprojekten an den Kernkraftwerken Würgassen und Stade ergaben, dass die Verarbeitung und Dokumentation der umfangreichen Mess- und Analyse-daten zu den erfolgskritischsten Schlüsselfaktoren im modernen Rückbau gehören. Die konsequente Umsetzung der Prozessdigitalisierung, in Kombination mit standardisierten Prozessabläufen und effizienter Automatisierung, sind Schlüsselbausteine, um den steigenden Anforderungen zielgerichtet zu begegnen. Dies geschieht mit der

Anwendung der neu entwickelten Software assistierten InSitu Freimessungen (SAIF/VEGAS). Die Digitalisierung in der Gebäudefreigabe beginnt mit der Erstellung eines digitalen Zwillings mittels 3D Laserscan. Darauf aufbauend kann eine Messplanung mit verschiedener Messtechnik durchgeführt werden. Für den Übergang von digitaler Messplanung zum realen Kraftwerk wird darüber hinaus mittels Positionierungstechnik sichergestellt, dass die reale mit der vordefinierten Position der Messgeräte übereinstimmt. Begleitend zum Durchlaufen des GeDuF Prozesses werden alle Schritte in der Software dokumentiert. Im Anschluss ist es möglich die gesamte Freigabedokumentation automatisiert zu erstellen.

Mit den vorgestellten maßgeschneiderten Digitalisierungs- und Automatisierungskonzepten sollen eine höchstmögliche Prozesssicherheit bei gleichzeitig hoher Effizienz erreicht und damit der erfolgreiche Weg zur „Grünen Wiese“ unterstützt werden.





DR. TEUN VAN DILLEN

12:00

THURSDAY

National Institute for Public Health and the Environment (RIVM)
Antonie van Leeuwenhoeklaan 9
3721 MA Bilthoven
Netherlands



www.rivm.nl

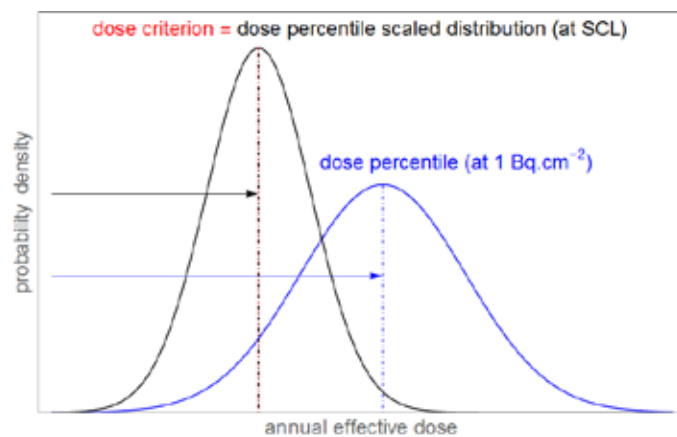
DERIVATION OF NUCLIDE-SPECIFIC SURFACE-CLEARANCE LEVELS FOR THE NORMAL REUSE OF OBJECTS LEAVING THE CONTROLLED AREA OF A NUCLEAR FACILITY

In the aftermath of the Fukushima nuclear accident (Japan, 2011), the Dutch National Institute for Public Health and the Environment (RIVM) developed a new methodology to assess the radiological consequences of surface contamination. This methodology, entitled SUDOQU (SURface DOse QUantification), was developed to calculate the annual effective dose resulting from surface contamination of imported non-food (consumer) goods, containers and conveyances from the area affected by the accident. SUDOQU distinguishes itself from other dosimetric models for surface contamination by taking into account mechanisms related to the removability of radioactive contamination in a mass-balance framework (Van Dillen and Van Dijk 2018).

In 2016, Bel V (subsidiary of the Belgian Federal Agency for Nuclear Control (FANC)) and RIVM started a collaboration to derive nuclide-specific surface-clearance levels for

nuclear facilities, because such levels were not explicitly specified in Belgian regulations. After successfully exploring its applicability, we used the SUDOQU model to derive clearance levels for the normal reuse of objects with a surface contamination leaving the controlled area of a nuclear facility. Based on probabilistic dose assessments, we derived clearance levels (in Bq per cm²) for 413 radionuclides, which have recently been implemented in Belgian regulation (Van Dillen et al. 2022).

We will present the characteristics of the methodology to derive surface-clearance levels. These derived levels, applying to the sum of fixed and removable radioactive contamination residing on the surface of objects, will be presented and their dependence on the half-life of the radionuclides will be investigated. They will be compared with the generic levels defined as contamination in the IAEA Transport Regulations (IAEA 2018, para 214) as well as with values derived by the European Commission.



S	U	D
R	Q	O
I	V	M



DR. OLAF NITZSCHE

12:25

THURSDAY

Brenk Systemplanung GmbH
Heider-Hof-Weg 23
52080 Aachen
Germany



www.brenk.com

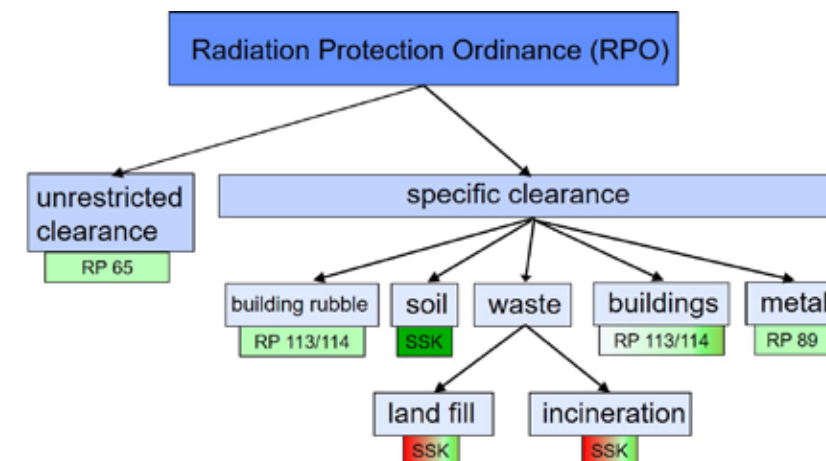
CHALLENGES OF DIFFERENT CLEARANCE OPTIONS WITHIN CLEARANCE PROCEDURES IN GERMANY

Material originating from a controlled area covered by a nuclear license can be cleared according to several clearance options, which are contained in the German Radiation Protection Ordinance. These options include the unrestricted clearance of large quantities according to IAEA recommendations (Basic Safety Standards, RS-G-1.7) and, in addition, specific clearance for disposal or incineration as normal waste, melting of metal scrap as well as several options of specific clearance of different substances or structures. Each clearance option is connected with a different set of nuclide specific clearance levels and requirements for averaging masses or averaging areas for measurements. Clearance is thus a mature process in Germany for more than two decades. Many aspects of this process have been adapted in other European countries.

The presentation provides a detailed overview of several of these clearance options with special emphasis on the main parameters:

- typical nuclide vector for the option with consideration of the facility type,
- clearance levels for nuclides within the nuclide vector,
- possible mass streams,
- averaging masses or averaging areas,
- different options for measurement,
- challenges of subtracting natural background and
- administrative challenges.

The advantages and problems of different options will be discussed based on anonymized examples from different types of nuclear facilities. The intended amendment of the Radiation Protection Ordinance concerning unrestricted clearance.





COMPANY PROFILES



AACHEN INSTITUTE FOR NUCLEAR TRAINING GMBH

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52222 Stolberg (Rhld.)
Germany

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PHONE +49 2402 1021 500
EMAIL schunk@nuclear-training.de
WEB www.nuclear-training.de

COMPETENCES IN NUCLEAR SERVICES

Our nuclear services focus on the radiological and material characterization of nuclear residual and waste materials. We offer wide-ranging knowledge in nuclear technologies such as radiation measurement techniques, waste management concepts and nuclear simulations.

As a contractor to waste producers, we have carried out numerous measurement campaigns since 2012 in order to characterize radioactive waste. The documentation for final

disposal was generated for qualification of the waste packages in line with the regulatory requirements. AiNT has the license to dispatch staff to undertake on-site measurements in controlled areas and has technical qualified personnel for radiation protection. Several expert statements from the TSOs confirm the suitability of the applied measuring methods and performed campaigns by AiNT for the radiological characterization according to the regulatory requirements.

DRUM SCANNERS AND GAMMA-SPECTROMETRIC MEASUREMENT DEVICES

- Design and layout of gamma waste scanners
- Measurement devices for detection of fissile material by active or passive neutron interrogation
- Radiographic measuring devices for filling heights and density determination
- Approval documents for the drum scanners
- Execution of experimental validation campaigns in our technical center
- Uncertainty and sensitivity analyses according to DIN EN ISO 11929
- Support for the qualification of the drum scanners
- Commissioning and training of employees

MEASUREMENTS FOR CLEARANCE

- In situ gamma spectroscopy
- Development of measurement protocols
- Statistical sampling methods
- Radiological mapping
- Application documents for clearance procedures



AiNT develops decommissioning strategies and concepts for the conditioning and packaging of radioactive waste in which we particularly highlight opportunities for cost savings. We support our customers in preparation of application documents and campaign related process plans for process qualification and provide expert advice in the licensing and authorization process.

Furthermore, we perform nuclear simulations based on precise modeling for applications such as

CHARACTERIZATION OF RADIOACTIVE WASTE

- Radiological characterization
- Inventory of hazardous materials
- Waste package documentation
- Re-qualification of legacy waste
- Non-destructive measurements
- Uncertainty evaluation and quantification

DECOMMISSIONING MANAGEMENT

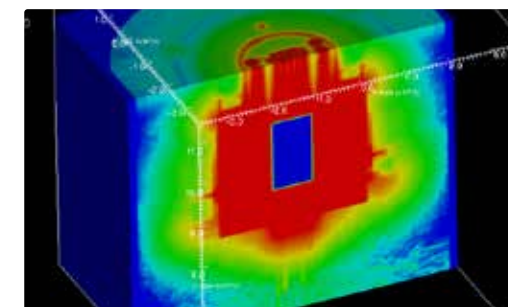
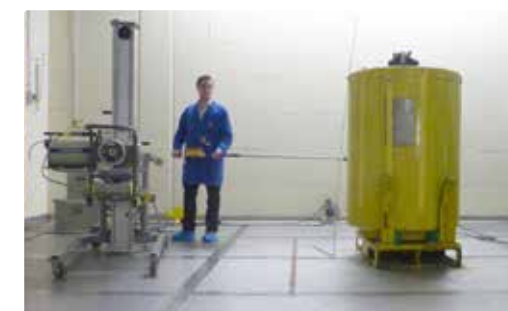
- Identification of relevant framework conditions
- Planning of technical realization and resources
- Preparation of schedules and test sequences
- Project controlling
- Radiation protection

NUCLEAR SIMULATIONS

- Calculation of dose maps
- Activation calculations, e.g. for reactor components
- Simulation of measurement systems
- Design of shielding against neutron and / or gamma radiation

radiation transport calculations, determination of activation of materials and modeling of non-destructive measurement systems. In addition, we develop innovative metrological systems for different purposes.

With high expectations to our work, we are open to support our customers in their challenging tasks and offer engineering and nuclear services for the safe, effective and efficient management of radioactive waste.



ATKINS ENERGY GERMANY GMBH

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22453 Hamburg
Germany

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**EIN NEUER NAME. EINE NEUE ÄRA.**

Unsere Unternehmensgruppe hat sich seit vielen Jahren stetig in Zusammenarbeit mit unseren Kunden in der Planung und Durchführung der komplexesten Projekte der Welt weiterentwickelt. Im Zuge dieser Entwicklung hat sich die SNC-Lavalin-Gruppe durch eine Reihe von Akquisitionen gestärkt, darunter Atkins und Faithful+Gould, um in einer konzernweiten Zusammenarbeit noch bessere Ergebnisse für Kunden, Öffentlichkeit und die Umwelt zu erzielen. Wir haben jetzt einen bedeutenden Meilenstein auf diesem Weg erreicht, indem wir unsere Marken harmonisieren, um ein Unternehmen, eine Strategie und ein integriertes Angebot zu schaffen.

Zukünftig werden SNC-Lavalin, Atkins und Faithful+Gould als AtkinsRéalis unter einer Marke am Markt auftreten und als ein weltweit führendes Unternehmen für Planung, Engineering und Projektmanagement agieren, das Menschen, Daten und Technologie miteinander verbindet, um die Infrastruktur und die Energie-

systeme der Welt zu verändern. Wir konsolidieren den gesamten Wert unserer derzeitigen Marken in diesem vereinten Haus. Die Firmierung Atkins Energy Germany GmbH ändert sich dadurch zunächst nicht.

Wir sind stolz auf das, was wir bisher erreicht haben und dies markiert einen wichtigen Meilenstein in unserem Wachstum. Wir glauben, AtkinsRéalis spiegelt besser wider, wer wir sind, was wir tun und wohin wir uns als ein Unternehmen bewegen, das Lösungen für die schwierigsten Herausforderungen der Menschheit entwickelt und die Grenzen des menschlich Machbaren ausreizt. Was sich jedoch nicht ändert, ist unser Engagement für sie, ihre Projekte und unsere Zusammenarbeit. Wir sind davon überzeugt, dass die Zusammenführung unserer Organisationen zu AtkinsRéalis es allen leichter machen wird, das Beste aus unseren globalen Fähigkeiten für sie herauszuholen, indem wir global denken und lokal liefern und so effektiver, effizienter und innovativer werden.

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EXPERTS FOR MEASUREMENTS IN RADIATION PROTECTION

Radiation protection is one of the most important parts in industrial safety and is subject to strict legal regulations. Exactly for this sensitive area BERTHOLD TECHNOLOGIES provides highly sensitive and reliable instruments.

The Berthold radiation protection division supplies advanced and reliable detection technology for measurement of radioactive contamination, dose and dose rate, activity and airborne radioactivity concentrations. The portfolio ranges from handheld instruments up to large customer-tailored systems for research, nuclear medicine, nuclear energy and decommissioning.

For many decades, customers have trusted Berthold to support their efforts in creating a healthier world, a safer environment and more efficient manufacturing processes. Our deep understanding of science combined with leading-edge technology empowers our clients with tools and solutions to pursue the most challenging applications - we improve life in meaningful ways.



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THE DECOMMISSIONING SPECIALIST - PROVEN RELIABILITY IN TOUGH ENVIRONMENTS

It's hard to think of an environment where remote control is more critical than in a nuclear plant. Here, Brokk robots are the preferred choice for nuclear decommissioning and can perform difficult tasks in four main categories:

- Dismantling and size reduction
- Sorting waste material
- Decontamination
- Demolition

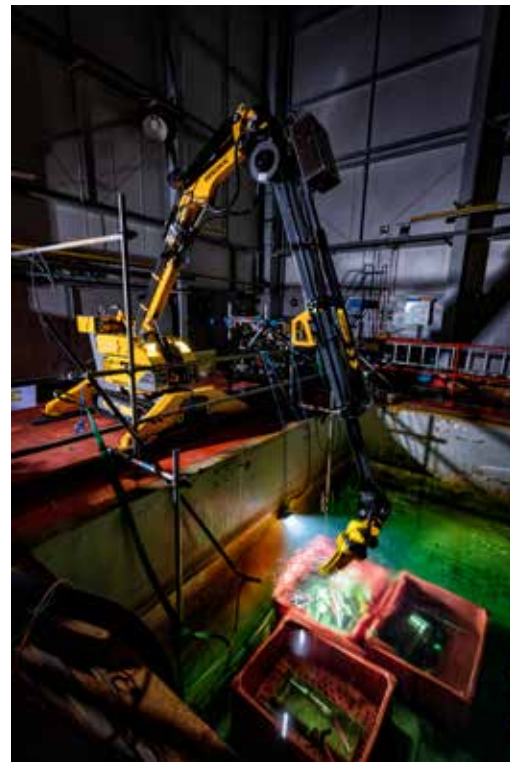
All Brokk robots come with unique features you won't find in typical demolition equipment, plus it can gain access to places where people and other machines can't go.

Remote-controlled handling, heat resistant design, flexible three-arm system, and an electric motor for powerful, quiet, fumeless operation, we leave nothing to chance when it comes to perfecting the performance of our machines. And since the robot is built for adaptability, our engineers can customize the robots to meet your specialized needs.



At Brokk we offer a proven combination of design, engineering and service that can tackle almost any undertaking. With over 8,000 machines working on exciting projects around the world, Brokk has become synonymous with safety, quality and efficiency.

For more than three decades Brokk has been involved in and delivered robots to decommissioning projects all over the world, resulting in an unmatched experience in tailor-made solutions.

**BRENK SYSTEMPLANUNG GMBH**

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**BRENK SYSTEMPLANUNG GMBH (BS)**

BS offers consultancy services for over 40 years. With more than 85 staff (engineers and scientists) we provide expert knowledge in the areas of radiation protection, nuclear technology, radwaste management including disposal, NORM, mining engineering, environmental management, plant/process engineering as well as software development, artificial intelligence, and business analytics. We are a Germany based company with several branch offices. Our customers comprise the private as well as the public sector on national and international level e.g. German and foreign governments and their different regulatory bodies, or IAEA and EC.

Our services in the nuclear sector include all aspects of radiation protection (activation/shielding calculations, dispersion modelling of radionuclides, safety assessments) and decommissioning (concepts, comprehensive support for clearance, radiological characterisation, clearance

measurements, licensing support, waste package optimization). Our remarkable set of specific measurement devices allows us to conduct radiation measurements in a timely manner even under exceptional conditions. Our software tool PUG3 supports an efficient and traceable planning and conduct of all steps of a clearance process from the very beginning. In the field of radwaste management we provide services related to waste processing, interim storages and disposals itself. For the latter our services cover the entire life cycle of a disposal for deep geological and near-surface disposal.

Several of our experts are appointed members of national advisory commissions (Commission on Radiation Protection (SSK), Nuclear Waste Management Commission (ESK)) and working groups of international organizations (IAEA, OECD/NEA).



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CYCLIFE, YOUR STRATEGIC PARTNER FOR YOUR NUCLEAR DECOMMISSIONING AND WASTE MANAGEMENT PROJECTS

As a European pioneer, Cyclife provides integrated nuclear decommissioning, dismantling and waste management services. Fully owned subsidiary of the EDF Group, Cyclife applies EDF's unique waste-led decommissioning approach to help its customers reduce costs and waste generation, optimise programmes, and recycle valuable materials through its subsidiaries.

Cyclife's three nuclear licensed facilities are located in the UK, Sweden and France. They process very low to low level waste, including waste size reduction and decontamination, as well as material recycling where possible. The facilities all deliver Best Available Techniques (BAT) in waste management and decommissioning consultancy services.

Cyclife also has a commercial structure in Germany and six engineering and expertise centres with highly qualified engineers: Cyclife Digital Solutions, Cyclife Engineering, Graphitech*, Waste2Glass* and Cyclife Aquila Nuclear.

They study specific radioactive waste treatment solutions. The teams also design waste treatment facilities, workshops, remoted tools and handling equipment, shielded installations, and transport/packaging to better address customers' needs. They can define and implement the complete dismantling scenario of a given nuclear installation, using the state-of-the-art technologies with the latest innovations, including digital.

*A joint venture of EDF and Veolia



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DORNIER NUCLEAR SERVICES GMBH – THE EXPERTS FOR NUCLEAR DECOMMISSIONING

Dornier Nuclear Services GmbH is a member of the Dornier Group, which brings together several companies to jointly assist our clients in the implementation of projects and provide guidance in decision-making processes. The Dornier Group is a global one-stop shop for engineering services with a focus on the infrastructure sector. A functioning and interlocking infrastructure plays a pivotal role in the 21st century and is a basic prerequisite for progress.

The number of nuclear power plants reaching the end of their lives, either for technical or political reasons, is increasing every year. Dismantling nuclear facilities, as well as dealing with radioactive waste and residual materials and treating them prior to final disposal poses great challenges for operators of nuclear facilities. We offer comprehensive know-how to support the entire process.

We have set ourselves the target of enabling our customers to dismantle their nuclear facilities safely and efficiently. To this end, our holistic disposal planning covers the topics of dismantling planning, disposal planning, packaging planning, radiation protection and repository documentation. Our highly motivated team of experts will provide you with solution-oriented and expert support for your individual tasks.

Our disposal planning maps out a decommissioning project through to disposal or clearance. The documents required for release or repository documentation are planned and maintained. We plan verification strategies and coordinate sequence schedules and documents within the scope of the supervisory and repository procedures in order to ensure efficient and easily verifiable repository documentation. This includes a certified team of radiation protection specialists who provide you with optimum operational support on site and train your staff.



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DSD HEAVY LIFT AG: CONCENTRATED COMPETENCE FOR HEAVY LIFTING AND DISMANTLING IN THE NUCLEAR SECTOR

DSD Heavy Lift AG offers its customers innovative solutions for handling heavy loads that are tailored to their needs. Our field of application ranges from infrastructure projects to nuclear dismantling. DSD Heavy Lift AG has been an independent company since January 2022 as part of DSD Steel Construction. Our team combines many years of industry experience with young and up-and-coming expertise. Mechanical engineers, construction engineers, hydraulics experts, assembly teams, and mechanics work closely together. Due to the high level of expertise, DSD Heavy Lift AG offers solutions for the effective and, above all, the safe dismantling of power plants as well as nuclear power plants and special solutions in the heavy lift sector.

Our services:

- Consulting planning and implementation of individual solutions in all our business areas
- Assembly and disassembly
- Lifting, moving and lowering of heavy loads
- Crane work and SPMT transports



We place particular emphasis on effective and safe work in order to deliver on time and reduce safety risks to an absolute minimum. We were able to demonstrate our cumulative expertise in our very first project: We worked on the construction of the Braila Bridge over the Danube in Romania, the largest suspension bridge in Europe. Our task was to lift and move 86 parts with a total weight of 50,000 t over a length of 1.9km without any incidents. We worked on the construction site with a team of up to 32 men, including numerous specialists. This enabled us to complete the project successfully, safely, and within the specified time frame. In the future, DSD Heavy Lift AG will successfully implement many more challenging projects in order to make a name for ourselves in the market and to continuously grow at a healthy rate.



FORTUM POWER AND HEAT OY

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FORTUM NUCLEAR SERVICES – SERVICES SUPPORTING SUSTAINABLE AND COST-EFFICIENT NUCLEAR DECOMMISSIONING AND WASTE MANAGEMENT

For more than 30 years, Fortum has been a forerunner in nuclear decommissioning and waste management. Our experience is based on combining the skills of service provider and a perspective of owner and license holder of nuclear power plant.

Decommissioning planning

Our decommissioning planning and engineering expertise covers holistically the whole decom process from shutdown of the facility to final disposal of the wastes. We have experience on preparing general level decommissioning strategies and decommissioning plans from the preliminary to final versions including extensive cost assessments covering also final disposal expenses.

Licensing and safety engineering in decommissioning

Fortum has the capability to support in all pre-decommissioning licensing and safety engineering activities to achieve timely and cost effective project execution.

Waste Management, Treatment and Disposal

Based on our experience on operational waste, decommissioning waste, the treatment of liquid waste with our highly-effective NURES® solution and nuclear waste disposal, we can help our clients to optimize the waste management of decommissioning project holistically.

Radiation safety engineering

Fortum has a strong in-house radiation safety engineering capabilities, covering radiation safety planning, preparation of ALARA plans and dose assessments as well as carrying out complex radiation shielding calculations and simulations.

Owner's engineering in decommissioning

Fortum has over 40 years of nuclear operator and license holder experience from Nordic's regulatory regime including licensing, planning and construction of new facilities such as storages and final repositories for nuclear wastes.



FRAMATOME GMBH



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FRAMATOME IN GERMANY - OUR CUSTOMERS' PERFORMANCE IS OUR EVERYDAY COMMITMENT!

Framatome is a major international player in the nuclear energy market recognized for its innovative solutions and value-added technologies for designing, building, maintaining, and advancing the global nuclear fleet. The company designs, manufactures, and installs components, as well as fuel and instrumentation & control systems for nuclear power plants and offers a full range of reactor services.

With 16,000 employees worldwide, every day Framatome's expertise helps its customers improve the safety and performance of their nuclear plants and achieve their economic and societal goals.

Framatome is owned by the EDF Group (75.5%), Mitsubishi Heavy Industries (MHI – 19.5%) and Assystem (5%).

Framatome in Germany also offers a competitive solutions portfolio for the post-operational-phase and dismantling of nuclear power plants which contains: dismantling of large components (RPV, PRV internals, Steam generator etc.), engineering, dismantling scenario studies, system decontamination, sampling, characterization, radiation protection, waste management, waste treatment and back fitting of (mobile) operating systems.

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EXCELLENCE FOR NUCLEAR

GNS Gesellschaft für Nuklear-Service mbH offers comprehensive solutions for the management and disposal of spent nuclear fuel and all types of radioactive waste from the operation of NPPs based on its nuclear expertise of 50 years.

For all phases of decommissioning GNS offers solutions from defueling to dismantling and packaging of RPVs and their internals and also other primary circuit components. Experienced activation calculations facilitate efficient cutting and packaging as well as minimal dose rates.

2.000 spent fuel/HLW casks of the CASTOR® and CONSTOR® type and around 9.000 MOSAIK® casks and GNS Yellow Boxes® for ILW are in use today in a number of countries on four continents. This makes GNS the world's top supplier of shielded transport and storage casks.

For more than three decades, GNS has been responsible for the management of all the radioactive waste and the spent nuclear fuel resulting from the operation of the German NPPs.



Its products and services comprise the design and manufacturing of casks and containers for ILW and HLW, the construction of equipment for conditioning and packaging of wastes as well as the operation of conditioning facilities and preparations for final disposal. For nearly three decades GNS also operated the central interim storage facilities for HLW, ILW and LLW at Gorleben and Ahaus.

GNS treats both solid and liquid radioactive waste and applies suitable treatment processes to ensure acceptability of the waste for interim storage and final disposal. In this context a large number of data and information needs to be acquired, documented and updated. For that GNS offers comprehensive software and database solutions, e.g. for tracking operational waste or residues from decommissioning.

With its more than 1000 employees, the companies of the GNS Group achieve an annual turnover of around 250 million euros.



JEPSON POWER GMBH

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JEPSON POWER
GERMANY
Leading Through Innovation since 1984

METAL CUTTING CIRCULAR SAWS FOR DISMANTLING OF NUCLEAR POWER PLANTS

A continuous pursuit of innovation is an important factor in the growth of any company. Since its founding in 1984, developing innovative solutions has been the motto of Jepson Power, the inventor of Dry Cutter technology for cutting steel, stainless steel and composite materials. This technology cuts without cooling, with a shorter cutting cycle, almost burr-free and with a longer service life.

Jepson Power's metal circular saws play a crucial role in the dismantling of nuclear power plants. The state-of-the-art saws and saw blades offer numerous advantages that make the process more efficient, safer and more environmentally friendly.

An important aspect is the precision that these metal cutting saws offer. They allow workers to make clean, straight, and nearly spark-free cuts, greatly improving the safety and efficiency of dismantling.

These high performance machines can easily cut through thick metal structures, which significantly speeds up dismantling. This allows workers to get more work done in less time, which in turn reduces costs.

Jepson Power's metal cutting circular saws also offer ecological advantages. By using their saws, there is no need for coolants and lubricants. These therefore do not have to be decontaminated and disposed of.

Furthermore, the saws are lightweight and portable, allowing workers to easily transport them to different job sites. This makes dismantling more flexible and efficient.

In addition to the technical advantages, Jepson Power also offers excellent customer service, providing training and support to ensure the workers can operate the saws correctly and achieve maximum efficiency.

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Krantz

KRANTZ - 145 YEAR 'S OF EXPERIENCE - TRADITIONALLY COMMITTED TO THE FUTURE

Clean air is one of the elementary preconditions for quality of life and human health. That is why it is important that the air we breathe day after day is treated well. We take this task very seriously.

We are the expert partner at your side at all times, especially concerning plant construction and ventilation services for nuclear power stations. Our products enjoy an excellent reputation and are used where quality and reliability matters, in both public and in commercial buildings. Examples are clean rooms, nuclear installations, high security laboratories and isolation wards.

Krantz offers a broad assortment of very different products and services for one common theme - clean air!

Air Technologies:

Krantz Air Technologies is responsible for the business areas of nuclear technology, process air technology and specialized technical solutions. This includes three nuclear and conventional business units:

- Plant Engineering and Construction
- Service and Maintenance
- Measurement and control technology

Thanks to over 45 years of experience in planning, installation and maintenance of air distribution systems in, for example nuclear power stations and laboratories, Krantz Special Technologies is able to serve the entire life cycle fulfilling the highest requirements and quality standards.

Filter & Damper Systems

Krantz designs, manufactures and sells Filter Systems and Dampers for HVAC systems in areas

with highest tightness requirements as nuclear facilities, bio-safety laboratories, isolation wards, decommissioning of chemical weapons etc. Made in Bavaria, Germany.

Filter Systems

Krantz offers a wide range of filter systems for applications with high tightness requirements, like: HEPA filter systems

- Re-cleanable HEPA filter systems
- HEPA filter air outlets
- Duct filters
- Filter walls
- Mobile filter systems
- In-cell filters
- Sorption filter systems
- Sorption filter elements
- Sorption cartridge filters

Dampers

Krantz offers a wide range of dampers for applications with high tightness requirements, like:

- Gastight dampers acc. DIN 25 496
- Air flow controllers
- Pressure relief dampers
- Louver dampers
- Non-return dampers
- Pressure surge dampers





MIRION
TECHNOLOGIES

MIRION TECHNOLOGIES (CANBERRA) GMBH

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MIRION TECHNOLOGIES (CANBERRA) GMBH

Mirion Technologies is a leading provider of products and services related to measurement, detection and monitoring of radiation. Mirion is built on 60 years of experience in research, problem-solving and product development. We approach our work through a lens of curiosity and rigor, with a spirit that compels us to question and constantly drive innovation in our field

As one of the global leaders in radiation measurement with over 1800 talented professionals, the mission is driven to protect people, property and the environment from the harmful effects of ionizing radiation.

To serve our customers all over the world Mirion maintains locations on different countries. Therefore, we can provide local support according to the country specific requirements for radiation safety.

The portfolio of Mirion Technologies embraces a large variety of solutions for spectroscopy, radiation detection health-physics and camera applications.

For D&D and especially for NDA applications Mirion has broadened their portfolio to provide solutions also for challenging projects. By applying state of the art of technology and science and following the customer's needs, these products are constantly developed further.

Mirion works with great partners to always be able to provide the best solutions and expand possibilities. Especially automatization and robotics applications are a new, exciting field for D&D applications.

Visit our booth to learn more about our capabilities for D&D and radiation safety. We are looking forward exchanging with you!



NUKEM TECHNOLOGIES ENGINEERING SERVICES GMBH

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NUKEM TECHNOLOGIES ENGINEERING SERVICES – YOUR PARTNER FOR NUCLEAR ENGINEERING SOLUTIONS

The NUKEM Technologies Group is world-wide active in the areas of radioactive waste management, the decommissioning of nuclear facilities and engineering.

Our engineers offer the entire range from concepts and feasibility studies up to development, procurement and supply of waste processing facilities as well as construction of complete waste treatment plants.

The decommissioning, decontamination and dismantling of nuclear facilities require not only a comprehensive technical know-how, but primarily a solid understanding of legal approval procedures. Our long-standing experience is instrumental in determining the needs of the operators of nuclear power plants or other nuclear facilities. We offer our customers a broad spectrum of services in engineering and consulting as well as radiation protection.

Consistent customer focus and quality management are fundamental to our corporate policy. We place a high premium on personalised customer service, timely project completion, providing our customers with clear and comprehensible documentation and superior quality products. A visible sign of our emphasis on quality is our quality assurance system based on DIN EN ISO 9001:2015. Furthermore, we are certified pursuant to DIN EN ISO 14001:2015 and ISO 45001. In addition, we hold other international certificates issued in Russia, Lithuania and France.



PEDI AG

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ALPHA-TIGHT HOUSINGS AND PROTECTIVE SYSTEMS FROM PEDI ENSURE THE PERSONAL AND ENVIRONMENTAL SAFETY DURING DISMANTLING PROCEDURES

Since more than 60 years, PEDI AG is a competent partner for the nuclear industry all over Europe.

The company is specialized in developing, manufacturing and selling of protecting and shielding products for persons and environment. During the dismantling process of radioactive contaminated equipment, components or building structures, the use of tight housings or encasements is necessary, stopping the distribution of airborne particles and dust. For this purpose, PEDI uses flexible housing materials with high mechanical properties and certified for the use for alpha-tight encasements. A so called dismantling tent serves as a work place for cleaning or maintenance or dismantling activities. Particularly, it can be used for storage or handling of radioactive substances in solid, liquid or gaseous condition. The decontamination tent includes a solid frame structure and a flexible housing. The frame structure remains completely outside of the tent, so it remains free of contamination. The inner space of the housing is completely empty and easy to clean. The housing

is permanently evacuated down to -200 Pa. After use, the tent housing will generate a minimum of waste in weight and volume.

In the field of Personal Protective Equipment, a vast range of established protective suits and auxiliaries is available: Depending on the method of operation, the suits are designed for integral ventilation or to wear with mask, for single or multiple use, for light or heavy works.

For the ventilated suits, a breathing air supply is needed. The PEDI air supply and air distribution components are engineered for high reliability, durability and long live cycle. Due to these characteristics, PEDI products assure an immediate readiness for operation at every time.

Airborne particles can be collected with a variety of air samplers, test swabs (smear tests) and screening tests, allowing an efficient air monitoring right around the clock.

More information on www.pedi.ch





ROBUR ENERGY
IHR KRAFTWERKSSPEZIALIST

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MORE THAN 30 YEARS OF EXPERIENCE AS A SUCCESSFUL SERVICE PROVIDER

ROBUR ENERGY is part of ROBUR, an industrial service provider with more than 3,000 colleagues. With more than 30 years of experience as a successful service provider and about 250 employees we support nuclear power plants, nuclear facilities and manufacturing firms. Experienced, specialized teams for maintenance, inspection, decommissioning and waste management, as well as our well-established proprietary EAM software (incl. operations management/waste tracking systems for NPPs) ensure successful projects.



Our NPP services include:

Post-operation & dismantling

- Decontamination, gutting and demolition of components and buildings/NPP as well as entire sites ("greenfield")
- Removal and decommissioning of highly contaminated systems, machines and plants using powerful equipment and remote-controlled appliances
- Cross-departmental decommissioning projects
- Operating residual material processing centers
- Provision of specialist personnel to support post-operation and decommissioning as well as decontamination and waste management

Handling & conditioning

- Disassembly and sorting of contaminated waste with consideration to nuclide vectors and acceptance criteria
- Assessment and radiological characterization of historical waste according to waste disposal legislation
- Conditioning and waste package production for the final repository, incl. disposal documentation
- Planning/implementation of waste treatment systems, special machines, remote controlled systems

Site cleanup & greenfield solutions

- Disposal planning for waste material eligible for clearance
- Complete solutions for the operation of waste management facilities
- Disposal/handling solutions for (TE)-NORM waste
- Clean up of hazardous waste from industrial sites



Our licenses & certifications

- Permission in accordance with § 25 StrlSchG
- DIN ISO 45001 & SCCP/SCC**/SCP
- DIN EN ISO 9001 & KTA 1401
- Handling agent for hazardous waste (KrWG)
- Asbestos and man-made fiber removal, work in contaminated areas



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WE RAISE ASSET LIFECYCLE MANAGEMENT PROCESSES TO INDUSTRY 4.0 LEVEL

RODIAS is a medium-sized IT services company specializing in asset and maintenance management solutions for buildings, facilities and complex industrial plants. With an agile and innovative approach, based on latest software technologies, we are enabling digital transformation for our customers. In addition to customer-specific implementations of the market-leading products IBM Maximo and Infor EAM, we have developed our own solutions around our focus area EAM (Enterprise Asset Management).

One example is our Insight Control Panel (ICP) product suite, which includes components for

360° DIGITAL DRIVEN DISMANTLING



resource planning, mobile data access and for mobile capturing of maintenance data. ICP works as a middleware solution, following the idea of RAD (Rapid Application Development) environment. In the backend it communicates with IBM Maximo, Infor EAM, SAP PM or other ERP and legacy systems to facilitate system-overarching processes.

Our portfolio also includes proven solutions for Internet of Things (IoT) and for smart analytics in the context of condition-based maintenance and predictive maintenance. In terms of enterprise asset management solutions, our openBMS is the de-facto standard for the nuclear industry in the German-speaking market. Our Data Manager for Maximo has become a huge success in many international IBM Maximo installations.

We are continuously expanding our special solutions portfolio, for example with our project resource optimization tool OPTIRA, which minimizes cost and duration of large and complex projects.

RODIAS was founded in Mannheim in 1984 and today stands for continuity and reliability in the industry as a recognized and independent specialist for consulting, design, optimization and implementation of EAM processes and solutions. Since 2018, RODIAS has been part of ROBUR Industry Service Group.



RODIAS
YOUR DIGITAL TRANSFORMATION SPECIALIST



We are the service provider for the digital transformation and digitalization of the professional industrial services market. In 2020 the former GIS - Gesellschaft für integrierte Systemplanung mbH and EAM Software GmbH have merged to RODIAS GmbH. The company is based in Weinheim near Heidelberg, Germany.

Currently, RODIAS employs more than 100 people across several locations in Germany.

Components of an Enterprise Asset Management System



Areas of application for an Enterprise Asset Management System



TRAWEMA GMBH

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TRAWEMA PROVIDES PORTABLE COLD CUTTING AND MACHINING SOLUTIONS WITH A GROWING APPLICATION FOR NUCLEAR DECOMMISSIONING/DISMANTLING.

Trawema GmbH, located in a close proximity to Cologne/Aachen, provides machinery and equipment to customers around the globe for performing dedicated on-site (in-situ) machining tasks for repair and dismantling applications. Team Trawema represents together more than 10 decades of expertise and experience in developing mobile and flexible tools for operations in complex environments, offering economical and practical solutions. We regularly work in the energy industry, such as maintenance of power plants, as well in heavy industries like mining and steel production. In recent years Trawema has successfully applied its expertise to the nuclear industry - for decommissioning of nuclear power plants (NPPs).

We strive for technical excellence, engineering innovation, and ease of operations. Paramount is for us safety and reliability - „The machine needs to be as safe as possible without any influence on reliability“ - robust testing, qualification and training are for us mandatory steps before operations start. At Trawema we believe that dismantling techniques should be reliable, straight-forward to operate, the tools should be easy to decontaminate and maintain, and contamination should be controlled. Our added value is creating tools that are easily deployable on site and transportable (e.g., IP2 container). It is also essential to limit creation of additional waste and/or waste difficult to manage, and so we work together with clients to ensure our tools are integrated with waste management plans and decommissioning concepts.



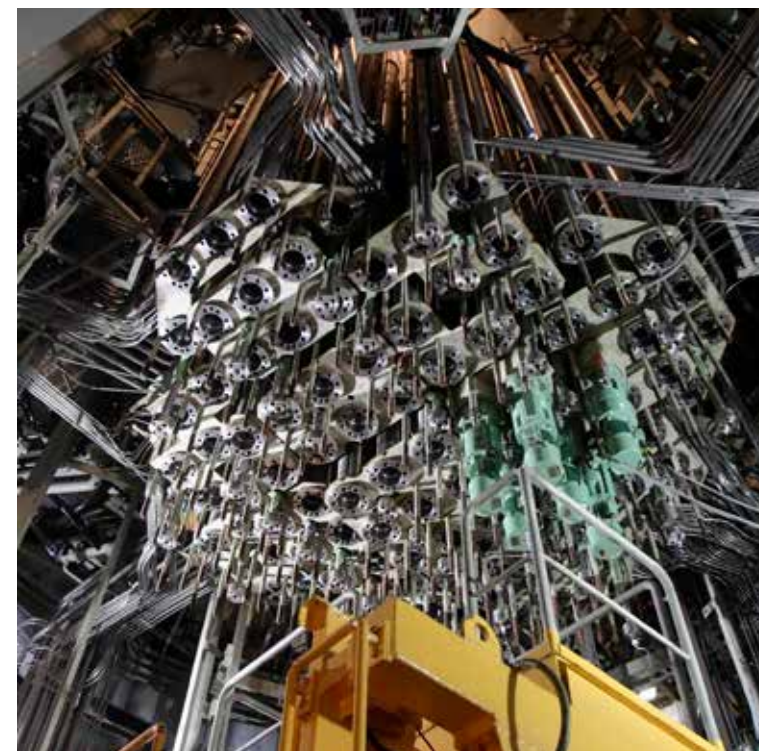
CASE STUDY: CONTROL ROD DRIVE HOUSING

Thermal-cutting methods offer advantages owing to ease of performing the cutting, but from a radiological risk and waste point of view, it can be problematic – hot temperatures melt and partly evaporate the metal and some of the radiological content, airborne radioactive material is easily created. Owing to the melting of the metal at high temperature, some contamination may remain fixed in the metal, and possibility to decontaminate dismantled structures is reduced. Use of the thermal-cutting methods also often requires extensive arrangements for dismantling that are inflexible and cost time.

Especially for the field of nuclear dismantling, Trawema developed and constructed specialized machines for cutting off Control Rod Drive Housings (pipes) which are connected to the calotte underneath of a core of a nuclear reactor - in this case Boiling Water Reactor (BWR). The speciality is the cold cutting process from inside to outside the pipe. Our method has many advantages, it can:

- reduce formation of air-borne and/or gas-phase radionuclides,
- limit possibility of change in chemical form of radionuclides, and
- decrease level of contamination generated.

The cut is made close to the reactor calotte (approx. 5 meter cutting elevation inside the pipe) to ensure easy handling of the reactor calotte for the post-segmentation phase. The cutting process can be handled either upside-down (overhead) from the containment underneath the Control Rod Drive Housing Flanges or in hanging position from the reactor floor level. Remote operations contribute to a reduced occupational dose rate of the operator, allowing for longer operations and therefore faster completion of the project. Our engineered solution was applied successfully and owing to its smart design it was easily decontaminated for transport and implementation at another site.



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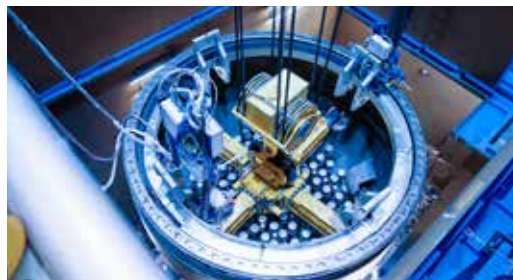


COMPREHENSIVE SERVICES FOR THE DECOMMISSIONING AND DISMANTLING OF NUCLEAR INSTALLATIONS

Uniper and their former companies have decades experiences and competences related to nuclear decommissioning. Our capabilities and experience ranges from decommissioning of research reactors to full scale nuclear power plants covering comprehensively the whole value chain of nuclear decommissioning projects.

Decommissioning planning

Our approach to decommissioning planning considers waste treatment and disposal solutions as early during operation as possible enabling optimization of waste management operations and minimization of the costs of decommissioning. We can support in all questions related to decommissioning planning, including e.g. strategy planning, dismantling and waste management planning and radiation analyses.



Pre-decommissioning and facility shutdown

Well-prepared decommissioning ensures the safe and efficient decommissioning of a facility, and minimizes delays and undue costs. We have capability, experience and know-how also from utility point of view to support our clients in all pre-decommissioning activities to achieve timely and cost effective projects, or support in a specific area such as licensing, waste management or cost analyses.

Dismantling

We have capabilities to perform even the most demanding dismantling activities, including large components (RPV, RPVIs, biological shield, steam generators etc.), volume driven dismantling and heavy liftings. UNS has decades of experience in large component dismantling from projects in the Nordics and Central Europe with excellent track record.

Project management

Successful project management is required in complex decommissioning projects. We have first-hand experience in delivering and managing projects ranging from large decommissioning programs in Sweden to individual dismantling projects and small cost optimization studies.



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DIE RICHTIGE PSA ZUR RICHTIGEN ZEIT AM RICHTIGEN ORT

Die UniTech Services Group ist mit zwei Verarbeitungsanlagen sowie Forschungs- und Entwicklungsstandorten der führende Anbieter von Schutzkleidungsmanagement-Dienstleistungen für die Nuklearindustrie in Europa. Der Hauptzweck dieser Dienstleistung besteht darin, sicherzustellen, dass der Kunde die richtige PSA (persönliche Schutzausrüstung) zur richtigen Zeit am richtigen Ort hat.

Seit 2012 bietet die Niederlassung UniTech Service Group Ltd auch einen Gerüstmonitoring- und Dekontaminationservice an. Für weitere Informationen zu unseren internationalen Kapazitäten besuchen Sie bitte unsere Website www.unitech-services.eu/de/

UniTech bietet auch eine Mobile Supply Store-Lösung an, bei der Produkte in einem rollenden Lagerhaus direkt an den Standort des Kunden geliefert werden.

UniTech bereitet derzeit den Bau einer neuen Verarbeitungsanlage im französischen Joinville vor, die im Oktober 2025 eröffnet werden soll. Diese Anlage wird zusätzlichen Service-Support durch einen eigens errichteten Zwischenlager- und Leasingbereich für kontaminierte Materialien und eine eigene Arbeitszone für TMD-Arbeit bieten.



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WÄLISCHMILLER ENGINEERING IS A GLOBAL MANUFACTURER OF MANIPULATORS, REMOTE HANDLING SYSTEMS AND ROBOTS FOR THE NUCLEAR SECTOR

For over seventy years Wälischmiller has produced world-class innovative equipment for the nuclear industry. The company is certified according to ISO 9001:2015, ISO 14001:2015, DIN ISO 45001:2018, KTA 1401 and ATEX.

Wälischmiller has a hard earned international reputation for performance, excellence in engineering and exceptional robotic hardware. In the most difficult and challenging nuclear environments, Wälischmiller has demonstrated the ability to bring solutions and success to many of the most difficult high-radiation remediation challenges.

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- High manufacturing depth including single part assembly
- All required specialised staff available within the company
- Installation at sites
- Worldwide service and maintenance

By working closely with our specialist engineers and project managers, you can be confident of receiving not just an off-the shelf product, but a custom-tailored solution to your problems that offers highest quality and guarantee of long-term operational safety to even most-demanding customers.

