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# ICOND

International Conference on  
Nuclear Decommissioning

10<sup>th</sup>  
Edition



# BOOK *of* ABSTRACTS

October 2021

ORGANIZER



IN COOPERATION WITH



# SAVE THE DATE



# iCOND

International Conference on  
Nuclear Decommissioning

11<sup>TH</sup>  
EDITION



**14. - 17. NOVEMBER 2022**

VERANSTALTER



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## IMPRINT

### AiNT

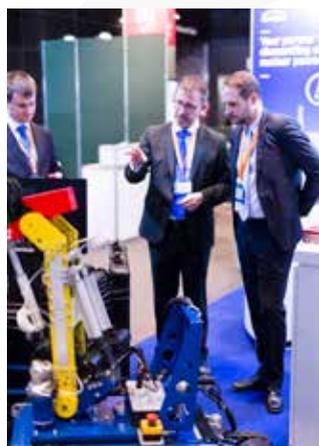
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## HINTERGRUND

Die Stilllegung und der Rückbau 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 im In- sowie Ausland 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 Rückbauaufgaben. Alle Beiträge werden simultan übersetzt (Deutsch/Englisch).

## BACKGROUND

The closure and 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 **ICOND 2020** REVIEW

Die 9. Ausgabe der ICOND fand aufgrund der Corona-Pandemie in Form einer virtuellen Konferenz mit der Bezeichnung ICOND DIGITAL 2020 statt. Die vorab aufgezeichneten und blockweise freigegebenen Vorträge befassten sich am ersten Tag mit den Themen Strategien und Marktentwicklungen. Hier stellte Herr Dr. Guido Knott, Geschäftsführer des größten deutschen Betreibers von Kernkraftwerken, die „Rückbaustrategie für die Kraftwerksflotte der PreussenElektra“ vor. Im Themenblock „Projektstatus und Erfahrungen“ referierte Bernhard Olm über die „Planung und Errichtung einer Zerlegehalle für die Großkomponenten“ der EWN. Im Kooperationsvortrag zwischen der ORANO und EWN wurden die „Fernhantierte Zerlegung und Verpackung von aktivierten Abfällen und Kerneinbauten“ vorgestellt.

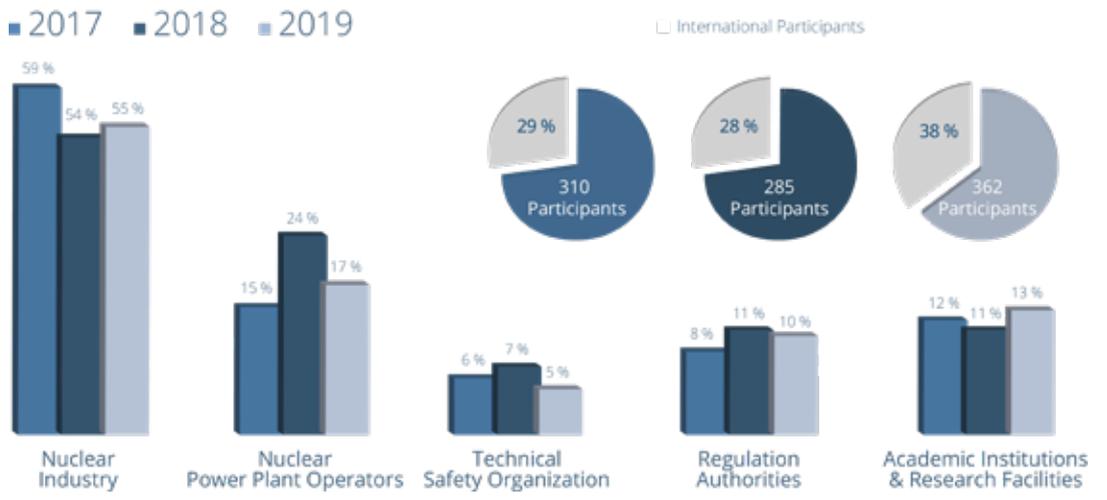
Der zweite Tag fokussierte Digitalisierungskonzepte im Rahmen der Stilllegung. Verschiedene Vorträge zeigten die Chancen und Optimierungspotenziale durch die Digitalisierung von Rückbauprozessen auf. Der zweite Block des Tages wurde neuesten Dekontaminierungsverfahren, wie u.a. der Laserdekontamination gewidmet. Unter dem Thema Charakterisierung & Abfallmanagement standen die Vorträge des letzten Tages der ICOND DIGITAL 2020. Hier wurden praktische Aspekte und technische Fortschritte anhand verschiedener Projekte für die radiologische und stoffliche Charakterisierung radioaktiver Abfälle aufgezeigt.

Due to the Corona pandemic, the 9th edition of ICOND took place in the form of a virtual conference called ICOND DIGITAL 2020. On the first day, the pre-recorded presentations, which were released in blocks, dealt with the topics of strategies and market developments. Here, Dr. Guido Knott, Managing Director of the largest German operator of nuclear power plants, presented the „Deconstruction Strategy for the Power Plant Fleet of PreussenElektra“. In the thematic block „Project status and experience“, Bernhard Olm spoke about the „Planning and construction of a dismantling hall for the large components“ of EWN. In the cooperation lecture between ORANO and EWN, the „Remotely handled dismantling and packaging of activated waste and core internals“ was presented.

The second day focused on digitalization concepts in the context of decommissioning. Various presentations showed the opportunities and optimization potential through the digitalization of decommissioning processes. The second block of the day focused on the latest decontamination processes, such as laser decontamination, among others.

The last day of ICOND DIGITAL 2020 was dedicated to the topic of characterization & waste management, where practical aspects and technical advances were presented on the basis of various projects for the radiological and material characterization of radioactive waste.

FAKTEN FACTS





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# EXHIBITORS 2021



iCOND  
**ICOND PROGRAM**

## SPEAKER REFERENCE WALL



## MONDAY October 18<sup>th</sup>, 2021

### PRE-CONFERENCE WORKSHOP

(Presentations are held in English)

- 11:30 Registration
- 12:00 Quick Lunch

### INNOVATIONS & DIGITALIZATION

- 13:00 **Welcome**  
Dr. Andreas Havenith – AiNT GmbH
- 13:05 **LD-SAFE: Laser Cutting Technology for the Dismantling of the Most Critical Components of Nuclear Reactors**  
Damien Roulet – ONET Technologies
- 13:30 **Purification and Treatment of Waters from Wet Cutting Pools and Sludges Processing into SIAL® Matrix**  
Marcela Blazsekova – Jacobs Slovakia
- 13:55 **Robotic Systems Supporting Decommissioning Operations**  
Dr. Arne Rönna – FZI Forschungszentrum Informatik
- 14:20 **Tele-Operation of Multi-Robotic Systems with Augmented Reality for Semi-Automated Handling and Cutting of Radioactive Waste**  
Sebastian Reitelshöfer – Lehrstuhl für Fertigungsautomatisierung und Produktionssystematik der Friedrich-Alexander-Universität Erlangen-Nürnberg
- 14:45 **COFFEE BREAK**
- 15:20 **An Innovative Decision-Making Tool for Nuclear Waste Flow Management Optimization during Dismantling**  
Oriane Farcy – Capgemini Engineering
- 15:45 **cleanNUCLEAR - Latest Developments of cleanLASER Ablation in Nuclear Industries**  
Sergej Retich – Clean-Lasersysteme GmbH
- 16:10 **Non-Destructive Material Characterization of Radioactive Waste Packages with QUANTOM®**  
Dr. Laurent Coquard – Framatome GmbH
- 16:35 **A Novel Approach to the Localization and the Estimate of Radioactivity with Large Clearance Monitors**  
Dr. Bastian Weinhorst – Safetec Entsorgungs- und Sicherheitstechnik GmbH
- 17:00 **AuDeKa – Major Achievements towards a Fully Automated Decontamination Solution for Dismantled Parts from Decommissioning**  
Franz Borrmann – iUS Institut für Umwelttechnologien und Strahlenschutz GmbH
- 17:25 **Determination of Fuel using the Passive and Active Neutron Counting Technique**  
Dr. Matthias Fritzsche – Mirion Technologies (CANBERRA) GmbH



## TUESDAY

October 19<sup>th</sup>, 2021



10:00 Registration

11:30 Quick Lunch

### STRATEGIES & MARKET DEVELOPMENT STRATEGIEN & MARKTENTWICKLUNG

12:45 **Welcome**

Dr. Andreas Havenith – AiNT GmbH

12:50 **Lessons Learned – Experiences of Great Britain in Decommissioning and Waste Management**

Lessons learned - Die Erfahrungen Großbritanniens bei Stilllegung und Abfallmanagement

David Peattie – Nuclear Decommissioning Authority

13:15 **NND's Journey towards a Digital Decommissioning and Waste Management Process**

NNDs Weg zur Digitalisierung im Stilllegungs- und Abfallmanagementprozess

Ole Jakob Ottestad –  
NND Norsk Nuclear Decommissioning

13:40 **Navigating Nuclear Decommissioning: Charting a Course within a Growing Market**

Erfolgreiches Navigieren im wachsenden Markt für den Rückbau der Kernkraftwerke

Dr. Jochen Latz – McKinsey & Company, Inc.

14:05 **Innovative Tools for Dismantling of Graphite Moderated Nuclear Reactors**

Neue Technologien für den Rückbau graphit-moderierter Kernreaktoren

Jean-Luc Flouttard – Cyclife DS

14:30 **The Belgian Decommissioning Market and ENGIE's Nuclear Services**

Der belgische Rückbaumarkt und ENGIEs nukleare Dienstleistungen

Peter Berben – ENGIE Corporate

14:55 **EXHIBITOR ROAD SHOW**

14:55 **COFFEE BREAK**

15:40 **The Squaring of the Circle – Packaging Germany's Nuclear Heritage, Update**

Die Quadratur des Kreises – Deutschlands nukleares Erbe wird verpackt, Update

Jörg Viermann – GNS Gesellschaft für Nuklear-Service mbH

16:05 **Disposal of Non-Radioactive Waste in Landfill Sites**

Entsorgung von nicht-radioaktiven Abfällen auf Deponien

Dr. Gabriele Greifeneder – PreussenElektra GmbH

16:30 **Difficulties with Landfilling of Released Waste from Nuclear Decommissioning**

Schwierigkeiten bei der Deponierung freigemessener Abfälle aus dem KKW-Rückbau

Prof. Hartmut Gassner – Anwaltsbüro Gassner, Groth, Siederer & Coll.

16:55 **Decommissioning Processes in Germany and Abroad from the Economic Scientist's Point of View**

Stilllegungs- und Abbauprozesse in Deutschland und International aus der Perspektive eines Wirtschaftswissenschaftlers

Dr. Ben Wealer – Technische Universität Berlin

17:45 **DEPARTURE OF SHUTTLE BUSES TO THE TIVOLI STADIUM**

Abfahrt der Shuttle-Busse zum Tivoli

18:15 **CONFERENCE DINNER AT TIVOLI STADIUM - SPONSORED BY ENGIE**

Conference Dinner am Tivoli





## WEDNESDAY

October 20<sup>th</sup>, 2021



### DECOMMISSIONING TECHNOLOGIES RÜCKBAUTECHNOLOGIEN

- 09:00 Decommissioning of the Ågesta PHWR Reactor Vessel and Internals**  
Rückbau des Reaktordruckbehälters inklusive Einbauten des Ågesta Druckschwerwasserreaktors  
Niklas Bergh – Westinghouse Electric Sweden AB
- 09:25 Development of a Contact-Arc-Metal-Grinding (CAMG)-Technology for Automated Underwater Cutting**  
Entwicklung eines Kontakt-Lichtbogen-Metall-Trennschleif-Verfahrens für automatisierte Unterwasserschneidaufgaben  
Emily Schmidt – Leibniz-Universität Hannover
- 09:50 Control Tools for Strategic Decommissioning Planning**  
Instrumente zur Steuerung der strategischen Rückbauplanung  
Marc Bogenstahl – Rodias GmbH
- 10:15 EXHIBITOR ROAD SHOW**
- 10:15 COFFEE BREAK**
- 11:00 Aerosol Source Term Characterization during Dismantling Operation at Fukushima Daiichi**  
Bestimmung des Aerosol-Quellterms beim Rückbau am Standort Fukushima Daiichi  
Dr. Emmanuel Porcheron – IRSN Institute de Radioprotection et de Sûreté Nucléaire
- 11:25 Dismantling and Disassembly of Control Rod Drive Room Components and Systems**  
Demontage und Zerlegung von Komponenten und Systemen des Steuerstabantriebsraumes  
Dr. Heiko Herbell – Framatome GmbH &  
Dr. Lars Behnke – RWE Nuclear GmbH
- 11:50 Decommissioning of the NPP Mülheim-Kärlich: Dismantling of the Steam Generators**  
Rückbau der Anlage Mülheim-Kärlich: Abbau der Dampferzeuger  
Philipp Moormann & Dr. Thomas Volmar – RWE Nuclear GmbH

**12:15 LUNCH**

**13:30 - 16:30 MEET YOUR COMPANY**

### CHARACTERIZATION AND WASTE MANAGEMENT CHARAKTERISIERUNG UND ABFALLMANAGEMENT

- 13:30 Characterization of Radioactive Waste Streams during the Decommissioning of Nuclear Power Plants**  
Charakterisierung radioaktiver Abfallströme beim Rückbau von Kernkraftwerken  
Dr. Marina Sokcic-Kostic – NUKEM Technologies GmbH
- 13:55 Decommissioning of Concrete Structures – How to Check it Non-Destructively**  
Die zerstörungsfreie Prüfung von Betonstrukturen für den nuklearen Rückbau  
Dr. Ernst Niederleithinger – Bundesanstalt für Materialforschung und -prüfung (BAM)
- 14:20 Smart Radiation Mapping**  
Smarte radiologische Charakterisierung  
Neil Owen – Createc
- 14:45 COFFEE BREAK**
- 15:15 Challenges in the Post-Qualification of Legacy Wastes**  
Herausforderungen bei der Nachqualifizierung von Altabfällen  
Souad Pederzani – GNS Gesellschaft für Nuklear-Service mbH
- 15:40 Material Analysis based on Material Vectors**  
Stoffliche Charakterisierung mittels Stoffvektoren  
Moritz Gradmann – TÜV Rheinland Industrie Service GmbH
- 16:05 Lessons Learned from Decades of Waste Characterization, Management and Deposition in Finland**  
Lehren aus der jahrzehntelangen Praxis in der Charakterisierung, dem Management und der Entsorgung von radioaktiven Abfällen in Finnland  
Dr. Petri Kotiluoto – VTT Technical Research Centre of Finland,  
Antti Ketolainen – Fortum Power and Heat Oy
- 16:30 - 19:00 GET TOGETHER - SPONSORED BY VND**
- 16:40 - 17:45 BUSINESS SPEED NETWORKING**



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## THURSDAY

October 21<sup>st</sup>, 2021



### COMPETENCE & TRAINING

#### KOMPETENZENTWICKLUNG & WEITERBILDUNG

- 09:00 Onsite or Online: How to Make your Presentation Go Nuclear!**  
In Präsenz oder online: Wie Sie Ihre Präsentation zum Strahlen bringen!  
Danielle Dobbe – LRCB – Dutch expert centre for screening
- 09:25 Introduction in ENEN+: Attract, Develop and Retain new Talents to Careers in the Nuclear Fields**  
Vorstellung des ENEN+ Projekts: Neue Talente für die kerntechnische Industrie gewinnen, entwickeln und behalten  
Emilia Janisz – European Nuclear Society

**09:50 COFFEE BREAK**

### CLEARANCE

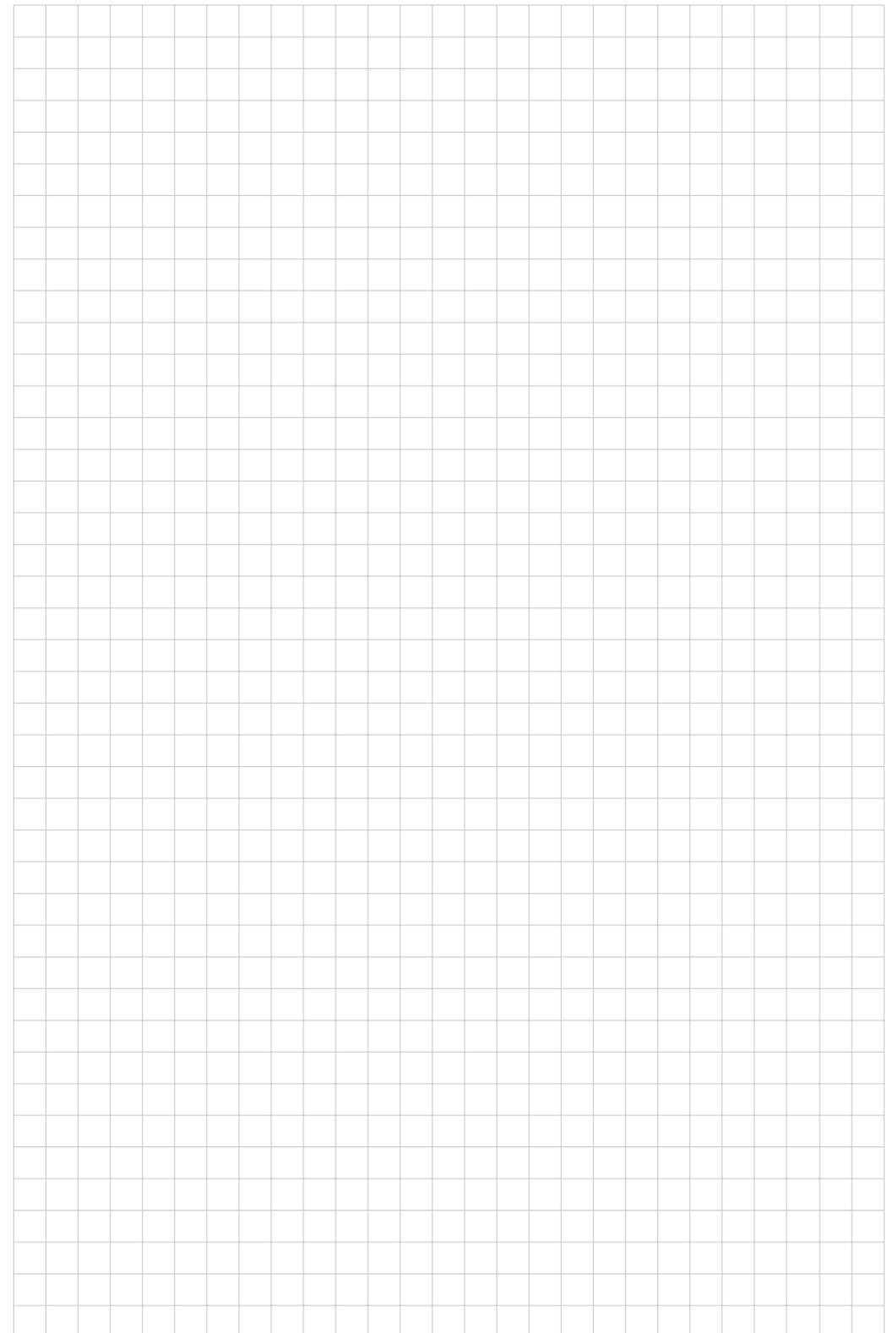
#### FREIGABE

- 10:20 Opportunities and Possibilities for Clearance in Nuclear Decommissioning**  
Chancen und Möglichkeiten für Freigabe beim Rückbau kerntechnischer Anlagen  
Dr. Anton Anthofer – VPC Nukleare Dienstleistungen GmbH
- 10:45 Case-by-case verification according to § 37 StrlSchV for the release of buildings and sites**  
Einzelfallnachweise nach § 37 StrlSchV für die Freigabe von Gebäuden und Standorten  
Dr. Stefan Thierfeldt – Brenk Systemplanung GmbH
- 11:10 State of the Art Free Release Monitor Systems**  
Gamma Freimessanlagen der dritten Generation  
Dr. Ingo Kölln – Ludlum GmbH
- 11:35 New Perspectives in Clearance of Metal Waste**  
Neue Perspektiven in der Freigabe von Metallen  
Dr. Tim Thomas – Safetec Entsorgungs- und Sicherheitstechnik GmbH

**12:00 FINAL STATEMENT AND OUTLOOK**

**12:15 QUICK LUNCH**

Änderungen im Programm vorbehalten. Keine Gewähr.



IC&ND

ABSTRACTS  
PRE-CONFERENCE  
WORKSHOP



**SPEAKER**

**MONDAY 13:05** EN

**Damien Roulet**

Company ONET Technologies  
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Website [www.onet-technologies.com](http://www.onet-technologies.com)



**SPEAKER**

**MONDAY 13:30** EN

**Marcela Blazsekova**

Company Jacobs Slovakia s.r.o.  
Piešťanská 3  
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Website [www.jacobs.com](http://www.jacobs.com)



**LD-SAFE: Laser Cutting Technology for the Dismantling of the Most Critical Components of Nuclear Reactors**

LD-SAFE is a project financed within the European H2020 program, focused on the use of laser cutting technology, both in air and under water, for the dismantling of nuclear power plants. In this way, it aims to demonstrate that the use of this technique in dismantling allows meeting technical and safety challenges in a more efficient and economical way than conventional cutting techniques.

Dismantling of the reactor vessel and internals represents a great challenge technically (complex shapes, hardening of materials and accessibility) and in terms of safety (high activation), involving long periods of planning and execution, and generally becoming a critical path.

In this context, laser cutting has certain advantages: excellent cutting performance; lower generation of dust and smoke and secondary waste with respect to thermal and mechanical techniques respectively, and safety in operation and maintenance (robustness and remote operation).

The project has 4 objectives:

- 1) Demonstrate the capabilities of a versatile laser cutting solution to address the key technical challenges in decommissioning of large nuclear facilities
- 2) Develop an environmental and safety assessment of the implementation of laser cutting for nuclear reactor decommissioning

3) Validate technically the laser cutting prototype in operational environment (demonstrator);

4) Demonstrate the economic advantage of using the laser cutting technology for the forthcoming reactor decommissioning market.

The LD-SAFE project started in July 2020 and will end in 2024 with a cold demonstrator which will open this technology to a large use for future reactors decommissioning.



Laser Dismantling Environmental and Safety Assessment

**Purification and Treatment of Waters from Wet Cutting Pools and Sludges Processing into SIAL® Matrix**

This abstract presents and summarizes the overall view on process of water purification including modification of filtration technology to specific operating conditions, process monitoring and treatment of captured sludge by using proven SIAL® solidification technology.

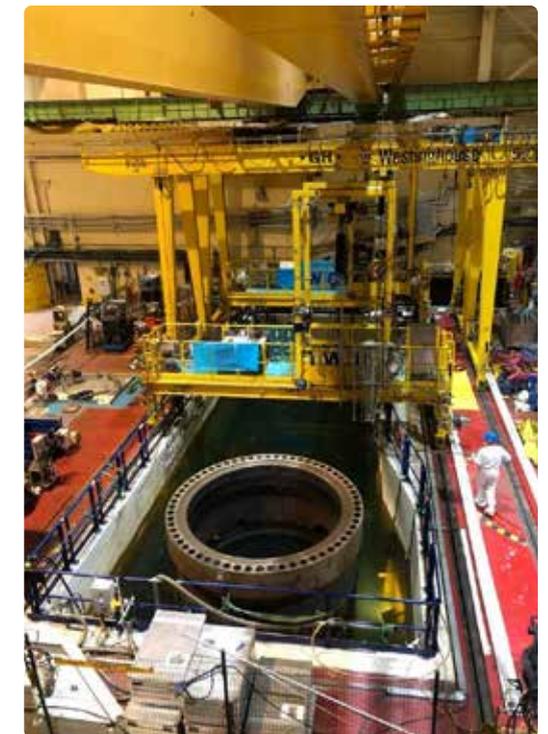
The purification process involves the controlled disinfection of the water using sodium hypochlorite and the subsequent filtration of the degraded biological mass by using modified filtration system.

The filtration method of choice was based on sand filtration units adapted to specific operating conditions in order to increase the efficient separation of even fine sludge. A specific fraction of inert glass filler was used to fill the filter units and the direct dosing of the selected non-ionic flocculant was placed before entering the filter columns by installing 10 m long bypasses. During the implementation of the pool cleaning procedure, the high efficiency of the filtration system was confirmed and a gradual improvement of the water quality in the wet cutting pool was verified.

The sludge collected on the filter units was regularly rinsed and continuously solidified into the SIAL® geopolymer matrix, and therefore the one of the main advantages of the used filtration system were the elimination of additional secondary solid waste production, such as used filter cartridges, thus effectively reducing the operating costs of the filtration process itself.

SIAL® is a proven, safe, cost-effective and licensed waste solidification technology, that has been used successfully for 20 years in Slovakia and the Czech Republic for processing of various type of radioactive waste streams. Radioactive waste solidification into matrix SIAL® is based on polycondensation process using a two-part mixture comprising a pre-determined blend of natural inorganic raw materials, produces a stable geopolymer.

Co-Authors: Helena Mrázová, Michaela Addová, Maroš Juraška, Jacobs Slovakia



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SPEAKER

MONDAY 13:55 EN

Dr. Arne Rönnau

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SPEAKER

MONDAY 14:20 EN

Sebastian Reitelshöfer

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### Robot and AI Supporting Technologies for Mobile Robot-Based Decommissioning Tasks

It is obvious, that robots can help reduce risks for humans in contaminated areas. But using these robots remotely creates some challenges operating them. Full autonomy is actually not desired due to the high risks in case of any problems. FZI has a long tradition of cooperating with companies operating robots in contaminated environments. Therefore, we are convinced that it can be a great benefit to include the expertise and experience of the humans operators. FZI has developed new sensors and software to support the operators of heavy, shielded robots. For example, a modular, high-resolution 3D LIDAR was extended by software to intuitively measure obstacles, doors or mesh the acquired point cloud for improved visualization. A traversability map supports the operator and an add-on localization module improves the track based indoor localization. FZI is part of the BMBF competence center »Robotic systems for decontamination in hazardous environments« - ROBDEKON. The main field of activity of ROBDEKON is the

research and development of novel robotic systems for decontamination tasks. ROBDEKON concentrates on three relevant application areas: the remediation of landfills and contaminated sites, the dismantling of nuclear facilities and the decontamination of plant components. FZI has developed a new high performance online 3D mapping system for mobile robots in these scenarios. A 3D motion planning approaches assists the operator and helps to move any kind of mobile or walking robots to the desired goal. Additional AI-based assistance functions help localize hazardous, contaminated objects. A force-based shared autonomy approach is used to manipulate or grasp different kinds of objects. Moreover, an AI-based detection of contaminated waste on a conveyor belt is the basis for our sorting robot. Overall, FZI has developed a wide set of modular robotic and AI-based technologies that can be used to support difficult decommissioning tasks with mobile robots.



### Tele-Operation of Multi-Robotic Systems with Augmented Reality for Semi-Automated Handling and Cutting of Radioactive Waste

Together with the partners Framatome and AiNT, a demonstrator cell for the tele-operation of multi-robot systems is being set up at the Institute for Factory Automation and Production Systems at the Friedrich-Alexander-Universität Erlangen-Nuremberg as part of the project VIRERO which is funded by the BMBF. The presentation will first give an overview of this novel, robot-based solution, whose intended field of application is the handling of radioactive waste for the preparation of conditioning and qualification as well as for sorting in different scenarios. The system allows for the manipulation of a wide range of parts such as electronic modules, filters and plant components as well as metal scrap. Several robotic systems with varying payloads, sensors and peripheral systems such as grippers and tools for cutting, which are

integrated in the modular system are introduced in an overview. In addition to this summary of the central components and basic functionalities, various concepts for the efficient remote control of multi-robot systems in a so-called augmented reality environment are presented. This is followed by a brief insight into the technical implementation of the underlying control architecture with a manufacturer-independent middle ware. Furthermore, approaches for the semi-autonomous support of users in varying tasks on the basis of learning systems are shown. Finally, an exemplary use case is presented which demonstrates how scrap parts are removed from barrels, sorted according to radiological criteria and placed on a table by tele-operation with a sub sequential cutting of large parts by a robot guided cutting device which is also tele-operated.



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SPEAKER

Oriane Farcy

Company Capgemini Engineering  
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MONDAY 15:20 EN



SPEAKER

Sergej Retich

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Website www.cleanlaser.de

MONDAY 15:45 EN



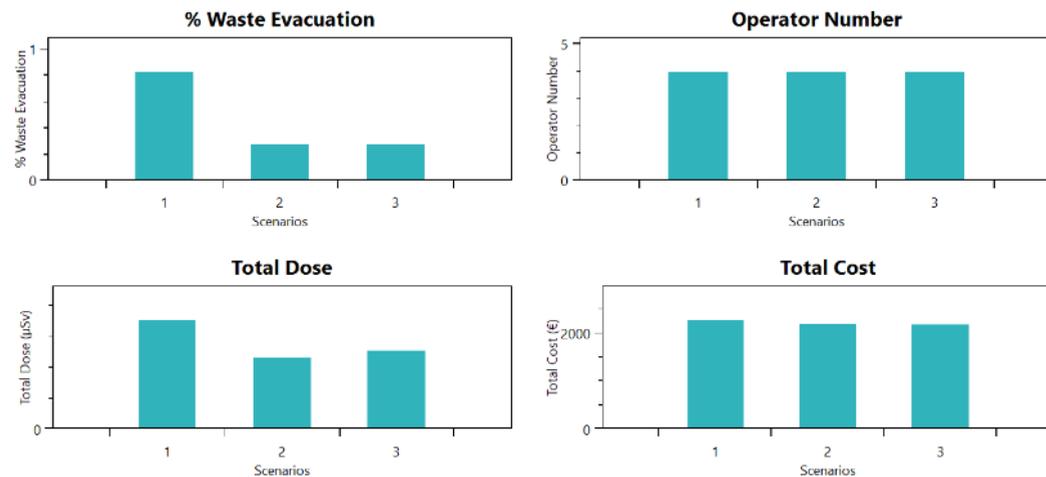
### An Innovative Decision-Making Tool for Nuclear Waste Flow Management Optimization during Dismantling

As the number of shutdown nuclear power plants increases, nuclear decommissioning activities are expanding worldwide. This is a global challenge: 300 nuclear facilities will be progressively decommissioned worldwide over the next 20 years and more than 10 decommissioning operations are on-going in France. New technologies and solutions in dismantling methodologies are needed to reduce costs and durations of these operations and to improve the safety of operators.

In order to prepare the decommissioning processes, we propose to develop a method to process all the data and knowledge associated with a single nuclear facility, and at the same time to use this information to propose the most efficient decommissioning scenarios. For this purpose, we have developed an innovative decision support tool called WELMS

(Waste Evacuation Lean Management System) which optimises decommissioning management. Its objective is to anticipate the performance of a suggested scenario for dismantling operations, using a logistic approach, and to determine how to improve the process in terms of cost, time, safety and performance.

Different cases were studied such as a nuclear waste stream during the decommissioning of a nuclear facility specializing in the maintenance and storage of nuclear equipment and a waste drum evacuation in a radioactive effluent treatment plant. The results showed the benefit of this type of analysis in identifying bottlenecks and saturation areas, as well as concrete key performance indicators. The initial decommissioning scenario was successfully tested and results allowed us to propose improvements.



### cleanNUCLEAR - Latest Developments of cleanLASER Ablation in Nuclear Industries

Laser ablation is becoming increasingly popular in the field of nuclear power plants. Often laser is an essential. Sometimes the laser is an important feature required in tenders. Each country has different requirements, so the laser is used in very different ways.

In operating nuclear power plants, laser technology offers many advantages in the area of maintenance. It can be used very efficiently to decoat functional surfaces for both non-destructive testing and to reduce dose rates. In decommissioning, the laser helps to minimize nuclear waste as a complementary tool.

Various recent studies underline the decontamination efficiency. Surface contamination with alpha and beta of different nuclide origins can be removed up to 100%.

Further developments of the hand-guided optics to higher compactness and more dynamics at further working distance as well as the user-friendly maintenance including the protective housing for hazard spheres increases the efficiency of the cleanLASER technology.

The current holistic concept of cleanNUCLEAR consists of a special configuration of a CL500 or a CL1000 laser in combination with the mobile nuclear extraction system of our partner company. The efficiency and functionality of the safe implementation of both systems has been successfully tested with contamination.



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SPEAKER

Dr. Laurent Coquard

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

Website [www.framatome.com](http://www.framatome.com)

MONDAY 16:10 EN

framatome



SPEAKER

Dr. Bastian Weinhorst

Company Safetec und Entsorgungs-  
und Sicherheitstechnik GmbH  
Kurpfalzring 98A  
69123 Heidelberg - Germany

Website [www.safetec-strahlenschutz.de](http://www.safetec-strahlenschutz.de)

MONDAY 16:35 EN

Safetec  
Entsorgungs- und Sicherheitstechnik GmbH



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## QUANTOM - Non-destructive Material Characterization of Radioactive Waste

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 2027. 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&DGNAA). This technology is able to identify, verify and quantify the amount of hazardous and non-hazardous substances in 200-l radioactive drums, which is required for a final disposal characterization.

The main benefits of QUANTOM® are summarized below:

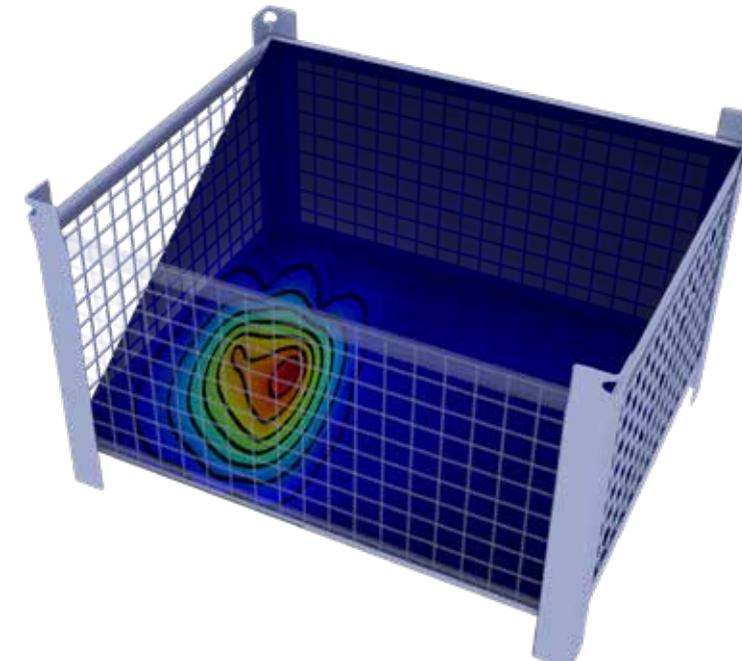
- Non-destructive multi-element analysis with high sensitivity (ppm-range) of the entire matrix
- Minimizing the transportation of radioactive waste drums and radiation exposure of the operation staff
- Fast measurement process (2h-4h per waste drum) with high measurement precision
- No repackaging and no increase of waste volume
- Reduction of costs (min. 50% per waste drum) compared to destructive analysis processes.



## A Novel Approach to the Localization and the Estimate of Radioactivity with Large Clearance Monitors

Dismantling nuclear power plants entails the production of a large amount of contaminated (or potentially contaminated) waste that must be disposed according to national and international regulations. A large part of the end products needs to be stored in special repositories, but a significant part of it is slightly contaminated or not contaminated at all, making it possible to free release it. One possible approach to free release measurements uses Large Clearance Monitors, chambers surrounded by plastic scintillation detectors that can measure up to 1000kg of waste.

Due to the composite nature of the detection system in a Large Clearance Monitor, it is easy to imagine that one can apply 3D imaging algorithms to localize radioactive sources inside a waste package. In this work we will show how a special algorithm that maximizes the conditional informational entropy allows decisions about the clearance of portions of the sample.



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SPEAKER

MONDAY 17:00 EN

Franz Borrmann

Company iUS Institut für Umwelttechnologien und Strahlenschutz GmbH  
Obernauer Str. 94  
63743 Aschaffenburg - Germany

Website www.ius-online.eu



SPEAKER

MONDAY 17:25 EN

Dr. Matthias Fritzsche

Company Mirion Technologies (Canberra) GmbH  
Stahlstrasse 42-44  
65428 Rüsselsheim - Germany

Website www.mirion.com



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### AuDeKa - Major Achievements towards a fully Automated Decontamination Solution for Dismantled Parts from Decommissioning

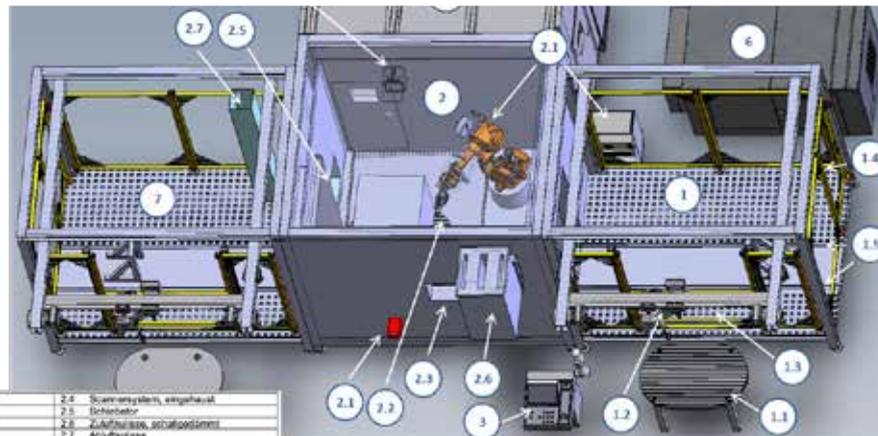
iUS Institut für Umwelttechnologien und Strahlenschutz GmbH has, together with its partners RST GmbH and Westfälische Hochschule Gelsenkirchen/Bocholt and funded by the German Ministry for Education and Research (BMBF) developed an automated solution for the decontamination of contaminated parts, i.a. from decommissioning of nuclear facilities.

To date, this decontamination is mainly conducted manually, posing not only radiation protection challenges, but also high physical stress for the workers due to heavy protection equipment.

In industrial environments, robots are widely used to do highly repetitive work. In decommissioning the employment of robots poses some difficulties. Besides the hostile environment (contamination, water spray, radiation fields),

the batch size of one is a specific problem. It would not be feasible to use teach-in solutions for the application of robots. Thus the major challenge and achievement of the project was to find a way to allow the surface decontamination of totally unknown parts.

With a laboratory test system we were able to demonstrate that this is feasible and can easily ported into a full size system. In addition, a complete semimobile plant was designed and an automated documentation approach, based on semantic technologies was designed. Further development is envisaged and will imply AI application to allow a machine learning approach to optimize the decommissioning process.



1. Werkzele - Bedienung	2.4. Scannersystem, ausgehend
1.1. Bedienfach mit Nulldetektor	2.5. Schwebecar
1.2. Transport für elektr. Leitungen	2.6. Schutzhülle, strahlungsstopp
1.3. Halbleiter (Grenzwert)	2.7. Arbeitstisch
1.4. Personenschutzgitter	3. Behälterpumpe
1.5. Scannersystem	4. Personenschutzgitter
2. Externeinheit	5. Schutzkranz, Personenschutz

### Determination of Fuel using the Passive and Active Neutron Counting Technique

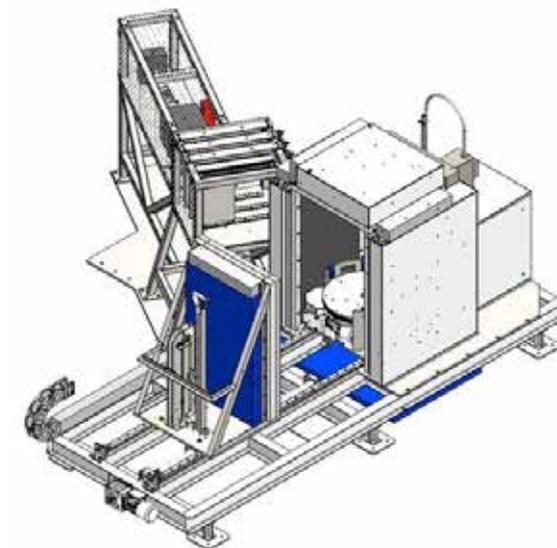
Waste management and waste conditioning for final repositories require detailed documentation of waste content and especially activity inventory.

Especially the direct determination of Nuclear Fuel in 200l drums is a challenging task which requires advanced neutron detection techniques.

The most common method is determining the fissile products by direct detection of spontaneous emitted neutrons. This works very well for nuclides like Pu-238, Pu-240 and Pu-242. In addition to the passive neutron detection method, the Differential Die Away (DDA) technique is used to determine the fuel mass of nuclides like Pu-239, Pu-241 and U-235.

Using these two approaches, a complete picture of the fuel content of a waste drum can be created which becomes even more detailed, if approaches like the Add-a-source technique are included which allow to obtain information about the matrix properties.

In this presentation a Passive-Active Neutron Monitor including a Gamma Spectrometry system will be introduced and some details about the DDA and Add-a-source technique will be given. In addition to that the calibration philosophy and potential improvements as well as some examples from a typical project will be presented, including the first results of a customer system.



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**ABSTRACTS  
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**SPEAKER**

**TUESDAY 12:50 EN**

**David Peattie**

Company Nuclear Decommissioning Authority  
Westlakes Science & Technology Park  
CA24 3HU Moor Row Cumbria - United Kingdom

Website [www.nda.gov.uk](http://www.nda.gov.uk)



**SPEAKER**

**TUESDAY 13:15 EN**

**Ole Jakob Ottestad**

Company NND Norsk Nuclear Decommissioning  
Storgata 2  
1767 Halden - Norway

Website [www.norskdekommissjonering.no](http://www.norskdekommissjonering.no)



**Lessons Learned – The Experiences of Great Britain in Decommissioning and Waste Management**

David Peattie is the CEO of the Nuclear Decommissioning Authority (NDA), a non-departmental public body tasked with clearing up the UK's earliest nuclear sites, including Sellafield, as well as managing radioactive waste and delivering a UK Geological Disposal Facility.

He will also discuss the NDA's Integrated Waste Strategy, and how it is being used to open up new opportunities that enable the whole of the UK nuclear industry to manage its radioactive waste in a more sustainable and value for money way.

In this talk, David will discuss the history of the UK nuclear decommissioning programme, the change in operating model from private-sector site ownership to a subsidiary model, and the opportunities and challenges the future holds for UK nuclear decommissioning.



**NNDs Journey towards a Digital Decommissioning and Waste Management Process**

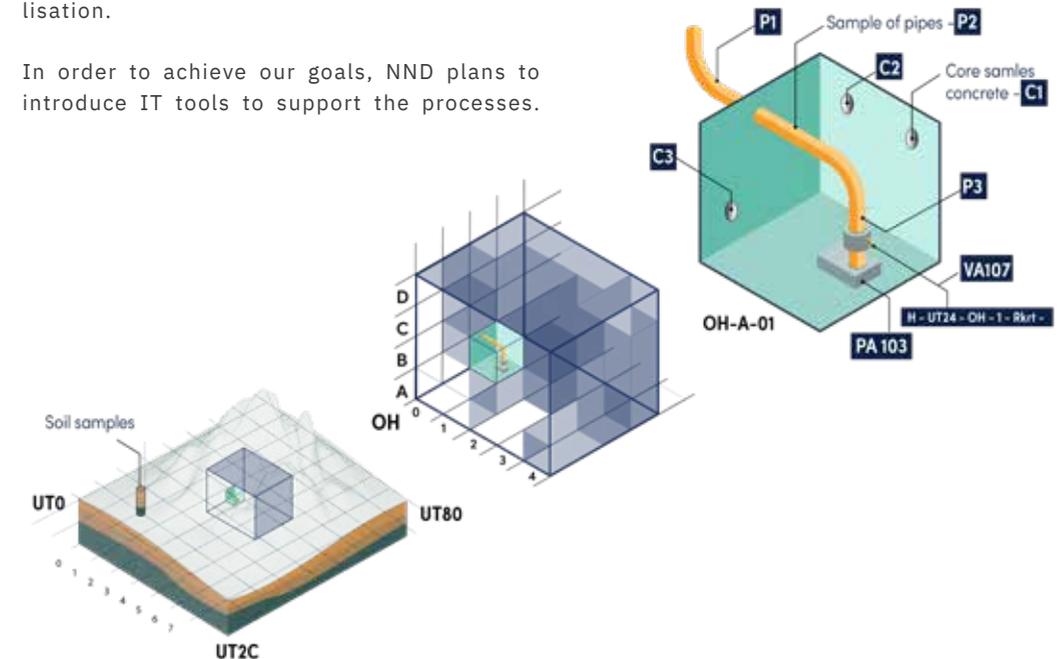
Norwegian Nuclear Decommissioning (NND) is a state agency, tasked with the decommissioning of the Norwegian nuclear reactors, handling radioactive waste management and the construction of a nuclear waste repository. As a newly established entity, NND is now in the process of obtaining the necessary permits and licenses to take over the nuclear reactors. We aim to start the practical decommissioning work circa 2024.

The IT support systems will need to support massive amounts of different data, with 3D visualisation as a major function to enhance decision support and planning. NND expects these IT support systems to be "commercial, off the shelf" and hopes to help to derive efficient IT support tools with functionality relevant to the decommissioning industry.

Amongst NND's goals are the maintenance of the records from the Norwegian nuclear era, to perform a safe and cost-efficient decommissioning and to utilise the existing nuclear competence in the local workforce throughout the work. We have concluded that the best way of achieving these goals is through digitalisation.

In this presentation, NND offers insight into the agency's purpose of using digital tools to support the main processes in the nuclear decommissioning and radioactive waste management. We will discuss expectations, challenges, today's situation, our long-term plans, and ambitions.

In order to achieve our goals, NND plans to introduce IT tools to support the processes.



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SPEAKER

Dr. Jochen Latz

Company McKinsey & Company, Inc.  
Christophstraße 17  
50670 Köln - Germany

Website www.mckinsey.com

TUESDAY 13:40 DE

McKinsey & Company



SPEAKER

Jean-Luc Flouttard

Company CYCLIFE Digital Solutions  
615 avenue de la Roquette  
30200 Bagnols-sur-Cèze - France

Website www.cyclife-edf.com

TUESDAY 14:05 EN

cyclife EDF GROUP

### Navigating nuclear decommissioning: Charting a course within a growing market

Worldwide more than 100 nuclear power units are currently shutting down and are at various stages of decommissioning; we expect this number to have more than doubled by 2030. The total cost of decommissioning these units until reaching a greenfield state exceeds EUR 150 billion. In the next decades, the decommissioning market is thus expected to form a growth segment in the energy sector which will attract many players.

While the entire market is maturing, there is significant cost pressure and improvement potential in nuclear decommissioning projects: we observe an average schedule overrun of 40 percent and a cost overrun of 57 percent compared to initial project plans. Key drivers for this are misaligned or unrealistic budgets and plans, insufficient risk awareness, failure to shift to a project mindset, suboptimal decision making, and conflicting incentives.

In our experience, the following four success factors are critical to address these challenges efficiently:

1. Selecting a fit-for-purpose contracting model with well-aligned incentives along the delivery models (1) license transfer from utility to supplier, (2) decommissioning partnerships between utility and supplier, as well as (3) owner-driven decommissioning
2. Building on cultural change to successfully manage the shift to a project-driven decommissioning organization
3. Optimizing scheduling based on Project Production Management (PPM), i.e., manufacturing planning and operations science for capital projects, inventory management, capacity allocation, variability control, etc.
4. Proactively managing internal and external stakeholders.

By applying these factors successfully, most schedule and cost overruns can be mitigated - offering a multi-billion EUR opportunity across the industry.

**Schedule optimization – PPM: Project Production Management**

**Project Management**  
Cost, Time & Cash  
Scope & quality  
Scheduling  
Resources

**Project Production Management**  
Cost, Time & Cash  
Scope & quality  
Process design  
Capacity  
Inventory  
Variability

### Innovative Tools for Dismantling of Graphite Moderated Nuclear Reactors

What are the most optimal ways to dismantle graphite reactors? What remote tools can help operators to safely remove radioactive graphite? What solutions will be the most cost-efficient for dismantling operations in reactors of such complexity and dimension?

These are questions that the recently launched Inno4Graph project is trying to answer through the development of physical and digital tools and methods to support the decommissioning of European graphite reactors.

The three-year EU-funded project INNO4GRAPH, which started on 1<sup>st</sup> September 2020, is addressing this need in two different phases:

Tools and methods will be used during tests and studies upstream of the dismantling operations to:

- Get an excellent knowledge of both the graphite properties thanks to in-situ

measurement of cracks and corrosion and the dismantling tools to be used;

- Evaluate the efficiency of the use of innovative tools in order to define the most adapted scenario for each reactor regarding the local context (technical constraints, regulations, ...) in terms of safety and cost-efficiency thanks to scenario grid analysis, mock-ups for physical tests and digital 3D models.

Innovative cutting and handling tools will then be made available during the dismantling operations.

The launch by EDF, the Coordinator of the Project, of a full-scale graphite reactor dismantling demonstrator in Chinon, France, in 2022 will facilitate the uptake and further development of the tools developed during the project.

Co-Authors: Delphine Delvallee (Graphitech, France) & Philippe Lefevre (EDF, France)

#### INNO4GRAPH PROJECT : INNOvative tools FOR dismantling of GRAPHite moderated nuclear reactors



Gas graphite reactor Chinon A2 (France - EDF) view by using DEMplus®

Representative mock-up of a part of the graphite stack (full scale)

Graphite reactors decommissioning demonstrator (France - EDF)

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**SPEAKER**

**TUESDAY 14:30 EN**

**Peter Berben**

Company **ENGIE Corporate**  
Blv. Simon Bolivar 34  
1000 Brussels - Belgium

Website [www.engie.com](http://www.engie.com)



**SPEAKER**

**TUESDAY 15:40 DE**

**Jörg Viermann**

Company **GNS Gesellschaft für Nuklear-Service mbH**  
Frohnhauser Str. 67  
45127 Essen - Germany

Website [www.gns.de](http://www.gns.de)



## The Belgian Decommissioning Market and ENGIE's Nuclear Services

According to the current Belgian Law, there will be a gradual withdrawal of nuclear power generation. The final shutdown dates of the Electrabel Nuclear Power Plants on the Doel and Tihange are respectively:

- Doel 3: 1st of October 2022
- Tihange 2: 1st of February 2023
- Doel 4: 1st of July 2025
- Tihange 3: 1st of September 2025
- Tihange 1: 1st of October 2025
- Doel 2: 1st of December 2025

As the Belgian NPPs are reaching their end of operation, the preparation of the dismantling of the NPP's – with focus on Doel 3 and Tihange 2 – is gaining momentum. The dismantling organization is being reinforced, transition plans are being developed, strategic choices related to the dismantling scenario's and options are in development, new infrastructures are being planned for, waste management treatment and evacuation routes are identified

and in development, application documents and the final decommissioning plan are in preparation for the licensing process.

During the presentation, an update on the status of the project, the main challenges and the way forward will be given.

Next to being an owner and operator of NPPs, ENGIE is also a renown international nuclear service provider, with companies in Belgium, France, UK and Germany. This presentation will also briefly describe and illustrate this with explaining opportunities for the treatment of small to large components. Additionally Tecnubel as a subsidiary of ENGIE offers competences regarding robots and electronic remote handling for waste management and decommissioning.



## The Squaring of the Circle - Packaging Germany's Nuclear Heritage, Update

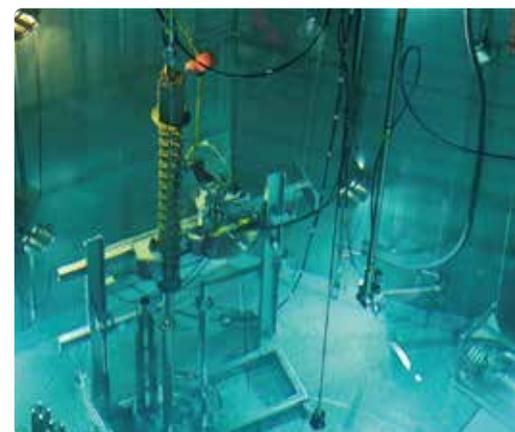
GNS Gesellschaft für Nuklear-Service mbH, world leading supplier of casks for spent fuel, HLW and ILW, also offers comprehensive services for management and disposal of spent fuel and all types of radioactive waste.

Design and supply of treatment facilities and all kinds of engineering support round off the GNS portfolio. Being in charge of all operations regarding the disposal of the waste and residual materials from all nuclear power plants in Germany, GNS also handles waste management projects abroad. Since the late 1980s, starting with the decommissioning of the Niederaichbach nuclear power station in Bavaria, GNS has been involved in all major nuclear decommissioning projects in Germany.

At first by processing scrap from dismantled systems together with industrial partners and by treating decommissioning waste with mobile facilities or waste treatment facilities in its central workshops, later also by doing D&D work on site.

At the beginning of the new millennium GNS gained substantial D&D experience being in charge of the complete dismantling of research reactors like the MERLIN reactor in Juelich or the two TRIGA reactors of the German Cancer Research Centre in Heidelberg.

Since then GNS has more and more specialised in taking care of the parts of a nuclear station that are the highest contaminated and activated components. In close cooperation with its subsidiaries Eisenwerk Bassum, Höfer & Bechtel and WTI, GNS is now able to offer and perform the whole spectrum of work required to prepare the above mentioned components and resulting waste for disposal. The presentation will give an update on the case studies from on-going decommissioning projects, such as the current dismantling operations at the EnBW sites Neckarwestheim and Philippsburg and the PreussenElektra site Unterweser that were introduced in last years presentation.



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**SPEAKER**

**TUESDAY 16:05 DE**

**Dr. Gabriele Greifeneder**

Company PreussenElektra GmbH  
Tresckowstraße 5  
30457 Hannover - Germany

Website [www.preussenelektra.de](http://www.preussenelektra.de)



**SPEAKER**

**TUESDAY 16:30 DE**

**Prof. Hartmut Gassner**

Company [GGSC] Rechtsanwälte PartmbB  
Stralauer Platz 34  
10243 Berlin - Germany

Website [www.ggsc.de](http://www.ggsc.de)



**Disposal of Non-Radioactive Waste in Landfill Sites**

The removal of conventional waste from nuclear power plants in decommissioning & dismantling (D&D) and the subsequent disposal of these non-radioactive waste on a landfill site are prerequisites for the timely dismantling of PEL's nuclear facilities, which must be guaranteed. Masses of up to 10,000 tons of material after clearance for landfill can be expected to be disposed of per Nuclear Power Plant Site.

Non-radioactive waste for which landfills are needed are solid substances which have passed specific or unlimited clearance or also generic release. The proportion of this non-radioactive waste is small in comparison to the total dismantling mass of a nuclear power plant, but securing this disposal route is a challenging task due to high public awareness. In order to ensure the rapid dismantling of the PEL facilities, landfill must

be made available as soon as possible.

PEL is obliged to dispose of materials in regional public waste disposal sites in accordance with the German Recycling Management Act (KrWG). Long-term onsite storage is not an option due to insufficient capacity and the postponing of a final solution.

Targeted measures must be planned, prepared, and carried out in due time and always in cooperation between the D&D project and the landfill-sites.

To ensure that conventional disposal through landfill runs smoothly, the responsible D&D project must continuously cooperate with its stakeholders amongst which are local politicians, responsible authorities, and other parties of interest. This is one of the most important requirements for success.



**Difficulties with the Landfilling of Released Waste from Nuclear Decommissioning**

Difficulties in the landfilling of released waste arise primarily from the fact that the public waste management enterprise regularly responsible for disposal are either unable to accept the waste because they do not have a suitable landfill site or do not want to accept it due to pressure from the public. For this purpose, the initial situation under waste law is presented: The basic obligation of waste producers, the regular disposal obligation of public waste management enterprises and the possibility of excluding waste from the obligation to transfer and dispose of it.

It is then explained that the waste authority can assign waste to certain landfills if their operators do not want to accept it, and to permit its acceptance in individual cases even if the landfill is not approved for such waste per se.

Then the waste hierarchy under waste management law, i.e. the priority of recovery over disposal, is explained. This is in conflict with the radiation protection law methodology of a conservative approach and the practical need for rapid disposal. This raises the question of whether and for which wastes landfilling is the option that delivers the best overall environmental outcome.

Finally, difficulties in planning are presented: If an administrative assignment is necessary, both the waste management enterprise responsible for disposal and the waste authority are dependent on the most concrete and precise information possible on the type, quantity and time of occurrence of released waste, in order to be able to make assignment decisions free of discretionary errors. For this, they need reliable information from the waste producer.

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**SPEAKER**

**WEDNESDAY 9:00 EN**

**Niklas Bergh**

Company Westinghouse Electric Company  
Fredholmsgatan 22  
72163 Västerås - Sweden

Website [www.westinghousenuclear.com](http://www.westinghousenuclear.com)



**SPEAKER**

**WEDNESDAY 9:25 DE**

**Emily Schmidt**

Company Institut für Werkstoffkunde  
Leibniz Universität Hannover  
An der Universität 2  
30823 Garbsen - Germany

Website [www.iw.uni-hannover.de](http://www.iw.uni-hannover.de)



Institut für  
Werkstoffkunde

## Dismantling of the Ågesta PHWR Reactor Vessel and Internals

The Ågesta Power Station was the first commercial nuclear plant in Sweden. It was commissioned in 1964 and was in operation for 10 years. It produced both electricity and district heating to the nearby households. Due to commercial reasons, it was permanently shut down in 1974. The reactor in the plant was of the Pressurized Heavy Water Reactor type (PHWR), using natural Uranium as the fuel and heavy water as moderator. The site is located in a rock cavern close to Farsta, which is approximately 20 km south of Stockholm city.

Since the shut down in 1974 only limited service has been carried out to maintain the necessary basic functions of the Power Station. The nuclear fuel and the heavy water have been removed from the site directly after the shutdown.

In late 2020, Westinghouse won the contract to dismantle and remove the Ågesta reactor pressure vessel and internals. The scope of the project is to plan, design and manufacture the tools for

segmentation as well as perform the site work. This includes remote underwater mechanical cutting of the reactor vessel and its internal components and packing the pieces in containers for the customer to remove from site. The site work will start in the fall of 2021, and is expected to be completed in the spring of 2023.

The Ågesta reactor is unique with some parts that have very thick material and high dose rates. The insulation around the vessel contains asbestos, and there is alpha contamination present due to the heavy water used as the moderator. This pose an additional challenge that is not normally present in a typical segmentation project.

The paper and presentation will go through the segmentation methodology and concept in more detail and show an overview of how the project will be carried out. It will also highlight how some of the challenges have been met using lessons learned from previous projects.



## Development of a Contact-Arc-Metal-Grinding (CAMG)-Technology for Automated Underwater Cutting

For the dismantling of contaminated and activated metal structures (e.g. reactor components), remote handling under the water surface represents an important technological mainstay. For this purpose, robust and fail-safe technologies are required, which are arranged side by side as alternative process in a kind of toolbox of dismantling technologies. This enables the realisation of technological alternatives for the safe fulfilment of the task.

Already in the tender planning stage, companies are involved to set the dismantling tasks and the required cutting technologies, which must be tested according to the state-of-the-art. In the present research project, CAMG cutting is addressed in order to prepare it for practical use. The objective of the project is to develop both the process and the cutting tools ready for use and to include them to the portfolio of thermal cutting processes for the dismantling of nuclear facilities. The overall objective of the project can be achieved through two main sub-objectives.

Firstly, the machine technology for CAMG cutting is to be transferred from the laboratory area to the application area. This is essentially done by developing a gallium-based high-current transformer, through which high currents can be transferred to the rotating disc. To this end, a modern overall concept for the construction of a CAMG machine is being developed and implemented so that the setup can be demonstrated under conditions similar to those in practical application. On the other hand, the improvement of durability of the cutting discs is being investigated by means of new manufacturing processes and by developing suitable resilient cutting materials.

Additive manufacturing offers a great potential, as the cutting materials are available in great variability and quantity and can be produced in a short time. The basics of cutting technology and the strategy of disc development within the newly launched FORKA project are presented. (Authors: Emily Schmidt & Dr. Thomas Hassel)



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**Marc Bogenstahl**

Company Rodias GmbH  
Eisleber Str. 4  
69469 Weinheim - Germany

Website [www.rodias.de](http://www.rodias.de)

WEDNESDAY 9:50 DE



### Digitalization Concept to Support Decommissioning Planning

The presence of radioactive inventory means that dismantling remains subject to nuclear law. In addition, until fuel-free, subsystems must continue to be operated to maintain the necessary safety. Systems that are no longer needed after shutdown of power operations are to be decommissioned and dismantled safely. These systems are interconnected in terms of process technology. So they must be partially converted to avoid undesirable effects on the systems in operation. The dismantled material must be directly processed in accordance with the radiation exposure. For this purpose, capacities must be built up at the site. All this means an enormous technical and organizational effort.

The operator of a nuclear power plant is obliged under Section 7 of the Atomic Energy Act to dismantle it at his own expense after its final shutdown. Thus the tracking and minimization of costs and compliance with the dismantling budget becomes a central issue of dismantling.

At the KKE site, a comprehensive digitization concept will help to carry out the tasks in

the most cost-efficient way possible while complying with all safety and regulatory requirements. Existing software is to be used, as the processes will be implemented successfully and safely. This means that a work order or §-19 measure for a decommissioning will continue to be processed through the operational management system.

Software specific to decommissioning will be developed and integrally networked with existing software at KKE. A central database will be created that compiles all dismantling-relevant data. This will be populated cyclically by the existing systems and the programs specific to dismantling.

The Insight Control Panel (ICP) from RODIAS is of central importance in the implementation of the digitalization concept. In IT terms, the main task of the ICP is to network the data of the various data silos and to make it available to the planner under a common interface.

In doing so, the entire planning process is to be transmitted to the operations management system, from strategic capacitive planning, through identification of the shutdown scope and pre-planning of the work tickets required for shutdown, and transmission of these work tickets. Mobile on-site feedback also takes place via the ICP. This facilitates work on site and ensures a direct feedback of progress into the planning system.

The presentation will provide insights into the digitization concept, the solution architecture and the realized application.



SPEAKER

**Dr. Emmanuel Porcheron**

Company IRSN Institut de Radioprotection et de Sûreté Nucléaire  
PSN-RES/SCA, BP 68  
91192 GIF SUR YVETTE - France

Website [www.irsn.fr](http://www.irsn.fr)

WEDNESDAY 11:00 EN



### Study of Aerosol Generation and Dispersion in the Context of Fukushima Daiichi Dismantling

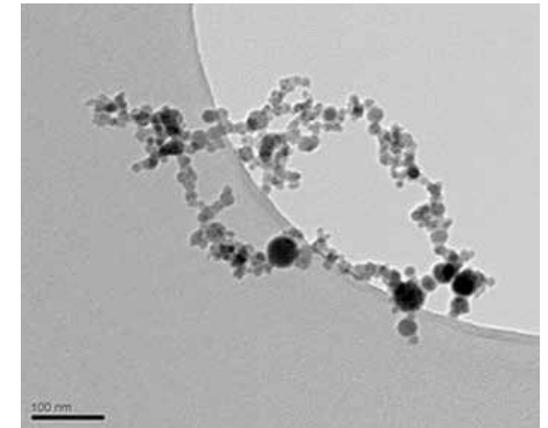
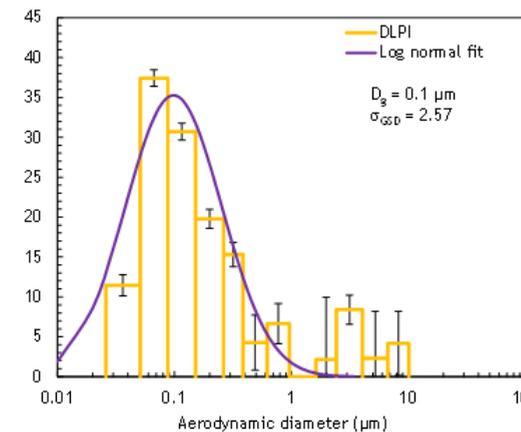
One of the important challenges for the decommissioning of the damaged reactors of the Fukushima Daiichi (1F) Nuclear Power Plant is the fuel debris (also called corium) retrieval.

The corium inside the reactor pressure vessel (RPV) and the one outside the RPV which has escaped the RPV and undergone a molten core-concrete interaction (MCCI) induce various configurations for retrieval operations that have to be studied.

The knowledge of aerosol characteristics in terms of size and generated mass during the cutting of corium provide useful insights into the dispersion of contamination during the evacuation of damaged reactors during decommissioning. Quantitative assessments of contamination dispersion risks are fundamental to the development of a safety case for the decommissioning of the Fukushima Daiichi plant.

This collaborative work between IRSN, ONET Technologies and CEA, managed by the Mitsubishi Research Institute on behalf of the Japanese Ministry of Economy, Trade and Industry (METI), presents the characterization of aerosols generated during cutting of corium simulants both in air and under water, with the laser technique. The objective is to obtain quantitative data for risk assessment related to the aerosol behavior and contamination released and disseminated when implementing this technique, over the next few years, in the process of decommissioning the damaged reactors.

This paper presents a part of the results stemming from this project, focused on the characterization and the dispersion of aerosols produced during laser cutting of in-vessel and ex-vessel corium simulants.



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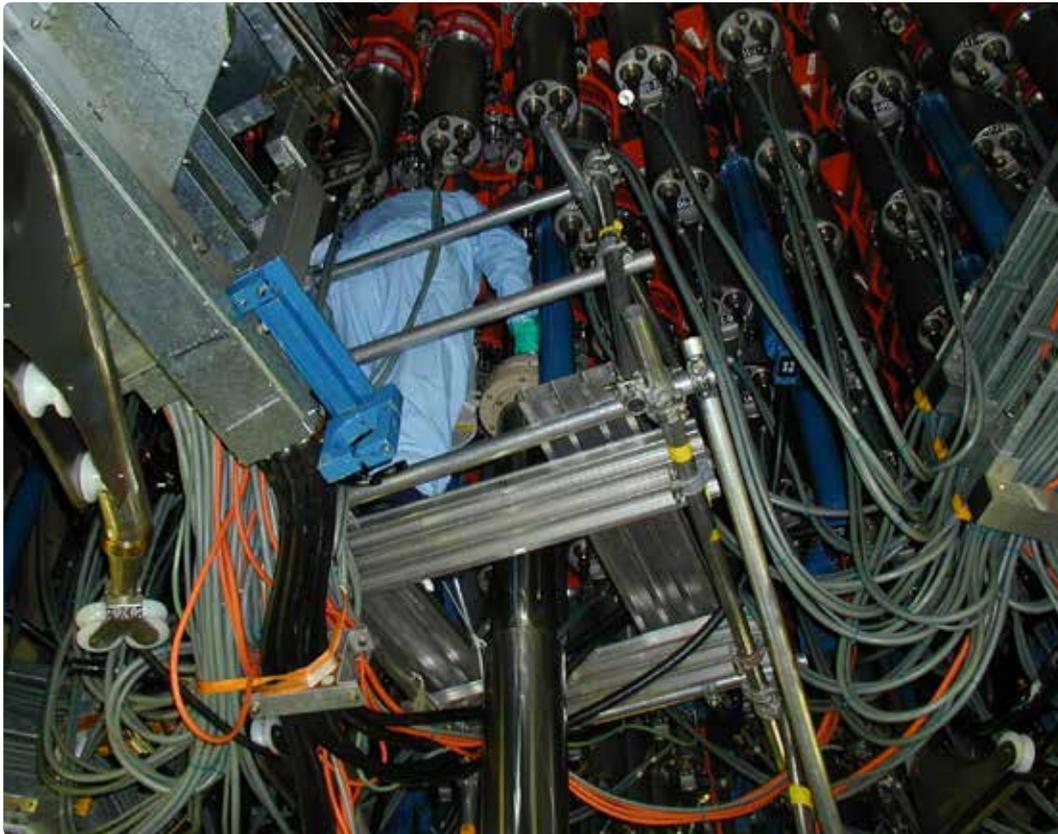
COMPANY PROFILES

**SPEAKERS****WEDNESDAY 11:25 DE****Dr. Heiko Herbell**  
**framatom**Company Framatome GmbH  
Paul-Gossen-Straße 100  
91052 Erlangen  
Germany  
Website www.framatome.com**Dr. Lars Behnke**  
**RWE**Company RWE Nuclear GmbH  
Dr.-August-Weckesser-Str.  
89355 Gundremmingen  
Germany  
Website www.rwe-nuclear.de**SPEAKERS****WEDNESDAY 11:50 DE****Philipp Moormann**  
**& Dr. Thomas Volmar****RWE**Company RWE Nuclear GmbH  
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56218 Mülheim-Kärlich - Germany  
Website www.rwe-nuclear.de

### Dismantling and Disassembly of Control Rod Drive Room Components and Systems

Lessons learned are presented from decommissioning, dismantling and disassembly of Boiling Water Reactor (BWR) Control Rod Drive (CRD) room components and systems. Operator and service provider experiences are presented in the areas of licensing, planning, execution, scheduling and waste management. Personal dose rate minimization is considered as well as special treatment for sealing containing asbestos.

Works in the CRD room can be performed before obtaining the final decommissioning license. Therefore, these tasks play a major role to secure the overall plant dismantling schedule by allowing parallel work on systems attached to the reactor pressure vessel (RPV) and its internals. Special plugs inside the reactor allow the removal of all CRD components without necessitating the removal of the reactor internals or the draining of the RPV beforehand.



### Decommissioning of the NPP Mülheim-Kärlich: Dismantling of the Steam Generators

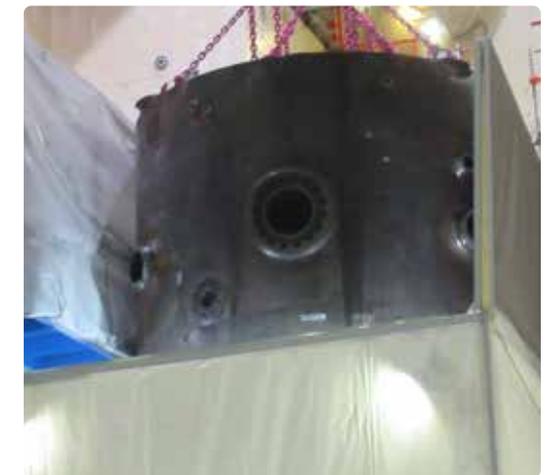
Last year an account of the decommissioning project Mülheim-Kärlich was given, which will be complemented by a review of the completed steam generator dismantling project in this year's presentation.

The nuclear power plant Mülheim-Kärlich has a diverse history. Planning and construction started in the 1970s. Influenced by the shift of public perception in terms of nuclear in Germany start of commercial operation was delayed until 1987. Because of legal actions against the plant operation needed to stop in 1988 already. Legal proceedings followed for the next ten years resulting in a verdict of the German Federal Administrative Court against restart. In the course of the first German nuclear phase out decision was taken to apply for a decommissioning license that was granted in 2004. Since then decommissioning and dismantling is ongoing. In Germany it is the first decommissioning project of a 1300 MW class NPP. Following a holistic decommissioning approach the project focused on reaching fit for purpose ser-

vice operations, a significant dismantling rate and reducing radioactive waste. Milestones were the minimized plant area, small operating systems on industrial level and a dismantling rate of up to 1000t/a so that some building areas of the RCA have already reached the status of cold and dark.

Such a dismantling rate can only be achieved by using modern industrial approaches, which have also been utilized for the steam generator dismantling project, that was executed in Mülheim-Kärlich from 2018 until 2020. More than 1200 Mg of material were decommissioned with an in-situ approach, separated and for the most part released into common recycling processes. The contactor's cutting technology as well as the established processual solutions were the key factors that enabled the successful completion of this project.

Next milestones will be the dismantling of the reactor pressure vessel and the reduction of the RCA in parallel to industrial like dismantling of system.



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**SPEAKER**

**Dr. Marina Sokcic-Kostic**

Company NUKEM Technologies  
Engineering Services GmbH  
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63755 Alzenau - Germany

Website [www.nukemtechnologies.de](http://www.nukemtechnologies.de)

**WEDNESDAY 13:30 DE**



**SPEAKER**

**Dr. Ernst Niederleithinger**

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und -prüfung (BAM)  
Unter den Eichen 87  
14480 Berlin - Germany

Website [www.bam.de](http://www.bam.de)

**WEDNESDAY 13:55 DE**



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### Characterisation of Radioactive Waste Streams During the Decommissioning of Nuclear Power Plants

Separation of radioactive waste into different streams is very important for keeping the costs of waste disposal low. This allows a common measurement procedure because matrix composition and other parameters are similar for the complete stream. An important issue comes from the acceptance conditions for long term disposal that are often not finally defined at this moment. Therefore, waste has to be placed in interim storages and should be prepared for further measurements to fulfil the final disposal criteria once they will be defined or changed in future.

At the same time the interim storage must be safe for a time of minimum 20 years according to the current regulation issues. The paper gives a survey about the current situation in respect to the requirements and measurement methods for radwaste as well as a preview for future developments. The focus is directed to the non-contact measurement of radioactive isotopes activities and matrix composition with 3- dimensional space resolution.

Among others, the method of neutron activation using neutrons from acceleration tubes without radioactive sources seems to be the most promising for measurement of matrix distribution. This method enables the compensation of gamma ray absorption effects and enhances the precision of activity determination.

Also, the progress of MCNP codes and faster computer hardware affords the significant progress in data analysis and interpretation. Another very promising method, originating from High Energy Physical Experiments (like in CERN), are the measurement of muons with drift chambers and similar detectors.

The muons originating from cosmic radiation can penetrate high density materials (like Uranium). The measurements of the muon deflections by these materials can be used for identification and localisation of the materials themselves.

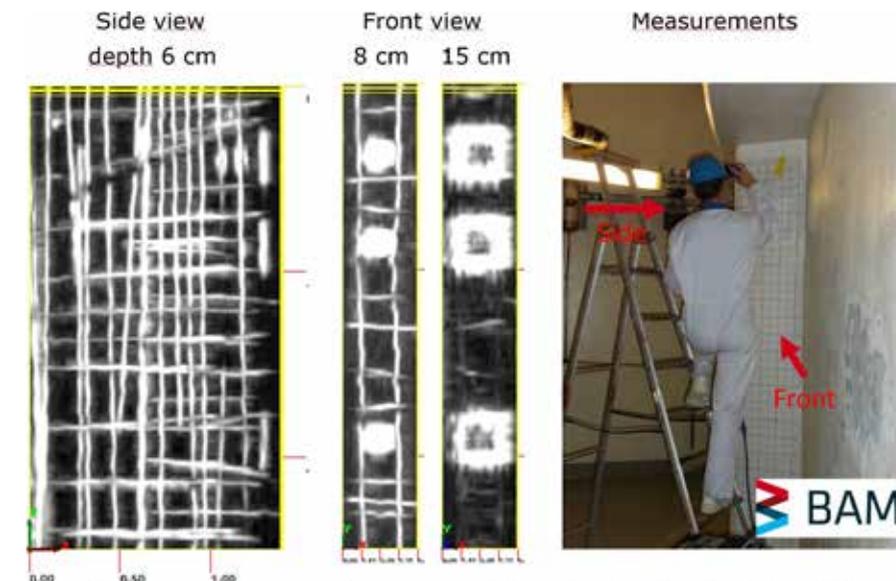


### The concrete part of nuclear decommissioning and how to check it non-destructively

Major parts of the constructions at nuclear facilities are made from reinforced or prestressed concrete. While most of it does not require decontamination or long-term storage after demolition, several challenges remain. For example, demolition in the core facilities has to be done in line with the deconstruction of the actual plant installations. Safety and load capacity must be assessed and ensured in all phases of the process, requiring detailed knowledge on the geometry and condition of the construction. Non-destructive tools can contribute by providing detailed insight into concrete constructions and reducing uncertainties.

A large toolbox is available, from simple standard tools such as rebound hammer and ultrasonic pulse velocity test for concrete strength estimation, advanced imaging tools to map the interior geometry of constructions, e.g. ultrasonic and radar echo methods or X-ray tomography up to upcoming, innovative tools such as muon imaging. All these methods have strengths and limitations and parameters which need to be adapted to the task. Recommendations are available to guide the method selection and to establish testing protocols.

Recently, works has been started to include the information from NDT into the BIM process, which would be of great help to plan and perform the decommissioning process. NDT results can also be used in probabilistic load capacity assessment.



Radar results on concrete, rebar and prestressing tendons in a NPP

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SPEAKER

Neil Owen

Company Createc  
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CA13 0HT Cokcermouth - United Kingdom

Website www.createc.co.uk

WEDNESDAY 14:20 EN



SPEAKER

Souad Pederzani

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

Website www.gns.de

WEDNESDAY 15:15 DE



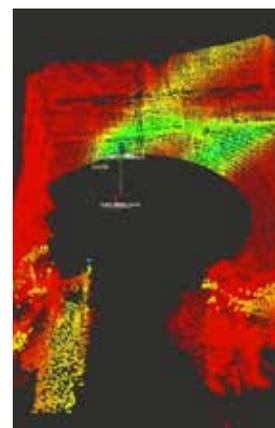
### Innovative Technology Solutions for Radiation Characterisation and Robotics - Solving Demanding Decommissioning Challenges

Createc is one of the thought leaders for innovation in the nuclear industry. Our strategy is to bridge the gap between university research and industry. We have close working relationships with academia and are often researching similar technologies, but we have an understanding of what it takes to move technologies from research stages and develop them to successful commercial products in the market.

And we have demonstrated this with industry firsts in the nuclear industry. Initially, with N-Visage, for high-dose gamma imaging. The N-Visage Scanner was the first instrument to be deployed at Sellafield for gamma imaging through a 6 inch penetration. RISER was the first on-site radiation imaging with a UAV or Drone also demonstrated at Sellafield inside the Windscale pile.

Thirdly, our open platform robotic system, developed after we were one of the winners in the Integrated Innovation in Nuclear Decommissioning competition.

We have a strong track record of taking products and technology to market. We strive to provide end users with a solution to their problem, not just a demonstration of the latest technology. And this is an international capability. We have taken our early-stage innovations and developed a strong export market, particularly in Japan. We also recognise that we can't achieve successful on-site integration alone and we have built up strong partnerships with tier 2 suppliers. Createc operate in in three main markets, Nuclear, Defence and Oil & Gas. Our technologies are cross-pollinated through these markets and opportunities are conjoined where possible.



### Challenges in the Post-Qualification of Legacy Wastes

According to Section 9a Para. 3 of the German Atomic Energy Act, the federal states must set up federal state collecting depots for the interim storage of radioactive waste accumulated in their territory.

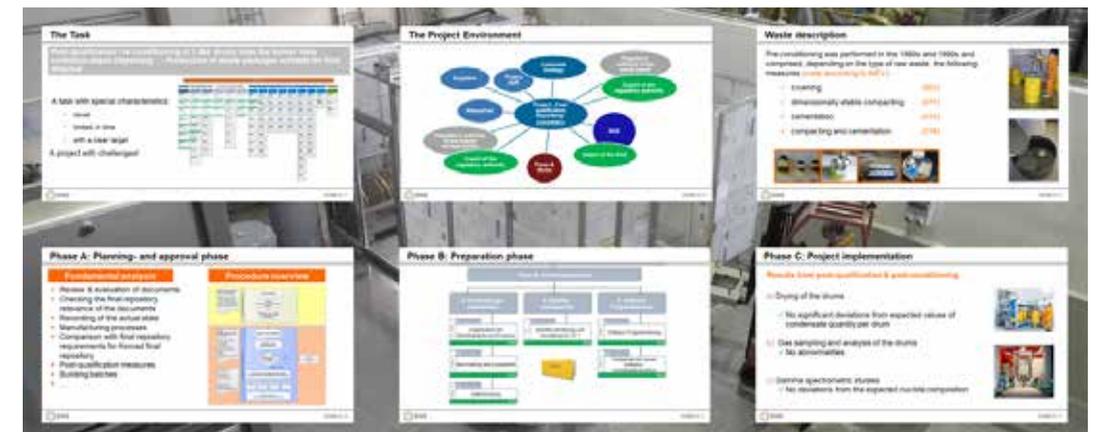
At its federal state collecting depot in Leese, the collecting depot (LNI) of the federal state of Lower Saxony stores amongst others 1,484 drums of waste from the years 1980 to 1990 from the former collecting depot of the federal state of Lower Saxony in Steyerberg, which was closed in 2000. This waste comes mainly from medicine, research and industry. In preparation for final disposal in the Konrad final repository, it has to be requalified or reconditioned.

The project includes among others the following services that are provided by GNS.

- Creation of concepts
- Transport handling
- Processing
- Documentation

The existing scope and the strongly varying quality of the available data on the overall very heterogeneous waste pose great challenges, especially in the preparation, review and release of concepts, both for GNS as conditioner as well as for the authorities and experts involved. In this context, the requirements for robust evidence management in conjunction with compliance with the radiation protection goals play an essential role. So far, there are hardly any comparable ongoing or completed post-qualification campaigns in Germany. The experience gained by GNS in the post-qualification and post-conditioning of the waste from Steyerberg shows the complexity and the differences to the treatment of radioactive waste from the recent past and the current operation.

The findings and experience gained from this project will point the way forward, both technically and in terms of the associated costs, for the repository-compatible post-qualification of currently more than 10,000 existing drums with comparable legacy wastes in Germany.



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**SPEAKER**

**Moritz Gradmann**

Company TÜV Rheinland Industrie Service  
Am Grauen Stein  
51105 Köln - Germany

Website [www.tuv.com](http://www.tuv.com)

**WEDNESDAY 15:40 DE**



**SPEAKERS**

**Dr. Petri Kotiluoto**

Company VTT Technical  
Research Centre  
Box 1000  
02044 Espoo - Finland  
Website [www.vttresearch.com](http://www.vttresearch.com)

**WEDNESDAY 15:15 EN**

**Antti Ketolainen**

Fortum Power  
and Heat Oy  
Keilalahdentie 2-4 CD  
00048 Espoo - Finland  
Website [www.fortum.com](http://www.fortum.com)

## Material Description of Radioactive Waste using Material Vectors

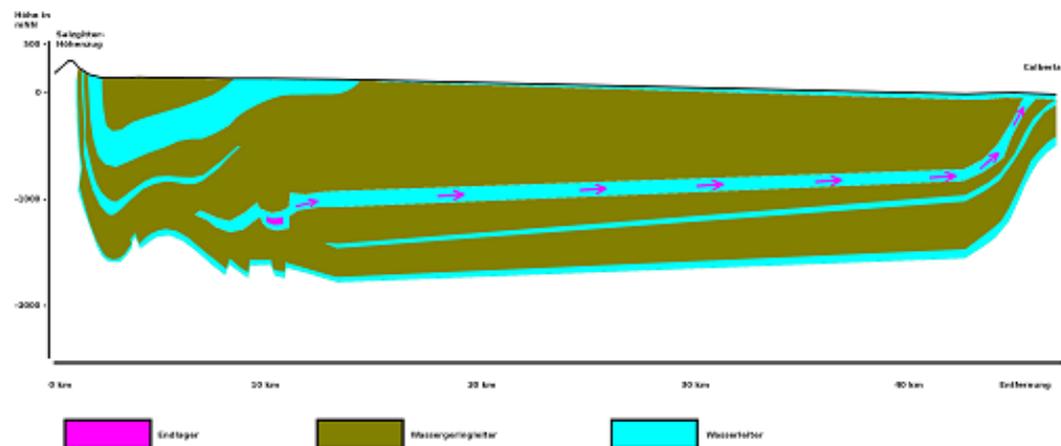
The regulatory framework of the Konrad deep geological repository requires the material composition of all radioactive waste to be fully described in order to rule out contamination of near-surface groundwater with chemically hazardous substances.

To achieve this goal, TÜV Rheinland Industrie Service (formerly ISTec), acting on behalf of BGE (Bundesgesellschaft für Endlagerung, formerly BfS) as the operator of the repository, has developed a concept for the material description of radioactive wastes using a material database. This concept allows for waste description using pre-made modular building blocks (basic materials) to assemble a virtual depiction of an individual waste's or waste type's composition (material vector).

Based on the used basic materials and their share in a waste, threshold values for individual waste types can be derived, thus providing the means to safely rule out hazardous groundwater contamination.

The Konrad repository is the first disposal project for radioactive waste that requires such a detailed material description of waste, therefore the development of the mentioned concept started from scratch.

This part of ICOND is meant to shortly present the general concept to the participants, as well as highlight some obstacles and lessons learned in the process of its development.



## Lessons Learned from Decades of Waste Characterisation, Management and Deposition in Finland

Finland has been operating four NPPs and one research reactor for decades, including efficient and safe management of radioactive waste streams. Currently VTT and Fortum are in the process of decommissioning the FiR 1 TRIGA Mark II research reactor located in a university urban campus area of Espoo, Finland.

VTT is the operator of the FiR 1. The license for decommissioning of FiR 1 was granted on 17th of June 2021 by the Finnish government, preceded by a detailed planning and licensing phase. A major step before obtaining the license has been the open call for tender by VTT for finding the company to dismantle the FiR 1 and to take care of the radioactive waste management. The agreement between VTT and Fortum was signed in March 2020.

As an operator and license holder of Loviisa NPP, Fortum has decades of experience on management, treatment and handling of radioactive wastes. Starting already from construction of Loviisa NPP Fortum has developed and maintained strong in-house nuclear engineering competences covering

also planning and engineering of decommissioning.

Fortum's competences on this sector have more recently strengthened and extended by experiences on large nuclear decommissioning projects via intensified Fortum-Uniper cooperation.

Dismantling of the FiR 1 research reactor will serve as an important test case for VTT, Fortum, and Finland in general, being the first nuclear facility facing decommissioning. FiR 1 decommissioning and waste management will benefit from the long history of the waste management in Finland, including existing LILW repositories, one of them operated by Fortum.

This presentation will cover lessons learned and best practices regarding waste management from characterisation to deposition. Information will also be shared regarding construction and readiness for operation of the world's first high level radioactive waste repository.



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**SPEAKER**

**THURSDAY 9:00 EN**

**Danielle Dobbe**

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**SPEAKER**

**THURSDAY 9:25 EN**

**Emilia Janisz**

Company European Nuclear Society  
Avenue des Arts 56, 2/C  
1000 Brussels - Belgium

Website [www.euronuclear.org](http://www.euronuclear.org)



**Onsite or Online: How to Make Your Presentation go Nuclear!**

Most of us need to present information sometimes, whether it is a short presentation, just for colleagues in a room at the office, or online with hundreds of 'invisible' people listening. Whatever the circumstances of your presentation, you probably want to get a message across! Hence, you want the audience to focus on that message, and remember it when they leave the room or log off the virtual meeting. Let's talk about two things that will make your presentation so powerful its actually nuclear, both onsite and online!

First: Less is more! As experts, we know so much about our subject, and we like to be thorough! We are sometimes inclined to tell the complete story, including every detail and everything related to it. Your audience, however, might get lost because they don't know as much as you do about the topic you are presenting.

Therefore, you should be clear about your goal or message, and make the journey towards it a visible path, not a maze! Your audience won't remember everything you said anyway! The rule 'less is more' also applies when it comes to your slides.

I often see slides with too much text, too much going on, huge tables filled with data, or very complex figures.

For some reason people think these types of slides are helpful, but in many cases, they will only distract your audience from what you are trying to convey, and make the audience remember even less. They also prevent your audience from seeing the clear path to your goal. Second, making a connection with your audience, and involving them, can really make a difference between a boring and an interesting presentation. When you connect with your audience, you will capture their attention, and you can take them along with you on the path to your message. Adapting to their level, telling a story or anecdote, smiling, and adding something personal to your presentation are ways to connect and engage your audience. And once they feel connected and engaged, they will pay more attention to you and are likely to remember more!

By keeping these two things in mind when preparing your presentation, you will bring more focus and personality to your presentation, two ingredients to make your content memorable and your presentation really radiate!



**ENEN+ PROJECT - Attract, Retain and Develop new Nuclear Talents Beyond Academic Curricula**

The European Nuclear Society and its Young Generation Network is a Learning Society, present in 21 European countries, and brings together over 12.000 nuclear professionals.

The EU- funded project ENEN+ project contributes to the revival of the interest of young generations in the careers in the nuclear sector. This is to be achieved by pursuing the following main objectives:

- Attract new talents to careers in nuclear.
- Develop the attracted talents beyond academic curricula.
- Increase the retention of attracted talents in nuclear careers.
- Involve the nuclear stakeholders within EU and beyond.
- Sustain the revived interest for nuclear careers.

The attraction, retention and development of the new nuclear talent can only be sustained beyond the project life through strong partnership of all nuclear stakeholders. Involvement of various nuclear stakeholders including academia, industry, international organisations and Technical support organisations is therefore of primary importance for the success and sustainability of the proposed activities also beyond the life of the project. Therefore the presentation will serve as incentive for discussion on how nuclear stakeholders can enforce their partnerships on sustaining the interest of professionals in nuclear career. What are the proven tools to increase the talents' retention?



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**SPEAKER**

**THURSDAY 10:20 DE**

**Dr. Anton Anthofer**

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**SPEAKER**

**THURSDAY 10:45 DE**

**Dr. Stefan Thierfeldt**

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**Opportunities and Possibilities for Radiologic Release in the Context of Nuclear Dismantling**

During the operation of nuclear power plants (NPP), routine release process of materials used in the „hot zone“, garbage or tools, is a well known procedure. In the context of the dismantling a NPP many materials have to be treated at once. The materials have to be separated by basic material, radiologically evaluated and measured for weight/size.

The layout of the processes, logistics, treatment facilities and permits from the surveiling authorities have to be adapted to the specific dismantling process and release strategy of each NPP.

Disposal methods for materials regarding radiation protection act/regulation (StrlSchV) are unrestricted release (§35 StrlSchV), specific release (StrlSchV §36), e. g. recycling or depositing. For unique circumstances, an individual release is possible (StrlSchV §37).

The release of tools and machines (according to StrlSchV §58) used in the „hot zone“ of a NPP can be useful, to reuse or repair/maintain these tools and materials outside of radiation protection areas.

In the presentation, general possibilities of release strategies in the context of dismantling processes are demonstrated. Early in the decision process, a special emphasis is necessary regarding the area and building clearance and strategic mile stones, like:

- Design of site concepts (dismantling concept, permit, radiation protection, documentation)
- Planning of area and building release
- Residual material treatment during all dismantling phases
- Possibilities of a useful digitalisation and 3D-planning the different types of clearance processes



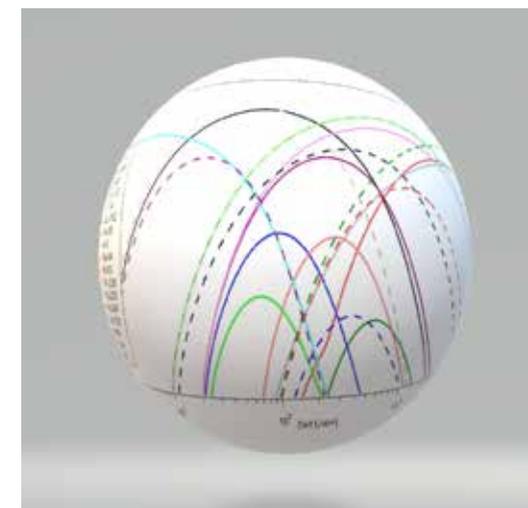
**Case-by-Case Approaches According to Section 37 StrlSchV for the Clearance of Buildings and Sites**

The regulations for (specific) clearance of buildings for demolition and for (specific) clearance of sites according to Section 36 (1) No. 6 and 2 StrlSchV (Strahlenschutzverordnung - Radiation Protection Ordinance) have already been successfully used for nuclear installations in Germany for two decades.

However, the occurrence of parts of buildings of NPPs that cannot be cleared (or only with very high effort) by using standardised clearance procedures and tabulated clearance levels according to Annex 4 Table 1 Column 13 StrlSchV, as well as the objective to fill the excavation pits remaining after removal of the buildings with cleared concrete rubble under aspects of sustainability and avoidance of transports, have led to the situation that for most sites today, case-by-case approaches in the sense of Section 37 StrlSchV are carried out (which may cover both clearance of buildings and clearance/release of the site).

While the first case-by-case approach could already be performed and completed about 10 years ago for the NPP Würgassen, more and more NPPs have followed this example in recent years. Taking into account the particularities of a specific plant, the site conditions and the existing residual activity allow the definition of a tailor-made approach while maintaining the same level of protection (10 µSv concept) as when applying generic regulations.

The presentation gives an overview of these new developments and the quasi-standardization of case-by-case approaches that has developed in recent years.



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**SPEAKER**

**THURSDAY 11:10 DE**

**Dr. Ingo Kölln**

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**SPEAKER**

**THURSDAY 11:35 DE**

**Dr. Tim Thomas**

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## State of the Art Free Release Monitor Systems

New detector-technologies have been established by the Ludlum-Hamburg R&D team during the last four years. In focus of this paper is the Multi-Channel-Energy-Analysis (MCEA) methods for Gamma-Plastic-Scintillation detectors as well as application examples from industry and research. The new specially designed HWM1800 free-release-chamber is the preferred machine to ensure reliable state of the art measurements in combination with an outstanding economic performance. The main features of this equipment are accuracy, high throughput and nuclide vector verification.

Technically, each Gamma detector of all new designed Ludlum GmbH Free Release Chambers is equipped with an 8-bit, 256 channel, ultrafast ADC converter. All kinds of energy

slots (windows) out of this 256-channel-information can be defined individually or as combination (sum) of selected channels. Although the energy resolution of a plastic scintillation detector is not optimal, it is herewith possible to see clear differences between certain nuclides.

The main application of this feature is the comparison and verification of measured nuclide compositions with given fingerprints (nuclide vector). Measurement results of large HWM1800 Free-Release-Chambers will be shown here and critical discussed.

Furthermore, we will discuss the comparison of calibration routines for the new 1800 litre Free Release Chambers with Monte Carlo simulations and real measurements.



## New Perspectives in Clearance of Metal Waste

One major path for clearance of large amount of waste arising from the decommission of nuclear power plants is based on measurement with large clearance monitors (also known as free release measurement facilities). These devices utilize multi-detector plastic scintillator arrays (large clearance monitors can consist of up to 24 plastic scintillators) to offer both, extremely low minimum detectable activities (MDA) and short measurement times for waste packages weighing up to one metric ton.

However, the clearance procedure for metal waste demands large amount of time and expense. One important step in that process is the treatment and scanning of the surface to prove the absence of any hotspots. Furthermore, the scanning via hand-held beta-sensitive monitors has to be performed meticulously.

To improve the clearance process both, in scope and reliability, we propose to apply state of the art statistical imaging. Thanks to

this novel approach, even small activities can be found in these cells within a high confidence and hotspot-activities can be localized within the waste. Thus, clearance criteria (i.e. the thresholds of allowed activity) can be applied to each cell and hotspot individually, increasing dramatically the whole clearance limit for the whole waste.

In this paper the software tool SIStec 2.0 is presented. It provides an intuitive user-interface to generate and simulate waste package models. Moreover, the software checks whether a real sample of the simulated type (i.e. with the same geometry or composition) can be released using the aforementioned imaging methods. These new powerful simulation capabilities will allow to significantly automatize the clearance process on various levels reducing drastically the preparation and the preliminary measurements needed to release waste.



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**BACKUP SPEAKER**



**SPEAKER**

**Dr. Martin Brandauer**

Company OECD-NEA  
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75775 Paris - France

Website [www.oecd-nea.org](http://www.oecd-nea.org)



**SPEAKER**

**Diego Espejo**

Company ENRESA  
Emilio Vargas, 7  
28043 Madrid - Spain

Website [www.enresa.es](http://www.enresa.es)



### International Activities Relating to Decommissioning and Legacy Management – a Status Report from CDLM

As a directorate of the Organization for Economic Co-operation and Development (OECD), the Nuclear Energy Agency (NEA) is an intergovernmental agency that facilitates co-operation among their 34 member countries with advanced nuclear technology infrastructures to seek excellence in nuclear safety, technology, science, environment, law, waste management and decommissioning. This contribution is dedicated to intensify and support international activities in the area of decommissioning.

Since 1975, the NEA has supported their member states through the Radioactive Waste Management Committee (RWMC) by the development of safe and economically efficient management of all types of radioactive waste based on the latest scientific and technological knowledge. Decommissioning activities have been addressed under this committee since 1978, but it was only in 2018 that the Committee on Decommissioning of Nuclear Installations and Legacy Management (CDLM) has been established. Similar to RWMC, the CDLM is further focusing and intensify international collaboration, promoting technological, regulatory and stakeholder involvement issues.

This is being addressed in three major constituents based on the CDLM statement for a holistic perspective on decommissioning and legacy management [1]:

1. Economy: this comprises the work done the area of harmonised approach of cost estimates [2], addressing uncertainties [3] as well as benchmarking [4].
2. Environmental safety through science and technology: relying on experience in preparation of decommissioning [5], recycling [6], safety case [7].
3. Society: by promoting Stakeholders Confidence [11] focusing on decommissioning issues based on case studies like the UK Stakeholders Workshop conducted in September 2020.

This contribution will address the most recent developments at NEA intended to support their member countries to further advance in their decommissioning of nuclear installations and legacy sites.

### Dismantling of the Radioactive Waste Warehouse Building N° 1 within the Jose Cabrera NPP D&D Project (Spain), Accomplished by ENRESA

Among the Spanish National Radioactive Waste Management Company's (ENRESA) activities and responsibilities is the dismantling and decommissioning of the Jose Cabrera Nuclear Power Plant, in Guadalajara, Spain, one of its biggest challenges has been the dismantling and demolition of the radioactive warehouse 1, due to its radiological conditions (contamination/impactation), history, characteristics and the great complexity of the cleaning, sorting, cutting & decontaminating, radiological surveilling, waste conditioning and waste management activities and works that had to be planned, designed and performed. This presentation will overview the overall decommissioning activities performed, techniques used and challenges faced on the dismantling of this building, from the previous operational phase until its successful completion, through the following stages:

- Initial status and previous works: operational history, waste legacy from the operational phase and further uses in the

- decommissioning.
- First cleaning activities, removal and management of operational radioactive waste packages and big pieces/equipment in a SAS workshop installed for dry cutting (replaced RPV head and other components from the cold branch).
- Systems desinstallation and disassembly from the conditioning workshop and waste immobilization plant.
- Cutting and dismantling of the auxiliary systems of the waste conditioning workshop.
- Decontamination and clearance activities for walls (impacted or facing controlled area): MARSSIM.
- Clearance process for final demolition of the building.
- Management of the contaminated/activated concrete: radiological characterization, segregation, crushing and further management.
- Final status for remediation.
- Conclusions, lessons learnt and further challenges.



Dismantling of the radioactive waste warehouse building N° 1 within the Jose Cabrera NPP D&D Project (Spain) by ENRESA

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**SPEAKER**

**Giacomo Mangiagalli**

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### Characterization via the RadHAND Integrated into the REACH<sup>TM</sup> System for a Low-Cost in-situ Waste Characterization of Nuclear Waste

A key aspect of operational activities and radioprotection in NPP is the management of nuclear waste. Providing efficient and reliable real-time radionuclide concentrations contributes invaluable information while processing nuclear waste as it can in turn reduce costs with packaging, transportation, and disposition for NPPs. Currently, waste characterization uses HPGe to determine the radionuclide concentrations and isotopes abundances. This requires NPPs to be equipped with a laboratory on site as well as radiological experts and immense amounts of time and effort to obtain the results for well-defined gamma-emitting radionuclides which are easily detectable. Current characterization practices involve obtaining waste stream specific distributions which are then applied to all waste packages of the same waste stream type. This type of analysis is typically performed by HPGe detectors whom the main drawbacks are the typical long measurement times, the time for post process analysis, and the high entry cost.

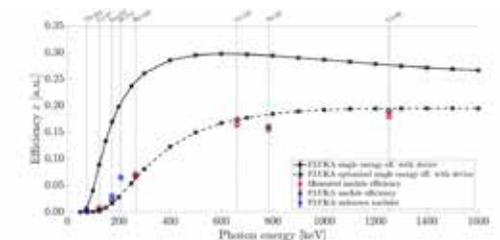
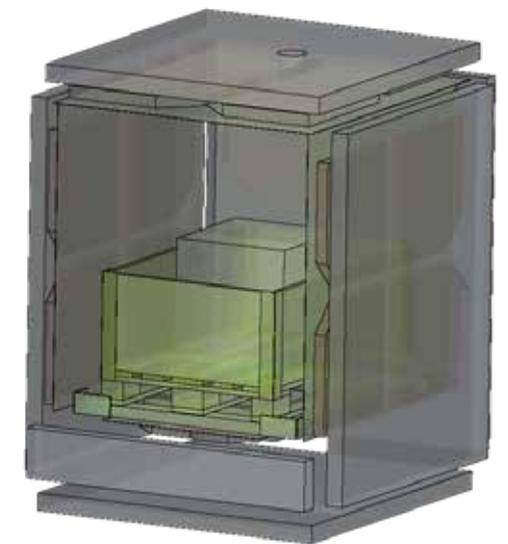
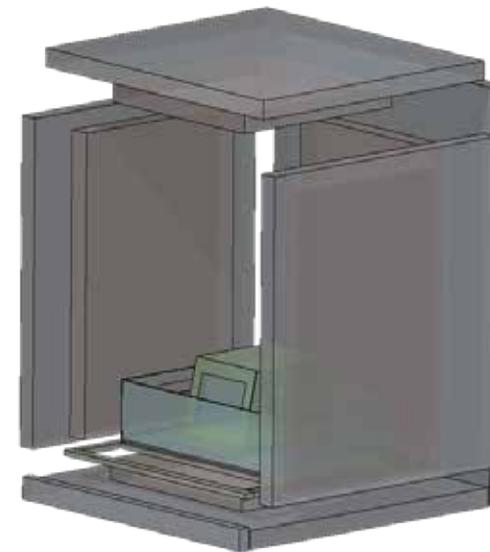
We developed a faster and user-friendly waste characterization toolkit which represents a step change in the characterization of LLRW. It is intended for all waste packages for open geometry measurements by providing a low-cost detection technology with an easily transportable device. It directly measures gamma dose rates and gamma emitting activity by radionuclide for packaged radioactive material. The RadHAND device is used for the gamma measurement and the data digitalization via RFID technology. The system can track the uniquely identified WP using the attached RFID tag and restore the WP characterization history using the database. This paper will show results for tests made with the RadHAND which measured real package radioactive waste from NA commercial power plants to evaluate its performances in fixed geometry configuration. The feasibility to substitute the old typical procedure based on HPGe characterization with this new system will be analyzed.



### Monte Carlo Simulations of Clearance Monitors Using the Code FLUKA

In recent years, the general interest on procedures for characterization and validation of clearance monitors has increased. The use of these devices is mainly linked to activities of decommissioning of nuclear reactors and particle accelerators. Monte Carlo simulation codes prove themselves a useful tool for determining conversion factors especially for non-conventional geometry configurations of the measured objects, and non-standard radionuclides.

In this presentation, a procedure for the simulation and characterization of such clearance monitors using the Monte Carlo code FLUKA is proposed.



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4<sup>th</sup>  
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## 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 area 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.



### 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



### MEASUREMENTS FOR CLEARANCE

- In situ gamma spectroscopy
- Development of measurement protocols
- Statistical sampling methods
- Radiological mapping

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 radiation transport calculations, determination of activation of materials and modeling of non-destructive measurement systems. 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.

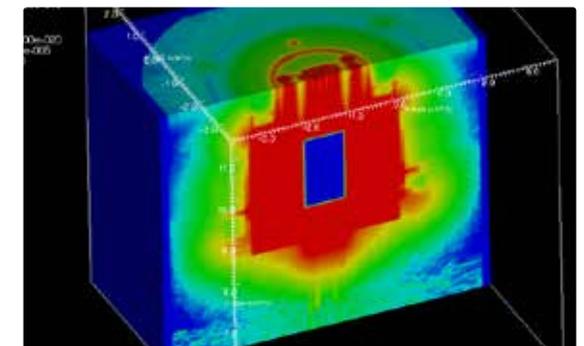
### DECOMMISSIONING STRATEGIES & PACKAGING CONCEPTION

- Identification of relevant framework conditions
- Waste package load planning
- Planning of technical realization and resources
- Preparation of schedules and test sequences
- Project controlling



### 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



## Experts in Nuclear Training

AiNT offers a modular based training program covering fundamental knowledge like „Basics of Nuclear Technology“ as well as advanced modules to specific topics such as „Decommissioning and Dismantling of Nuclear Facilities“ or „Conditioning, Release and Final Disposal of Radioactive Waste“.



Since 2011, more than 1000 people have participated in the modular training program. Our customers include representatives from utilities, nuclear industry research institutions and regulatory authorities. We cooperate with more than 70 lecturers with outstanding professional expertise in our seminars.

Our customized inhouse trainings are well appreciated by authorities and renowned companies such as Siemens, Westinghouse, CNNC, ROSATOM, German regulations authorities and research institutions like the University of Basel.

## Heavy Transport - Next Level

August Alborn GmbH & Co. KG is an experienced and competent family-run company since 1891. We are specialized in heavy lifting, fluids, relocation and transportation of large components, heavy and wide loads in the conventional as well as in the nuclear area.

Individual and economic solutions by the project processing in all areas, permanent call availability, careful planning and coordination accompanied with very short – term actions characterize our provision of service. We also provide feasibility studies, detailed routes and time planning, route reconnaissance and obtain the necessary permits.

This is achieved by qualified and committed team of employees, using advanced equipment and innovative technology. We provide a wide range of transportation devices and special vehicles like saddle trucks, low loaders, flatbed trailers with high pay loads, mobile cranes and special

equipment like our 1,440 to. hydraulic gantry. Our new JMG mobile crane with max. capacity of 35 to. introduces the highest quality standards:

- the most powerful in compact size,
- the most precise and user friendly with the radio control,
- the most agile and safest among electric cranes.

The responsible use of the environment and resources is reflected in our quality management and certified according to ISO 9001:2015 - SCC\*\* (Version 2011). “If you intend to rebuild yourself, do it every day” has been our motto for 130 years.



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Website www.ansaldoenergia.com



## Ansaldo Nuclear Provides in-House, fully Combined Engineering, Procurement and Construction Capabilities for the Nuclear Markets.

Ansaldo Nucleare S.p.A (Italy) and Ansaldo Nuclear Ltd(UK), together operating under the name Ansaldo Nuclear, provide design, engineering, manufacturing, assembly, testing, commissioning, site installation and integrated logistics through life support of bespoke solutions for all of the four nuclear business lines in which they operate: Nuclear New Built, Fusion, Plant Operation Assistance and Decommissioning and Waste Management.

With forecasted revenues of 90 million € in 2021 and a total workforce of above 400 employees, Ansaldo Nuclear operates in the domestic and international nuclear markets, managing the entire business from its headquarters and operational offices in Genova (Italy) and Wolverhampton (UK), directly and through the branches located, among others, in Romania and France, and the representative office in Russia.

With its Engineering Units that cover a wide range of disciplines, and its manufacturing capabilities based in Wolverhampton (UK), Ansaldo Nuclear is a "One Stop Company" fully dedicated to the Nuclear Industry and to the Sustainability of the Nuclear Option.

The Decommissioning and Waste Management business line has been focused on Italian and UK markets, with some relevant activities on foreign markets (Lithuania, Russia, Ukraine and others).

Ansaldo Nuclear collected extensive experience in waste management over the years, with capabilities that include the design, erection and commissioning of facilities for the size reduction, sorting, decontamination of solid waste, remote handling bespoke solutions, nuclear cranes and handling devices, equipment and associated control systems for the retrieval of active components from silo storage.

The company developed a remarkable decommissioning set of skills and grew through the management of field operation, leveraging strategical cooperation with dismantling companies.

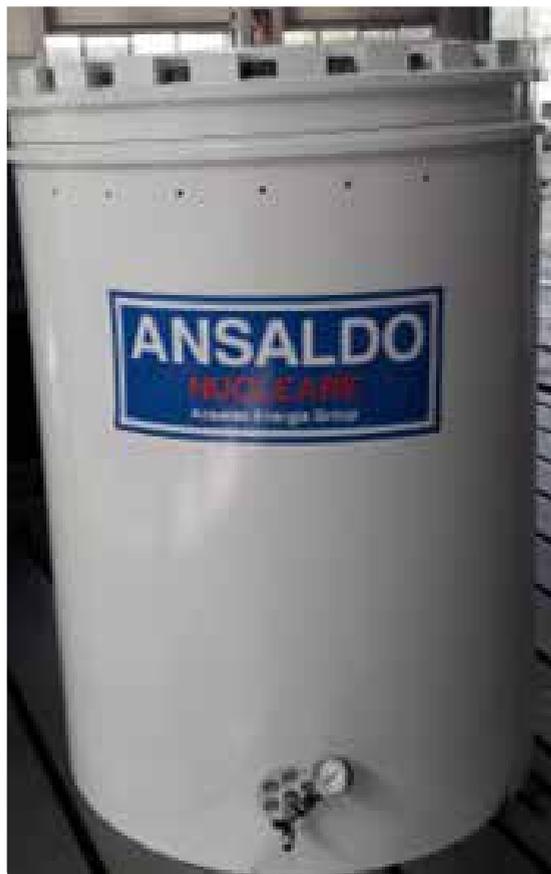
Ansaldo Nuclear, through its Mechatronics department, provides design, construction, and commissioning of cutting and handling custom machines for nuclear decommissioning. Moreover, Ansaldo Nuclear own an important portfolio in terms of products and technologies, that includes Technologies for pre-disposal of "hard to condition" organic waste (notably, ion exchange spent resins through a Wet Oxidation Technology – WOX) and processes for the off-line decontamination of metal waste from dismantling (down classified through the PHosphoric Acid DEContamination – PHADEC).

In the coming years the Decommissioning market is forecasted to exponentially grow, hence Ansaldo Nuclear is continuously investing on new products and technologies. In this regard, Ansaldo Nuclear developed an innovative technology: a pilot plant for the vitrification of iron phosphates at temperature above 1000°C is demonstrating the repeatability and excellent chemical resistance of glasses. The retention yields for radionuclide simulants are larger than 95%, and minimum fraction of P2O5 lost in the melting. Small amounts of "fluxing" chemicals improve the process, even reducing the melting temperature and improving retention yields. The resulting vitrified waste can also be directly stored into one of Ansaldo's main Products: the CONTAS. CONTAS is the Ansaldo High Integrity Container for the conditioning of solid heterogeneous Intermediate Level Waste: a forged carbon steel cylindrical container, overall dimension  $\varnothing 1100\text{mm} \times 1500\text{mm}$  (h), usable volume 500 liters, general minimum wall

thickness 160mm which makes it particularly suitable for b-g emitters waste.

CONTAS exercise is guaranteed for a lifetime of 50 years without any maintenance intervention, extendable to 100 years with few possible refurbishing operations (such as gasket replacement and small repairs).

Safety, Quality and Sustainability are key values driving our „New Clear“ business. All the above elements, combined with 60 years of experience, make Ansaldo Nuclear a reliable industrial partner in the whole nuclear sector.



## SNC-Lavalin / Atkins

Founded in 1911, SNC-Lavalin is a global fully integrated professional services and project management company and a major player in the ownership of infrastructure. From offices around the world, SNC-Lavalin's employees are proud to build what matters.

Our teams provide comprehensive end-to-end project solutions to clients in nuclear, oil & gas, mining & metallurgy, infrastructure and clean power.

In 2017 we acquired Atkins and became one of the most complete nuclear services companies in the world. With more lines of business, we now provide complete end-to-end offerings for the entire nuclear life cycle.

Our combined Nuclear team of close to 3,000 talented people are part of one of the most complete nuclear services companies in the world.

We're well positioned to design and engineer the next generation of nuclear power plants, including CANDU® reactors and SMRs. Alongside this, we continue to maintain existing genera-

ting fleets, project manage and perform life extensions, design, advise and install technology upgrades, and safely decommission and manage the waste from legacy facilities.

Together with Holtec International in 2018 we've formed Comprehensive Decommissioning International, LLC (CDI) with the express purpose of creating a company to provide all-encompassing project solutions for the accelerated decommissioning of retired nuclear power plants. By leveraging strong financial histories, technical and project management capabilities, depth in life-cycle fuel experience, and innovation through first-to-market technologies, CDI has positioned itself as a solution provider and leader in this exciting and growing market in the US and is now embarking into Canada and Europe.

Through our subsidiary Atkins Energy Germany GmbH we are providing products and services in radioactive waste management and decommissioning of nuclear facilities including large component removal and segmentation and packaging of reactor pressure vessels and internals.



## 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.



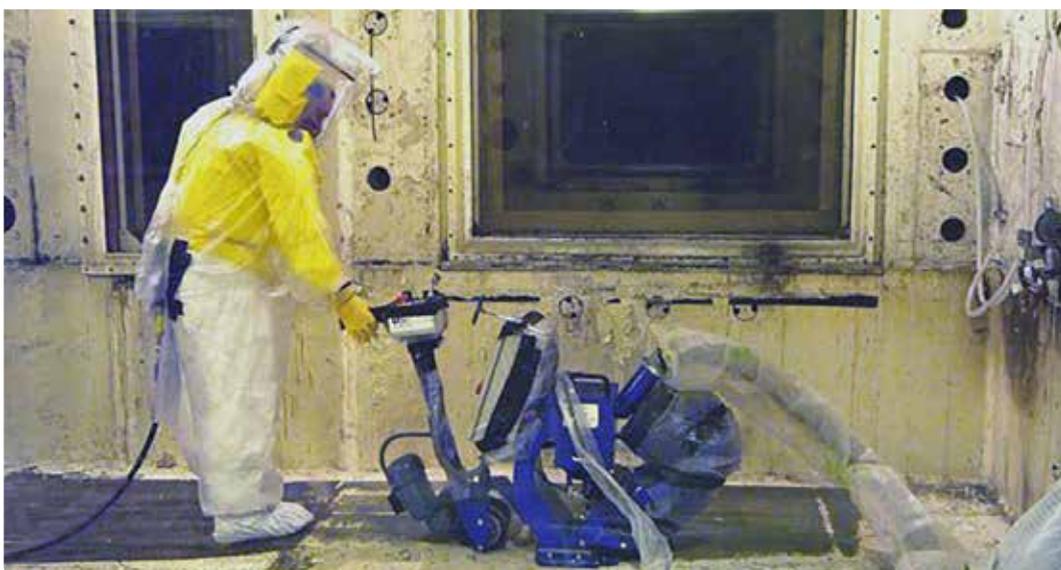
## The Innovators in Surface Preparation - Surface Preparation Machines and Accessories

Blastrac is the leading international developer and manufacturer of surface preparation equipment. We have a full range of over 50 different machines for preparing & maintaining floors and other surfaces of all kinds of materials. Our innovative techniques are developed in-house, on demand through our strong R&D Department. Our range of equipment includes:

Shot Blaster, Horizontal Steel Blasters, Vertical Steel Blaster, Scarifiers, Multi-task Vehicles, Hand Held Equipment, Single Disc Floor Grinder, Floor Stripper, Dust Collectors. When looking at the use of our equipment we make a distinction between several industries. In these industries some of our machines have specific applications.

These industries are:  
Remediation, Industrial Flooring, Decorative Flooring, Airports, Highways, Steel.

Blastrac Green Technology- Blastrac offers eco-friendly surface preparation solutions in several industries. Our machines don't use chemical substances or waste valuable drinking water. For a clean environment and future.



## Designers and Manufacturers of Systems Based on Semiconductor Detectors and Nuclear Electronics

Baltic Scientific Instruments (BSI) was established in 1994 on the basis of Riga Research and Development Institute for Radio-Isotope Apparatus (RNIIRP, est.1966). RNIIRP had a responsibility for the development of instruments for radiation detection and measurement for the atomic energy industry, mining, oil and gas industries, space and military applications. RNIIRP developed a broad range of products, and the highest level of technical knowledge and skills to meet the most sophisticated technological demands of that time. These are the foundations of the capabilities that BSI now brings to global markets.

Since its founding as a private enterprise BSI has specialized in the development and fabrication of devices for spectrometric analysis based on semi-conductor and scintillation radiation detectors. Our products are applied in multiple industries: nuclear power; environmental monitoring; geophysics and the mining industry; medicine and healthcare; research including space sciences; security systems and customs control; and other spheres. To succeed in global markets for radiation detection and analysis equipment BSI has mastered the most demanding quality standards in each market where we have chosen to compete.



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## Brenk Systemplanung GmbH (BS)

BS offers consultancy services for more than 40 years. More than 70 engineers and scientists provide expert knowledge in the areas of radiation protection, nuclear technology, radwaste management including disposal, NORM, software development, mining and environmental management and plant/process engineering. We are located in Aachen (headquarters), Hamburg, Bruchsal and Andernach. Our customers belong to several sectors within the private sector in Germany and outside but also to the German government, regulatory bodies of the German States, foreign governments and international organizations such as IAEA and EC.

Our services in the nuclear sector include all aspects of radiation protection (e.g. activation/shielding calculations, modelling of dispersion of radionuclides, safety assessments) and aspects of decommissioning (e.g. concepts for decommissioning, licensing support, comprehensive support for clearance including e.g. concepts and planning, radiological characterisation, clearance measurements, licensing support, optimization of waste packages).

Our remarkable set of specific measurement devices (e.g. in-situ gamma spectrometers, laboratory gamma spectrometers, contamination monitors, NaI-/CsI-spectrometer) allows us to conduct radiation measurements in a timely manner even under exceptional conditions. Our dedicated software tool PUG3 supports an efficient and traceable planning and conduct of all steps of a clearance process from the early beginning. In the field of radwaste management we provide services related to waste processing, interim storages and disposals itself. For the later our services cover the entire (project) life cycle of a disposal for both, deep geological and near-surface disposal types.

Employees of BS are appointed members of national advisory commissions (e.g. Commission on Radiation Protection – SSK, Nuclear Waste Management Commission - ESK) and of working groups of international organizations (e.g. IAEA, OECD/NEA).



## CAEN SyS, the CAEN SpA Spectroscopy Division - Innovative Nuclear Measurement Systems

CAEN SyS, the Systems & Spectroscopy Division of CAEN SpA, is a worldwide leader in development of Radiation Measurements Systems and Spectroscopy Solutions, engaged with high performance operations involving Nuclear Facilities, Measurements Laboratories, Security and Safeguards Applications.

CAEN SyS is committed to delivering exceptional nuclear measurement instrumentation, expertise and technical support, offering radiation detection instrumentation and integrated turn-key solutions with added value and operational benefit for customers, enhancing safety and security through nuclear measurements in the following Areas: SECURITY, SAFETY & SAFEGUARDS, LABORATORIES.

CAEN SyS Systems & Spectroscopy Division is built upon CAEN traditions of teamwork and partnership. The CAEN Network Companies (or Group) is a cluster of Companies with excellence know-how.



Decades of collaboration and co-development with very large international research projects have maximized CAEN SyS capability to translate customer's needs and expectations into cost-effective and reliable solutions.



CAEN SyS enormously benefits from its foundational relationship with CAEN, a world leader in designing multi-input electronics for a wide range of radiation detectors, and nowadays is involved in several leading-edge R&D collaborative projects, to continue expanding and developing expertise in high-level electronic design, and to extend competence and skills into complementary and relevant applications for the benefit of the community.

The longstanding expertise along with the full range of products and service provided by the CAEN Network Companies (or Group) allow CAEN SyS to be at the forefront of innovation and excellence within the culture of safety and security.

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## The Clean-Lasersysteme GmbH (cleanLASER) Develops and Produces High-Precision Laser Systems for Industrial Surface Processing.

cleanLASER systems are primarily in operation with mold and tool cleaning, paint stripping and de-coating as well as cleaning and modification of metallic surfaces.

The portfolio of the world market leader ranges from low to high power laser systems, moreover cleanLASER offers flexible workstations, customer specific systems as well as gantry systems.

With the cleanNUCLEAR, contaminations with factors of up to 100 % for  $\alpha$  and particularly high factors for  $\beta$  and  $\gamma$  radiation can be removed. The homogenized blasting technology makes it possible to gently clean all common geometries and metal materials below the degradation threshold for reuse or recycling.

The process can thus be used economically and in an environmentally friendly manner for both decommissioning and maintenance work on running nuclear power plants. Cleaning using laser light as a dry process replaces the chemical wet and the mechanical blasting process.

The variety of possible applications is large: Production, Dismantling/Bearing, Deployment in the disaster area or Research and development.

The advantages of the technology include

- Decontamination factor up to 100 % possible
- High decontamination area rates with  $> 15 \text{ m}^2/\text{h}$  for slightly adhering contaminations (rust, oxides) and  $> 8 \text{ m}^2/\text{h}$  for solid contamination (hot area, paint)
- Enormous reduction of hazardous and expensive secondary waste (further development of extraction systems)
- Flexible technology configurations in mobile or stationary control cabinets, hand-held and/or automated optics, up to 50 m fiber tube package
- Negligible influence on base material allows reuse of decontaminated devices/products (hardness, tensile and macro tests successful)
- Prevention of the spread of impurities (corrosion infiltration tests successful)



## Innovative Technology Solutions for Radiation Characterisation and Robotics - Solving Demanding Decommissioning Challenges

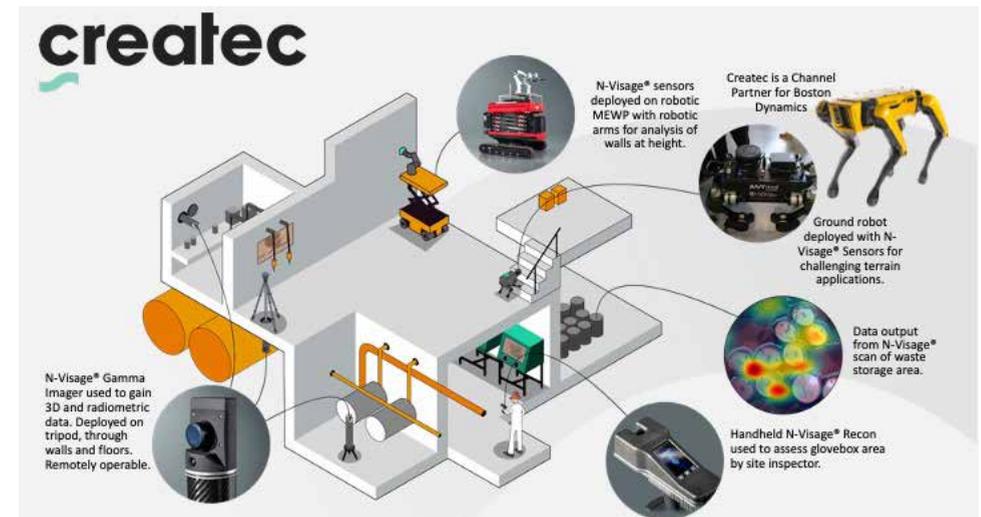
Createc is one of the thought leaders for innovation in the nuclear industry. Our strategy is to bridge the gap between university research and industry. We have close working relationships with academia and are often researching similar technologies, but we have an understanding of what it takes to move technologies from research stages and develop them to successful commercial products in the market.

And we have demonstrated this with industry firsts in the nuclear industry. Initially, with N-Visage, for high-dose gamma imaging. The N-Visage Scanner was the first instrument to be deployed at Sellafield for gamma imaging through a 6 inch penetration. RISER was the first on-site radiation imaging with a UAV or Drone also demonstrated at Sellafield inside the Windscale pile. Thirdly, our open platform robotic system, developed after we were one

of the winners in the Integrated Innovation in Nuclear Decommissioning competition. We have a strong track record of taking products and technology to market. We strive to provide end users with a solution to their problem, not just a demonstration of the latest technology. And this is an international capability. We have taken our early-stage innovations and developed a strong export market, particularly in Japan.

We also recognise that we can't achieve successful on-site integration alone and we have built up strong partnerships with tier 2 suppliers.

Createc operate in in three main markets, Nuclear, Defence and Oil & Gas. Our technologies are cross-pollinated through these markets and opportunities are conjoined where possible.







### ENGIE Deutschland Stands for a Sustainable Energy Future and Improved Energy Efficiency.

We generate, buy, distribute, deliver and save energy. As a service provider with profound technical know-how, we plan, install and operate building technology and energy technology systems and plants, and support these via comprehensive services.

With a successful company history spanning more than 100 years and the reach of the worldwide ENGIE Group, we are a partner that gets the most out of energy every day – and this includes optimizing the energy of the people working together with us.

### Rely on our competence in power plant technology. ENGIE: your partners for building services systems when dismantling nuclear and radiation-protected plants.

Technical building equipment in the fields of radiation protection and nuclear technology is held to very high standards: here, only 100 percent counts. If a radioactive waste storage facility is to be conditioned or a pressure differential system is to be implemented in a reactor building, the technology must function with absolute reliability.

We are experts in complex supply and disposal systems in nu-clear plants. We concentrate our know-how particularly on the dismantling of nuclear plants and their associated auxiliary facilities. We promise engineering, execution and commissioning and all downstream maintenance work from a

single source: on time, with cost transparency and responsibility.

Trades in which we are proficient

- Air conditioning
- Electrical engineering
- Fire protection technology and sprinkler systems
- Heating technology
- Industrial sanitary technology
- Measuring and control technology, building automation
- Process technology: Water (supply and disposal), compressed air
- Refrigeration



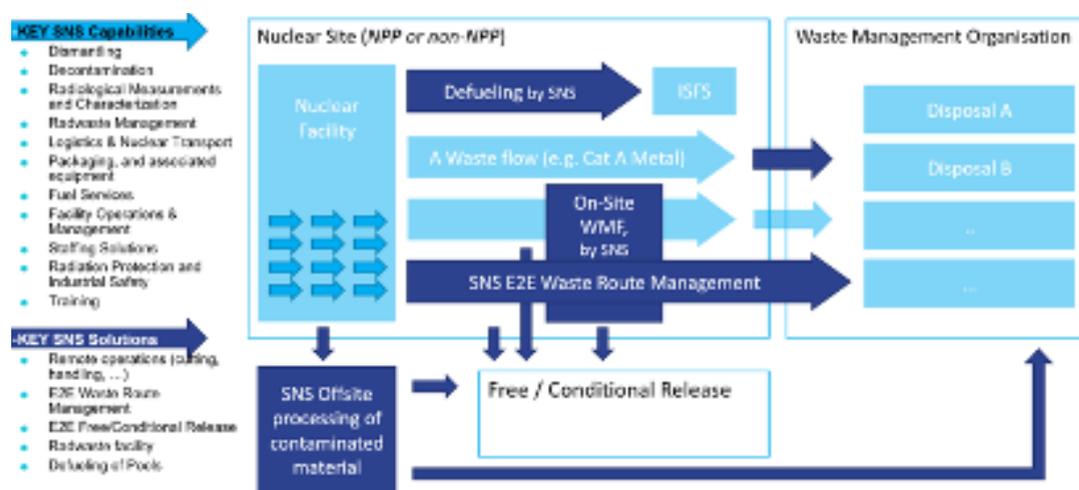
## “Specialized Nuclear Services” (SNS) - Capabilities and Solutions

“Specialized Nuclear Services” (SNS) constituted by the companies Transnubel / Tecnubel is the expert in nuclear integrated solutions since 1969 and is the value for money solution-partner for processing radioactive materials onsite or offsite.

Since more than a decade, SNS has shifted its operations to successfully become a specialist contractor in decontamination, dismantling and decommissioning of nuclear facilities. The current structure allows to plan in an early stage the projects, to train and qualify execution personnel, to manage and supervise execution of the project on a broad spectrum of activities from dismantling & decontamination over radiological measurements and characterization until waste management and free release of materials and buildings.

The unique capability to provide end-to-end packaging, associated equipment and nuclear logistics, completes the service offering of SNS. Our engineering teams focus on having the most effective and efficient technologies and processes to deliver optimal and most cost-effective service for the client.

Our activities are summarized in the picture here below:



Since many years, SNS invested in know-how and technologies to grow to become the highly integrated solutions and service provider of today.

Tecnubel, as part of SNS, supports various nuclear players in their development of a complete Safety Culture by offering radiological protection, consultancy and safety training services.

At Tecnubel, health and safety, physical control, nuclear security and quality assurance departments are integrated, which enables to share experiences and skills. It relies on a strong physical control department to circulate the principles of a good Nuclear Safety Culture throughout the complete organization. Tecnubel also benefits from the training expertise, to meet internal requirements for the development of the staff. The introduction of a single Human Resources department and implementation of a «training and skills» procedure that applies to the whole company, enables exchange and a faster availability of skills.

Tecnubel has become the contractor for Nuclear Safety Culture training at the Belgian Doel nuclear power plant. From the beginning of 2020, it operates a prevention fire service at Doel. This service is assured by a team of 40 Fire Safety Officers, operating 24h/24.

Tecnubel obtained authorization to operate a nuclear installation in Dessel (Belgium) in order to carry out maintenance, decommissioning and decontamination works, as well as

to store contaminated radioactive materials there. In 2018, Tecnubel also received an operating license for a second installation, equipped as a workshop and located at Villers-le-Bouillet (close to the Tihange NPP), to decontaminate and condition equipment and material from nuclear installations from Belgium, and from abroad. With these facilities, Tecnubel also has additional controlled areas for storing the equipment needed for overhaul of the NPPs.

Recently, it finished successfully the decommissioning of the Framatome owned FBFC fuel facility and won the contract for the decommissioning of the ONSF (old Best Medical production site) Fleurus nuclear site - both in Belgium. With these new achievements, Tecnubel continues to gain useful and practical experiences to help German operators and institutions in their decommissioning challenges.

To conclude, Tecnubel is your partner from the beginning of your project until the end and offers a full spectrum of technical skills and capabilities in the field of decontamination and dismantling.

**ENGIE Laborelec has Developed for Decades around ENGIE Electrabel, the Operator of the Belgian Nuclear Fleet to Support the Operation, Maintenance and Upgrades of the 7 Power plants.**

From this history we inherit:

- A very operational feedback obtained on the field and through the diagnosis and resolution of the entire range of hazards that a nuclear installation may encounter over 50 years of operation
- A human capital of great value; at least one expert for each technical topic at stakes to manage a NPP
- A rich fleet of equipment which makes it possible to respond to a very wide range of requests from Electrabel in terms of diagnosis, qualification and development of new technologies (particularly in terms of radioactive waste management)
- A corporate culture, a DNA that perfectly balances field pragmatism, scientific rigor and a driver of innovation

Laborelec has always been open and active apart from strictly supporting the Belgian fleet, deploying its skills and resources for the benefit of other players on other types of facilities. This facet of our activity, until then in the minority, has been growing in recent years, in a context of upheaval in the nuclear industry in Belgium. In this period of growing concerns regarding D&D and radioactive waste

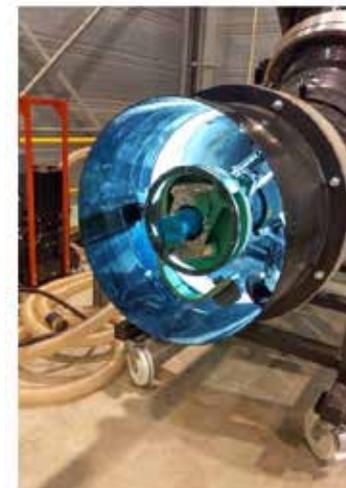
management, our capabilities in NDT, Characterisation, Nuclear Chemistry, materials and concrete are key as well as our understanding of ageing mechanisms. We have the ambition to have more and more D&D and radioactive waste management systems being developed, installed and tested in our laboratories generating the highest value from our assets (technological halls).

We're convinced that our unique profile combining expertise and pragmatism obtained on the field by our experts can make the difference when complex problems need to be solved at reasonable total costs. Mote specific on D&D, we characterize your radioactive material on your site using physico-chemical and radiological testing methods. We have decades of experience in characterizing operational and legacy waste streams from Belgian nuclear power plants, making sure to remain aligned with changing regulations. In addition to operational waste streams, we can characterize the new types of waste that will result from D&D activities, including reactor vessel components, control rods and other components from the reactor pool, shielding material, and all types of bulk materials.

We carry out complex gamma spectrometry measurements at your site, using our own detectors and completing the process of getting our methodology approved by the authorities. We also provide onsite calibration services for radiological measurement equipment, making sure that the measurements are reliable.

In addition to characterizing waste streams, we develop and monitor solutions for the sorting, treatment and conditioning of any radioactive waste that will result from your plant's final shutdown and dismantling. We have decades of valuable experience at Belgian nuclear power plants with developing and applying chemical decontamination methods and viable solutions for the conditioning of radioactive waste.

We test and validate these waste conditioning processes, making sure that they are accepted by the waste authorities in a timely manner. If needed, we assist operators in their discussions with the authorities, for example regarding changing regulations and acceptance criteria.



### 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 14,000 employees worldwide, every day Framatome's expertise helps its customers to 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%).

Famatome 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, RPV 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.

### Competence for Nuclear Services

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 nuclear power plants based on its nuclear expertise of more than 40 years.

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 intermediate level waste (ILW) and high level waste (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.

Almost 1.900 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.

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.

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.

With its 700 employees the companies of the GNS group achieve a turnover of more than 200 million Euros.





### HEBETEC Engineering AG - Partner for Nuclear Decommissioning - Lifting - Lowering - Moving - Support Heavy Loads

Hebetec offers comprehensive services in the lifting engineering area being supported by long lasting experience of its employees.

Thanks to the large variety of specialists, such as mechanical and civil engineers, hydraulic experts, mechanics and experienced assembly supervisors, the company can revert to an extensive knowhow on most different sectors of the lifting engineering and thus appear as a competent partner.

The field of activities ranges from the preparation of concepts over execution like lifting, lowering or sliding heavy loads down to leasing of hydraulic equipment which largely has been developed in house.

Hebetec Engineering AG offers solutions for the safe and efficient decommissioning of Nuclear power plants.

The minimisation of the collective dose rate is of paramount importance to our professional and proper dismantling always in the foreground. Experienced engineers advise, work out proposals for solutions, plan and accompany our customers' projects until their successful completion.

Hebetec Engineering AG takes over the overall planning and the coordination of the specialized partners for individual works. Through detailed planning as well as close and timely coordination we minimize delays and security risks.

Our services:

- Engineering - Customized Solutions - Planning
- Coordination - assembly and disassembly - moving, lifting, lowering of components
- Crane work - Road transport - Specialized expert and assembly teams



Nuclear Power Plant Mühleberg  
Switzerland  
Generator 150t  
Lifted + transported in 11.2020

### In-house Transport of LLW

IEM FörderTechnik GmbH is a leading provider of material flow systems for bulk and piece goods handling for more than 50 years. Our business unit Nuclear Decommissioning is specialized in the development of proper and secure transport systems as well as disposal methods for nuclear facilities. It's our task to design conveyor systems for the most diverse stages of dismantling/decommissioning and to adapt these systems to the special requirements of each individual nuclear facility. We develop and manufacture conveying solutions for the whole process as well as for individual tasks within the process.

IEM FörderTechnik is your partner for:

- feasibility studies of in house transport logistics and handling processes
- conveying systems for handling of bulk materials, e.g. concrete demolition waste, by dust proof trough chain or corrugated belt conveyors
- conveying systems for piece goods (barrels, transportboxes and containers)
- airlock systems with radiological monitoring
- handling systems for low level waste
- mobile barrel testing systems
- barrel tipping systems for residual material processing



## Jacobs Supports Hundreds of Nuclear Programs Worldwide at Existing Facilities, Decommissioning Sites and Next Generations Systems.

Jacobs – the global technology-forward solutions company – draws on decommissioning experience from the world’s most challenging nuclear sites including Chernobyl, Fukushima, Savannah River, and Sellafield. It has developed a waste-informed decommissioning approach which is the key to safer, faster, and cheaper restoration of nuclear sites. Our experience has enabled Jacobs to draw many important lessons about the management of nuclear decommissioning projects. Some of these are summarised below.

- Enhanced understanding of the various waste streams through early and robust characterisation, as well as identification of its provenance requires a comprehensive suite of waste characterisation tools and the ability to tailor these techniques to individual projects and site regulatory requirements. Jacobs uses intrusive sampling operations, fingerprint derivation and in-situ measurements from a range of materials, including reactor bio-shields, concrete, metals, sludges, fuel element debris and ion exchange resins. To provide full-range sample analysis, Jacobs operates one of the largest radiochemistry laboratories in the U.K. ANSWERS®, Jacobs’ proprietary software suite for reactor physics, radiation shielding, dosimetry and nuclear criticality, is key to modelling the performance of radioactive materials in order to inform decommissioning strategy.

- Radioactive waste management processes need to be aligned to the waste hierarchy so that the option to divert waste from disposal

is available where practicable. Effective application of the waste hierarchy at the UK’s Low Level Waste Repository has extended the life of the facility by 100 years and saved the taxpayer £2 billion.

- Data quality objectives provide a systematic planning approach to establish project acceptance criteria and create a detailed sample and analysis plan. This determines the quality and quantity of data required, meeting regulatory requirements.

- An innovative approach to radiological characterisation techniques can improve safety and ensure a quicker results turnaround. To monitor radiation in storage ponds at Sellafield, Jacobs has developed a specially adapted remotely operated vehicle (ROVs) and underwater in-situ gamma spectroscopy to detect leaking radioactive sources. Where areas are inaccessible due to safety constraints e.g., height or dose exposure, Jacobs uses unmanned aerial vehicles (UAVs) to survey both external and internal areas through an exclusivity agreement with Texo Drone Survey & Inspection Ltd (Texo DSI) for the UK Nuclear sector.

- A detailed inventory leads to reduced lifecycle costs for radioactive and controlled waste management and decommissioning as a whole and gives stakeholders confidence that waste management decisions are based on realistic data. Data management is required at every stage, using geographic information systems (GIS) to analyse and manage the

data, which can be shared for collaboration through maps and apps. This allows the decommissioning programme to plan, adapt and maintain safe operations.

- Optimisation of each step in the decommissioning process will avoid repetition, which can generate excessive quantities of secondary waste. Secondary wastes can often be reduced to 3-5% of the mass of the primary wastes.

- Pre-treatment decontamination processes, both on-site and off-site, are a key tool in waste volume reduction. These include:

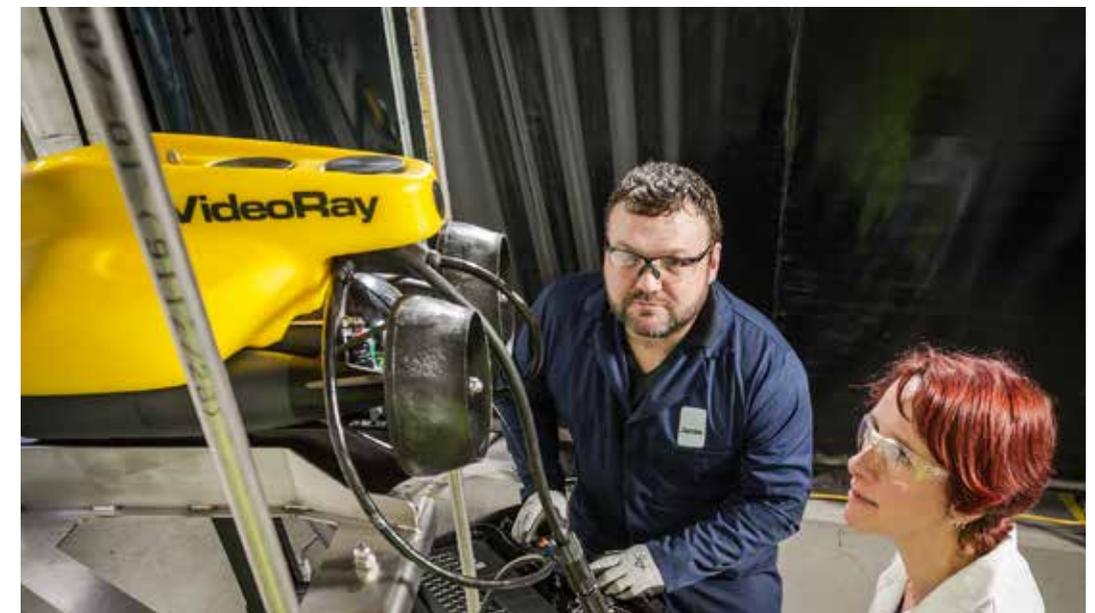
- Surface decontamination by intrusive shot blasting or simple manual wiping

- Chemical decontamination e.g. electrochemical baths and handheld pads to decontaminate vessels and circuits

- Scabbling, either manually or using remotely operated equipment, to remove contaminated material from surfaces

- Strippable coatings used to tie down contamination onto surfaces

- Size or volume reduction of irregular shaped items to maximise packaging efficiencies within waste containers. This is usually achieved using cutting, incineration, smelting and compaction.



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## Konecranes is a World-Leading Group of Lifting Businesses™

Konecranes is a world-leading group of Lifting Businesses™, serving a broad range of customers, regardless of your lifting needs, Konecranes is committed to providing you with lifting equipment and services that increase the value and effectiveness of your business.

The Konecranes organisation brings the expertise of Konecranes Nuclear Equipment and Service (KNES) providing cranes designed specifically for nuclear applications combined with our experience in providing cost effective designs with shorter delivery periods using our state of the art COTS crane components (especially suited to Decommissioning Applications). Our quality control program ensures that each nuclear crane and component is designed to meet or exceed all mandated standards.

Service & Modernization – our extensive network services all makes and models of material handling equipment worldwide to support the nuclear industry. Services include outage support, inspections, repairs, and maintenance. We provide any OEM parts for any brand of overhead crane or hoist including re-engineered & re-manufactured parts (motor rewinds, brakes, etc.).

RailQ generates 3D and 2D graphs of the runway rails and identifies misalignment and other problems of your cranes.

RopeQ wire rope inspection - visual and Non-Destructive (NDT) rope inspection service that examines what you cannot see with a visual only inspection.

Please do not hesitate to contact us through our website. We would be happy to help solve your lifting challenges.



## Clean Air is a Basic Foundation for Quality of Life and Health. It is therefore Essential to Handle well the Air that we Breathe on a Daily Basis. We take this Task very Seriously. With our State-of-the-Art Technology, we meet the highest Demands for Air Distribution Systems and the Strictest Requirements for Air Quality Control.

Krantz develops, designs and manufactures air distribution systems, cooling and heating systems for ceiling and facade installations as well as exhaust gas filtration, dampers and clean air solutions.

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. Our Air Technologies and Filter & Damper Systems department is specialised in nuclear and

conventional business.

This includes three nuclear and conventional business units:

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

Krantz also 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.

To get to know our service areas please visit our booth or [www.krantz.de](http://www.krantz.de).





### Mirion Technologies: your preferred Partner for D&D Challenges and Safety in Radiation Measurements

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.

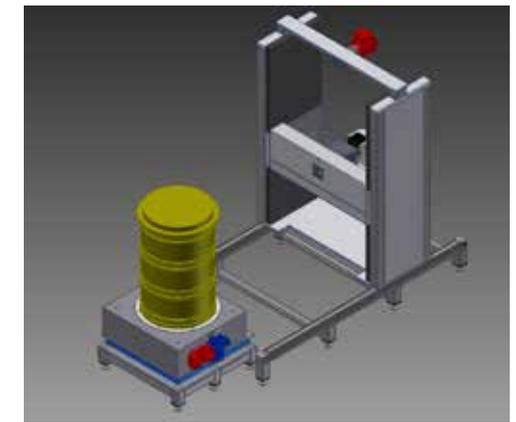
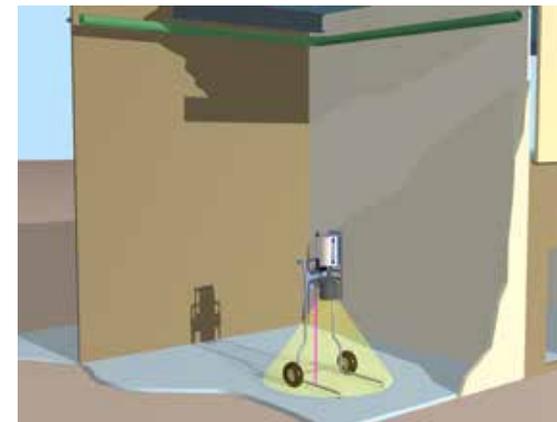
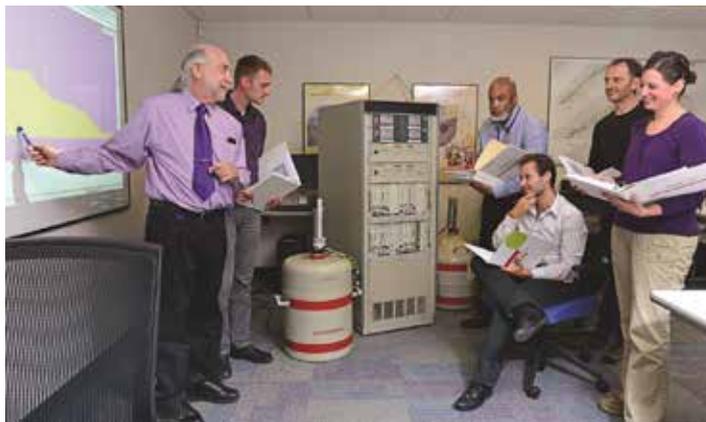
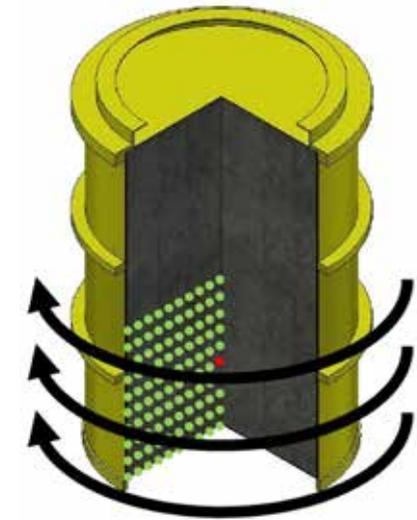
For D&D and especially for NDA applications Mirion has broadened their portfolio to provide solutions also for challenging projects. By applying state of the art of technology and

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 – 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. German energy suppliers have also confirmed our compliance with the quality assurance standards set forth in KTA 1401.

Furthermore, we are certified pursuant to DIN EN ISO 14001:2015 and ISO 45001:2018. Our project quality management is certified through our compliance with ISO 10006. In addition, we hold other international certificates issued in Russia, Lithuania and France.



## 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](http://www.pedi.ch)





## 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 as well as research installations and industrial clients. 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 buildings using state-of-the-art equipment and remote-controlled appliances
- Cross-departmental decommissioning projects
- Operating residual material processing centers and waste treatment facilities
- Provision of specialist personnel to support post-operation and decommissioning as well as decontamination and waste management

### Handling and 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 Section 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



## 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 the 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 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. 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 80 people across several locations in Germany.



## Sweco plans and designs the sustainable communities and cities of the future. Together with our clients, we design solutions that address urbanisation, capture the power of digitalisation, and make our societies more sustainable.

We combine our vast international experience with local know-how. Sweco has 17,500 experts across Europe. We have offices in 14 countries and we carry out projects in 70 countries annually throughout the world. We combine a strong local presence with offering our clients access to the total knowledge at Sweco. Whatever challenge you may have, you can count on Sweco to solve it.

Decommissioning virtually first - plan and execute smarter and safer with a digital twin. Sweco offers a new solution for decommissioning of nuclear power plants: digital twin platform for decommissioning planning and execution in 3D/BIM, AR and VR. Solution enables maximizing of deconstruction waste recycling, turning recyclable deconstruction waste to into value and to all stakeholders, better project planning, control, safety, communication and transparency.

Having accurate inventory of the nuclear plant for planning and execution, including up to date quantities, materials, locations and radiation levels, creates basis for a successful and safe decommissioning.

Digital twin of the plant can provide that information and it can be utilized throughout the project.

The 3D presentation of the plant makes it easy to communicate and understand what, where, how and when. Visualization of current situation, options and what if scenarios makes the digital twin a powerful tool for optimization, making informed decisions and ensuring compliance, as well as safety.

Sweco's solution utilizes fast laser scanning technology to create a point cloud of the plant. The point cloud is then turned into a digital twin and enriched with data. We can speed up the process utilizing AI to create digital twins to the required level of detail.

Read more and find the right contact:

<https://www.sweco.fi/en/decommissioning>

<https://www.youtube.com/watch?v=HFtEdF-MbpA4>



**TS Quadrat GmbH -  
 Your strong Partner for Nuclear Technology / Waste Management**



TS Quadrat GmbH is a nuclear engineering specialist for materials handling technology and special purpose system construction.

Many of the above systems can be designed as mobile solutions to suit the customer project.

We provide in-depth, comprehensively planned and documented systems and components for safely handling radioactive waste during operations or decommissioning of nuclear facilities.

We offer our customers full-service support from planning, design and documentation to production/execution.

These include:

- Conveying and handling systems for drums, pellets and containers
- Measurement stations
- Flame cutting systems
- Container & Drum Loading
- Casting / Concreting / Supercompaction
- Gantry crane systems
- Special and bespoke processing plants
- Residual substance logistics

As our customer, you benefit from the experience and expertise our team has gained from the large number of projects we have successfully completed over the past decade - plus our quality management system certified in accordance with DIN EN ISO 9001:2015.

For more information, please visit [www.tsquadrat.com](http://www.tsquadrat.com) or reach out to us directly for a more detailed conversation on how TS Quadrat GmbH can solve your problem.



**Die richtige PSA zur richtigen Zeit am richtigen Ort**

Die UniTech Services Group ist mit zwei Verarbeitungsanlagen und 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.

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

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

UniTech bereitet derzeit den Bau einer neuen Verarbeitungsanlage im französischen Lyon vor, die im November 2022 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.

[www.unitech-services.eu/de/](http://www.unitech-services.eu/de/)



## VND – The nuclear decommissioning experts

The last nuclear power plant in Germany will be shut down in 2022, thus completing the nuclear phase-out. But even without being on the political agenda, nuclear power plants around the world are reaching the end of their technical lives and have to be decommissioned and dismantled.

Dismantling these nuclear facilities, as well as dealing with radioactive waste and residual materials and treating them prior to clearance and final disposal, necessitates extensive know-how and compliance with a wide range of regulations. This will pose great challenges for operators of nuclear facilities in the future. In October 2017, VPC therefore decided to create the Nuclear Services business line with the goal of accompanying the administrative and technical process of decommissioning and dismantling nuclear facilities, and implementing it safely and efficiently end-to-end.

The success of the business line on the market and its strong growth led to it being separated from VPC GmbH on 1 January 2020 and spun off to form an independent company, VPC Nukleare Dienstleistungen GmbH (VND).

Our services focus on:

- dismantling planning
- disposal planning
- packaging planning
- final repository documentation actively supported by our field service
- radiation protection specialists for operation and decommissioning

Since 2019, we have been training radiation protection specialists (VGB) for operational deployment in operation and decommissioning in our clients' nuclear facilities in cooperation with a certified training center.

The aim is to create a new radiation protection workforce, and ensure rapid and comprehensive practical and theoretical further qualification of the staff following their training, thereby securing availability of radiation protection specialists for the tasks facing our clients in the future. VND is a member of the Dornier Group and can thus also apply its expertise in energy-related tasks in the important infrastructure areas of plant engineering and operation, energy and environmental technology, renewable energies, mobility, aviation, water and real estate, and, conversely, can access the resources of these Dornier Group business lines. For more information visit our parent company here:

<https://www.dornier-group.com/en>



## 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.

### FULL RANGE SUPPLIER

- Products reaching from simple tools to advanced solutions
- Universal grippers

- Mechanical telemanipulators for a wide range of applications (models A100 and A200)
- Remote-controlled power manipulators from the A1000 series for handling heavy loads
- Robot system TELBOT® with unique capabilities which includes unlimited rotation in all axes, no wiring inside or outside the TELBOT® arm, and unlimited fast and precise movement

### PRODUCTS FROM A SINGLE SOURCE

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





[www.icond.de](http://www.icond.de)



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