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# ICOND

International Conference on  
Nuclear Decommissioning

8<sup>th</sup>  
Edition



# BOOK *of* ABSTRACTS

November 2019

Organizer



in cooperation with





SAVE  
THE DATE

Aachen - Germany  
24<sup>th</sup> - 26<sup>th</sup> November  
Pre-Conference  
Workshop 23<sup>th</sup> November

# iCOND 2020

9<sup>th</sup> International Conference  
on Nuclear Decommissioning

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## IMPRINT



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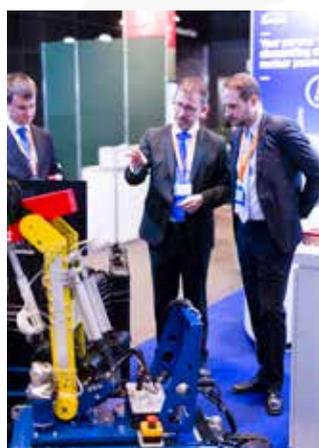
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## HINTERGRUND

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/Russisch).

## 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/Russian) will be available.



**RÜCKBLICK** **ICOND 2018** **REVIEW**

Die ICOND 2018 wurde mit einer Key Note durch Stephan Krüger von PreussenElektra eröffnet. Als verantwortlicher Leiter für den Rückbau der Kernkraftwerke des Unternehmens erläuterte er die Flottenstrategie für einen optimierten Rückbau.

Durch die wachsende Anzahl internationaler Beiträge wurden Erfahrungen von Teilnehmern aus der ganzen Welt geteilt. Beispielsweise wurde der aktuelle Status des Rückbaus des Kernkraftwerks ZION in den USA im Rahmen eines Vortrags von Herrn Stefan Dätig (NIS Siempelkamp) vorgestellt. Im Pre-Conference Workshop referierten Gäste aus dem europäischen Ausland, ergänzt durch nationale Vorträge, über neue Technologien im Bereich des Rückbaus wie Laser Cutting Technology, Surface Treatment oder Measurement Systems.

Ergänzend gab es Vorträge zur Projektorganisation und Marktentwicklung. Hier präsentierte Dr. Jochen Latz von McKinsey & Company die Marktperspektiven für den Rückbau kerntechnischer Anlagen und relevante Erfolgsfaktoren um sich international auf dem Rückbaumarkt zu behaupten.

Über 20 Unternehmen nutzten die vollständig ausgebuchte Ausstellerfläche im Eurogress Aachen, um ihre rückbauspezifischen Produkte und Dienstleistungen dem Fachpublikum zu präsentieren.

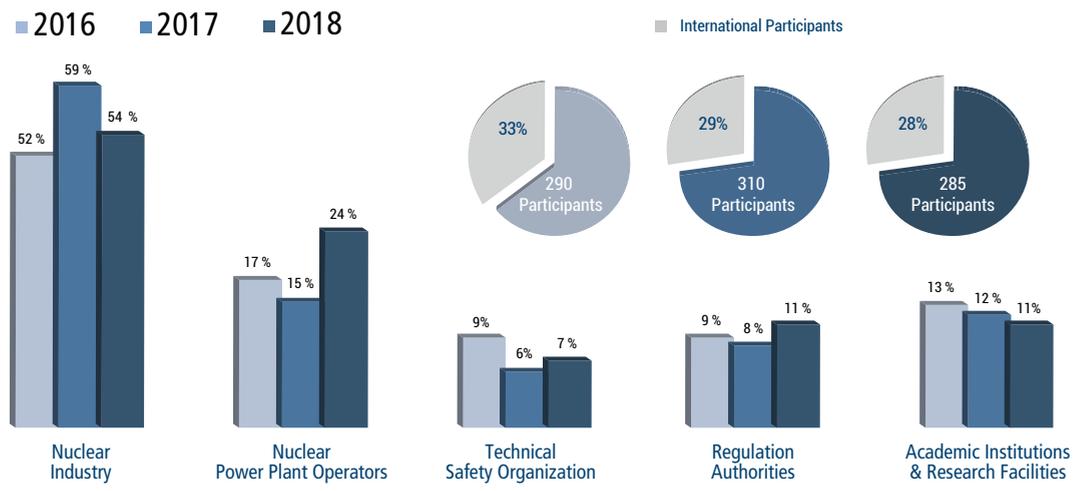
The ICOND 2018 was opened with a key note by Stephan Krüger, Head of Department Dismantling at Preussen Elektra. As the responsible manager for the decommissioning of the company's nuclear power plants, he explained the fleet strategy for optimized dismantling.

Due to the growing number of international contributions experiences of foreign participants were shared. For example, the current status of the decommissioning of the nuclear power plant ZION in the USA was subject of a lecture. In the Pre-Conference Workshop, European participants, supplemented by national presentations, spoke about new technologies in the field of dismantling such as Laser Cutting Technology, Surface Treatment or Measurement Systems.

In addition, there were presentations on project organization and market development. Dr. Jochen Latz of McKinsey & Company focused on market perspectives for the decommissioning of nuclear facilities and relevant success factors to successfully assert oneself internationally in the field of dismantling.

More than 20 companies used the fully booked exhibition space at Eurogress Aachen to present their dismantling-specific products and services to the specialist audience.

**FAKTEN** **FACTS**





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# EXHIBITORS 2019 iC&ND



**AiNT** **Aug. Alborn** **asup** **automess** **BERTHOLD**  
*Levy transport - next level!*  
**BLASTRAC** **BS** **BSI** **CAEN Sys**  
**createc** **ENGIE** **ENVINET** **factair** **FINNUCLEAR**  
**James Fisher Nuclear** **fortum** **framatome** **GRADEL** **HTE**  
**HEXAGON PPM** **JE PROJECT** *Kromby* **LYNKEOS TECHNOLOGY LTD**  
**MIRION TECHNOLOGIES** **MOTT MACDONALD** **KONECRANES** **NRG** **NUKEM Technologies**  
**NUCLEAR SHIELDS** **pedi ZURICH** **PLATOM** **SNC-LAVALIN** **ATKINS**  
**SWECO** **TECNUBEL** **ThermoFisher SCIENTIFIC** **TRACTEBEL**  
**UniTech Services Group** **VPC** **VTT** **Llywodraeth Cymru Welsh Government**

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## SPEAKER REFERENCE WALL



## MONDAY November 11<sup>th</sup>, 2019



**13:15 WELCOME**  
Dr. John Kettler – AiNT GmbH

### NEW TECHNOLOGIES & PRACTICES

- EN 13:30** Optimized Plastic Scintillation Detectors for Body Monitors and Clearance Systems  
Daan van Bree – James Fisher Nuclear GmbH
- EN 14:00** Release Measurement for Radioactive Residues: Methodological, Technical and Economic Aspects  
Dr. Marina Sokcic-Kostic – NUKEM Technologies Engineering Services GmbH
- EN 14:30** Optimizing Waste Management Costs by Simulating Real Technologies and Clearance Limits  
Dušan Daniška – AquilaCosting
- EN 15:00** 3D Plant Characterisation and Analysis Software to Plan Worker Dose Up-take and Decommissioning Activities  
Neil Owen – CREATEEC Ltd.
- 15:30 COFFEE BREAK**
- EN 16:00** Standardised Electronic Platforms for Motion Control and Sensing in Radiation Environments  
Jens Verbeeck – MAGICS Instruments N.V.
- EN 16:30** Monitoring of Radioactivity in Air and Water of Nuclear Facilities  
Dmitrii Chernykh – ENVINET GmbH
- EN 17:00** Ventilation Concepts for Nuclear Decommissioning  
Tobias Finken – Krantz GmbH
- EN 17:30** Underwater Vacuum Cleaners for Nuclear Dismantling  
Claude Maack – Gradel S.à.r.l.

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# TUESDAY November 12<sup>th</sup>, 2019



- 10:00 **REGISTRATION**
- 12:00 **QUICK LUNCH**
- 13:00 **WELCOME** Dr. John Kettler – AiNT GmbH

## STRATEGIES & MARKET DEVELOPMENTS

- D** 13:15 **The EWN, the Interim Storage Facility ESTRAL and the Waste Management Strategy at Lubmin in Germany**  
Die EWN, das Zwischenlager ESTRAL und die Abfallbehandlungsstrategie in Lubmin  
Henry Cordes – Entsorgungswerk für Nuklearanlagen GmbH
- D** 13:40 **Storage of Low-level Radioactive Waste in Germany – Status and Challenges**  
Zwischenlagerung vernachlässigbar wärmentwickelnder Abfälle – Status und Herausforderungen  
Jens Pöppinghaus – BGZ Gesellschaft für Zwischenlagerung mbH
- EN** 14:05 **Nuclear Decommissioning in the EU – Strategies and Funding**  
Stilllegung von Kernkraftwerken in der EU – Strategien und Finanzierung  
Gianfranco Brunetti – European Commission
- D** 14:30 **European Decommissioning Market Overview**  
Überblick über den europäischen Markt für den Rückbau kerntechnischer Anlagen  
Michael Kruse – Arthur D. Little GmbH
- 14:55 **COFFEE BREAK & EXHIBITOR PRESENTATION**
- D** 15:45 **Concentration and Synergies on the Nuclear Decommissioning Market – Strategic Orientation using the Example of SAT Kerntechnik GmbH / ROBUR Energy GmbH**  
Konzentration und Synergien auf dem kerntechnischen Rückbaumarkt – Strategische Ausrichtung am Beispiel der SAT Kerntechnik GmbH / ROBUR Energy GmbH  
Andreas Haars – ROBUR Energy GmbH & Frank Ambos – SAT Kerntechnik GmbH

- D** 16:10 **New Opportunities? The Japanese Decommissioning Market beyond Fukushima**  
Neue Geschäftschancen? Der japanische Rückbaumarkt kerntechnischer Anlagen außerhalb von Fukushima  
Dr. Jochen Latz – McKinsey & Company
- EN** 16:35 **Reorganization of Responsibility for the Decommissioning of Nuclear Facilities in Russia**  
Neuordnung der Verantwortung im Bereich des Rückbaus kerntechnischer Anlagen in Russland  
Dmitry Bazhenov – TVEL - Fuel Company of ROSATOM

**D** 17:00 - 17:45  
**PANEL DISCUSSION:**  
**RECENT DEVELOPMENTS OF THE NUCLEAR DECOMMISSIONING MARKET**  
**PODIUMSDISKUSSION:**  
**AKTUELLE ENTWICKLUNGEN DES NUKLEAREN RÜCKBAUMARKTES**

**PARTICIPANTS / TEILNEHMER:**  
 Henry Cordes, Michael Kruse, Frank Ambos, Dr. Jochen Latz

**18:15 CONFERENCE DINNER AT AULA CAROLINA (FORMER CHURCH BUILT IN THE 13TH CENTURY) SPONSORED BY ENGIE GROUP**





## WEDNESDAY November 13<sup>th</sup>, 2019



### NUCLEAR SAFETY & COMPETENCE

- D** 09:00 **Nuclear Safety and Waste Management Research with the Young Generation**  
Forschung für die nukleare Sicherheit und Entsorgung radioaktiver Abfälle mit der jungen Generation  
Dr. Annika Schäfers – Bundesministerium für Wirtschaft und Energie
- EN** 09:25 **ARTEMIS – The IAEA Integrated Review Service for Radioactive Waste and Spent Fuel Management, Decommissioning and Remediation**  
ARTEMIS - Der integrierte Überprüfungsdienst der IAEA für die Entsorgung radioaktiver Abfälle und abgebrannter Brennelemente sowie für die Stilllegung und Sanierung  
Dr. Vladimir Michal – International Atomic Energy Agency
- 09:50 ROAD SHOW - EXHIBITOR ELEVATOR PITCH** 
- 10:15 COFFEE BREAK**
- EN** 10:45 **CAROLINE: A High Integrity Cask with Dedicated Manipulation and Transportation Means**  
Ein Behälter hoher Integrität mit spezieller Handhabungs- und Transportvorrichtung  
Guido Mulier & Robby Vandendries – TECNUBEL N.V.
- D** 11:10 **Engineering for the Post-Operation Phase – Strategy of a German OEM**  
Ingenieurdienstleistungen für die Nachbetriebsphase – Strategie eines deutschen OEM  
Frank Weser – Framatome GmbH
- EN** 11:35 **Decommissioning of Nuclear Facilities in Norway**  
Stilllegung kerntechnischer Anlagen in Norwegen  
Martin Andreasson – Norwegian Nuclear Decommissioning (NND)

**12:00 LUNCH**

### PROJECT STATUS & EXPERIENCES

- EN** 13:00 **The Decommissioning Planning of 101 Heavy Water Research Reactor**  
Rückbau des Schwerwasserforschungsreaktors 101 in China  
Ruizhi Li – China Institute of Atomic Energy (CIAE)
- EN** 13:25 **Decommissioning of the Ignalina NPP – Planning and Execution**  
Stilllegung des Kernkraftwerks Ignalina - Planung und Ausführung  
Diana Lasyte – SE Ignalina Nuclear Power Plant
- EN** 13:50 **Current Status of Nuclear Decommissioning in Taiwan**  
Aktueller Stand der Stilllegung von Kernkraftwerken in Taiwan  
Yun-Chung Chi – Atomic Energy Council
- 14:15 COFFEE BREAK**
- EN** 14:45 **Radionuclides Inventory Calculations of Reactor 1 (RBMK-1000) at Leningrad Nuclear Power Plant**  
Bestimmung des Radionuklidinventars für Reaktor 1 (RBMK-1000) des Kernkraftwerks Leningrad  
Ruslan Kotykov – Leningrad Nuclear Power Plant - Rosenergoatom
- EN** 15:10 **Radwaste Repositories – Examples of Radwaste Repositories Design in Belgium and France**  
Endlager für radioaktive Abfälle – Beispiele der Endlagerkonzepte in Belgien und Frankreich  
Jos Boussu – TRACTEBEL ENGINEERING S.A.
- EN** 15:35 **Lessons Learned from International Decommissioning Planning**  
Erfahrungen aus den internationalen Stilllegungsplanungen  
Niklas Bergh – Westinghouse Electric Sweden AB

#### 16:15 BUSINESS SPEED NETWORKING

Make new contacts and get in touch with experts from operators, nuclear industry, authorities and research.



**16:30 GET TOGETHER SPONSORED BY** 



# THURSDAY

## November 14<sup>th</sup>, 2019



### CHARACTERIZATION & WASTE MANAGEMENT

- D** 09:00 **Packaging Planning using AI-based Algorithms**  
Erstellung von Verpackungsplanungen unter Verwendung KI-basierter Algorithmen  
Dr. Philip Harding – Brenk Systemplanung GmbH
- D** 09:25 **ASGS - An Innovative Way for Waste Characterization - From the First Study to Experimental Validation**  
ASGS - Ein innovativer Weg zur Abfallcharakterisierung - Von der ersten Studie bis zur experimentellen Validierung  
Dr. Matthias Fritzsche – Mirion Technologies (Canberra) GmbH
- EN** 09:50 **3D Imaging of Nuclear Waste Containers with Muography**  
3D-Bildgebung von Containern gefüllt mit schwachradioaktiven Abfällen mittels Myonen Tomografie  
Prof. Dr. Ralf Kaiser – Lynkeos Technology Ltd.
- EN** 10:15 **The Characterization of Radioactive Waste: A Critical Review of Techniques Implemented or under Development at CEA**  
Die Charakterisierung radioaktiver Abfälle: Eine kritische Überprüfung der bei CEA implementierten oder in der Entwicklung befindlichen Techniken  
Dr. Cédric Carasco – Commissariat à l'énergie atomique et aux énergies alternatives CEA
- 10:40 COFFEE BREAK**
- D** 11:15 **Retrieval of Radioactive Waste from the Asse II Mine - Current Conceptual Design for the Storage Chamber 7/725**  
Rückholung radioaktiver Abfälle aus der Schachanlage Asse II - Aktuelle Konzeptplanung für die Einlagerungskammer 7/725  
Matthias Ruhl – Uniper Anlagenservice GmbH &  
Dr. Jens-Uwe Schmollack – TÜV Rheinland Industrie Service GmbH

- EN** 11:40 **An Advanced Concept for Radioactive Liquid Waste Treatment – Technology and Experiences**  
Ein fortschrittliches Konzept für die Behandlung radioaktiver flüssiger Abfälle – Technologie und Erfahrungen  
Martin Lerche – Fortum Nuclear Services
- D** 12:05 **Radiochemical Characterization: The Case of Ion Exchange Resins**  
Radiochemische Analyse am Beispiel von Ionenaustauscherharzen  
Patrick Haaß – Nuclear Research and Consultancy Group NRG

**12:30 FINAL STATEMENT AND OUTLOOK**

**12:45 LUNCH TO CONCLUDE THE EVENT**

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ABSTRACTS  
PRE-CONFERENCE  
WORKSHOP



SPEAKER

MONDAY 13:30 EN

Daan van Bree

Company James Fisher Nuclear GmbH
Uwestraße 12
22525 Hamburg - Germany
Website www.jfn-hamburg.com

Optimized Plastic Scintillation Detectors for Body Monitors and Clearance Systems

James Fisher Nuclear is for the British nuclear industry well-known as service provider and as supplier for customized systems. In order to be able to continue to offer its customers excellent service and contamination and clearance monitors, JFN has successfully assembled a team of experienced physicists, designers and engineers in Hamburg since 01.08.2017.

This presentation will summarise recent trends for optimized Plastic Scintillation Detectors for Body-Monitors and Clearance Systems. We will show you state of the art products, which are benefitting of the Optimized detector size, new electronics and much more. Our products are rounded by an excellent service and customer orientated solutions.

Daan van Bree, an engineer with over 30 years experience of international sales of radiation protection instruments will guide you through the presentation.



Clearance Chamber HWM-1800
Designed to carry out radiological measurements and decision measurements of large and / or bulky materials in lattice boxes, barrels or other types of containers. 1800 L measuring chamber



SPEAKER

MONDAY 14:00 EN

Dr. Marina Sokcic-Kostic

Company NUKEM Technologies Engineering Services
Industriestraße 13
63755 Alzenau - Germany
Website www.nukemtechnologies.de

Release Measurement for Radioactive Loose Waste: Methodological, Technical and Economic Aspects

During dismantling of the nuclear sites like nuclear power plants, a lot of radioactive material is generated, mainly as loose waste like soil, rubber or metallic pieces. All this material has to be disposed and if possible dismissed from the Atomic Law.

The basis of this administrative acts are release measurements which document the radioactive inventory of the waste.

During the last years, methods and devices have been developed and refined for this purpose like conveyor belt measurement systems, drum measurement systems, gross gamma systems or systems for measuring of surface contamination. The trend points to reliable and high sensitive measurement procedures with automatic operation (batch / drum measurement of specific activity, Hot Spot determination, separation

of batches or pieces with different activities etc.) and high material throughput.

In the data analysis a change from the "Frequentist Statistical" to the "Bayesian Theory" has happened. This change was not so important in respect to the calculated error uncertainties, much more error handling of statistical, systematic and normalisation errors is now consistent although with a larger computational effort. The "Bayesian Theory" also changed the viewpoint of the measurement uncertainties.

Finally it will be shown that present solutions are functioning both under methodological and technical aspects as well as under economic consideration.



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SPEAKER

MONDAY 14:30 EN

Dušan Daniška

Company AquilaCosting
Veterna 20
921 01 Piestany - Slovakia

Website www.aquilacosting.com

Optimizing Waste Management Costs by Simulating Real Technologies and Clearance Limits

Transparent and benchmarkable estimation of waste management costs in NPP decommissioning has been a challenge for a long period of time. Even now the cost estimation methodologies largely vary from country to country.

Therefore OECD/NEA has published and IAEA is recommending the International Structure for Decommissioning Costing of Nuclear Installations - the „ISDC“. Role of this document is to make the costing more transparent and benchmarkable so that the knowledge in estimating decommissioning costs can be internationally shared.

One of the parts of the ISDC is dedicated to estimating costs for management of radioactive waste (RW). These costs depend on many factors, mostly on the costs for used waste treatment technologies and clearance levels for RW.

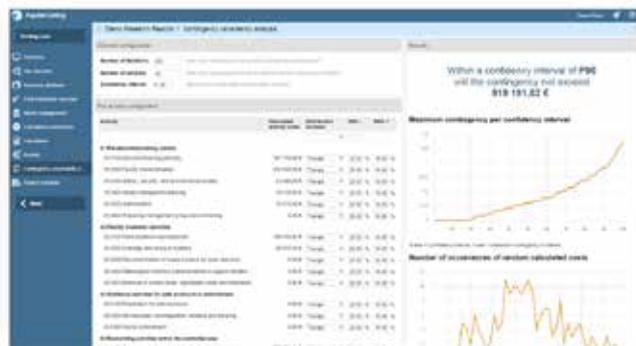
Optimization of both decommissioning and waste management costs can be automated using AquilaCosting software. This software allows user to precisely define the waste treatment process, separately for each type of RW. The definition includes all steps of treatment starting with removal from NPP and finishing with disposal in the waste repository; while the waste materials, their radioactivity and amounts or mass is calculated from the NPP's inventory and radiological characterisation.

With more advanced features like radionuclide decay simulation or batch automation can the optimization process be even more accurate and faster.

This cost estimation methodology has been verified with several cost estimation projects across Europe and is now available in the user-friendly software AquilaCosting.



Sample visualisation of a simple waste management flow for a carbon steel



Uncertainty analysis of cost estimation using Monte Carlo methodology



SPEAKER

MONDAY 15:00 EN

Neil Owen

Company Createc
4 Derwent Mills
CA13 0HT Cockermouth - United Kingdom

Website www.createc.co.uk

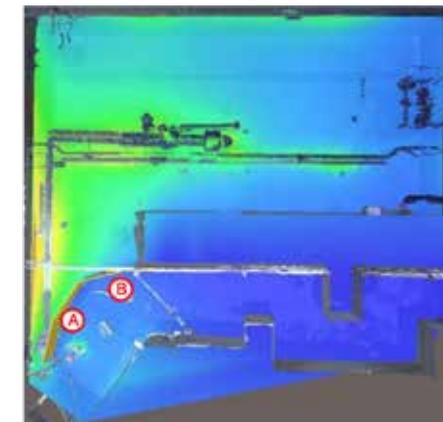
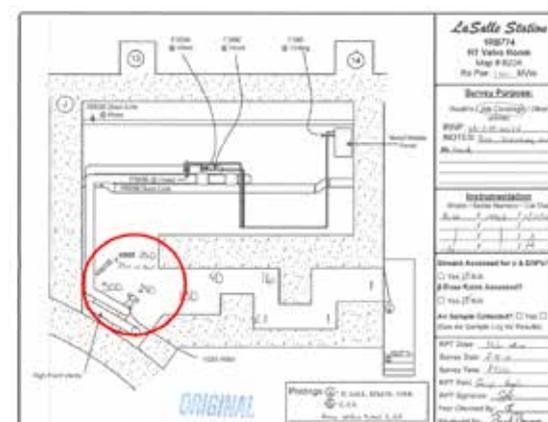
3D Plant Characterisation and Analysis Software to Plan Worker Dose Up-take and Decommissioning Activities

Createc have developed a suite of innovative tools to aid plant characterisation and decommissioning that are intrinsically set in 3D space. The tools, known collectively as N-Visage Fusion are designed to provide an estimate of the distribution of radiation within the plant, even if the source term becomes complex. This information is created via a point kernel approach which provides an almost unlimited level of freedom for the model creation, allowing the user to interact with a comprehensive "point cloud" based model.

The innovation of the N-Visage approach is that the input data is agnostic to the survey method employed. Createc have however developed a set of fully ruggedized sensors that have been optimised for

various aspects of plant characterisation and are integrated closely to the modelling approach. The instruments include N-Visage Scanner and N-Visage Recon.

In this paper, Createc and their US partner Transco Products Inc (TPI) describe a real-world Fusion case study, showcasing the power of the 3D approach. LaSalle Generating Station in Illinois is a 2-unit GE BWR site. During an outage in February 2018 the Reactor Water Clean-up valve required maintenance in the area circled red in Figure 1. The N-Visage Scanner was employed to take the survey data, a 3D point cloud radiation model was produced and finally an optimised shield package was created to protect workers during the required work. The optimised shielding allowed the plant to reduce the dose up-take by 55%, saving an estimated 12mSv over previous maintenance periods; and once complete actual dose-rates were well within 7% error of that predicted.



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SPEAKER

MONDAY 16:00

EN

### Jens Verbeeck

Company MAGICS Instruments N.V.  
Cipalstraat 3  
2440 Geel - Belgium

Website [www.magics.tech](http://www.magics.tech)



SPEAKER

MONDAY 16:30

EN

### Dmitrii Chernykh

Company ENVINET GmbH  
Hans-Pinsel-Str. 4  
85540 Haar - Germany

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

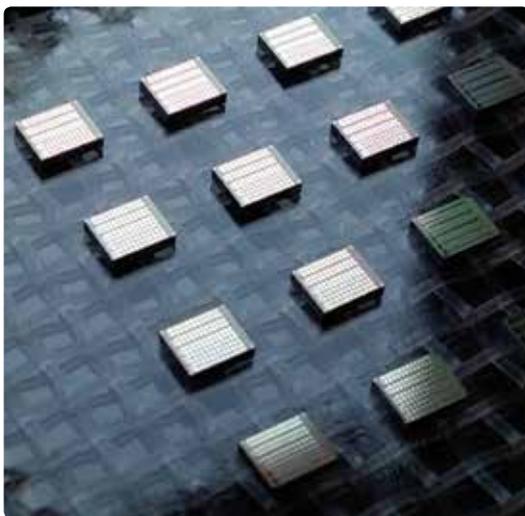
## Digital Sensing and Control Solutions for a Decommissioning and Inspection Renaissance

Most of today's commercial off-the-shelf (COTS) electronics are not specified to meet the demanding requirements of advanced nuclear applications requiring operation in nuclear environments. They can only maintain their functionality in these radioactive environments through shielding which leads to heavy and bulky solutions, making the design, installation, replacement and usage of these electronic solutions complex and expensive. It holds back the automation and autonomous revolution that is changing automotive industries.

Therefore, MAGICS is introducing digital sensing and control solutions resistant for nuclear environments to pave the way for a nuclear automation renaissance. In this presentation MAGICS Instruments will demonstrate a Gamma and Neutron radiation tolerant closed-loop motion control system. The system is capable of transmitting sensor data and controlling relays/motors over 215 meters cable at 2 Mbit/s. It

has several advantages: First, the analog signal can be digitized close to the sensor. In this way, signal degradation over long cables to the control room through noise/interference can be avoided. Secondly, multiple sensor signals can be transmitted digitally over only 3 twisted pairs. Hereby the number of cables is greatly reduced in the umbilical going to the control room, saving cable engineering and costs. Thirdly the digital bus protocol allows for easy interoperability of tools and sensors and reduces the need for customizations. Finally, introduction of digital solutions in these extreme environments allows for more advanced robotic or remote handling solutions, ease-up usage of remote handling tools and introduce time saving automation techniques from automotive industries. The motion control system consists of a bus communication chip with integrated RS485 transceiver that communicates to 4 SPI slave ASICs. (1) A resolver/LVDT to digital converter to read out angle information from a resolver or linear displacements from a LVDT; (2) A resistive bridge sensor signal conditioning ASIC to read out RTDs, thermocouples, force or torque sensors and strain gauges; (3) A 24V 10-channel limit switch conditioning ASIC to read the status of limit switches connected to it; (4) A 24V 10-channel relay driver ASIC to drive high-side solid-state or mechanical relays. Up-to three SPI slaves ASICs can be connected to the bus communication chip.

Modules can be composed and chained by only 3 twisted pairs with the BUS communications and SPI slaves. The end-result is a plug-and-play digital motion control for nuclear environments.



## Environmental monitoring solutions applied to decommissioning: 30 years of experience at ENVINET

Environmental radiation monitoring networks are installed either as nation-wide networks or as ring-monitoring networks around sites that are considered as possible sources for unintended radioactive releases. These networks typically are composed of fixed installations, supplemented by a number of mobile devices. Thanks to their high versatility, components of these networks are easily employable in monitoring solutions for other radiation protection disciplines like the decommissioning of nuclear sites.

Low-power gamma dose rate monitors like MIRA can endure week-long power outages and still reliably provide radio protection staff with vital dose rate information. Spectroscopic probes like SARA offer nuclide specific information in real-time to help decide processing strategies depending on the identified nuclides. Supplemental aerosol monitors like SIRA allow to detect smallest traces of radionuclides in the air that might have escaped from processing sites. Highly sensitive, mobile spectroscopic detectors like MONA are used to quickly survey large areas to assess decontamination needs.

All data can be collected in a central monitoring software like NMC. Such a software supports field-personnel as well as local and remote operators by mission-specific data preparation techniques and presentation layers. For emergency cases, data exchange functionalities are available for immediate data sharing between local staff, authorities and the various entities involved in CBRN.

During the last 30 years, the evolution of environmental monitoring system has led towards versatile systems with a horizon considerably beyond their original purpose. Similarly, the basis for radiological preparedness has been continuously evolving, as well as the requirements for decommissioning of nuclear installations. In this talk, the application of environmental monitoring solutions in the framework of decommissioning projects will be presented.



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SPEAKER

MONDAY 17:00 EN

### Tobias Finken

Company Krantz GmbH  
Uersfeld 24  
52072 Aachen

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

## Ventilation Concepts for Nuclear Decommissioning

During the decommissioning phase, the functions and functional areas of the building parts have to be viewed differently in some cases and adapted extensively to the requirements during the deconstruction. Particularly in the case of nuclear facilities, where the subsequent decommissioning was only taken into account to a limited extent during the planning stage, major challenges arise in order to make the building utilisation phase of the deconstruction as safe as technically possible. These considerations also affect the ventilation concepts of the building parts. Often the original ventilation is switched off when the power plant is shut down, so that a new ventilation concept adapted to the requirements becomes necessary for the following period.

The most important point here is the safe separation of the large quantities of dust that are sometimes generated during decommissioning and cutting processes in order to guarantee a completely contami-

nation-free exhaust air. Special attention must be paid at all times to the safety of persons working on site. HEPA filters are able to filter even the smallest particles < 0.2 micrometer out of the air. On the other hand the maximum filter loading at high dust concentration in the air is already reached after a short period of use and requires changing and cost-intensive disposal of the contaminated filter cells. To face this problem, filter systems with a recleaning function are usually used under operating conditions with high dust generation to be expected, as during the deconstruction process of nuclear facilities.

In this presentation, ventilation concepts for the decommissioning phase of nuclear power plants shall be outlined and the most important key points to be considered shall be explained by means of examples. The focus is on the use of recleanable filter elements of the HEPA filter class.



SPEAKER

MONDAY 17:30 EN

### Claude Maack

Company GRADEL sàrl  
6, Z.A.E. Triangle Vert  
5691 Ellange - Luxembourg

Website [www.gradel.lu](http://www.gradel.lu)

## Underwater Vacuum Cleaners for Nuclear Dismantling

Description of the miscellaneous tasks, a vacuum cleaner is facing during the whole decommissioning campaign. As situations are changing during a project, unexpected events have to be mastered by the vacuum cleaner in any situation.

Gradel relies on large heritage and references concerning vacuum cleaners and has continued in the past years to adapt its family of vacuum cleaners to be in line with the huge tasks awaited by its customers.

Solutions for suction of huge amount of sawed chips, or even larger parts like screws and nuts through the pump system is standard. The visibility in the pool for the operators is mandatory. Here a compromise has to be found in terms of fine particle filtration.

How to avoid formation of alga's? What to do when organic particles are disturbing visibility in water?

How to reduce cost of filter cartridges? Creating a huge customer value by using modular filtration systems which can be adapted to the situation of the pool water at any time.

Waste reduction by underwater compression of fine filter cartridges. Long-time waste storage. Presentation of a new filtration material for maximum reduction of radiolysis gas formation in long term storage.



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SPEAKER

TUESDAY 13:15

DE

### Henry Cordes

Company EWN Entsorgungswerk für Nuklearanlagen GmbH  
Latzower Straße 1  
17509 Rubenow - Germany

Website [www.ewn-gmbh.de](http://www.ewn-gmbh.de)



SPEAKER

TUESDAY 13:40

DE

### Jens Pöppinghaus

Company BGZ Gesellschaft für Zwischenlagerung mbH  
Frohnhauser Str. 67  
45127 Essen - Germany

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

## EWN's Role in the German Decommissioning, Dismantling and Disposal Landscape

EWN GmbH (nowadays: Entsorgungswerk für Nuklearanlagen GmbH) is a company based in the northeast of Germany and emerged in 1990 as the legal successor to the former GDR collective "Kernkraftwerke Nord/ Bruno Leuschner" at Lubmin/Greifswald site. Alongside with the 1966 founded NPP Rheinsberg/Berlin (70 MW) which mainly served for research, teaching and training for nuclear energy production, NPP Nord played a major and strategic role in the energy production of the former GDR until shutdown in 1990.

Nowadays, our task comprises the decommissioning and dismantling of the Greifswald and Rheinsberg NPP, the safe processing of radioactive residues and waste as well as the safe interim storage of nuclear power fuel and radioactive waste. With its 5 former 440 MW Russian-style PWR, an interim storage for high, medium and low active waste and many treatment and decontamination facilities on site EWN even nowadays represents one of the world's largest nuclear facilities.

Since 1995 when we obtained our decommissioning license, and 1998 when the Interim Storage North (ZLN) took up operation, EWN had to enter widely uncharted dismantling territory, test technologies and develop procedures. By this, we gained experience and expertise that is undisputed and acknowledged way beyond Greifswald. As headquarter of EWN Group comprising the former nuclear research plants at Karlsruhe (WAK/KTE) and Jülich (AVR/JEN) EWN has responsibility for roughly 30 % of medium and low active "Konrad-waste" as well as 74 CASTOR casks at Lubmin and 152 at Jülich.

EWN Group performs and fulfills its obligations as a state owned company legally on its own and independently from our "federal sister" BGZ. Despite of this, there is close cooperation and exchange of knowledge.

Currently, EWN has initiated a licensing procedure for an interim storage building replacing ZLN's ship 8 and is erecting a cutting and treatment facility for our large components at Lubmin.



## Storage of Low-level Radioactive Waste in Germany – Status and Challenges

According to the act on the organisational restructuring in the field of nuclear waste management in Germany released in 2016 the central responsibility for interim storage of radioactive waste from the German utilities is being transferred to BGZ. To this end BGZ has taken over the on-site interim storage facilities for highly active waste at the NPP sites at the beginning of 2019. In addition we will manage the twelve storage facilities for low and medium-active waste as from 2020 on.

The current and future operational management of the interim storage facilities provides BGZ with a variety of challenges. In particular, the separation and implementation of functionalities for an autarkic operation are extremely demanding in view of licences and practical implementation. The prime importance here is a sustainable interface regulation in order to ensure a continuous flow of information and material between BGZ and the German utilities under

consideration of the complex interrelationship given. Moreover it should be taken into account that in future special demands will be posed on waste logistics in view of the parallel processes of emplacement into storage facilities and removal of waste arising from dismantling on one hand and the operation of the Konrad repository on the other. All the more because the interim storage facilities were originally designed to receive waste packages. Besides the operational requirements it is the process-related data and document transfer having a specific role since BGZ must obtain all data related to the waste packages which are required for the later transfer into a final repository.

This presentation gives an overview on the latest status of the current and future preparations at BGZ all aiming to continue the safe and reliable operation of interim storage of radioactive waste.



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SPEAKER

TUESDAY 14:05

EN

### Gianfranco Brunetti

Company European Commission - Directorate General Energy  
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2920 Luxembourg - Luxembourg

Website [www.ec.europa.eu/energy/index\\_en](http://www.ec.europa.eu/energy/index_en)



TUESDAY 14:30

DE

### Michael Kruse

Company Arthur D. Little GmbH  
The Squire 13  
60600 Frankfurt am Main - Germany

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

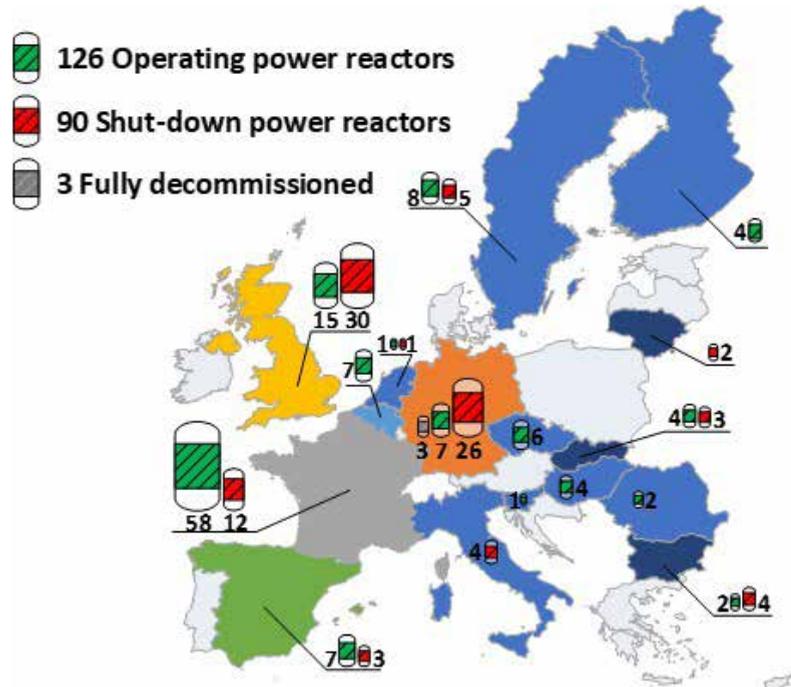
## Nuclear Decommissioning in the EU - Strategies and Funding

The EU-28 nuclear industry is definitely moving into a new phase characterised by increased activities in the back-end of the lifecycle, namely decommissioning and, consequently, waste management.

On the one hand there are 126 nuclear power reactors in operation in 14 Member States, with a total capacity of about 115 GWe; new build projects are envisaged in 10 Member States. On the other hand there are 90 reactors in shut down mode and the average age of operating reactors is close to 31 years. The back-end of the fuel cycle needs therefore increasing levels of attention. Careful planning and enhanced cooperation among Member States will be needed. All EU Member States operating nuclear

power plants will have to take politically sensitive decisions on geological disposal and the long-term management of radioactive waste.

In the last decade the EU nuclear landscape has undergone significant changes with the organisation of the comprehensive risk and safety assessments ('stress tests') of the EU nuclear power reactors after the Fukushima Daiichi accident and the adoption of landmark legislation on nuclear safety, radioactive waste and spent fuel management and radiation protection. Recently the European Commission has published relevant reports and studies providing a comprehensive overview to the European Union (EU) citizens on these important issues.



## Perspectives on the Market and Future Prospects of nuclear Decommissioning

Since the origination of commercial nuclear power in the 1960s, the industry has managed to become a significant element of the power generation portfolio of more than 30 countries. Together with research reactors, today more than 70 countries operate or used to operate nuclear facilities. Another 8 countries, e.g. Turkey and Egypt, intend to become commercial nuclear energy players within the next decade. Despite the political debate regarding the future of nuclear energy in several countries such as Germany or Belgium, these figures show that nuclear energy will keep its relevance or even gain importance considering global climate warming and the need for de-carbonization.

At the same time, from today until 2030, globally more than 80 nuclear plant units will reach the end of their design-base life-time of 60 years or be phased-out due to political decisions. This trend is complemented by the continued closure of research reactors, e.g. Halden in Norway.

In the past, decommissioning and disposal of nuclear facilities was seen by the licensee as a given necessity. Operators did not realize the full optimization potentials since each decommissioning project was treated individually or managed rather from a technical point of view than from a large capital project perspective. At the same time, supply chain players predominantly focused on their local markets and did not maximize the full business potential of their capabilities.

This situation has changed. Although local regulation and local players still largely determine domestic market dynamics, players such as Cyclife, Fortum, Holtec and TVEL try to establish multinational business models. At the same time operators become more willing towards new solutions and industrialized approaches and optimize their make or buy.

In a nutshell the international decommissioning market has become more mature and dynamic. This article discusses the industry trends and takes an anticipative view on the future of decommissioning.



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SPEAKERS

TUESDAY 15:45

DE

Andreas Haars

Frank Ambos

Company ROBUR Energy GmbH SAT Kerntechnik GmbH  
 Coloradostraße 7 Vangionenstr. 15  
 27580 Bremerhaven - Germany 67547 Worms - Germany  
 Website www.robur-energy.com www.sat-kerntechnik.de



SPEAKERS

TUESDAY 16:10

DE

Dr. Jochen Latz

Dr. Benjamin Sauer

Company McKinsey & Company, Inc. McKinsey & Company, Inc.  
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 Tokyo 106-0032 - Japan  
 Website www.mckinsey.com

### Concentration and Synergies on the Nuclear Decommissioning Market - Strategic Orientation using the Example of SAT Kerntechnik GmbH / ROBUR Energy GmbH

In response to the Fukushima Daiichi accident on March 11th, 2011, the German government declared a 3-month moratorium on the reactor lifespan extension passed in 2010 and temporarily shut down 8 of the 17 reactors operating at the time. On May 30th, 2011, the German government decided to shut down all Nuclear Power Plants (NPPs) by 2022.

Not only did this decision change the market for all companies operating in the NPP service industry, it also created a huge new market: Dismantling of NPPs, along with clearance of contaminated areas. Nonetheless, it took until 2017 for the first 9 NPPs to receive their first decommissioning licenses, with one more to follow soon. Decommissioning of the remaining 7 NPPs will only start over the next decade. Therefore, we must conclude, the market is still in its early stage.

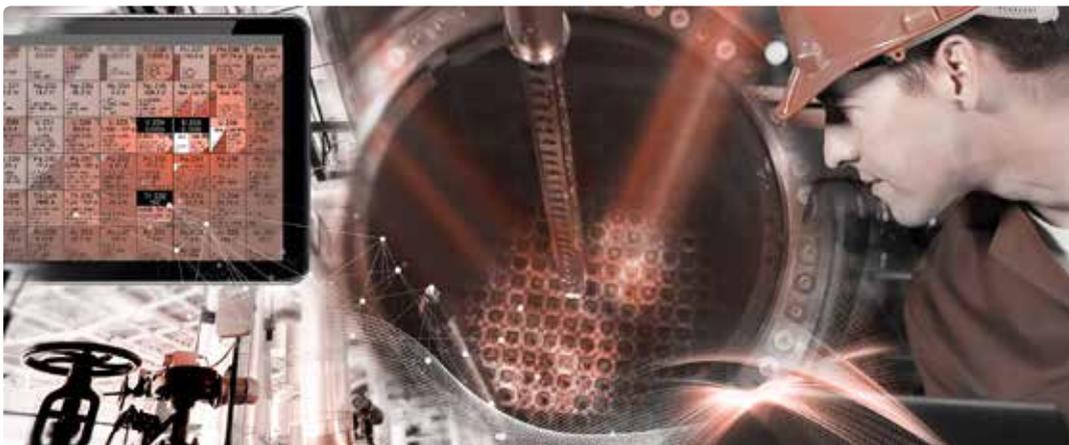
With new players entering the market, consolidation started, and new alliances were formed to cope with low prices and low margins. In 2015, ROBUR became an active player in this market and since then,

ROBUR ENERGY is building up its company and service portfolio, applying a buy-and-build-strategy.

We will discuss ROBUR ENERGY's strategy, its service portfolio regarding the NPP services and decommissioning market, as well as intended alliances and the potential for new partners joining the group.

Founded in 2015 in response to the changing challenges of high-quality and increasingly digital industrial services, ROBUR now ranks among the top 10 industrial service providers in Germany with 20 companies and sales of approx. EUR 200 million in 2019 and is rapidly establishing global presence.

More than 2,000 colleagues globally work in the wind, water, energy, industrials and process industries. As expert partners for our customers, we create integrated solutions from the planning to implementation, to operation and maintenance, to relocation and decommissioning and support our customers with digital and automation solutions in shaping their digital transformation.



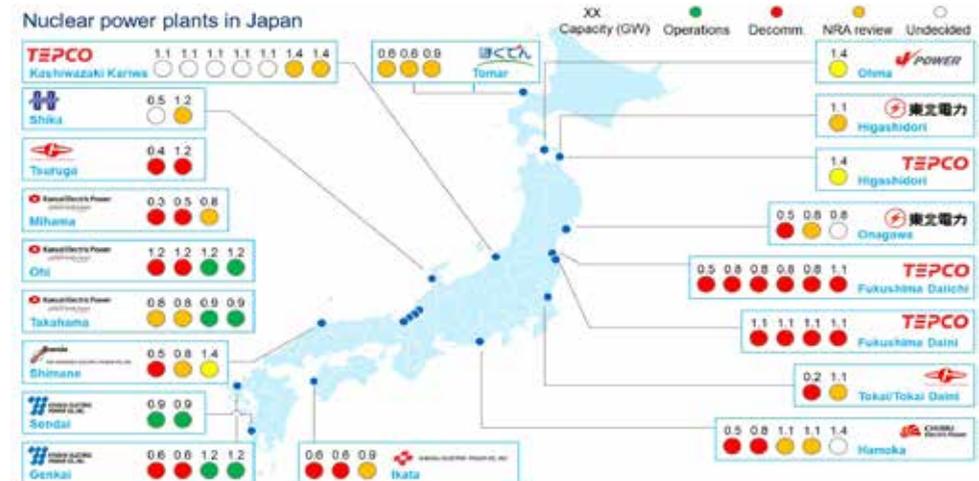
### New Opportunities? The Japanese Decommissioning Market beyond Fukushima

The decommissioning market in Japan offers significant business opportunities. This is to the benefit of both sides – for international decommissioning players as well as for Japanese operators who can leverage the global experience.

Following the accident that occurred at the Fukushima Daiichi plant in 2011, all commercial reactors in Japan were shut down. The regulator then demanded that significant safety upgrades be made to reactor units so they could be put back into operation. Sendai 1 was the first reactor that was restarted in 2015. Today, 9 reactor units are back in operation, 6 units have passed the review, and 12 units are still under review. There are 18 units already planned for decommissioning, excluding the 6 units at Fukushima Daiichi. Of the 18 planned, only Tokai is in the actual decommissioning stage. Fugen, Hamaoka 1 & 2, and Tsuruga 1 are in the peripheral decommissioning stage – all others are still in decommissioning preparation. The Japanese decommissioning market is still developing, as the owners were rushed into decommissioning following the accident at Fukushima. This current

environment provides significant opportunities for leveraging learnings from international players in order to reduce decommissioning costs and time. Based on our experience, we see an opportunity to pursue improvements in the following four key areas.

- Optimizing the decommissioning strategy and solving the fuel backend bottleneck at Rokkasho offer potential to reduce the project timeline significantly below the current base case of 25 to 40 years.
  - Best-practice approaches can be applied to capital project execution in engineering and contracting as well as in lean project execution.
  - A culture and mindset change from a stable operations organization to a project- and cost-focused decommissioning organization represents one of the biggest challenges when transitioning into decommissioning.
  - Partnering between suppliers and utilities or among utilities is a way to stabilize portfolios by securing critical expertise and resources.
- These and other optimization levers can generate significant value in decommissioning in Japan.



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SPEAKER

WEDNESDAY 9:00 DE

Dr. Annika Schäfers

Company Bundesministerium für Wirtschaft und Energie  
Scharnhorststr. 34-37  
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Website www.bmwi.de



SPEAKER

WEDNESDAY 9:25 EN

Dr. Vladimir Michal

Company IAEA International Atomic Energy Agency  
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Website www.iaea.org

Nuclear Safety and Waste Management Research with the Young Generation

There is continuous need for nuclear safety and waste management research in Germany. The technical-scientific expertise is to be preserved and extended even beyond the year 2022 for many decades to come. It is the young generation of scientists that will maintain and further develop Germany's competence for operation, decommissioning and safety aspects of nuclear facilities as well as for waste management, interim storage and final disposal. The promotion of young scientists as well as international cooperation are therefore key components of the research funded by the Federal Ministry for Economic affairs and Energy in the field of nuclear safety and waste management.

In order to meet this objective and to gain and reaffirm the interest of young scientists in nuclear safety and waste management research, actions need to be taken in the following fields:

- (a) education, training and research
- (b) career prospects, international networking and economic cross border activities
- (c) societal anchoring.

The German Federal Government confirmed the need for the preservation of expertise and personnel in the nuclear field in their coalition agreement in 2018: "We want Germany to have a lasting influence on nuclear safety in Europe - even after the phase-out of national nuclear power use. In order to have a say in safety issues, one needs to be able to do so. Therefore, the preservation of know-how is indispensable."



Bundesministerium für Wirtschaft und Energie

ARTEMIS - The IAEA Integrated Review Service for Radioactive Waste and Spent Fuel Management, Decommissioning and Remediation

ARTEMIS is the IAEA's integrated expert peer review service for radioactive waste and spent fuel management, decommissioning and environmental remediation programmes. Based on IAEA safety standards and technical guidance, as well as on international good practices, ARTEMIS is available for Member State organizations, facilities and activities involving radioactive waste or spent fuel management, radiological impact assessments for human health and the environment, the management of residues arising from uranium production as well as the decommissioning and remediation of sites contaminated by radioactive materials.

- Benefits of ARTEMIS include:
- improved organizational performance relating to the issues under review;
  - enhanced safety, optimized operations and reduced costs;
  - improved transparency and stakeholder confidence, including with the general public;
  - strengthened national programmes through improved national policies and strategies; and
  - improved quality of decision making processes due to availability of additional perspectives.

ARTEMIS reviews aim to provide independent expert opinion and advice to assist Member States in improving performance in the area or activity under review. ARTEMIS also contributes to improving transparency and increasing national and international confidence in Member States' organizations, facilities, programmes and activities related to radioactive waste management.

The ARTEMIS review service is available for government policy and decision makers, regulators, organizations responsible for radioactive waste management, facility operators, other implementing organizations and their technical experts.



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SPEAKERS

WEDNESDAY 10:45 EN

### Guido Mulier / Robby Vandendries

Company Tecnubel GmbH  
Borsigstraße 7  
76185 Karlsruhe - Germany

Website www.tecnubel.de



SPEAKER

WEDNESDAY 11:10 DE

### Frank Weser

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

Website www.framatome.com

## CAROLINE: A High Integrity Cask with Dedicated Manipulation and Transportation Means

At Tecnubel a new high integrity cask, named CAROLINE, is available for the market.

This is a new developed type B(U) packaging with a large cavity for the transport and (interim) storage of high activated radioactive material and/or waste. CAROLINE can be equipped with extra shielding and/or drainage to allow underwater loading also.

Tecnubel is a provider of integrated services for the decontamination and decommissioning of nuclear installations, with over 30 years of experience in logistics issues during the execution of dismantling projects.

The presentation will explain why loading of high and intermediate-level radioactive waste into type B packaging is challenging. Often waste is stored in drums that need to be loaded into a type B packaging for transfer to a waste facility. To protect the workers, the dose uptake needs to be as low as reasonably achievable. The loading/unloading systems and the type B packaging need to be designed, allowing the autonomous loading/unloading of the waste to minimize dose uptake by the workers during the operations.

After one year of design and construction, the autonomous system is ready for the loading and un-loading of two new-build type B packagings CAROLINE-R80. The autonomous system's design is based on the experience gained during many years of nuclear transport of drums.

In order to load and unload the drums in different kinds of nuclear facilities, many interface challenges have to be treated. Physical properties of the autonomous system such as dimension and weight are limiting factors, as many facilities are not equipped to handle such large and heavy packagings. Different specific equipment is designed in order to facilitate remote loading and unloading operations to cope with the high dose rate waste.

Different tests have been executed in Belgian nuclear facilities to optimize the autonomous loading/unloading of drums. In future, other contents, such as high level radioactive liquid or hospital sources, can also be loaded with this autonomous system.



## Engineering for the Post-Operation Phase - Strategy of a German OEM

During the post-operation phase and decommissioning of nuclear power plants there are various challenging engineering tasks. At first the utility slewing into the decommissioning phase defines a sequence of work in respect of mandatory safety requirements. Done that, a detailed planning for every work package and stage of decommissioning, yet each system is elaborated.

Concepts for specific tasks as well as design solutions for system adaptations and modifications corresponding to the respective decommissioning phase will be shown. Furthermore some concrete engineering solutions in different stages of development (idea, offer, and project) will be presented.

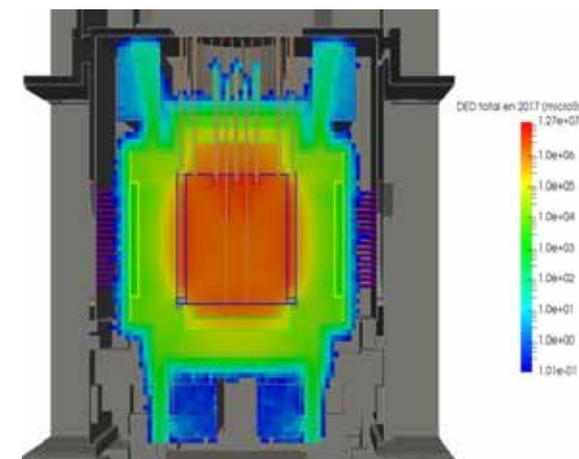
Nuclear safety continues to be the basis for all activity planning in the post-operation phase. Although the requirements for fulfilling the safety requirements will change during the decommissioning, the assurance of the necessary and available safety function for every step of decommissioning is crucial.

Suppliers/OEMs, performing periodic safety reviews and probabilistic risk assessments (e.g. Shutdown PSA) revert on system and design data, which they have dealt with or studied in depth. This data and system know-how prepares them for a wide range of tasks in the post-operation phase and it certainly helps to optimize the work sequence planning beyond the shutdown sequence of safety systems, but also about temporary modifications of existing systems during post-operation/decommissioning.

The presentation focuses on selected engineering services for post-operation/ decommissioning, such as AIMS for plant 3D model and a visual twin. AIMS not only supports on reporting of decommissioning progress during all stages but helps to prepare solutions for restricted (high dose rate) locations due to limitless virtual access and the possibility of virtual elaboration of work-, transport- and handling sequences.

AIMS will be able to provide data of in-situ assessments, e.g. of radiological and/or structural analyses and residual radiation activity for all plant inventory and specific components locations.

This activity mapping will help to optimize the dismantling activities in respect of contamination by selection of the most efficient tools and technologies in cutting and packaging as well as shortening the radiation exposure duration of operating staff.



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SPEAKER

WEDNESDAY 11:35 EN

### Martin Andreasson

Company Norwegian Nuclear Decommissioning (NND)  
Storgata 2A  
1767 Halden - Norway

Website www.nnd.no



SPEAKER

WEDNESDAY 13:00 EN

### Ruizhi Li

Company China Institute of Atomic Energy (CIAE)  
Sanqiang Str.1  
102413 Beijing -China

Website www.ciae.ac.cn

## Decommissioning of Nuclear Facilities in Norway

In the midst of summer 1951 Norwegian scientists managed to start and handle a nuclear reactor. This made Norway the 6th country in the world to master the art of controlled nuclear fission.

This was a great accomplishment, followed by many others in the Norwegian nuclear research program, but after almost 70 years of reactor operation and experimental nuclear research the time has come to decommission the nuclear infrastructure and restore the used sites to its original state. This is a journey that will take at least a generation to accomplish and

Norwegian Nuclear Decommissioning, NND, has been assigned this task. The volume of radioactive waste is low compared to many other countries but the complexity of the high level waste from the research activity is high.

In this lecture NND will comprehensively describe how we work to solve this challenge.



## The Decommissioning Planning of 101 Heavy Water Research Reactor

China Institute of Atomic Energy, founded in 1950s, is a part of China National Nuclear Corporation (CNNC) and it is a multidisciplinary institute. Heavy water research reactor (code: 101) is located in the CIAE and it is the first nuclear reactor of China. HWRR started to construct in 1956 and went into first criticality in 1958. HWRR is a tank type reactor using heavy water as primary coolant and moderator. Its nominal power is 7MW, while strengthened thermal power is 10MW. Between 1978 and 1981, the reconstruction project was implemented and operational parameters upgraded after that. After 49 years of long term operation, HWRR permanently shut down at the end of 2007 for the termination of operational license.

HWRR is the first nuclear reactor to be decommissioned in China. Immediate dismantling is chosen as a preferred decommissioning strategy. During the transition phase, many preparations had been conducted:

- Reactor was defueled and all SNF were moved to the storage pool for interim storage.
- Primary coolant system and secondary coolant system were drained after reactor defueling.

- Operational waste on the site was cleaned up.
- Preliminary characterization survey was implemented.
- Parts of supporting systems were modified, including ventilation system and radiation monitoring system, etc.

The decommissioning project are challenging for the following reasons:

- Lack of design and engineering experience in the domestic.
- Project duration is long (more than 10 years) with uncertainty and related financial risks.
- Key techniques such as dismantling of reactor internals, retrieval and conditioning of I-graphite blocks, decontamination and decommissioning of high dose rate hot cells have not been identified yet.

According to the planning, a phased approach will be applied in the HWRR decommissioning project. The presentation will give some introduction on HWRR decommissioning planning and key pending issues.



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SPEAKER

WEDNESDAY 13:25 EN

### Diana Lasyte

Company Ignalina Nuclear Power Plant  
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31152 Visagino municipality - Lithuania

Website www.iae.lt



SPEAKER

WEDNESDAY 13:50 EN

### Yun-Chung Chi

Company Atomic Energy Council  
80, Sec. 1, Chenggong Rd., Yonghe Dist.  
23452 New Taipei City - Taiwan (R.O.C)

Website www.aec.gov.tw

## Decommissioning of the Ignalina NPP - Planning and Execution

Ignalina Nuclear Power Plant (INPP) is a state enterprise carrying out pilot immediate dismantling project of decommissioning of the nuclear power plant with two urane-graphite RBMK-1500 reactors which were in operation between 1984-2009. In the course of decommissioning INPP develops the existing spent fuel and radioactive waste management infrastructure by constructing new facilities, i.e., the Interim Spent Fuel Storage Facility, the Radioactive Solid Waste Retrieval and Management Facility, the Landfill Facility for Very Low Level Waste, the Near Surface Repository for Low and Intermediate Level Short-lived Radioactive Waste.

Currently, INPP has completed all the operations related to spent fuel unloading from both reactors, only 25 % of spent fuel assemblies shall be removed from pools and placed for temporary storage. It is planned to commence treatment and loading of heavily damaged fuel and recovery of spent fuel debris in 2020, anticipating the final defueling by August 2022.

Completion of defueling operations will enable INPP to proceed with the new challenging project related to the dismantling of the reactors and storage of the irradiated graphite, the first optioneering stage of which will be launched in the immediate future. The main objective of the one-of-a-kind R3 reactor core dismantling project is the key one for INPP decommissioning critical path objecting at the development of technologies for radioactive waste management generated as a result of dismantling of both graphite stacks and removal of reactor structures and equipment. The final stage of this project, including dismantling of both reactor cores (graphite + radial and axial shielding materials) is planned for 2027.

INPP performing a challenging decommissioning of two graphite-moderated RBMK-1500 type nuclear reactors accumulates a unique experience and competencies to be applied in providing similar services within the exact nuclear sphere, as well as to act as a valuable industrial partner. The INPP decommissioning is set to be completed by 2038.



## Current Status of Nuclear Decommissioning in Taiwan

After three years of review by the Environmental Impact Assessment conference on May 15, Taiwan's Environmental Protection Administration announced that it has approved a 25-year decommissioning plan for Taiwan's No. 1 nuclear power plant (NPP), also known as the Chinshan NPP. According to this formal plan, decommissioning is going to be divided into four stages, including post-operation transition (8 years), decommissioning and dismantling (12 years), demolition of the reactor building and turbine building (3 years), and site recovery (2 years). The plan also pushes the Taiwan's oldest NPP to enter the final stage of decommissioning. The operating license for Unit 1 expired on Dec. 5 of last year, with the license for Unit 2 slated to expire in July of this year. However, on May 7, Deputy Legislative Speaker stroke a gavel as the legislature passed draft amendments to the Electricity Act at the Legislative Yuan. The amendment was modified in compliance with the result of mid-term elections and multiple-referendums on November 24, 2018. The multiple-referendum voting consisted of 10 questions ranging from LGBTQ rights to the development of nuclear power. The nuclear energy referendum wording goes like this: Do you agree with abolishing the first paragraph of Article 95 of the Electricity Act? This referendum is asking for the flexibility to extend the usage of nuclear power after 2025. A majority of the voters were in favor of

abolishing article 95, which means they don't want to rule out nuclear power as an energy source in the future. The result, however, was an obvious setback for the ruling Democratic Progressive Party. And voters decisively rejected the government's phase-out of nuclear power, 59% to 41%. President Tsai Ing-wen took responsibility for the election losses and stepped down as party chief on the same day. Yet the response of the government downplays that despite the success of opponents to continue with nuclear energy, policy will likely remain unchanged. President Tasi said that her goal is still to make Taiwan a nuclear-free homeland. Cabinet spokeswoman re-emphasized in a statement, "It is not possible to postpone the phase-out of the No. 1, 2 and 3 nuclear plants for legal reasons." Currently, the decommissioning of the No. 1 and No. 2 NPPs is still underway. However, the government may immediately face a further referendum on whether to restart work on the fourth NPP at Lungmen in New Taipei City by pro-nuclear advocates. What will be the final results of the post-election impact on the upcoming decommissioning work in Taiwan? The debate seemingly remains polarized. Arguments for and against nuclear power will go on after referendum keeps reactors running.



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SPEAKER

Jos Boussu

Company TRACTEBEL ENGINEERING S.A.  
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1000 Brussels - Belgium

Website www.tractebel.engie.com

WEDNESDAY 15:10 EN



SPEAKER

Niklas Bergh

Company Westinghouse Electric Company  
Fredholmogatan 22  
72163 Västerås - Sweden

Website www.westinghousenuclear.com

WEDNESDAY 16:00 EN

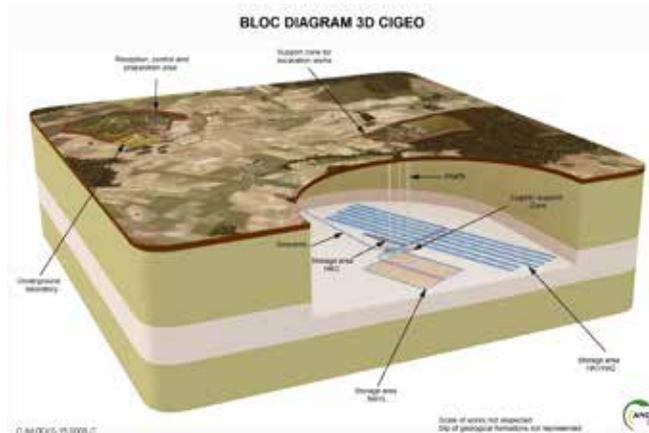
## Radwaste Repositories - Examples of Radwaste Repositories Design in Belgium and France

Belgium and France are both developing Radwaste Storage and Final Disposal facilities. Projects are in different stages, some far more advanced in their development than others. A brief overview will be given on the scope and the status of these projects, and the role of Tractebel in the engineering phases of these projects.

- Cat A Final Disposal Facility (the cAt project) in Belgium consists of the construction of a surface disposal facility for low and intermediate level short lived waste. The disposal concept of cAt consists of monoliths, containing the waste, being placed in concrete modules, which during operation are temporarily protected against weather conditions by a fixed steel roof.
- Conceptual Design of the Belgian Geological Disposal Facility for Category B and C Wastes (low-level and intermediate-level long-lived waste, high-level waste and spent fuel). For more than 40 years, ONDRAF/NIRAS has been studying the concept of a geological disposal facility (GDF), within poorly indurated clays, as an option for the long-term management. In absence of policy regarding the long-term management of this waste, an hypothetical reference geological disposal facility has been conceptualized.

Tractebel acts as architect-engineer for ONDRAF/NIRAS to study and develop the construction and operation of the GDF.

- The Cigeo project in France aims at the deep disposal of most of the French radioactive waste, primarily from nuclear power plants and from the reprocessing of their spent fuel. Cigeo will be built along the border of the Meuse and Haute-Marne departments in eastern France. During its industrial phase, the project is split in several Sub Systems under the coordination of the Prime Contractor. Tractebel is involved in SubSystem 2 (SS2) and SubSystem 4 (SS4).
  - SS2 or „Nuclear Surface Facilities“ is composed of a series of buildings that handle the radioactive waste packages after their transfer from the producers' own storage facilities to Cigeo. High-level wastes and intermediate-level wastes are dealt with.
  - SS4 project involves the design of nuclear and non-nuclear installations for the construction and operation of underground and surface/bottom connecting structures as required for the storage of HLW and LLILW packages.



## Lessons Learned from International Decommissioning Planning

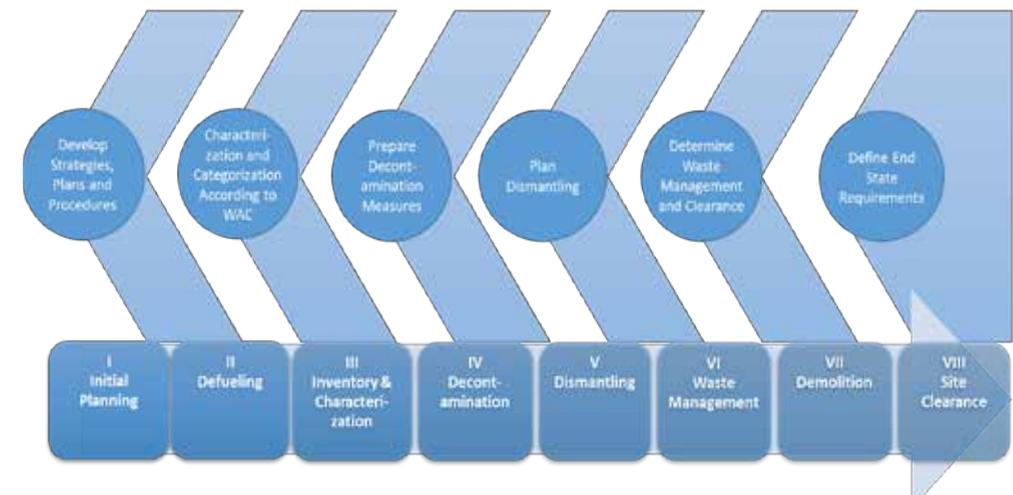
Decommissioning of Nuclear Power Plants is an increasing reality in many countries with nuclear power. Decommissioning planning is one of the first and most important activity in a decommissioning project. It sets the foundation for a successful project.

Already many years before final shutdown, planning of the decommissioning work is usually started in order to understand for example the costs, waste volume capacity and licensing work needed. In many countries it is required to have a final decommissioning plan before any decommissioning work is allowed to commence.

Westinghouse has been involved in international decommissioning planning for more than 30 years. As many plants are now moving into decommissioning, the focus has shifted from preliminary to final decommissioning plans with budgets instead of funding plans, strategic decisions instead of choices, waste volume specifications instead of estimates and a defined approach instead of multiple scenarios.

Westinghouse has developed a methodology based on the planning and execution of many decommissioning projects globally to help the customers adopt a systematic planning process where strategy development is done with the end state in mind, where the goals are clearly outlined and the starting point described. The process and steps to reach the desired end state needs to be clearly defined and all options/alternatives evaluated from a cost/benefit point of view. This is followed by a thorough and quantitative risk analysis in order to give solid recommendations and credible conclusions.

One important feedback is that real decommissioning experience from reference projects is invaluable for a safe, fast and cost effective realization of the decommissioning, taking advantage of lessons learned, good practice and previous knowledge in order not to make the same mistakes twice. The presentation will discuss in more detail some feedback from different international decommissioning planning projects.



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SPEAKER

THURSDAY 9:00 DE

### Dr. Philip Harding

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Website www.brenk.com



SPEAKER

THURSDAY 9:25 DE

### Dr. Matthias Fritzsche

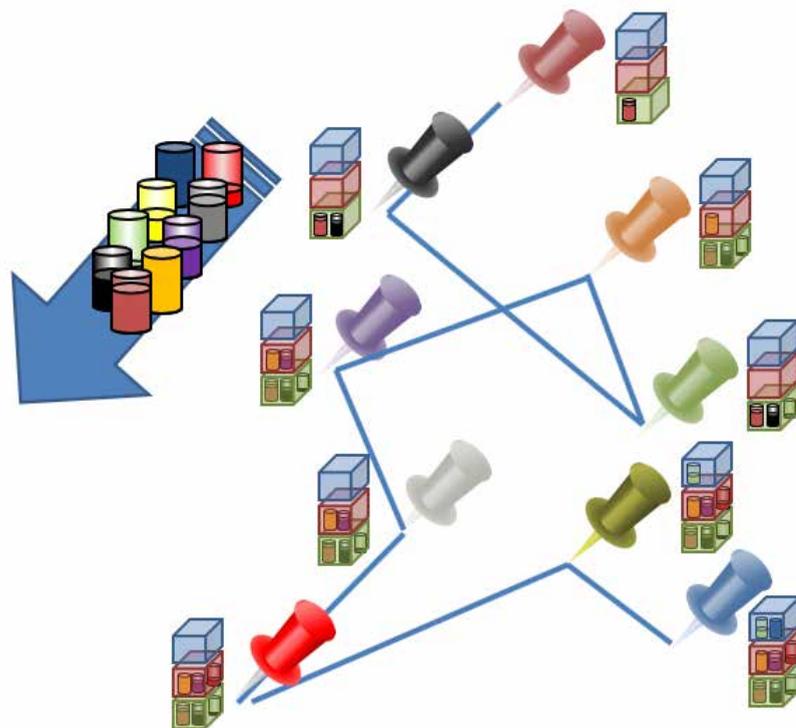
Company Mirion Technologies (Canberra) GmbH  
Stahlstrasse 42-44  
65428 Rüsselsheim - Germany

Website www.mirion.com

## Packaging Planning using AI-based Algorithms

During the decommissioning of nuclear facilities and the operation of storage repositories, many problems arise in the context of solving resource allocation problems. Typical problems include the packaging of waste into containers or casks. The solutions to these problems, that is, the allocation of waste items to containers or casks, must comply with all relevant limits, such as those from the final repository Konrad, but also from transport and interim storage facility regulations. Not only must these legal limits be considered, but the operator is interested in such an allocation and packaging sequence so as to minimize costs, which consist of immaterial costs

one the one hand (such as manipulation costs) and material costs (container or cask) one the other; the latter can be further subdivided in costs for the container/cask itself and the volume costs for the final repository Konrad. Here we report results from an ongoing BMBF-funded research project: The manually generated solutions to four separate planning problems such as the ones described above are compared to solutions generated with methods from operations research / artificial intelligence. Their total costs are compared taking into consideration the immaterial and the material costs, also taking account of the time required to generate these solutions.

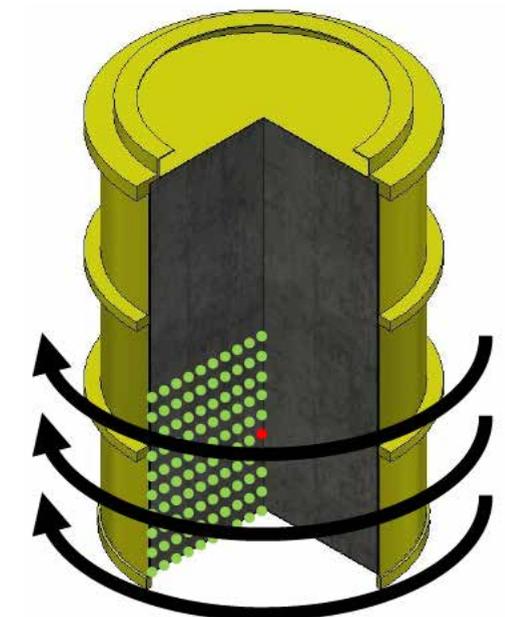
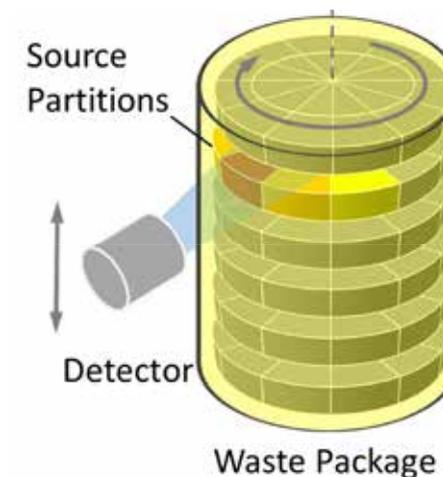


## ASGS - An Innovative Way for Waste Characterization - From the First Study to Experimental Validation

The qualification of radioactive waste packages for disposal in the Konrad geological repository requires the declaration of the activity inventory determined via measurement. The declaration is based on the conservative estimate which is strongly influenced by the measurement uncertainties and the conservativity introduced by simplifying assumptions. Mirion and AiNT collaboratively developed an advanced gamma scanning method which increases the accuracy in determination of the nuclide-specific activity, thus significantly reducing the measurement uncertainty. The novel waste assay system called Advanced Sectorial Gamma Scanner (ASGS) provides measurement results with higher accuracy and higher sensitivity than the widely used Segmented Gamma Scanning (SGS) while maintaining a high measurement throughput.

activity. A new analysis routine ECIAD (Efficiency Calculation for Inhomogeneous Activity Distributions) was developed and the reconstruction method could be tested using simulated gamma spectra that were generated for an assumed hot-spot activity. The simulation shows, that with respect to SGS the conservative estimate for the activity can be reduced significantly using the ASGS method, in some cases even by a factor of 2. An ASGS system will be commissioned in the Technical Centre of AiNT, where the ECIAD analysis routine is integrated in a user-friendly operation software. The system will be used for validation of the measurement and analysis method, which is planned to be completed early 2020. The validation serves to verify the performance of the method, benchmark the system against SGS, and to support customers in qualifying the measurement system for the regulators' approval.

In the first phase of the development, a novel scanning method was devised which is based on sectorial scanning of the waste drum and an algorithm for spatial reconstruction of the nuclide-specific



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SPEAKER

THURSDAY 9:50 EN

Prof. Dr. Ralf Kaiser

Company Lynkeos Technology Ltd. No 11 The Square, University of Glasgow G12 8QQ Glasgow - United Kingdom

Website www.lynkeos.co.uk



SPEAKER

THURSDAY 10:15 EN

Dr. Cédric Carasco

Company Commissariat à l'Énergie Atomique Centre de Cadarache 13115 Saint Paul Lez Durance - France

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3D Imaging of Nuclear Waste Containers with Muography

Muons are fundamental, charged particles that form part of our naturally-occurring background radiation. They are produced in particle showers in the upper atmosphere from the impact of cosmic rays. These muons are incident at sea-level at a rate of about one per square centimetre per minute and with average energies of about 3 GeV, approximately four orders of magnitude that of typical X-rays. This allows them to penetrate thick shielding and in addition to their high energies, muons are highly penetrating and can traverse hundreds of metres of rock, which has opened up the possibility to use them for challenging imaging applications.

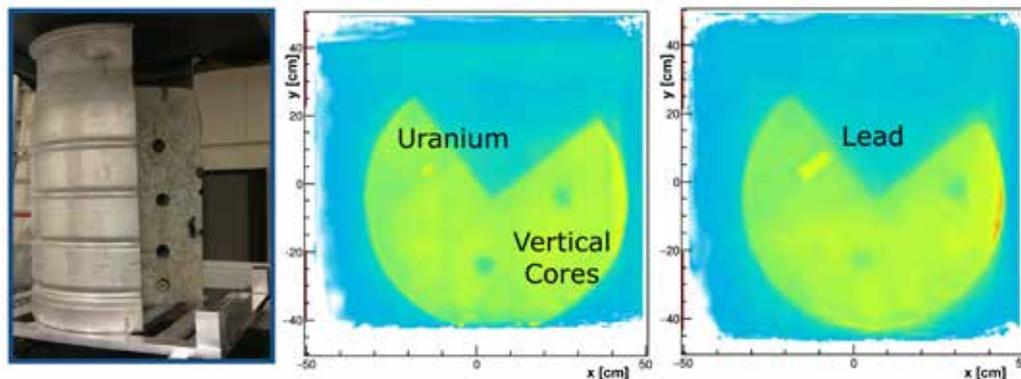
Due to the properties of Cosmic-ray muons, muon imaging, or muography, is especially suitable for applications that combine thick shielding with sufficient time available for measurements. Nuclear waste containers fit into this category very well.

The Lynkeos Muon Imaging System (MIS) uses scintillating fibre detectors read out with 64-channel Hamamatsu multi-anode photomultipliers for the

tracking of the incoming and outgoing muons. Two module above the active detection volume of about 1.5 m3 detect the incoming muons and two modules below then allow to see which muons have been absorbed and which ones have been scattered, and by how much. This information is used by our reconstruction software to form a 3D muon tomography image.

The Lynkeos MIS is the worldwide first, CE-marked muon imaging system for the characterization of nuclear waste containers. It has been successfully deployed on the Sellafield site in October 2018. Since then it has been used for quality assurance measurements on GeoMelt waste vitrification products. A new series of tests with future waste containers is about to begin this autumn.

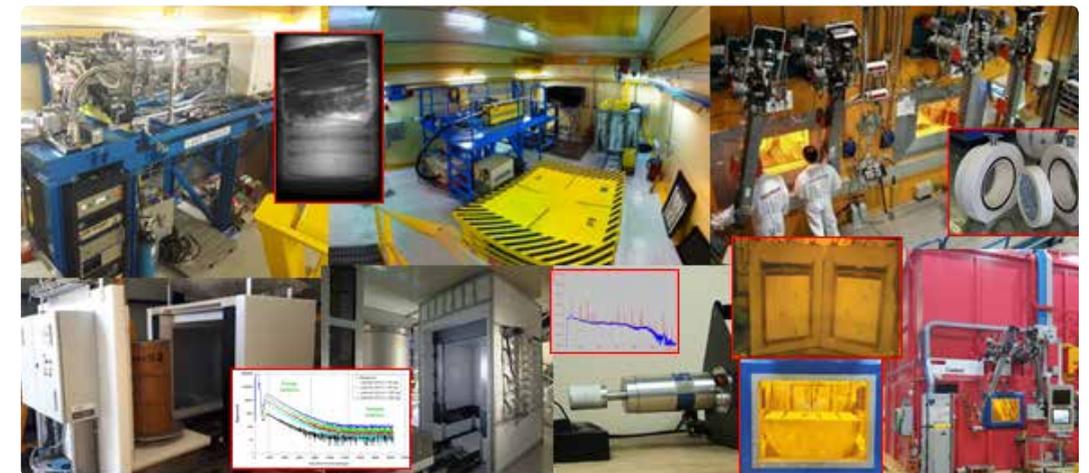
This talk will present the technology and the Lynkeos MIS as such, together with results from measurements on ILW drums and GeoMelt containers.



The Characterization of Radioactive Waste: A Critical Review of Techniques Implemented or under Development at CEA

In order to check compliance regarding existing regulations, CEA has developed a wide range of destructive and non-destructive techniques for the characterization of radioactive wastes. In particular, the use of linear electron accelerators allows performing high energy X-ray radiography and tomography of large and dense waste packages and opens the possibility to explore dual energy X-ray interrogation to build atomic number images. Another important capability of these accelerators is to allow photo-fission of nuclear material, which is today the only technique able to characterize uranium and plutonium in large concrete waste packages. On the other hand, passive and active neutron measurements

allow the measurement of nuclear material in smaller packages whereas destructive characterization of sampled wastes are performed to check the physical properties of the waste as well as difficult to measure radionuclides. The main approaches explored by CEA are presented as well as CEA measurement facilities and examples of applications.



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**SPEAKERS****THURSDAY 11:15 DE****Matthias Ruhl**

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**Dr. Jens-Uwe Schmollack**

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

**SPEAKER****THURSDAY 11:40 EN****Martin Lerche**

Company Fortum Power and Heat Oy  
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Website [www.fortum.com/nuclearservices](http://www.fortum.com/nuclearservices)

### Retrieval of Radioactive Waste from the Asse II Mine - Current Conceptual Design for the Storage Chamber 7/725

From 1967 to 1978, low and intermediate-level radioactive waste was stored in the former Asse II salt mine in Lower Saxony. Facing the singular challenge to retrieve radioactive waste from a mine which was dedicated for final storage, the four partners Uniper Anlagenservice, TÜV Rheinland, Deilmann-Haniel and Ercosplan Ingenieurgesellschaft have formed a consortium to develop on behalf of BGE a concept for the retrieval from 12 chambers on the 725 and 750 m level. The planning started for chamber 7/725 with in total 8530 drums of low level radioactive waste. The technical concept is divided in 3 basic parts and complemented by a radiation safety concept analysing operational conditions incl. occurrences as well as design basis accidents. In phase A all preparatory works, such as excavation of underground transport drifts and preparation of accesses to the storage chambers, installation of equipment for retrieval and for radiation protection equipment are planned. Phase B covers the real retrieval including uncovering radioactive waste from salt layers, unstick radioactive

waste and loading into liners, transportation to airlocks via a roof-mounted transport system (monorail), loading in qualified containers and further transportation to the hoisting shaft. Most of the work in phase B will be done remote-controlled. Phase C includes the dismantling of equipment used for retrieval and filling of emptied chambers. Radiation protection measures, contamination measurements of material/personnel and monitoring are indispensable part of the conceptual planning. A concept for ventilation of all areas including radiation protection areas has been developed. The technical concept combines existing and proven mining technology with the requirements of nuclear dismantling and radiation protection technology. It reflects current legal and safety requirements in mining and radiation protection as well as current standards of science and technology and is generally licensable in all aspects.



### An Advanced Concept for Radioactive Liquid Waste Treatment - Technology and Experiences

Fortum's NURES® technology offer solutions to treat radioactive liquid waste. The technology enables the treatment of active liquid originating from fuel pools, emergency cooling systems and storage tanks, as well as other liquid waste that has occurred in Nuclear Power Plants during operation. The water treatment solutions are flexible and can be scaled from small amounts of liquid waste to larger amounts up to 1000 m³/year capacity.

Fortum NURES® technology provide complete solutions to treat radioactive liquid waste originating from NPP's and nuclear research facilities. NURES® technology was originally designed for Fortum's fully owned Loviisa Nuclear power plant to remove cesium from evaporator concentrates. The NURES® pro-

duct family now consists of four main selective Treat products: CsTreat®, CoTreat®, SrTreat® and SbTreat®. The Treat products can be used in series and remove the most common nuclides in radioactive liquid waste, originating from PWR and BWR reactors. In addition to Nuclide removal, Fortum also provides boron removal from the liquid, with the BORES® technology. By combining NURES® and BORES® technology, radioactive liquid can cost effectively be decontaminated into a liquid, that can be released from surveillance.

The presentation will include a technical insight of NURES® technology and presentations of case studies.



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SPEAKER

THURSDAY 12:05 DE

Patrick Haaß

Company Nuclear Research and Consultancy Group NRG
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Website www.nrg.eu

Radiochemical Characterization: The Case of Ion Exchange Resins

The High Flux Reactor in Petten, Netherlands, is used for the production of medical isotopes as well as a material research reactor; during its exploitation several types of radioactive wastes are produced and accumulated.

That is the case in particular for the Ion Exchange Resins (IER) in use to treat the water of the primary water circuit of the reactor and the demineralizing basin. The Nuclear Research and Consultancy Group (NRG) is pursuing a policy of footprint reduction and waste volume minimization to achieve enhanced waste management and cost reduction. The treatment of the used resins has therefore been changed and the disposal route switched from cementation towards incineration.

Treatment and characterization of IER has already been practiced by several operating reactors, however the approach taken by NRG offers a combination of characterization techniques and the integration of some of the complex issues which have to be encountered in the waste management business:

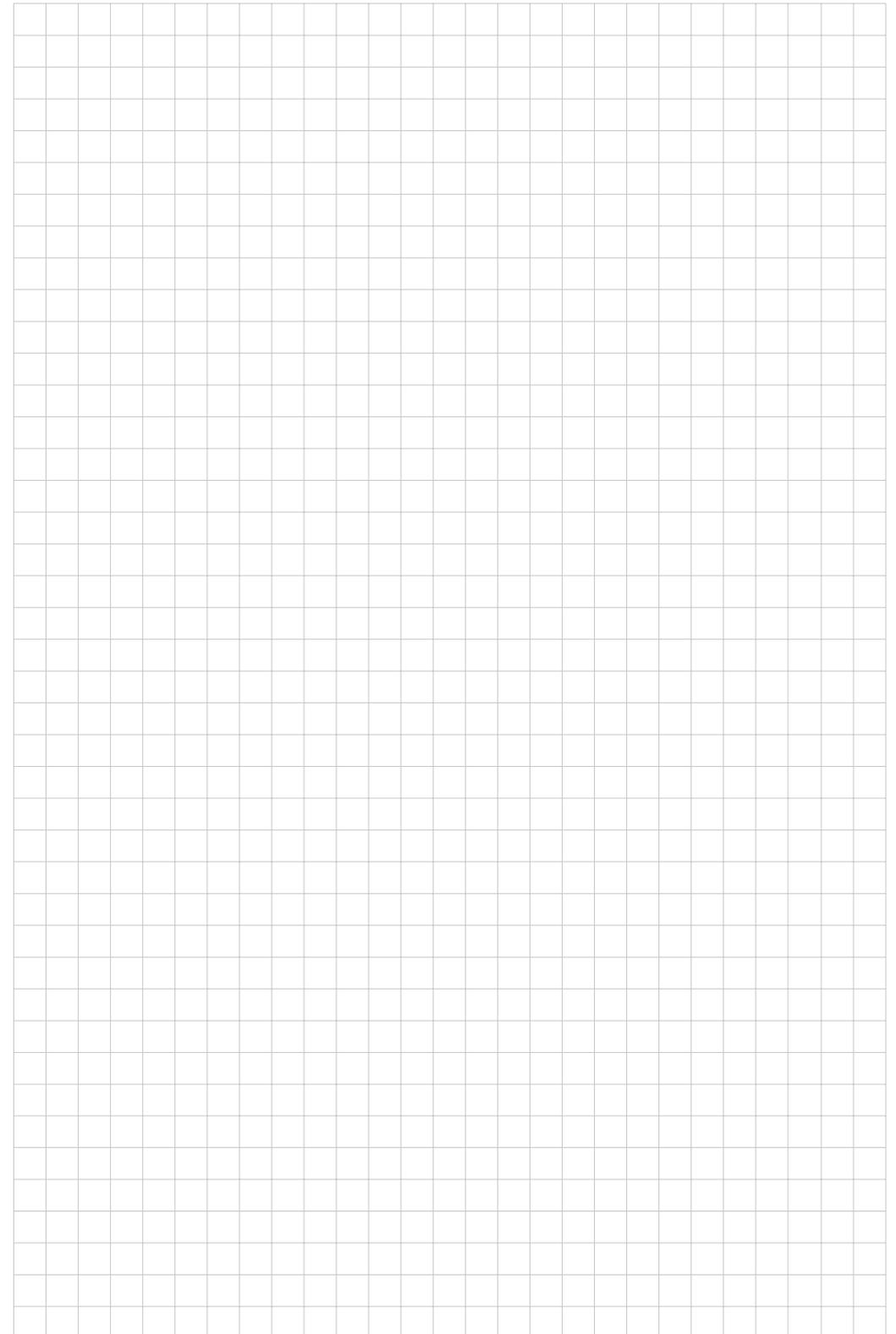
- Representative sampling/Homogeneity
• Nuclides analysis selection
• Homogeneity guarantee
• Analysis method
• Reproducibility

The required characterization is foreseen to be provided by the following methodology:

- 1. Non-Destructive:
• Gamma spectrometry (Specifically for Co-60 and Cs-137)
• Total alpha/total beta via Liquid Scintillation Counter
2. Destructive:
• Specific beta-emitting nuclide analysis
o H-3
o C-14
o Cl-36 (under advanced development)
o Fe-55
o Ni-63
o Sr-90
o Tc-99 (under advanced development)
• Alpha spectrometry

Destructive analysis, elaborated by the Consultancy and Services group, consists as a first step on a complete digestion of the resin to maximize the recovery of radionuclides. The desired radionuclides are chemically isolated by selective separations and extractions and later measured using a Liquid Scintillation Counter.

The results provided so far are fitting the profile of required characterization for both transport and incineration.



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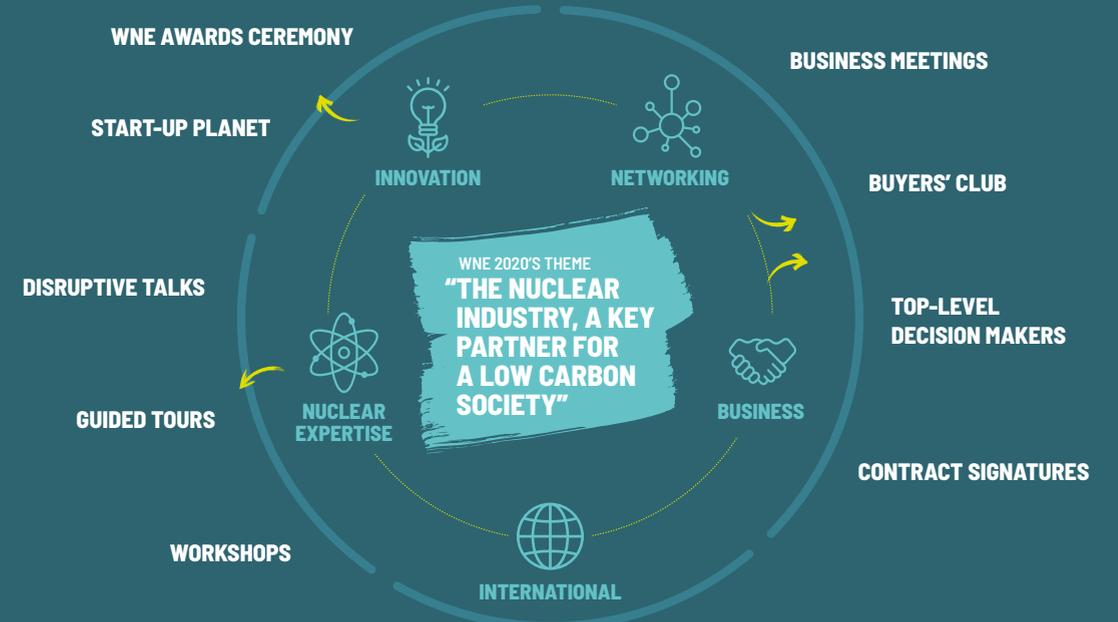
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## Competences in Nuclear Services

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.

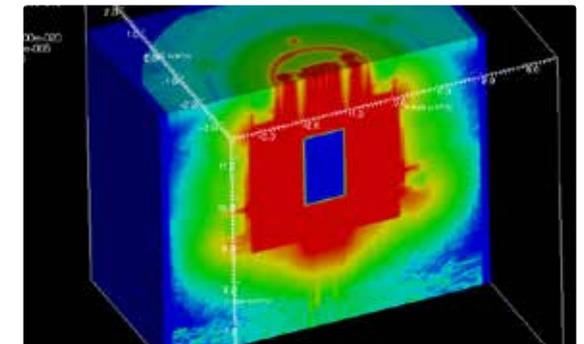
### DECOMMISSIONING STRATEGIES & PACKAGING CONCEPTION

- 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



*heavy transport - next level!*

## 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, ISO 14001:2015 and SCC\*\*: 2011 Version.

“If you intend to rebuild yourself, do it every day” has been our motto for 125 years.



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## Arbeitsschutz- und Umweltprodukte Work Safety and Environmental Products

ASUP GmbH - der Komplettausrüster für Sanierer und Entsorger - ist seit 20 Jahren spezialisiert auf Arbeitsschutz und Umweltprodukte. Durch Direct Sourcing in Asien und eine enge Zusammenarbeit mit den renommierten europäischen PSA-Markenherstellern erreichen wir eine maximale Produktverfügbarkeit zu allerbesten Konditionen. Wir sind der Partner für Industrie, Handwerk, Kommunen und Entsorgungswirtschaft. Mit mehr als 100 Mitarbeitern garantieren wir an fünf Standorten in Deutschland und der Schweiz Top-Service und maximale Sicherheit.

ASUP GmbH was founded in 1999 and has been specializing in the distribution of products and solutions in the field of occupational safety regarding the safe handling of hazardous materials for 20 years. As a partner for industry, trade, municipalities and

the waste management industry, and with more than 90 employees at four locations in Germany and Switzerland, we guarantee first-rate service and reliable security.

With our in-house representatives, we are able to respond to individual customer requests while ensuring high levels of product availability as well as reliable delivery. We have developed a portfolio of attractive private labels, and as a direct importer we can offer particularly favorable purchasing conditions to our customers for a large number of products. Our online shop is available to you 24/7.

In order to keep you up to date regarding the handling of pollutants, we offer a comprehensive training program at both the Seevetal location and nationwide, through a comprehensive training program.

ASUP Technik GmbH, our sister company also based in Seevetal, is an established full-service provider of protections for ships and against corrosion.



## 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 generating 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.



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Website www.automess.de



**Baltic Scientific Instruments, Ltd.**  
Ramulu Street 3  
LV-1005 Riga - Latvia

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Email sales@bsi.lv  
Website www.bsi.lv



## Automess GmbH

Our company has approximately 30 employees and has been active in development, production, and sales of nuclear radiation meters since 1970. Our main activity is development and production of portable radiation meters like Dose Rate Meters and Personal Dosimeters. With the various models dose rates in the range of 1 nSv/h (0.1 µR/h) to 10 Sv/h (1000 R/h) can be measured. Our robust, waterproof, aluminium die cast housings allow use of the instruments even in tough environmental conditions.

Our instruments serve radiation protection purposes in the fields of industry, research, working place safety, civil defence, disaster control, and fire brigades.

Many years of experience in the field of nuclear radiation measuring techniques has ensured a high level of development and production based on state-of-the-art technology. Already in the year

1978 we produced the Scintomat 6134A as the first portable, battery-powered radiation meter which was equipped with a microprocessor.

In 1984 we produced the Dosimeter 219.1 as the first Electronic Personal Dosimeter which was equipped with a microprocessor.

Where required and applicable, our radiation meters are PTB certified (Physikalisch-Technische Bundesanstalt, German National Institute for Standardisation).

In 1995 our quality management system was certified according to DIN EN ISO 9001 and KTA 1401.

Representatives in many countries ensure world-wide sales and service of our products.



## 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 semiconductor 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.



**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.



**Safe and Reliable Operation of Interim Storage Facilities**

BGZ Gesellschaft für Zwischenlagerung mbH (BGZ Company for Interim Storage) is a privately-organised federal company based in Essen, Germany, and guarantees the safe and reliable operation of the Ahaus and Gorleben interim storage facilities. On 1 January 2019, the approved, decentralised interim storage facilities at German nuclear power plant sites were also transferred to BGZ. From 2020 on, BGZ will also manage the twelve storage facilities for low and intermediate-level radioactive waste from German nuclear power plants. This means that in the future, BGZ will be fully responsible for all the interim storage of radioactive waste from the energy supply companies.

and for the disposal of radioactive waste were redefined at the end of 2016: This Act states that the operators of nuclear power plants are responsible for decommissioning and dismantling, as well as for the proper packaging of radioactive waste. The implementation and financing of interim and final storage is the responsibility of the Federal Government. The sole shareholder of the BGZ is the Federal Republic of Germany, represented by the Federal Ministry for the Environment.

The mandate of BGZ is derived from the Act on the Reorganisation of Responsibility in Nuclear Waste Management. The responsibilities for the decommissioning and dismantling of nuclear power plants

We are highly aware of our responsibility for safe and reliable interim storage – and we act accordingly. Safety in all areas, quality and reliability are our top priorities. To this end, we continuously improve the relevant safety and quality aspects in the planning and execution of our processes and services. We systematically record and evaluate relevant events in order to initiate appropriate improvement measures.



## 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.



## Brenk Systemplanung GmbH (BS)

BS has been active in the consultancy business for 40 years now. The services cover the areas of radiation protection, nuclear technology, software development, plant and process engineering as well as radwaste disposal, mining and environmental management. Founded at Aachen, BS has now additional branches in Hamburg, Bruchsal and Andernach, with about 50 engineers and scientists in total.

Our work in the nuclear field is executed under contracts mainly with the nuclear industry as well as with administrative bodies of the EU, international organizations like IAEA and OECD/NEA, national governments and responsible licensing authorities of Federal States of Germany. It covers all aspects of radiation protection, like dose assessments, activation and shielding calculations, calculation of dispersion of radionuclides in the environment, and a large variety of services in the area of decommissioning and dismantling, such as planning, execution of licensing procedures (both in the nuclear and the conventional sector), radwaste management, measurements, decontamination, clearance of materials and buildings and release of sites. We provide

a broad set of measurement devices for radiological characterisation and clearance, including nine in-situ gamma spectrometers, several laboratory gamma spectrometers, contamination monitors etc. Our extensive software packages installed at several NPPs in Germany support clearance processes considerably.

We also deal with NORM and radioactive materials discovered in scrap or waste loads. Our license for handling radioactive substances allows us to offer complete waste management solutions from a single source.

Our activities in the field of radwaste disposal cover the entire (project) life cycle of a disposal facility for radioactive waste: site selection, execution of (long-term) safety analyses, planning and construction as well as operation and management issues of repositories and their decommissioning and dismantling, both for deep geological and near-surface repositories.

Several of our employees are appointed members of advisory bodies like SSK (Commission on Radiation Protection) and ESK (Nuclear Waste Management Commission) as well as and of international working groups of IAEA, EU and OECD/NEA.



## Innovative Nuclear Measurement Systems

CAEN SyS, CAEN Systems and Spectroscopy Division, relies upon an extremely strong foundational knowledge of nuclear measurement instrumentation in developing Radiation Measurements Systems and Spectroscopy Solutions. These systems and solutions are perfectly suited to operations involving Nuclear Fuel Facilities, Nuclear Power Plants, Measurements Laboratories, and Security Applications.

CAEN SyS offers innovative nuclear measurement solutions based on cutting-edge technology. Our solutions are designed to enhance workforce safety, maintain the assets of a nuclear facility, and protect and safeguard the public and the environment both inside and outside a nuclear site. Effective environmental monitoring of a nuclear facility is the cornerstone of any high-quality early warning and detection system. CAEN SyS Systems and Spectroscopy division products have been designed to quickly identify a potential accidental release of radiation, thus ensuring safe operational conditions.

CAEN SyS Systems and Spectroscopy division offers a diverse array of innovative instruments and solutions ideally suited for several Nuclear Safety-related applications:

- Technology solutions for contamination assessment, pre-Dismantling, Decommissioning and Radioactive Waste operations
- Radioactive Waste digitization, tracking via RFID and
- spectroscopic processing monitoring (liquid and solid)
- Gamma Spectroscopy Systems: Portable & Laboratories
- Customized Nuclear Measurements Systems
- Mobile Laboratories for Environmental & Nuclear Emergencies
- Nuclear Fuel quality controls and characterizations



## Using 3D maps to find your contamination with Createc's N-Visage 3D Radiation Characterisation System

Createc is an innovative technology company using advanced imaging systems to solve decommissioning challenges in radiation characterisation and radiation protection.

The N-Visage system provides invaluable information for planning and managing decommissioning projects, saving time and reducing dose exposure for nuclear workers.

N-Visage instruments collect images, radiometric and 3D data from an environment - the right instrument is selected from the range, dependant on dose levels, man access, contaminations etc. The instruments can be deployed manually or remotely with ground and aerial unmanned vehicles.

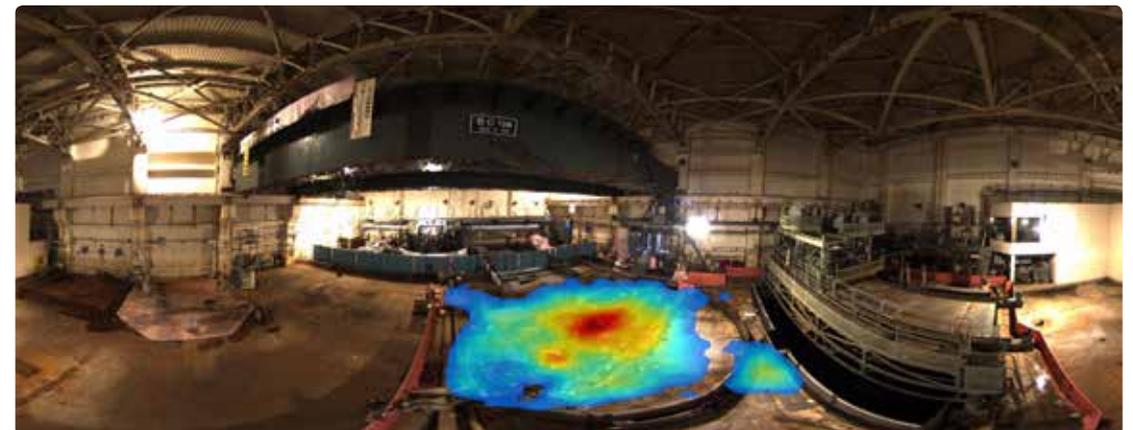
N-Visage Fusion software combines the data from the instruments to build up a 3D model showing the location of radiation sources on the model surface. Decommissioning scenarios can be modelled in the software showing the resultant changes in dose levels in the environment.

Createc is based in the UK and has been working with nuclear facilities in the UK, Europe and the USA, as well as a full programme at Fukushima in Japan.

Established in 2010 the company has combined decades of experience of the nuclear industry with exploitation of the latest technologies in sensors and applied imaging. The result is a range of products and technologies for radiation imaging, that can fully characterise even the most challenging environments.

Createc is also developing a next generation solution for robotics used in remote decommissioning.

The programme is called Elephants to Ants - rather than using huge demolition robots, the approach is to integrate a number of smaller robots in a flexible, dynamic way. Createc has demonstrated the potential of modular off-the-shelf units that can be rapidly and reliably reconfigured whenever unexpected challenges arise, as they always will. This will accelerate decommissioning and maximize re-use of technology across projects, sites and countries.





## Energieanlagen Greifswald GmbH (EAG) is an Internationally Operating Service Provider for Plant Engineering and Construction in the Conventional and Nuclear Sector

Energieanlagen Greifswald GmbH (EAG) is an internationally operating service provider and stands for comprehensive industrial plant and pipeline construction from a single source. Under one roof, we combine almost all disciplines for projects and services. Under the leadership of the company's founders, who together have more than 50 years of technical/commercial experience in a wide range of industrial sectors, our company employs more than 125 people at the German sites in Greifswald and Berlin.

An important business area is the dismantling of nuclear plants.

Thanks to the know-how acquired over many years in revisions in nuclear power plants and in various decommissioning projects, we are one of the German specialist companies that meet the high requirements for work in nuclear plants. This is also the support of the approvals in accordance with KTA 1401 and

§ 25 Strahlenschutzgesetz. In decommissioning, all contaminated components and materials are professionally dismantled by our experienced employees and fed to disposal or cleaning (decontamination) as radioactive waste.

We offer the following services:

- Engineering and project management
- Revisions in nuclear power plants
- Dismantling and disassembly of nuclear equipment
- Construction of supply systems and decommissioning systems



## Leading in Environmental Radiation Detection

For 30 years, our customers have been relying on ENVINET's solutions in monitoring environmental parameters. With over 4,500 online detectors in operation, we are the leading manufacturer of networks for the monitoring of environmental radiation.

ENVINET's products and solutions reflect the experience and innovative capacity of our team. Our name stands for top quality and both extremely reliable and functional solutions.

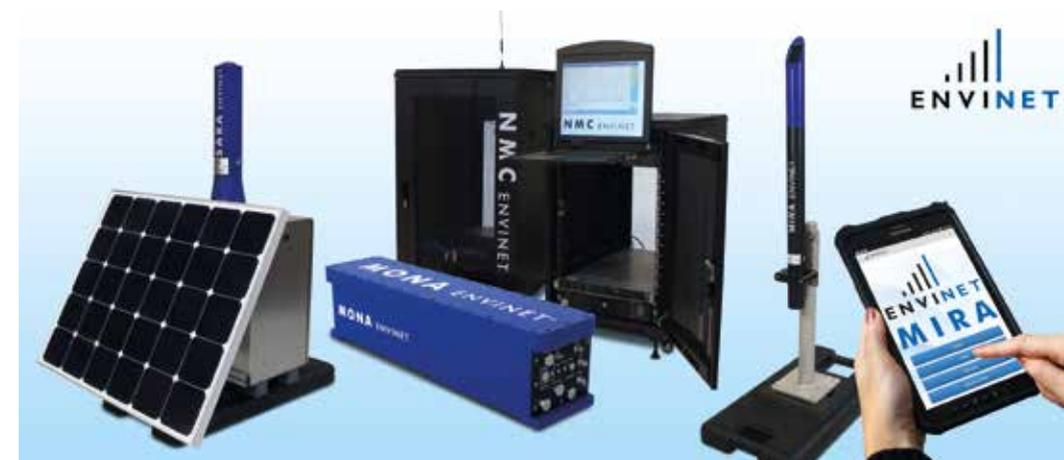
We create turnkey integrated solutions for radiation monitoring, especially:

- Nationwide early warning systems
- Ring monitoring systems around nuclear plants
- Area monitoring systems within nuclear facilities
- Water monitoring systems for use in either sweet or salt water

- Mobile solutions for the detection and localization of radioactive contamination
- Deployable probes for temporary dose rate monitoring in variable locations

ENVINET offers a full range of products from detector to central control and analysis software, including all required local services and training, thereby providing optimally configured functionality. We also offer a seamless integration with other systems for monitoring of non-radioactive parameters such as meteorological or air quality and decision support systems (DSS), providing a solid complete solution for on-line environmental monitoring.

Our solutions find an application in ensuring radiation safety and implementing radiation protection during decommissioning and remediation of nuclear sites.



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### Technology. Energy. Service.

Our diversity is what makes us unique: at ENGIE Deutschland GmbH, we combine competence from the areas of technology, energy, and service to create an overall portfolio which allows us to tackle even the most demanding tasks. Our well-founded knowledge in all areas of construction technology is the basis for our outstanding solutions in complex plant engineering and technical building management, and for innovative energy services in the areas of energy contracting, energy management, and energy efficiency. Our portfolio is rounded off by the competence in refrigeration technology offered by ENGIE Refrigeration GmbH.

We use our know-how, our technical infrastructures, and our individual services, to help our customers make their buildings, facilities, and core processes more efficient. This means: increased availability and greater quality whilst maintaining reliable operational readiness and improved flexibility - and without sacrificing the valuable cost advantages we offer compared to competitors.

The more than 100 years of experience that our companies boast, and the power of the global ENGIE Group make us a partner who knows how to best utilise energy every day - including the energy of the people working with us.



### Building services for NPP dismantling We are your partner 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 nuclear 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



## Nuclear Service Provider, Experienced in D&D

Tecnubel is a provider of integrated services for the decontamination and decommissioning of nuclear installations, with over 30 years of experience in providing advanced solutions for the nuclear industry.

We provide a wide range of services such as the maintenance and clean-up of nuclear installations, including waste management and decommissioning. Through our subsidiary Transnubel, we transport radioactive material and provide engineering services, including the design and construction of transport and storage containers. An example of this last is the developed and licensed high integrity cask CAROLINE. This is a new developed type B(U) packaging with a large cavity for the transport and (interim) storage of high activated radioactive material and/or waste. CAROLINE can be equipped with extra shielding and/

or drainage to also allow underwater loading. Next to this cask, dedicated manipulation and transportation means have been developed and are available.

We also support 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. Therefore, we rely on the Transnubel physical control department to circulate the principles of a good Nuclear Safety Culture throughout the complete organization. We also benefit 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. Moreover, as from the beginning of 2020, we will operate a prevention fire service at Doel. This service will be assured by a team of 40 Fire Safety Officers, operating 24h/24.

We 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, we received an operating license for a second installation located at Villers-le-Bouillet (close to the Tihange NPP), to decommission equipment and material from nuclear installations from Belgium, Germany and wider abroad. With these different installations, Tecnubel also has additional controlled areas for storing the equipment needed for overhaul of the Belgian and German NPPs.

With the successful decommissioning of the Belgonucleaire MOX fuel facility, Tecnubel was able to bring back into its teams experienced engineers and operators who are helping with the decommissioning of German nuclear installations such as located in Duisburg, Karlsruhe and Biblis.

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. We gained a lot of experience in D&D due to our active participation in planning and successful execution of decommissioning projects, such as the nuclear fuel factories Belgonucleaire and Framatome FBFCi in Belgium, as well as GNS in Duisburg, Germany. We own a wide range of materials and tools for executing D&D projects, including remote controlled equipment (robotized vehicles, electric and mechanical master/slave manipulators, etc.).



## More than 60 Years of Nuclear Experience by your Side

Tractebel provides a full range of engineering and consulting services. As one of the world's largest engineering consultancy companies and with more than 150 years of experience, it's our mission to actively shape the world of tomorrow. With about 4,400 experts and offices in 33 countries, we are able to offer you multidisciplinary solutions in energy, water and infrastructure.

For over 60 years, Tractebel has been developing reliable and innovative solutions in nuclear engineering. Our high-level engineering and consulting services offer added-value, with an uncompromising approach to safety, across the full lifecycle of nuclear installations, from design to decommissioning. Developing your decommissioning project cost-effectively.

We offer tailor-made and cost effective services for preparing the post-operational and decommissioning phases. We act as project manager or architect / owner's engineer to support the implementation of your decommissioning activities and to follow-up the execution. Our integrated approach encompasses safety & licensing, civil works, nuclear systems, mechanics and handling, radiation protection and waste management.

Our main services

- Inventory of Equipment and Structures;
- Radiological Characterization of Systems and Equipment;
- Design of Waste Management Facility dedicated to the processing of decommissioning waste;
- Definition of Decommissioning Scenarios:
  - o Selection of decommissioning techniques;
  - o Drafting of decontamination and decommissioning procedures;
  - o Feasibility studies for the removal of Large Components, including structural and lay-out studies, mechanical studies (e.g. pre-cutting activities, handling operations ... ) and definition of removal sequence and schedule;
- o Cost-benefit analysis & Schedule Optimization;
- o Evaluation of quantities of waste generated;
- Decommissioning Plans, Safety Analysis Reports, Environmental Impact Reports;
- Development of Decommissioning Radiation Protection/ALARA Program.

Developing your decommissioning project cost-effectively



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**fortum**

### Factair are a Market-Leading Manufacturer of Breathing-Air Systems and Test Instruments Specifically Designed for the Nuclear Industry and Available for Sale or Hire.

Factair is a specialist manufacturer of breathing-air systems for the Nuclear industry.

With over 40 years' experience in the design and manufacture of packages we can produce bespoke systems in portable, containerised and skid mounted formats to suit your requirements. These systems are available in self-contained diesel engine driven units or electrically powered versions. These systems are the ideal solution for nuclear decommissioning projects where a secure source of airline breathing-air is required for suit based work. Factair can offer these systems for sale or hire.

In addition to these Factair has a range of filtration systems which are able to filter compressed-air into breathing-air, well in excess of the requirements of EN12021:2014. These systems include optional temperature control systems to reduce or raise the breathing-air supply temperature and improve the comfort of suit wearers.

As well as breathing-air distribution systems Factair is a market leader in breathing-air quality test instruments. At this year's ICOND Factair will be showcasing its latest electronic air quality testing

instruments. These units, which are available in both portable and stationery continuous monitoring versions, provide accurate readings for a range of air quality standards including breathing-air to EN12021 (and medical and surgical air to HTM 02-01 / EU Pharmacopeia).

For portable instruments Factair offers the F8000 Safe Air Tester. Mounted in a PELI case this instrument tests electronically for VOC, CO, CO<sub>2</sub>, O<sub>2</sub>, H<sub>2</sub>O and oil aerosol with an Impactor. With a large 175mm touch screen colour menu driven display and rechargeable batteries/mains operated it can also continuously monitor and data log results for up to 3 months. Test results are downloadable as either individual test results or a data log file to PC software. The instrument will test against a range of international breathing-air standards or alternatively user defined criteria.

When the application requires continuously monitoring Factair offers the F8100 Safe-Air Monitor. This again tests electronically for VOC, CO, CO<sub>2</sub>, O<sub>2</sub>, H<sub>2</sub>O and oil aerosol with an Impactor. The instrument has a touch screen colour menu driven display and is mains power operated with rechargeable battery backup.



### Fortum – For a cleaner world

We are a leading clean-energy company developing and offering solutions for our customers in electricity, heating, cooling, as well as solutions to improve resource efficiency.

For the nuclear industry, we offer outstanding expertise and innovative solutions across technical disciplines and for all phases of the nuclear power plant life cycle. From the design and licensing of a new plant through safe operation of the nuclear power plant all the way to the decommissioning and final disposal of nuclear waste, our 40 years of experience gives us world-leading capabilities.

Expertise over the nuclear waste lifecycle  
As both a nuclear power plant and nuclear waste facility licensee and operator, we have unique experience in optimising strategies and solutions for nuclear waste management. We can help our customers to significantly reduce the waste volumes and waste management costs at nuclear power plants by optimising the entire process, from waste collection to final disposal.

We offer nuclear waste management solutions for new builds, operating nuclear power plants and plants under decommissioning. Tailored to customers' needs, the scope of our delivery can vary from small scale consultancy assignments to turnkey deliveries of waste management solutions.

Unique customer value by innovations  
Our proprietary technologies, like NURES® for nuclide removal, Apros® for dynamic process simulation, ADLAS® for licensing and ReMaint® for maintenance optimisation, enable us to deliver unique customer value and benefits.

We are also pioneers in the nuclear industry in the utilisation of 360° videos, digitalisation, virtual and augmented reality in our daily work to boost efficiency of power plant maintenance, as well as engineering and personnel training.





**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, and fuel and instrumentation and 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 improve the safety and performance of their nuclear plants and achieve their economic and societal goals.

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

Framatome in Germany also offers a competitive solutions portfolio for the post-operational-phase and dismantling of nuclear power plants which contains: studies, engineering, system decontamination, sampling, characterization, radiation protection, waste management, waste treatment and backfitting of (mobile) operating systems.



**HEBETEC Engineering Ltd - 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



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Website www.konecranes.com/industries/nuclear



### Track your Nuclear Waste, Everywhere it Goes

JE Project is a tech company providing you with the right tools that will make your work easier and more efficient.

We have developed and pioneered a tracking system that can be used in all types of industries. Our tracking system is real-time, accurate, highly customizable, fully scalable and cost efficient.

Through our Intelligent Locating System, you can track in real-time all the stages of nuclear waste disposal flow, ensuring the management of the nuclear waste complies with the requirements of the national safety regulations. You can also monitor the mobility of your personnel to make sure they achieve the standards required for their position (ALARA).

Our software can send daily email reports of waste and personnel movements, which are specifically designed to cover your needs.

It can also be used for:

- Avoidance collision
- Geo fencing
- Visitor/Personnel security
- Real-time tracking of waste, personnel, visitors, equipment, forklifts, inventory
- Ensure everything is in the right place at the right time

- Personnel behavior analytics
- Improve processes
- Area monitoring
- Test emergency protocols
- Provide access control in high-security and restricted areas
- Track multiple fast moving objects in real-time (forklifts)
- Materials handling

JE Project can also create custom software adapted to your business workflow. We build quick, easy to use and robust databases, which provide key information in real time to personnel in order to maximize their time and efficiency. We also automate many systems and procedures, saving you time and money.

Our software can communicate with other databases and IoT devices, making them adapt seamlessly to your everyday environment.

Feel free to contact us at [info@jeproject.gr](mailto:info@jeproject.gr)  
- share your vision and speak about your needs.

**Our job is to find the perfect solution for you!**



### 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.



ABOUT ICOND

PROGRAM

ABSTRACTS

COMPANY PROFILES

**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)



**Process Instrumentation, Measurement Solutions and Services for safe Operation and Decommissioning**

In nuclear facilities and nuclear power plants, process instrumentation has a very important role: the functional safety and accuracy of measurements in the process is essential for a safe and efficient operation during decommissioning phase. Founded in 1921 and headquartered in Duisburg, Germany, KROHNE is one of the market leaders in industrial process measurement technology with over 3,900 employees worldwide.

Our Nuclear Industry Division comprises a dedicated team of engineers and technicians that develop process instrumentation and measurement solutions specific for nuclear projects with a high level of safety consideration in all project procedures. We offer proven designs and engineered solutions for flow,

level, temperature and pressure measurement for nuclear island as well as for turbine island e.g. steam/water cycle systems, cooling systems, emergency power generation or auxiliary systems. Our product range includes dedicated devices resistant to radiation and/or seismic. We also provide complementing project management, design and calculations, qualification, testing and documentation services.

KROHNE holds all relevant approvals and certifications for design, manufacturing and testing of instrumentation for nuclear power plants (e.g. ASME Section III, RCC-M) as well as qualifications and test reports according to IEEE 323, IEEE 344, and RCC-E for safety-related applications.



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### Lynkeos Technology is the first Company Worldwide to Commercialise Muon Imaging for the Characterisation of the Contents of Nuclear Waste Containers.

Lynkeos Technology is an award-winning spin-out from the University of Glasgow, founded in August 2016 to commercialise its novel Muon Imaging System (MIS). We have designed, developed and demonstrated this state-of-the-art, passive 3D imaging system for use within the nuclear industry. Lynkeos is the first company in the UK, and one of only six companies worldwide, developing this innovative 'muography' technology that uses naturally-occurring background radiation to inspect the contents of complex structures. Lynkeos focuses on nuclear waste characterisation, civil engineering structural health inspection and monitoring, nuclear safeguards verification and energy asset decommissioning as the commercial applications for its technology.

The MIS locates, identifies and produces accurate 3D images of materials and voids present within dense and/or shielded structures such as nuclear waste containers and reactors, masonry bridges and civil infrastructure. The imaging results are used for risk evaluation to

underpin industrial safety cases, quality assurance and preventative maintenance planning. There is currently no other practical means of producing this information without the use of very high levels of artificial radiation, destructive intrusion or manual intervention.

Lynkeos has developed a full-scale MIS and successfully demonstrated its ability to provide high-resolution 3D imaging of small fragments of uranium within shielded, concrete-filled containers. The technology has been developed through seven years of collaborative funding totalling £4.8 million from Sellafield Ltd. on behalf of the Nuclear Decommissioning Agency (NDA) and in collaboration with National Nuclear Laboratory (NNL). Manufacture, accreditation and deployment of a CE-certified MIS to the NNL Central Laboratory facility at Sellafield was undertaken in 2018 through a £1.6 million First-Of-A-Kind Deployment of Innovation contract with Innovate UK. This is the first deployment worldwide of muon imaging technology within the civil nuclear industry.



### Design, Manufacture, Installation and Commissioning of Overhead Travelling Cranes. We also Carry out Upgrades and Refurbishments of Existing Cranes. Design and Manufacture of Bespoke Lifting Frames and Beams.

Mona Lifting Ltd have manufactured innovative lifting and engineering products for the power and manufacturing industries since 2004. Specialising in the design, manufacture and installation of overhead cranes and providing bespoke lifting and engineering solutions. Due to demand in 2011 we moved into a new 17000 square foot engineering workshop with 4 acres of yard space to cope with the increasing work load and scale of the components manufactured. We currently have 28 employees.

We have also invested in an 800 cubic metre heated and filtered spray booth, to complement our 400 cubic metre abrasive blast cleaning room which is the largest facility in the area. Ever since the formation of the business we have worked extensively in the Nuclear and Power generation sectors so it has been essential to have our quality management system accredited to ISO 9001-2015 and our welding production system accredited to

BS EN 1090 Welding fabrication of steel structures to Execution Class 3.

We have also started the Fit4Nuclear process. Our site personnel hold full CTC Security clearances and are Radiologically Classified Workers. We can now boast that companies such as Magnox, Engie, Cavendish Nuclear, Magellan Aerospace, James Fisher Nuclear, URENCO and ABB to name but a few are amongst our client portfolio.

We have worked throughout the UK on various nuclear sites, Berkeley, Oldbury, Sellafield, Wylfa and Trawsfynydd. We are currently Manufacturing a 105 Te SWL C Hook which will be used to lift sections of the Hadron Collider at CERN, Geneva and have won the contract to design, manufacture and install remote handling cranes for James Fisher Nuclear at Winfrith.



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

Mirion Technologies is a leading provider of innovative products, systems and services related to the measurement, detection and monitoring of radiation.

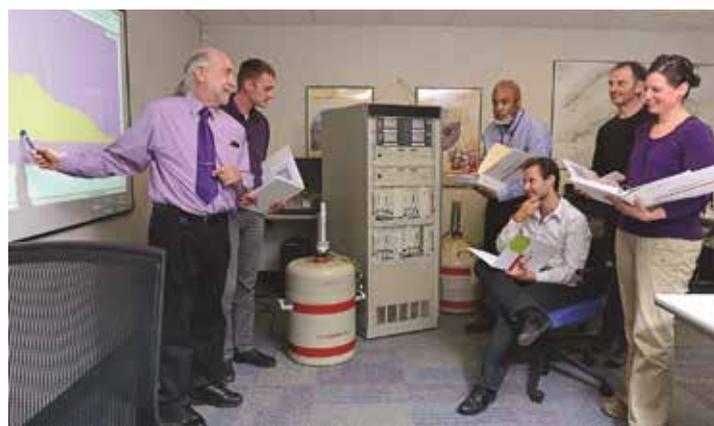
As a global leader in radiation measurement, the mission is driven to protect people, property and the environment from the harmful effects of ionizing radiation.

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

For decommissioning of nuclear facilities Mirion provides innovative solutions for contamination monitoring and waste characterization.

One of the core products are Non Destructive Assay Systems. These systems allow characterization of high radioactive as well as intermediate and low activity waste.

By applying the state of the art of technology and science and following the customer's needs, these products are constantly developed further to provide always the best solutions.

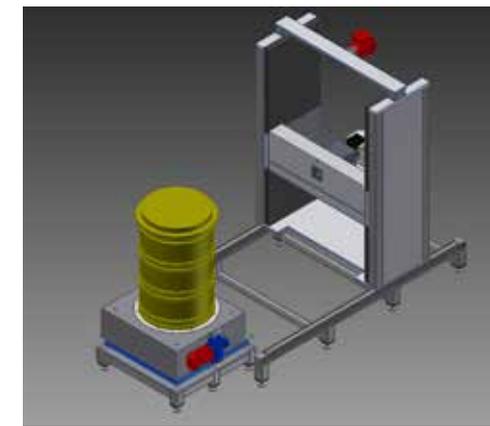
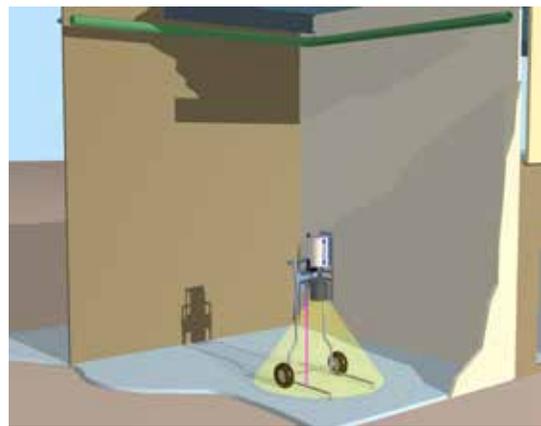
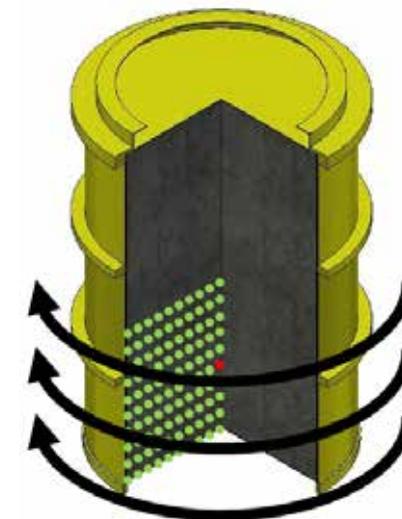


We develop advanced and innovative tools that meet or exceed your needs, focusing directly on the success criteria for the D&D projects such as acceleration of site clean-up, minimization of waste volumes or reduction in waste sentencing costs.

As automatization plays an important role in our daily life, robotic solutions will also be a part of our D&D solutions.

Another key part of Mirion is our service team which supports our customers with innovative solutions and

provides services such as maintenance, training and application support. The service team also supports approval processes for new systems and provides full support for the implementation of regulatory needs.



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Website www.nrg.eu



## Mott MacDonald - a Global Engineering, Management and Development Consultancy Opening Opportunities with Connected Thinking

Mott MacDonald is a global engineering, management and development consultancy. We are employee-owned with around 16,000 staff operating globally.

Within the UK nuclear decommissioning sector, we are a delivery partner and supplier to Sellafield, Magnox and Dounreay. We provide programme, project and commercial support to key programmes and engineering design for many facilities which handle, package and store radioactive wastes.

Our dedicated multidisciplinary teams have the all-round skills and deep subject knowledge to deliver full lifecycle services within the nuclear sector. Our decommissioning capabilities are based on a continuous track record in the UK nuclear sector that extends over a 30-year period. Our programme and project managers, commercial managers, project controllers, engineers and environmental experts have taken lead roles in the world's highest profile infrastructure and

development projects. Whatever you need, you can be confident that Mott MacDonald will find efficient and creative ways of meeting your ambitions.

**Consultancy Services:** We provide technical, commercial and financial advisory services along with P3M transformation, organisational development, governance and assurance, helping to enable major programmes.

**Delivery Partner Services:** We provide programme, project, commercial and construction management as well as the full suite of project controls required by complex programmes.

**Engineering Services:** We manage and develop conceptual engineering solutions and provide end-user focused designs covering every aspect of nuclear engineering. This delivers world-class safety, environmental, technical and security performance.



## NRG | Ensuring Nuclear Performance - Your Partner in Decommissioning Projects

NRG unites over 60 years of nuclear engineering, research, and 24/7 operational reactor experience into one unique purpose: the safe reliable and efficient utilization of nuclear technology. With over 650 highly qualified engineers, consultants, and operational staff and our unique nuclear infrastructure in The Netherlands, we give customers and partners access to the best expertise and extensive experience.

We are involved in legacy waste and decommissioning projects. Covering the whole cycle from waste retrievals and repackaging to safe storage. We are internationally recognized for supporting decommissioning projects and for our material characterization expertise. We design sampling tools to retrieve high and medium active samples and transport them to our laboratories for further characterization and analysis.

Our promise to our customers: We strive to be at the forefront, a visionary and innovator in the advancement of nuclear technology. We invest a significant amount of time and resources in research and development to continuously improve nuclear safety, to optimize the use of nuclear assets and to reduce the nuclear footprint for next generations.

We are happy to meet you during ICOND in booth CAT1 #04



## Your Radiation Shielding Production Facility

Nuclear Shields is a manufacturer of radiation shielding based in the Netherlands with more than 40 years of experience. The production facility is designed to meet the requirements of long term serial production and one-off custom projects.

Lines of communication are short due to our small team of sales and engineering personnel. The focus on good and fast communication with the client helps us improve our services every day and makes sure the customer is satisfied.

Our production facility includes all departments needed to fully complete long term serial production and one-off custom projects. Departments include:

- Lead casting department
- Full CAD/CAM design
- CNC machining department (5-axis, milling and turning)

- Spray-painting department
- Assembly department
- QC department, including CMM and gamma cameras

Next to the standard solutions, we manufacture radiation shielding solutions based on customer specific requirements and drawings. Communication lines during this process are short to make sure all needs are satisfied. Our standard products can be found on our website.

We manufacture a wide array of radiation shielding solutions, such as:

- Nuclear waste containers / casks
- Shielded glove boxes
- Shielded shutters
- Shielded storage boxes
- Custom lead parts



## NucTecSolutions GmbH - Radiation Protection, Decommissioning and Emergency Management

NucTecSolutions GmbH was founded in 2006 as a radiation protection services and demolitions company. As a multidisciplinary service company, NucTecSolutions GmbH has the possibility to provide services of all kind with radioactive substances in all areas. Due to the unique company structure, we connect planning and project planning with the targeted implementation on site with a precise working team of young, technically competent employees.

Our Developments in measurement technology, handling techniques and decontamination processes, together with our own infrastructure, like many analysis- and mobile-units, as well as a first-class trained team, allow projects to be efficiently interlinked. This combination provides a efficient service in radiation protection, decommission and renovation at the highest level of cost effectiveness. A direct connection between planning, radiological analysis, the actual dismantling, decontamination and measurement

for the release of radioactive material is quite usefull for small- to medium-sized projects.

Our main services are:

- Dismantling and decommission
- Waste treat management
- Decontamination and measurement of large surfaces and buildings
- Radiation protection engineering
- Project engineering

After several incidents, NucTecSolutions GmbH decided in 2014 to include services for nuclear emergency into the portfolio. Since 2019 the services for nuclear emergency are outsourced to the newly established SENS (Special Forces Nuclear Safety) to further improve the capabilities to handle nuclear emergencies.

NucTecSolutions GmbH stands for high-level radiation protection combined with efficient dismantling.



## 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 OHSAS 18001:2007. 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)



## The Core Team of Nuclear Experts

Platom Oy is the leading private nuclear expert in Finland that provides expertise and excellent products for the nuclear industry. What makes our know-how special is that we work within one of the most strictly regulated environments in the world. In addition, we are passionate about our work and strive to continually grow as experts and provide the best customer experience to our clients.

Our mission is to increase the cost-efficiency of our clients by executing challenging projects in schedule and offering all nuclear expert services from one provider. Platom's organization of around 60 highly motivated employees possesses knowledge and experience in a wide variety of related areas, such as Radioactive Waste Management, Decontamination, Decommissioning and Dismantling, Engineering and Equipment Deliveries, Radiation Safety and Protection, UF6 Solutions: Autoclaves and Auxiliaries, Licensing Management and Qualification & Safety and Process Analyses.

Our customers include nuclear power plants, research centres and waste management facilities in Finland and abroad. We have for example designed and delivered:

Waste management systems and apparatus for solid and liquid radioactive waste, cleaning equipment for the reactor cavity and the spent fuel transport cask, autoclaves for legacy waste treatment and nuclear fuel fabrication & dismantling of contaminated waste systems.

Our engineers and experts work together to create the safest and most cost-effective solutions for our customers. The knowledge of the entire organization is available for each project, ensuring the best possible outcome.



## Specialist for Decommissioning and Waste Management in Nuclear Facilities

ROBUR ENERGY is part of ROBUR, an industrial service provider with more than 2,000 colleagues. With more than 25 years of experience as a successful service provider and about 250 employees we support nuclear power plants, nuclear facilities and manufacturing firms. Experienced, specialized teams for maintenance, inspection, decommissioning and waste management, as well as our well-established proprietary EAM software (incl. operations management/waste tracking systems for NPPs) ensure successful projects.

Regarding the NPP services we are focused on following services:

### Post-operation & dismantling

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

### Handling and conditioning

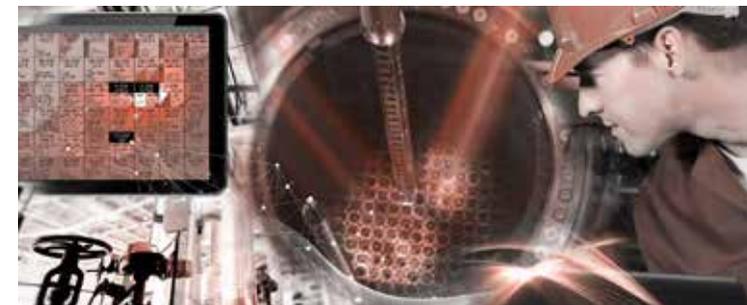
- Disassembly and sorting of contaminated waste with consideration to nuclide vectors and acceptance criteria
- Assessment and radiological characterization of historical waste according to waste disposal legislation
- Conditioning and waste package production for the final repository, incl. disposal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

### Waste management

- 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

### Extract of our certificates

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



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## SENS (Special Forces Nuclear Safety) – Nuclear emergency preparedness and response

NucTecSolutions GmbH has founded the rapid task force SENS due to several incidents involving radioactive substances.

SENS benefits of the know-how, first-class personnel and equipment from the NucTecSolutions GmbH. The focus of the SENS is the development of decontamination methods, as well as decontamination and the measurement of radioactive substances after an accidental spread in buildings and urban terrain.

Specially developed systems, such as mobile negative pressure maintenance, mobile fully automated environmental monitoring system and mobile waste treatment stations are just a few components for the accident-related handling of radioactive materials. In areas without any infrastructure, you can easily attach our radiation

protection systems to buildings. Since our components are built as dual systems, it is also possible to easily set up adequate infrastructure for normal dismantling.

The combination of continuous activities in radiation protection, decommissioning activities and nuclear emergency protection is optimal for the NucTecSolutions GmbH and the SENS, since in case of emergency there is sufficient material, measurement equipment and a well trained team available for deployment. As for the dismantling, a team with emergency protection experience in case of unpredictable events during work, is quite reasonable.

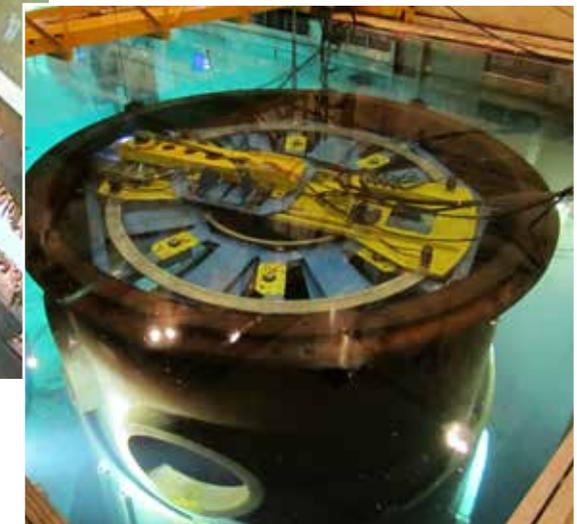
For further information, visit us at [www.sens.bayern](http://www.sens.bayern)



## SIEMPELKAMP NIS - Solutions and Service for Decommissioning of Nuclear Facilities



Thermal Cutting Sequence of the Reactor Vessel in the Core Zone



Execution of Remote Controlled Disassembly, Segmentation and Packaging of the RPV Internals

Siempelkamp NIS with headquarter in Alzenau, Germany, is one of the major international companies in the nuclear decommissioning market. Especially in the disassembly and packaging of RPV and RVI components Siempelkamp NIS has made a name.

The dismantling of radiologically contaminated large components is one of the most complex and difficult tasks within the decommissioning of nuclear facilities. Therefore Siempelkamp NIS offers consulting, planning, production, installation and service on site for decommissioning of large components.

With its innovative segmentation strategies and cutting tools, Siempelkamp NIS has successfully implemented national and international dismantling projects in recent years. This applies to the segmentation of RPV on air as well as for the segmentation of RPV internals under water.

## Pioneering Coupling Systems for Nuclear Applications

The functional safety of coupling systems plays a crucial role in both, the operation and decommissioning of nuclear power plants. As the world's leading supplier of connection technology, Stäubli Connectors can now offer safe and reliable quick and multi-connect couplings for all applications in the nuclear industry.

Stäubli, founded in Horgen, Switzerland in 1892, a time at which the use of nuclear technology was still a distant prospect, is now an international group headquartered in Pfäffikon, Switzerland. More than 5,500 employees work in the three business divisions of Connectors, Robotics, and Textile. With 14 production facilities, sales and service offices in 29 countries, and even more agencies in 50 countries, Stäubli is close to its customers around the globe. This worldwide network guarantees short delivery times and optimal customer service.

As a subsidiary for Germany and Austria, Stäubli Tec-Systems GmbH in Bayreuth, with its Robotics and Connectors divisions, is one of the most important companies within the Group. Stäubli Connectors has made a name for itself as the world's leading manufacturer of quick couplings, multi-coupling systems, and tool-changing systems. Operating and functional safety, service life, efficiency, as well as economy and sustainability distinguish Stäubli's coupling technology.

The Connectors complete program includes advanced connection solutions for liquid media, gases, and electrical energy. Each Stäubli component, including mono-couplers, electrical connectors, and multi-coupling systems for all energy sources, is based on components of exceptional quality and impresses with its first-class workmanship. These solutions set standards in terms of reliability, efficiency, performance, and

ergonomics, while increasing productivity and guaranteeing maximum operational safety at the same time. This is one of the reasons that major operators in the nuclear industry around the globe rely on Stäubli.

Developing and producing high-performance solutions for user-specific tasks is part of the Stäubli strategy. As a reliable partner of the industry for more than 60 years, the experienced Stäubli professionals know the conditions and expectations in the nuclear industry very well. This expertise can be seen in every coupling.

Proven solutions for almost every application.

Any leakage can have unintended and potentially fatal consequences – be it an environmental disaster or a contamination risk for employees. The reliability and durability of the Connectors solutions ensure the highest level of security, so that fitters can work on the equipment with confidence and operators can rely on maximum security.

Stäubli quick couplings and multi-couplings can be found in all sectors of the nuclear industry, be it in breathing-air supply, remote handling, or dismantling and disposal. Remote handling is supported by specially designed couplings that can be easily operated with gripping systems. In addition, couplings can be found on containers for low and medium active waste. Here, the first-class components ensure tightness and safety.

The series of application examples could be extended at will. In any case, Stäubli is very familiar with the stringent equipment and design standards in the nuclear industry. Thanks to the expertise of the entire Group, tailor-made solutions can also be implemented to meet user-specific requirements.



### Waste management

Quick connectors for filling, draining and venting on liquid effluents, as well as for leak testing and gas overlaying. (barrels, containers, tank trucks)



### Breathing air

Products for safe and reliable breathing air supply. Direct connection from personal protective equipment to breathing air network



### Remote handling

Specifically designed quick-release couplings for remote handling of circuits in hot cells and glove boxes.

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### Sweco is an International Consulting Company Offering Services in the Fields of Consulting, Engineering, Environmental Technology and Architecture. We are No. 1 Architecture and Engineering Consultancy in Europe.

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, who and when. Visualization of the present, options and what-if scenarios, makes the digital twin a powerful tools for optimization, making informed decisions and ensuring compliance as well as safety.

SMART SOLUTION FOR NUCLEAR DECOMMISSIONING - Digital Twin Platform for Decommissioning Planning and Execution

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 of the plant. This usually is a very time-consuming manual process but with Sweco's AI solution we can speed up the process and create digital twins to the required level of detail.

- Deliver Business Success: Optimize planning, costing, verification, simulation, execution and tracking of decommissioning using 3D and augmented/virtual reality
- Going Beyond Compliance: Up to date and visual information that is easy to understand and use for training, risk management and safety planning
- Circular Economy Leadership: Enables maximizing of deconstruction waste recycling, turning recyclable deconstruction waste also into value



### Thermo Fisher Scientific - Optimizes Radiation Safety, Operational Efficiency and Regulatory Compliance

Thermo Fisher Scientific Inc. is the world leader in serving science, with revenues of more than \$24 billion and approximately 70,000 employees globally. Our mission is to enable our customers to make the world healthier, cleaner and safer.

From routine monitoring in the nuclear industry and surveillance to emergency response situations, Thermo Scientific™ advanced, integrated radiation detection and radioactivity measurement instruments mitigate the threat and keep you and your workforce safe. Our product portfolio of radiation detectors, radiation monitoring devices, and radiation measurement instruments provide comprehensive, real-time monitoring, early warning, and complete information in the palm of your hand, in the work place, and in your neighborhood.

Our radiation monitors support your challenges in decommissioning of nuclear plants and waste management in a practical and safe way. Among others, we offer contamination monitors, neutron flux monitoring systems, portable devices, area monitors, vehicle monitoring systems, passive and active dosimetry solution developed and produced at our manufacturing sites in Erlangen, Germany, Oakwood/Ohio and San Diego California in the United States.



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### TS Quadrat GmbH - Your Strong Partner for Nuclear Technology / Waste Management

TS Quadrat GmbH - formerly Liese GmbH - is an engineering specialist for materials handling technology and special system construction.

We provide in-depth, comprehensively planned and documented systems or components for safely handling radioactive waste. These include:

- Conveying and handling systems for drums, pellets and containers
- Gamma measurement stations in cooperation with Marschelke Messtechnik (software engineering) and ORTEC® AMETEK® GmbH (nuclear instrumentation)
- Drum and pellet scanner
- Cementation
- Supercompaction
- Filling stations

- Lidding stations
- Weighing systems
- Gantry crane systems
- System control solutions and monitoring
- Special processing plants

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

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

For more information, visit [www.tsquadrat.com](http://www.tsquadrat.com)



### 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 zur richtigen Zeit am richtigen Ort hat.

Seit 2012 bietet die UniTech Service Group auch einen Gerüstmonitoring- und Dekontaminations-service an. Für weitere Informationen zu unseren internationalen Kapazitäten besuchen Sie bitte unsere Website [www.unitech.eu](http://www.unitech.eu).

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

UniTech bereitet derzeit den Bau einer neuen Verarbeitungsanlage im französischen Haute Marne vor, die im November 2019 eröffnet werden soll. Diese Anlage wird zusätzlichen Service-Support durch einen eigens errichteten Zwischenlager- und Leasingbereich für kontaminierte Materialien und eine eigene Arbeitszone für TMD-Arbeit bieten.



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## VPC GmbH - The Energy Experts

For more than 50 years, VPC has its roots in power and heat generation and distribution and has made a significant contribution to the reconstruction of the East German energy landscape. Even today, VPC is the first address for cost-efficient operation or pragmatic new construction or conversion of fossil energy producers.

VPC has been dealing with the effects of the energy turnaround on the power plant park for a long time and has built up expertise in renewable energies such as hydropower and biomass in good time. Especially for the new challenges of combined heat and power generation in a highly volatile electricity market, VPC develops clever plant concepts with heat storage units, power-to-heat plants and flexible CHP plants.

Its main customers include electricity and heat suppliers as well as grid operators. The company's long-standing customers also include well-known power plant suppliers and general contractors, ministries, research institutes and international development banks.

In addition to the consideration of pure energy supply, our customers expect more and more system solutions. This is why VPC has been a member of the Dornier Group since 2019 and thus also serves energy-related tasks in the important infrastructure areas of mobility, aviation, water and real estate.

VPC's success has been shaped to this day by its 250 employees spread across several locations worldwide.



## VTT is a visionary research, development and innovation partner, focused on technologies that go beyond the obvious.

VTT Technical Research Centre of Finland (established 1942) is the leading multidisciplinary research, development and innovation company in Northern Europe. VTT has a solid track record in supporting nuclear power plants as well as regulators internationally. VTT is well networked, e.g. a founding member of NUGENIA.

VTT has unique experimental and computational infrastructure, and profound expertise in a wide variety of technologies as well as cognitive sciences. The topics of VTT's nuclear services include plant lifetime and cost optimization, structural safety and integrity, material characterization and testing, risk-informed inspection, NDE methods, safety analysis and licensing support, digital I&C, control rooms and human factors, and organization safety culture. Our new hot cell facilities were commissioned in 2017.

VTT has been instrumental in supporting radioactive waste management solutions in Finland for many decades, including implementation of the world's first high level radioactive waste repository to be granted a construction license. VTT has operated Finland's FiR1 research reactor, which stopped operation in 2015 and is in the process of decommissioning. VTT has developed our own technologies to aid in safe and efficient decommissioning and waste management practices.

One of VTT's key strengths is the capability of combining expertise within the organization. We welcome discussions with us also on such diverse topics, e.g. wireless technologies, cyber security or virtual and augmented reality.



## Welsh Government

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Llywodraeth Cymru  
Welsh Government

## We are the Devolved Government for Wales – Responsible for Key Areas of Public Life such as Health, Education and the Environment

The Welsh Government consists of:

- the First Minister
- Welsh Ministers
- the Counsel General

They are supported by civil servants who work across devolved areas that include key areas of public life such as health, education and the environment.

Wales has its own government, making policies and laws for our country.

We are working to help improve the lives of people in Wales and make our nation a better place in which to live and work.

Our responsibilities include:

- education
- health
- local government
- transport
- planning
- economic development
- social services
- culture
- Welsh language
- environment

