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ICOND

International Conference on
Nuclear Decommissioning

7th
Edition



BOOK *of* ABSTRACTS

November 2018

Organizer



in cooperation with





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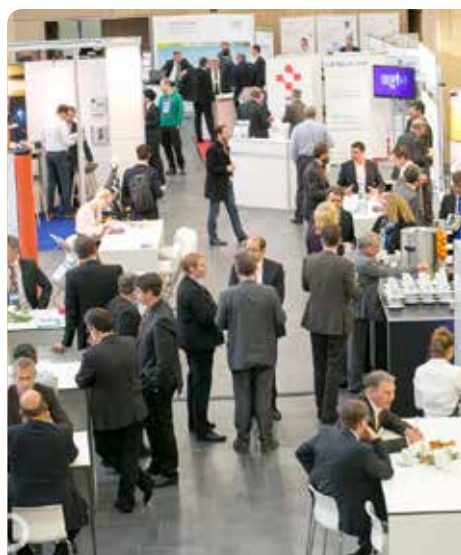


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Bildquellen / Picture Sources: Bernhard Ludewig, AiNT, Eurogress Aachen, RWE Power, Aachen Tourist Service
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Design, Satz & Druck: www.Lindemann-Projekte.de



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 wesentliche Randbedingungen darstellen.

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, außer beim Pre-Conference Workshop, werden simultan übersetzt (D/EN/RU, Pre-Conference Workshop EN/RU).

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 in the decommissioning of nuclear plants in a practical way, and to define optimal planning variants for decommissioning implementation. Simultaneous translation (GER/EN/RU, Pre-Conference Workshop EN/RU) will be available.



RÜCKBLICK

ICOND 2017

REVIEW

Im November 2017 fand zum sechsten Mal die ICOND in Kooperation mit dem TÜV Rheinland sowie den belgischen Unternehmen TECNUBEL und TRACTEBEL statt. Mit 310 Teilnehmern aus zwanzig Nationen nahm die Teilnehmerzahl das dritte Jahr in Folge zu. Über zwanzig Unternehmen nutzten die vollständig ausgebuchte Ausstellungsfläche im Eurogress Aachen, um ihre rückbauspezifischen Produkte und Dienstleistungen dem Fachpublikum zu präsentieren.

Die ICOND 2017 fokussierte die Neuausrichtung der kerntechnischen Wirtschaft bedingt durch den Kernenergieausstieg in Deutschland. Frau Dr. Ruth Welsing von der Kanzlei Kümmerlein, Rechtsanwälte und Notare stellte die Änderungen durch das im Jahr 2017 erlassene Gesetz zur Neuordnung der Verantwortung in der kerntechnischen Entsorgung dar. Dem Gesetz zufolge sollen die Kraftwerksbetreiber für die gesamte Abwicklung und Finanzierung der Bereiche Stilllegung, Rückbau und fachgerechte Verpackung der radioaktiven Abfälle zuständig bleiben. Für die „Durchführung und Finanzierung der Zwischen- und Endlagerung“ wird hingegen künftig der Bund verantwortlich sein. Herr Wolfgang Honetschläger, der verantwortliche Leiter für die Rückbauprojekte bei der EnBW Kernkraft GmbH, referierte über die ganzheitliche Strategie für den Rückbau der EnBW Energie Baden-Württemberg AG. Die vorgestellte Unternehmensstrategie behandelte die Aufgabenstellungen: Genehmigungs- und Personalmanagement, Reststoffentsorgung sowie Endlagerungsvorbereitungen. Die ersten Rückbautätigkeiten in Neckarwestheim wurden präsentiert.

Der internationale Erfahrungsaustausch erfolgte sowohl im Plenum, basierend auf Initialvorträgen von Teilnehmern aus Taiwan und Russland, sowie während des Pre-Conference Workshop, welcher erstmalig die spezifischen Besonderheiten bei der Stilllegung kerntechnischer Forschungseinrichtungen thematisierte.

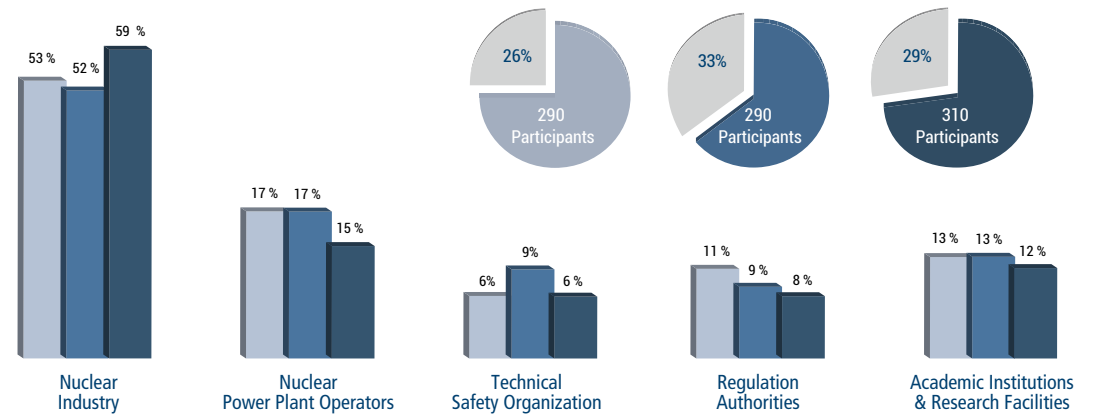
In November 2017, ICOND took place for the sixth time in cooperation with TÜV Rheinland and the Belgian companies TECNUBEL and TRACTEBEL. With 310 participants from twenty nations, the number of participants increased for the third year in a row. More than twenty companies used the fully booked exhibition space in the Eurogress Aachen to present their dismantling-specific products and services to the specialist audience.

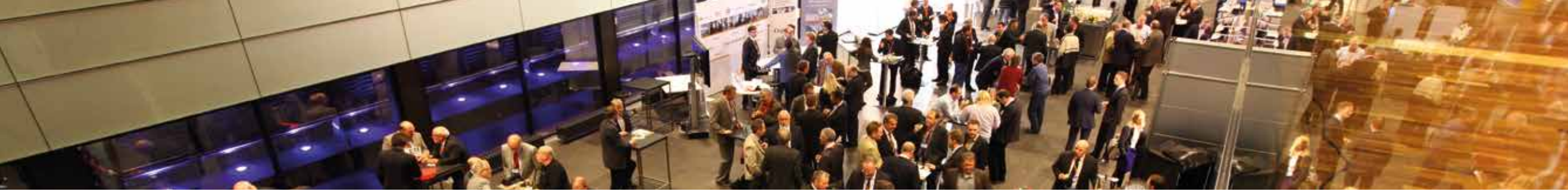
ICOND 2017 focused on the reorientation of the nuclear industry due to the nuclear phase-out in Germany. Miss Dr. Ruth Welsing of the law firm Kümmerlein, attorneys and notaries presented the changes by the law on the reorganization of responsibility in nuclear waste disposal adopted in 2017. According to the law, the power plant operators are responsible for the entire handling and financing of the areas of decommissioning, dismantling and professional packaging radioactive waste. However, the federal government will be responsible for the „implementation and financing of interim and final storage“ in the future. Mr. Wolfgang Honetschläger, responsible for the dismantling projects at EnBW Kernkraft GmbH, presented the holistic strategy for the dismantling of EnBW Energie Baden-Württemberg AG. This corporate strategy deals with the following tasks: approval and personnel management, disposal of residues and final disposal preparations. In addition, the first decommissioning activities in Neckarwestheim were presented.

The international exchange of experience took place in both plenary sessions, based on initial presentations by participants from Taiwan and Russia, and during the Pre-Conference Workshop, which for the first time focused on the specific features of the decommissioning of nuclear research institutions.

FAKTEN FACTS

■ 2015 ■ 2016 ■ 2017





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EXHIBITORS 2018



iCOND

ICOND PROGRAMME



SPEAKER REFERENCE WALL

automess

BS
Brenk
Systemplanung

BSI
BALTIC SCIENTIFIC
INSTRUMENTS

CAEN SyS
Systems and Spectroscopy Solutions

cyclife
GROUP EDF

EnBW

EWN
Entsorgungswerk für
Nuklearanlagen

FORMIBOS

framatome

IFE

KTE
Kerntechnische
Entsorgung Karlsruhe

McKinsey&Company

MIRION
TECHNOLOGIES

netalux
we light up the dark

NPL
National Physical Laboratory

NRG

NUC TEC SOLUTIONS

NUKEM
Technologies

olenian

ONET
TECHNOLOGIES

orano

Preussen
Elektra

RWE

Safetec
Entsorgungs- und Sicherheitstechnik GmbH

Siempelkamp
Nukleartechnik

TECNUBEL
Your project needs our care

TRACTEBEL
ENGIE

TECHNISCHE
UNIVERSITÄT
DRESDEN

TÜVRheinland
Risktec

MONDAY November 5th, 2018



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

NEW NUCLEAR DECOMMISSIONING TOOLS

- EN 13:30 **Evolution of Portable Dose Rate Meters**
Matthias Feyl – automess GmbH
- EN 14:00 **Measurement Systems for Waste Management, Decommissioning and Dismantling**
Giuliano Mini – CAEN SyS s.r.l.
- EN 14:30 **Waste Assay Monitoring Systems**
Mangirdas Zavackas – BSI Instruments Ltd.
- EN 15:00 **Development of Laser Technologies for Mobile Surface Decontamination**
Torsten Kahl – Technische Universität Dresden
- 15:30 **COFFEE BREAK**
- EN 16:00 **Surface Treatment by Laser Cleaning**
Pieter Cretskens – Netalux N.V.
- EN 16:30 **L.DCom - The Laser Cutting Technology for Nuclear Decommissioning**
Julien Guillemin – ONET Technologies SAS
- EN 17:00 **Radiochemical Characterization of Reactor Internals: Lessons Learnt**
Tanja Tomasberger – NRG Nuclear Research & Consultancy Group
- EN 17:30 **PUG³ Software for the Support of Clearance Measurements**
Dr. Tobias Hein – Brenk Systemplanung GmbH

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TUESDAY November 6th, 2018



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

STATUS & ECONOMICS

- D** 13:15 **Decommissioning of PreussenElektra NPPs**
Rückbau der PreussenElektra Kernkraftwerke
Dr. Guido Knott – PreussenElektra GmbH (Vorsitzender der Geschäftsführung / CEO)
- EN** 13:45 **Strategies for Radiological Characterisation in Decommissioning of Nuclear Facilities**
Strategien für die radiologische Charakterisierung zur Stilllegung kerntechnischer Anlagen
Arne Larsson – Cyclife Sweden AB on behalf of OECD/NEA
- EN** 14:15 **Experience in the Decommissioning of the ZION Nuclear Power Plant in the USA**
Erfahrung beim Rückbau des Kernkraftwerks ZION in den USA
Stefan Dätig – Siempelkamp NIS Ingenieurgesellschaft mbH
- D** 14:45 **Shipping of Spent Fuel from the Obrigheim NPP to the Neckarwestheim on-site dry Storage Facility over the River Neckar**
Transport der abgebrannten Brennelemente auf dem Neckar von Obrigheim nach Neckarwestheim
Ronald Schürle – EnBW Kernkraft GmbH
- 15:15 COFFEE BREAK**
- D** 16:00 **Decommissioning of the Nuclear Power Plant Mülheim-Kärlich**
Rückbau des Kernkraftwerks Mülheim-Kärlich
Dr. Thomas Volmar – RWE Nuclear GmbH - Anlage Mülheim Kärlich

- EN** 16:30 **In-situ Metrology for Decommissioning Nuclear Facilities – MetroDECOM II**
In-situ-Metrologie für die Stilllegung kerntechnischer Anlagen – MetroDECOM II
Dr. Steven James Bell – National Physical Laboratory (UK)
on behalf of the MetroDecom II Consortium

- D** 17:00 - 17:45 **PANEL DISCUSSION: NUCLEAR DECOMMISSIONING IN GERMANY**
PODIUMSDISKUSSION: RÜCKBAU DER LEISTUNGSREAKTOREN IN DEUTSCHLAND

PARTICIPANTS / TEILNEHMER:
Dr. Thomas Volmar
Prof. Dr. Bruno Thomauske
Gerrit Niehaus

- 18:15 CONFERENCE DINNER AT THE FORMER RAILWAY DEPOT**
sponsored by Tractebel & Tecnubel



WEDNESDAY November 7th, 2018



- EN** 09:00 **Dismantling of the Fuel Fabrication Plant of FBFC in Belgium**
Rückbau der Brennelementefabrik von FBFC in Belgien

Nathan van Raemdonck – TECNUBEL B.V. &
Felix Langer – NUKEM Technologies Engineering Services GmbH

- EN** 09:30 **Dismantling of Nuclear Facilities in Belgium and abroad**
Rückbau kerntechnischer Anlagen in Belgien und im Ausland
- Jos Boussu – TRACTEBEL Engineering S.A.

PROJECT ORGANISATION & MARKET DEVELOPMENT

- D** 10:00 **Challenge or Opportunity? Decommissioning Market Perspectives and Success Factors**
Herausforderung oder Chance? Marktperspektiven für den Rückbau kerntechnischer Anlagen und Erfolgsfaktoren
- Dr. Jochen Latz – McKinsey & Company, Inc.

10:30 COFFEE BREAK

- EN** 11:00 **Risk Management in Nuclear Decommissioning**
Risikomanagement als Teil der Rückbaustrategie
- Patrick Wilson – TÜV Rheinland Risktec Ltd.

REACTOR INTERNALS

- D** 11:30 **Experiences in PWR Full System Decontamination – Effective and Material-Saving Process**
Erfahrungen mit der Primärkreisdekontamination im DWR – Effektiver und materialschonender Prozess
- Dr. Dietmar Nieder – RWE Nuclear GmbH - KKW Biblis &
Markus Thoma – Siempelkamp NIS Ingenieurgesellschaft mbH
- D** 12:00 **Cutting and Packaging of Irradiated Control Rods at Brunsbüttel NPP**
Zerlegung und Verpackung von bestrahlten Steuerelementen im Kernkraftwerk Brunsbüttel
- Ralf Oberhäuser – ORANO GmbH &
Ralf Borchardt – EWN Entsorgungswerk für Nuklearanlagen GmbH

12:30 LUNCH

DIGITALISATION

- D** 13:30 **Virtual Reality Training (VRT) – Safety in Dismantling of KTE Nuclear Facilities**
Virtual Reality Training (VRT) – Sicherheit beim Abbau von kerntechnischen Anlagen der KTE
- Timo Liedtke – KTE Kerntechnische Entsorgung Karlsruhe GmbH
- D** 14:00 **Building Information Modeling – Efficient and Optimized Dismantling Planning**
Building Information Modeling - Effiziente und optimierte Rückbauplanung
- Shahin Farahzadi – formitas AG

14:30 COFFEE BREAK

- EN** 15:00 **Use of VR in Decommissioning Planning and Training**
Einsatz von VR bei Planung und Training des Rückbaus
- Jan Porsmyr – Institute for Energy Technology

RADIATION PROTECTION

- EN** 15:30 **Accident with Significant Activity Release – Decontamination and Protection against Nuclear Hazards**
Unfall mit bedeutsamer Aktivitätsfreisetzung – Dekontamination und nukleare Nachsorge
- Martin Rathgeber – NucTec Solutions GmbH
- 16:00 **BUSINESS SPEED NETWORKING**
An opportunity to get in contact with other participating experts from operators, nuclear industries, authorities etc.
- 17:00 **Get together**
sponsored by TÜV Rheinland Industrie Service GmbH



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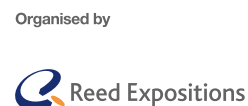
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ABSTRACTS
PRE-CONFERENCE
WORKSHOP



SPEAKER

MONDAY 13:30 EN

Matthias Feyl

Company automess GmbH
Daimlerstrasse 27
68526 Ladenburg - Germany

Web www.automess.de



SPEAKER

MONDAY 14:00 EN

Giuliano Mini

Company CAEN SyS s.r.l.
Via Vetraia 11
55049 Viareggio - Italy

Web www.caensys.com

Evolution of Portable Dose Rate Meters

The discovery of radioactivity in 1896 was a major scientific milestone. Hans Geiger and Walther Müller introduced the Geiger-Müller counter tube in 1928. A first forerunner already existed in 1913. The development of electronics to amplify the impulses and stabilising the high voltage is much more complex and was only ready for series productions around the 50s.

With development of the microprocessors, this technology was also increasingly used in radiation measurement instruments. Advantages are the smaller design and a lower power consumption compared to circuits with individual components. In the following years, radiation measurement instruments were continuously improved, but no major changes occurred. Often there were also adaptations to new measurement variables necessary.

The requirements of nuclear power plants or fire brigades for a portable radiation measuring device are as follows for example, simple operation and robustness. Through the introduction of digital displays, read-off errors in analog displays were remedied. Often the possibility of calibration is also required. Until today, the Geiger-Müller counter tube is still the most widely used detector type. Other detector types are for example the Scintillator or the PIN Diode. Although groundbreaking changes in nuclear radiation measurement technology are unlikely, it will be interesting to see how ionising radiation will be measured in the future.



Measurement Systems for Waste Management, Decommissioning and Dismantling

An innovative Platform for a seamless digitization of the information produced during the characterization of radioactive waste, contaminated objects, and in general radioprotection measurements has been developed by CAEN SyS. The Platform is based on a spectroscopic handheld instrument integrating RFID technology, barcode reader, camera, voice recorder, and geo-localization, a selection of radiation tolerant RFID tags tested above 300 Gy integrated dose, ruggedized portable RFID readers and a secure database framework capable to collect data also from external sources such as gamma scanners and imaging systems. The Platform allows for real-time measurement of dose rate, radiation spectroscopy, tagging, tracking and inventorying of items. All data produced by the Platform are securely stored into the non-volatile memory of the RFID tags and in the database for both onsite and remote access to the information by operators. This paper presents the

current development of the Platform and shows the advantages of such approach to achieve an easy yet reliable waste traceability, waste bagging optimization, and a structured methodology for radiation measurements, meeting an excellent quality control as increasingly required by Safety Authorities. Applications here envisaged and explored are dismantling and decontamination operations, radioprotection measurements and patrols, nuclear material management, safeguards and verification inspections. More in general, the Platform can address the needs of all plants, research laboratories and facilities that are looking to improve their Safety Standards, decrease operational costs, have a precise knowledge of the contaminated environment and objects as well as optimization for personnel dose minimization.



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SPEAKER

MONDAY 14:30 EN

Mangirdas Zavackas

Company Baltic Scientific Instruments Ltd.
Ganibu Dambis 26
LV-1005 Riga - Latvia

Web www.bsi.lv



SPEAKER

MONDAY 15:00 EN

Torsten Kahl

Company Technische Universität Dresden
George-Bähr-Str. 3
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Web www.tu-dresden.de

Waste assay monitors based on HPGe detectors

Having the relevant technologies and the capacity to produce own HPGe detectors which provide a high efficiency of gamma-radiation registration and excellent energy resolution, we demonstrate the results of the development of our own equipment for RAW characterization based on these detectors.

Radioactive waste monitors for small, medium and large volumes of those wastes are presented. The monitors' calibration by the registration efficiency are made using standard sources in point geometry as well as from by the complex calculation of the

efficiency curves using the Monte Carlo simulation method. The volumetric activity sources were manufactured in the form of real 200, 400, and 700 litre barrels with matrix-fillers in order to calibrate the monitors using the direct verification method. The peculiarities of the metrological aspects and software that controls the monitors are presented.



Development of Laser Technologies for Mobile Surface Decontamination

Modern high power lasers promise high productivity, reliability and the possibility of industrial automation. Well known is the application of laser technologies for cutting and for cleaning.

At Technische Universität Dresden high power laser systems were used for the development of laser based decontamination of radioactive and chemical-toxic contaminated surfaces. The ongoing research and development project LaPlus is aimed to the decontamination of metallic surfaces as well as the decontamination of concrete surfaces coated with chemical-toxic substances (PCB).

Inside the project the laser-based technology was modified for mobile decontamination of both base materials including the development of special laser tools. The suitability of the mobile laser systems was demonstrated at real PCB-contaminated surfaces at the Mehrzweckforschungsreaktor (MZFR) in Karlsruhe. These experiments served as "proof-of-concept" for the laser-based technology. The presentation deals with the development of special laser tools and the practical demonstration of the surface decontamination. The results demonstrate the high efficiency of the laser processing for the decontamination of PCB-containing protecting coatings in nuclear power plants.

A general overview of the results of the research project LaPLUS and outstanding tasks will complete the presentation.



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SPEAKER

MONDAY 16:00 EN

Pieter Cretskens

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3550 Heusden-Zolder - Belgium
Web www.netalux.com



SPEAKER

MONDAY 16:30 EN

Julien Guillemain

Company ONET Technologies SAS
36 Boulevard de l'Océan
13009 Marseille - France
Web www.onet-technologies.com

Surface Treatment by Laser Cleaning

About

Netalux is a privately owned Belgian company, unique in its kind focussing 100% on laser cleaning and works only with the best suppliers.

We offer on site as well as off site services. This state of the art technology we use allows us to remove a wide variety of contaminants such as paint, oxides, rust, grease, etc. Substrates are most likely to be a steel alloy, although others like e.g. concrete are just as possible.

How

Our technique allows for a low noise, low dust operation without the use of chemicals or high pressure air. Adjacent personnel is not bothered or at risk. The setup is easy: within a 5m perimeter specific safety goggles are mandatory. The area is protected with safety screens. The high energy light pulses are absorbed by the contaminant and, upon reflection, the contaminant is heated creating a thermal shock between both layers. Dust and gasses are filtered and contained by instant suction.

Working with light enables us to preserve the substrate and eliminate secondary waste. The total project is therefore safer, healthier and environmen-

tally friendlier than conventional methods. It's a stable process that allows for superior cleanliness and precision.

Nuclear applications

Laser cleaning can be used for two applications in the nuclear industry: decontamination for re-use and for free release purposes.

The software allows for a 100% control of the process, protecting all essential properties of the substrate. It even allows for automation, creating huge opportunities in high dose rate or other critical environments.

Minimising the radioactive waste is a primary goal, in an operational phase as well as in a dismantling or decommissioning phase.

Challenges

Laser cleaning still has challenges ahead. It's a new technique and validation tests in nuclear are ongoing with positive outcome. Our experience in other industries, where toxic contaminants in harsh environments are a day to day challenge, combined with our nuclear knowhow helps us moving forward.



L.DCom - The Laser Cutting Technology for Nuclear Decommissioning

We propose to present our solution Laser Cutting for Nuclear Decommissioning "L.DCom" at the pre-conference Workshop. From an initial R&D program of the French Alternative Energies and Atomic Energy Commission (CEA), L.DCom is the result of the last industrial development of Onet Technologies to offer an innovative proven technology for dismantling operations of highly-activated nuclear components. Thus, we believe that it falls well within the theme of the Workshop.

In addition to the presentation of L.DCom and of the on-going innovative developments, we would like to share with the audience our practical experience acquired in real conditions with this technology. We propose to present the advantages of the laser cutting technique, when a remotely-operated solution is necessary, which lead to its selection by our clients for such applications.

Introduced by Onet Technologies as a world first in December 2015, the technology has demonstrated its full potential in an industrial-scale project to

dismantle dissolvers in the UP1 spent-fuel reprocessing facility at the CEA Marcoule site in France.

This technology was selected by the Japanese government for the removal of fuel debris from the damaged Fukushima Daiichi reactors. The CEA and Onet Technologies are working together since 2014 to further develop the laser cutting for this very complex application. Underwater and deep gouging techniques to cut the corium are being simultaneously developed. Currently, we are also studying for Dounreay Site Restoration Ltd the feasibility of using this technology for the dismantling of highly-active systems and components on the site of Dounreay.

We believe that one of the biggest decommissioning technical challenges for the coming years lie in the high-activity field. On the basis of our industrial successes, we are in the process of promoting our solution L.DCom on the decommissioning market worldwide.



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**SPEAKER****MONDAY 17:00****EN****Tanja Tomasberger**

Company NRG Nuclear Research & Consultancy Group
 Westerduinweg 3
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Web www.nrg.eu

**SPEAKER****MONDAY 17:30****EN****Dr. Tobias Hein**

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

Web www.brenk.com

Radiochemical Characterization of Reactor Internals: Lessons Learnt

NRG, a company from the Netherlands, is historically an international recognized nuclear partner for irradiation of materials used in the nuclear industry. A comprehensive infrastructure of hot cells and laboratories are operational. NRG also delivers dismantling and characterization services for (highly) activated reactor internals in German NPPs which are in decommissioning. All services are in one hand from planning, cutting, sampling, radiochemical characterization and packaging. Dedicated, engineered and manufactured tooling is used and enables cutting, container manipulation, and various forms of simple, and more complex sampling such as the sampling of both the stainless steel hull and the absorber material from control rods.

The samples are taken from various positions of reactor internals and the reactor pressure vessel, and packed in small aluminum bins, designed for handling in hot cells. The samples are packed in special-purpose, shielded containers and transported from the NPP to NRG. The samples are unpacked in a concrete hot cell and transferred to a chemical hot cell for dissolution

in case of high active samples, or to the radiological labs at NRG in case of low and medium active samples. Due to the different chemical constitutions of the various metals and control rods, the procedures for the chemical analysis varies. The route for the stainless steel hull samples is more complex than that for the absorber samples: there are more nuclides to be determined, so more treatment steps and column separations are necessary. Our chemical separation methodology is optimized for both high active and lower active samples and can be detected with the highest possible precision.

The results of our various, high-end characterizations not only address Konrad acceptance criteria, they also provide new insights into the real activation of the various zones in the reactor pressure vessel. Similarities, as well as differences with upfront activation calculations using reactor physics codes do exist. These insights can help building more precise dismantling and packaging strategies.

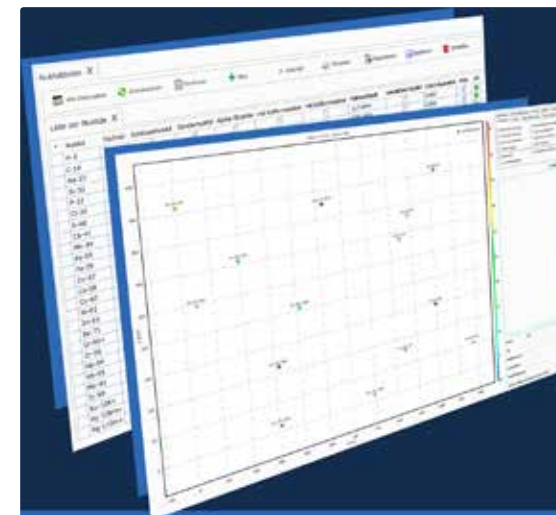
**PUG³ Software for the Support of Clearance Measurements**

In the course of a decommissioning project, the number of clearance measurements can reach seven digit numbers. As the manual management of such a large number of measurement results is a tedious and error prone process, it is tempting to use modern database technology to automatize this process. In the last years PUG³ has been developed for the support of clearance measurements. It supports the clearance of buildings, sites as well as other materials, however in the following the support of the clearance of buildings will be exemplified.

The clearance procedures for buildings consist of a radiological characterisation of a building, a decontamination step if necessary, followed by measurements for checking the success of decontamination, and the actual decision measurements for demonstrating compliance with clearance levels. For a nuclear power plant, the number of samples taken during this procedure can easily reach a few 10,000, while the number of single measurements can reach several 100,000 single surface measurements and several 10,000 measurements with in situ gamma spectro-

metry. This large number of data together with the correct interpretation according to the valid nuclide vector, the penetration depth of the contamination, the correction for radioactive decay etc have to be managed.

For this reason, the versatile software tool PUG³ has been developed by Brenk Systemplanung GmbH. Many steps of the data evaluation and report generation during the clearance process outlined above can now be carried out automatically. This software tool has been successful in the support of the completion of the clearance process in KWW and is currently installed in several additional facilities. Experience with the use of software tools in actual clearance procedures show significant advantages in the quality of the clearance documentation, the productivity and the acceptance of the clearance documentation with the authorities.



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SPEAKER

TUESDAY 13:15 DE

Dr. Guido Knott

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Decommissioning of PreussenElektra NPPs

PreussenElektra GmbH as the largest German Nuclear Company has huge challenges to decommission its six power plants.

Based on the experiences of the nearly finished decommissioning projects Würgassen and Stade, a new ambitious strategy to manage and optimize all activities after final shut down has been developed.

Nuclear decommissioning projects are challenging for the following reasons:

- 1. Project duration is long (up to 15 years) with high uncertainty and related financial risks.
2. Political and regulatory influences can lead to challenges in all aspects of the projects.
3. The people element is of the utmost importance.
4. Governance and decision making, finding the balance between a "must do" project and proactive/deliberate decision making.

PreussenElektra set up the decom strategy called „Baseline 2" in 2016, aligned with the discussion

on federal level about „KfK". EON SE, the owner of PreussenElektra, confirmed this strategic approach. The new strategy optimizes the scope of activities, planning, risks and financial aspects.

The presentation will deliver the main content of this strategic approach along five insights:

- 1. Key lessons learned in our projects Würgassen and Stade.
2. Main characteristics of the new strategy and how we include mechanisms for continuous improvement.
3. What is our structure to guarantee the so-called fleet approach.
4. How do we motivate our main asset "people" to take up these new challenges.
5. Where do we see upside potential in our projects in the area of technical innovation, disposal management and stake holder management.

Finally, we will show some highlights of current activities in our decom projects at Unterweser (KKU), Isar Unit 1 (KKI-1) and Grafenrheinfeld (KKG).



SPEAKER

TUESDAY 13:45 EN

Arne Larsson

Company Cyclife Sweden AB on behalf of OECD/NEA
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Strategies for Radiological Characterisation in Decommissioning of Nuclear Facilities

Characterisation is a key activity enabling planning and implementation of decommissioning of nuclear facilities. Effective characterisation allows the extent, location and nature of radiological contamination and other important parameters to be determined providing crucial information to facilitate facility dismantling, the management of material and arising waste, protection of workers, the public, the environment and associated cost estimation.

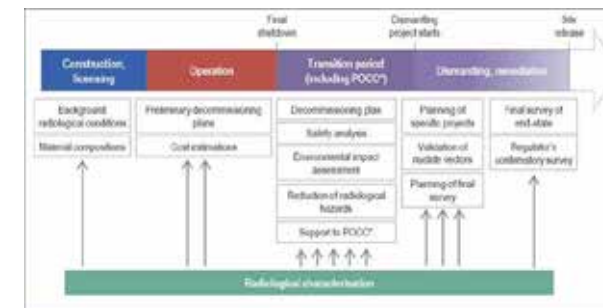
The Expert Group on Radiological Characterisation for Decommissioning (TGRCD), under the auspices of the Nuclear Energy Agency's (NEA) "Working Party on Decommissioning and Dismantling" (WPDD), had provided high-level guidance for practitioners in characterisation for decommissioning. This work, performed between 2014 and 2017, focused on facility characterisation from waste and materials perspective.

The guidance report is written for characterisation practitioners who carry out the tactical planning, preparation, optimisation and implementation of characterisation to support the decommissioning of nuclear facilities and the management of associated materials and waste. It compiles recent experience of NEA member countries in radiological characterization, including the experience of international experts

and practitioners; the learning from inter-national case studies and international conferences; and national approaches to the application of international and national regulations, standards and guidance documents. Using this comprehensive approach and evaluation studies, the report identifies relevant good practices and sets out set out practical guidance covering all stages of the characterisation process as related to decommissioning.

The Expert Group's work is completed and the final report titled "Radiological Characterisation from a Waste and Materials End-State Perspective: Practices and Experience" was issued by NEA in November 2017 and is available for download.

The presentation will give a summary of the detailed report regarding: (a) strategic aspects; (b) management arrangements; (c) key activities in the characterisation process from initiation to final reporting; and (d) management of data, assumptions and uncertainties. This is set within the context of an integrated holistic approach to characterisation, considering the optimum approach to providing the necessary characterisation of radiological, physical, chemical and biological information to support decommissioning and associated waste management.



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SPEAKER

TUESDAY 14:15

DE

Stefan Dätig

Company Siempelkamp NIS Ingenieurgesellschaft mbH
Industriestr. 13
63755 Alzenau - Germany

Web www.siempelkamp-nis.com



SPEAKER

TUESDAY 14:45

DE

Ronald Schürle

Company EnBW Kernkraft GmbH
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74847 Obrigheim - Germany

Web www.enbw.com/enkk

Experience in the Decommissioning of the ZION Nuclear Power Plant in the USA

Siempelkamp NIS was contracted in 2010 to perform the segmentation of the reactor vessel internals (RVI) and the reactor pressure vessel (RPV) of Unit 1 & Unit 2 at the nuclear power plant in Zion, IL, USA.

The Engineering of the machinery was realized internally in cooperation with vendors for subsequent manufacturing and delivery on site.

A scope split was established where the engineering and manufacturing of the RVI-equipment was performed by our US-colleagues (Siempelkamp Nuclear Services) and the RV-equipment by Siempelkamp NIS in Germany.

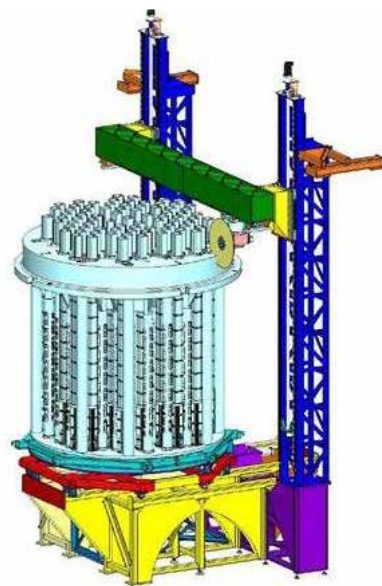
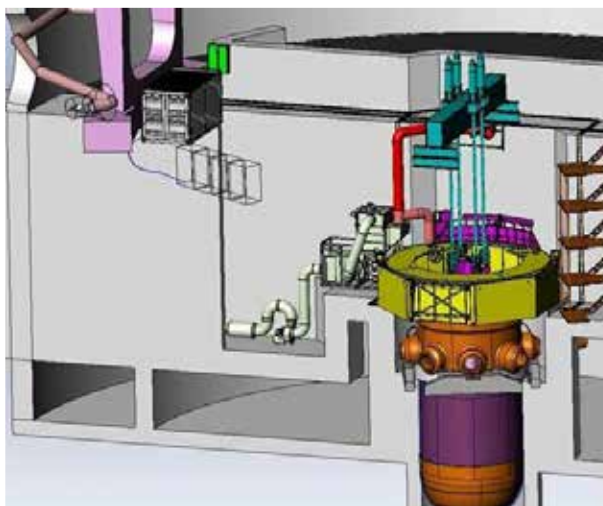
Subsequent to manufacturing a full dressed Mock-Up had been performed for both scopes RVI and RPV in the United States. After the successful Mock-Up the equipment was shipped to the power plant and installed in the controlled area.

The execution of the RVI-segmentation started 2011 in Unit 2 to be continued in Unit 1 with some overlapping and ended in 2015. The execution of the RPV-segmentation started 2015 directly after RPV in Unit 2 and moved to Unit 1 with no overlapping. The

RPV-segmentation was completed in December 2015. This presentation will give a summary of the following experiences Siempelkamp as a German company made in this project.

- Differences between Germany and USA in:
 - o Cultural- and professional contact
 - o Work environment
 - o Safety regulations
 - o Time scheduling
 - o Engineering
 - o Cooperation with Vendors
- Mock-Up Test performance
- Execution of segmentation
 - o Management specific
 - o Radiation protection
 - o Handling of radioactive material
 - o Trouble shooting
 - o Physical

Along with the experiences some visual impressions of Mock Up and project execution will accompany the presentation.



Shipping of Spent Fuel from Obrigheim NPP to the Neckarwestheim on site dry Storage Facility over the River Neckar

Germany has decided to phase out nuclear power by the end of the year 2022. Operation and postoperation as well as decommissioning and dismantling of the EnBW nuclear power plants are in the responsibility of EnBW Kernkraft GmbH (EnKK).

Power is still produced in the units Neckarwestheim II and Philippsburg 2. The units Neckarwestheim I and Philippsburg 1 went out of operation in 2011, decommissioning/dismantling started in 2017. The NPP in Obrigheim ceased operation in 2005, decommissioning started in 2008.

In 2012, EnKK established a strategy for the dismantling of all units, communicated and thus created clarity for politics, society, business partners and employees. In order to ensure the safe, efficient and rapid dismantling, various preparations are currently in progress. EnKK has a clear strategy which is implemented consistently since 2012. Therefore EnKK takes the lead in dismantling in Germany.

These measures are designed to ensure safe, efficient and near-term decommissioning and to lead the company successfully into the future.

The lecture gives information about the project „Shipping of spent fuel from the Obrigheim NPP to the Neckarwestheim on-site dry storage facility over the river Neckar“ which is an important part of the EnKK dismantling strategy. It shows in particular the background of this project, the efforts made and the successful closure of this top project.

EnBW Kernkraft GmbH:

- Three sites: Philippsburg, Neckarwestheim, Obrigheim
- Stands for safety
- in operation
- in the transition phase
- during decommissioning and dismantling
- Employees: approx. 1600



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SPEAKER

TUESDAY 16:00

DE

Dr. Thomas Volmar

Company RWE Nuclear GmbH - Anlage Mülheim Kärlich
Am Guten Mann
56218 Mülheim-Kärlich - Germany

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SPEAKER

TUESDAY 16:30

EN

Dr. Steven James Bell

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Decommissioning of the Nuclear Power Plant Mülheim-Kärlich

The nuclear power plant Mülheim-Kärlich has a diverse history. Planning and construction started in the 1970s. Influenced by the shift of public perception in terms of nuclear in Germany start of commercial operation was delayed until 1987. Because of legal actions against the plant operation needed to stop in 1988 already. Legal proceedings followed for the next ten years resulting in a verdict of the German Federal Administrative Court against restart. In the course of the first German nuclear phase out decision was taken to apply for a decommissioning license that was granted in 2004.

Since then decommissioning and dismantling is ongoing. In Germany it is the first decommissioning project of a 1300 MW class NPP. Following a holistic decommissioning approach the project focussed on reaching fit for purpose service operations, a significant dismantling rate and reducing radioactive waste. Milestones were the minimized plant area, small operating systems on industrial level and a dismant-

ling rate of up to 1000t/a so that some building areas of the RCA have already reached the status of cold and dark. Such a dismantling rate can only be achieved by using modern industrial approaches.

This was achieved by a small number of staff. A key success factor to achieve this is the change of staff culture coming from an operational regime towards a strict project and process thinking. A small site in terms of staff, systems, area etc. has the advantage that there are reduced running costs making the project robust against unforeseeable challenges.

Current work comprises demolishing the former switch-yard building, the publicly strongly perceived demolishing of the cooling tower and the dismantling process of the steam generators. The planning and tendering phase for the reactor pressure vessel has just started. Therefore an intense dismantling phase is to come.



In-situ Metrology for Decommissioning Nuclear Facilities – MetroDECOM II

There are currently more than 200 nuclear installations in the EU that have reached, or soon will reach the end of their expected lifetime. A significant challenge exists: how to deal with the radioactive waste generated during nuclear decommissioning in a cost-effective manner while minimising the impact on the public and the environment.

The key to safe and cost-effective disposal of the waste is accurate characterisation of its physical, chemical, and radiological properties. Therefore, the MetroDECOM II project will provide the nuclear industry the following new, metrologically validated measurement capabilities:

- In-situ methods for rapid measuring the radioactivity content of materials on a nuclear site
- A novel automatic measurement system to check whether waste packages are safe for clearance or must be disposed as radioactive waste
- A sophisticated radioactive waste characterisation system, suitable for use as a waste repository acceptance system for very low, low and intermediate level radioactive waste
- On-site measurement systems and methods for monitoring the condition of radioactive waste repositories, including airborne radioactivity and temperature/strain.

The project aims to support the nuclear industry to reduce significantly the decommissioning costs by focusing on high technology readiness levels, on-site use of the new technologies, traceability and measurement uncertainties, and knowledge transfer.

This presentation is given on behalf of the MetroDECOM II consortium, which consists of national metrology institutes, nuclear sites and instrumentation companies, and is funded by BEIS and the European Metrology Programme for Innovation and Research (EMPIR). EMPIR is jointly funded by the European Union and the EMPIR participating countries within EURAMET.



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**SPEAKER****WEDNESDAY 09:00 EN****Nathan van Raemdonck Felix Langer**TECNUBEL B.V.
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NUKEM Technologies
Engineering Services GmbH
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www.nukemtechnologies.de**SPEAKER****WEDNESDAY 09:30 EN****Jos Boussu**Company TRACTEBEL Engineering S.A.
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Dismantling of the Fuel Fabrication Plant of FBFC in Belgium

FBFC International, part of the Framatome group and located in Dessel, is since 2012 in a state of decommissioning and dismantling. This class 1 site, established in the fifties, was used for the production of uranium fuel pellets and elements, meant for the nuclear power plants. A part of the plant was also used for the assemblage and storage of MOX elements. As a result of the many years of production, most of the equipment and structures are alpha contaminated and have to be measured and decontaminated within the framework of decommissioning. Besides the buildings, the decommissioning of the site also includes the excavation and sorting of 16 000 tons of soil containing small quantities of uranium. Tecnubel, part of the ENGIE group, has been involved from the beginning in the dismantling and decommissioning of the plant and is since 2016 responsible for the complete project management of D&D of the site. This all happens in close collaboration with the plant manager of Framatome. With more than 30 years of experience, Tecnubel takes charge of the radiological measurements of the concrete structures within the

contaminated buildings. If necessary, a proper method is selected for the decontamination of alpha contaminated surfaces. These range from shaving to needle scaling and washing with chemicals. After each decontamination, a proper second measurement is being performed to ensure the contamination has been properly removed. In close collaboration with Nukem Technologies, the Fremes installation was created to perform the measurement and sorting of suspected soil containing small quantities of uranium. The installation measures at a minimum throughput of 10 t/h the quantity of uranium in the soil and sorts it consequently in the right area: <1 Bq/g; 1-10 Bq/g and >10 Bq/g. The +30 operators performing the radiological measurements, decontamination and soil sorting are closely managed to ensure the works are perfectly in line with strict demands of Framatome.



Picture: Courtesy of FBFC International

Dismantling of Nuclear Facilities in Belgium and abroad

Since the early days, Tractebel has been involved in decommissioning and radioactive waste management projects throughout Europe.

During this presentation, an overview will be given on early projects, and more specific information on challenges and return of experience on recent projects to which Tractebel contributed will be explained:

Decommissioning projects:

An overview will be given of Tractebel's involvement on the

- participation in the dismantling of the BR3 reactor in Belgium, first PWR in Western Europe;
- drafting of preliminary decommissioning plan for Belgian NPPs;
- participation in the drafting of the licensing documentation for stage 2 of Bohunice NPP V1 decommissioning;
- cost assessments for the dismantling of nuclear facilities (Belgium and Netherlands);
- audit on the funds for the decommissioning of nuclear facilities (France);

- participation in the Project Management Unit for the decommissioning of the Ignalina NPP;
- participation in the decommissioning of the Belgonucleaire MOX fuel fabrication plant;

More focus and challenges will be presented in the ongoing projects where Tractebel has a role of

- owner's engineer for the dismantling of the contaminated tanks of the former Eurochem fuel reprocessing plant;
- owner's engineer for the decommissioning of the former Best Medical Belgium facilities;

Radwaste Management projects:

Present status and challenges are presented on the following projects:

- owner's engineer for the surface nuclear facilities (SS2) and underground facilities (SS4) of the deep geological repository in France (CIGEO);
- near surface repository in Belgium;
- conceptual studies for the geological repository in Belgium;
- Spent Fuel storage facilities in Belgium.





SPEAKER

WEDNESDAY 10:00 DE

Dr. Jochen Latz

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SPEAKER

WEDNESDAY 11:00 EN

Patrick Wilson

Company TÜV Rheinland Risktec Ltd..
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Challenge or Opportunity? Decommissioning Market Perspectives and Success Factors

While today about 100 nuclear power units worldwide are shutting down and are in various decommissioning stages, we expect this number will more than double by 2030. The total cost of decommissioning these units until reaching a greenfield state exceeds EUR 150 bn.

From 2000 to 2018, the global decommissioning market was estimated to be EUR 27 bn. Today, the market is at a turning point with expected growth rates around 20% per year in the coming years, leading to a value pool of EUR 77 bn from now until 2030. In the next decades the decommissioning market will form a growth segment in the energy sector, attracting many players.

The entire market is evolving: Newly formed JVs are entering the market, operators experienced in decommissioning are offering their expertise to market and traditional nuclear suppliers, intending to secure and increase their market share. And we see three different delivery models emerging: License transfer from

utility to supplier, decommissioning partnerships between utility and supplier, and utility-driven decommissioning. The model choice is affected by various factors, e.g., local regulation, owner capabilities, and resource strategy.

Is this a challenge or opportunity for suppliers and utilities? Past decommissioning projects have showcased the challenges of these projects, e.g., observed cost and schedule overruns. Therefore, gaining opportunities despite the significant value pool will be challenging. In our experience, we have identified various success factors, e.g., early involvement of suppliers, a clearly defined decommissioning and contracting strategy, a project-driven decommissioning organization, efficient regulatory stakeholder management, and tight project controlling to assure progress. These and other factors could lead to a projected savings potential of up to 30% of decommissioning costs.



Risk Management in Nuclear Decommissioning

As industries and countries around the world increase the focus on nuclear decommissioning and clean-up, significant challenges are emerging. There can be considerable political, regulatory and commercial pressures to make progress, yet it is vital that activities are carried out safely and risks are shown to be as low as reasonably practicable (ALARP).

When a plant has ceased to be operational, the transition to post-operational clean out and decommissioning results in a fundamental change in activities and the associated risk profile of the plant. A short increase in plant risk may be acceptable on ALARP grounds for a long term risk reduction.

The challenge faced by operators during this period is the change to a decommissioning mind-set and potentially a change to the required skill-sets alongside retention of plant knowledge.

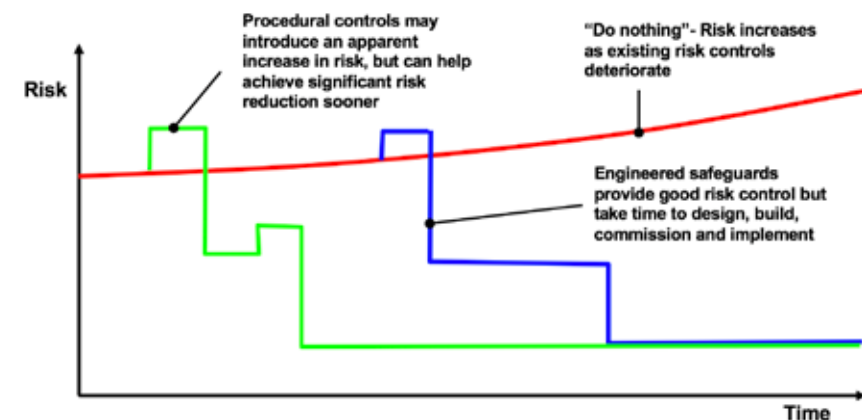
In the event that plant knowledge is not retained and there is incomplete or insufficient information at the start of a decommissioning project a staged approach may be proposed with hold points to manage any potential uncertainties.

The safety arguments for decommissioning operations will require fit for purpose, proportionate and pragmatic approaches. For example a change in activities may require a change to the claimed safeguards and where practicable a reuse of existing systems and a review of the potential for operational based safety measures.

Decommissioning operations require a degree of flexibility and presentation of a clear safe operating envelope against which it is understood how far operations can be modified.

The changes in approach required to successfully manage risk during the decommissioning process are identified and it is concluded that organisations will have to accommodate change through dynamic 'out of the box' thinking.

This paper uses recent project experience to illustrate these challenges and possible solutions to safely manage the nuclear decommissioning process whilst meeting stakeholder requirements.



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SPEAKER

WEDNESDAY 11:30 DE

Dr. Dietmar Nieder

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Markus Thoma

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Ingenieurgesellschaft mbH
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SPEAKER

WEDNESDAY 12:00 DE

Ralf Oberhäuser

ORANO GmbH
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91058 Erlangen - Germany
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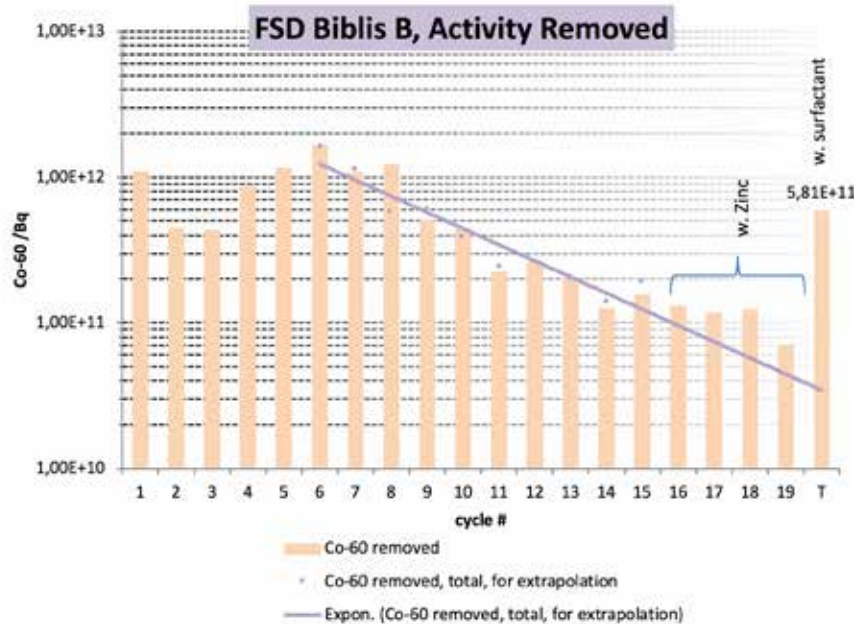
Ralf Borchardt

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Experiences in PWR Full System Decontamination – Effective and Gentle Process

A Full System Decontamination (FSD) was performed in the Biblis NPP units A and B. High decontamination factors (around 100) were obtained by applying the ASDOC_D-MOD process. This process showed to be very efficient in both, the total consumption of chemicals and ion exchange resins. The monitored corrosion effects were very low - even with regard to chromium steels sensitive to corrosion. These were for example deployed in the primary coolant pumps. With the aim of process optimization, an injection of zinc and surfactant into the reactor circuit were performed by the power plant chemistry. Nevertheless, the process required far less time than initially estimated.

Im Kraftwerk Biblis wurden in den Blöcken A und B Primärkreisdekontaminationen, hauptsächlich gemäß dem ASDOC_D-MOD-Verfahren, durchgeführt. Dabei konnten sowohl hohe Dekontaminationsfaktoren von ca. 100, als auch geringste Materialabträge an korrosionsempfindlichen Chromstählen, wie sie z.B. bei den Hauptkühlmittelpumpen eingebaut sind, erzielt werden. Gleichzeitig war der Chemikalieneinsatz relativ gering und der Verbrauch an Ionentauscherharzen lag deutlich unter den Abschätzungen. Zusätzlich wurden im Block B anlagenseitig versuchsweise sowohl mehrere Zinkdosierungen als auch abschließend ein Tensidschritt zur Ergebnisverbesserung durchgeführt. Der vorgegebene Zeitrahmen wurde deutlich unterschritten.



Cutting and Packaging of Irradiated Control Rods at Brunsbüttel NPP

Within decommissioning of Brunsbüttel Nuclear Power Plant the processing of irradiated control rods is one major step in remaining core waste removal.

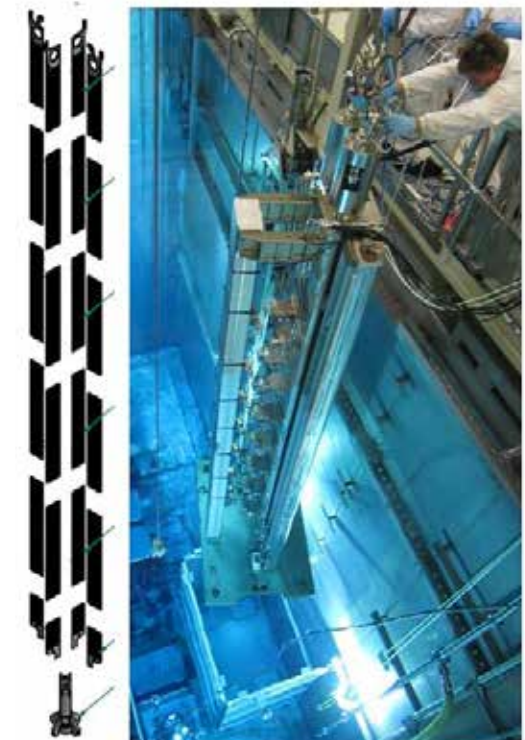
A number of 151 of boiling water reactor control rods needs to be cut and packed under water, prior to dismantling of the reactor pressure vessel internals. For this it is important to apply a reliable process which can be performed remote controlled under water in the spent fuel pool and which enables a volume reduced packaging - in line with the respective regulatory frame work.

Within the engineering phase the required documentation to apply the storage campaign is prepared and agreed on with experts and authorities. The tooling and equipment is prepared for use. Based on radiological data derived from theoretical calculations, dose rate measurements and sampling a sophisticated cutting and packing planning is performed with the overall goal of minimization of storage containers.

The process is as follows. After cutting off the foot segment the control rod-dismantling is done by two vertical saw cuts through the center of the control rod. The results are four blades per one control rod. The further cutting of the control rod-blades is done by a hydraulic shear to achieve the required length. The cutting pieces are then placed in the foreseen storage containers at dedicated positions in line with the packing concept.

Within the presentation a general overview over this project is given. The major steps in planning and preparation are described, followed by the introduction of the cutting concept and the dedicated equipment. The packing concept with its equipment is presented and impressions from the on-site performance are shown.

Co-Author: Dr. Michael Hinderks, Vattenfall Europe Nuclear Energy GmbH



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SPEAKER

WEDNESDAY 13:30 DE

Timo Liedtke

Company KTE Kerntechnische Entsorgung Karlsruhe GmbH
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SPEAKER

WEDNESDAY 14:00 DE

Shahin Farahzadi

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Virtual Reality Training (VRT) – Safety in Dismantling of KTE Nuclear Facilities

The Reprocessing Plant Karlsruhe (WAK) was constructed in the 60's as a pilot reprocessing plant for nuclear fuels and in operation from 1970. In 1991 the operation was stopped and decommissioning of the entire plant was initiated, among others the disposal of about 60 m³ high active waste concentrate (HAWC) from the storage tanks. For that the Vitrification Facility Karlsruhe (VEK), was built to process these highly active liquids into HAWC glass canisters. About 55.6 t of waste glass were produced between 2009 and 2010 in the inductive heated ceramic melter. After the operational phase, decommissioning was carried out and dismantling of VEK started.

Different challenging dismantling steps were identified during decommissioning planning phase for which Kerntechnische Entsorgung Karlsruhe GmbH (KTE, former WAK GmbH) decided to introduce VRT technology.

VEK 3D-CAD models of entire hot cells (e.g. receipt tank and evaporator cell) were implemented into virtual software environment and connected to a real master arm and power manipulator operator panel. In this way the operator is able to virtual demonstrate the feasibility of dismantling steps.

Additionally VRT is been used for qualification tests and training for remote dismantling staff. Therefore dismantling scenarios such as packaging and handling of pipes are designed.

The presentation will be an overview of current training activities.



Building Information Modeling – Efficient and Optimized Dismantling Planning

Building Information Modelling (BIM) is a planning method, which represents the life cycle of a building, both built and still in development, through digital models. Those models are made using object-oriented CAD-software and contain components, which could carry any number of attributes and information. A complete BIM model is therefore a building database that contains all geometrical and non-geometrical information about design, planning, execution, management, restoration or demolition.

The deconstruction of highly complex structures, for example power plants, puts the chosen planning method to the test. Conventional methods, such as two-dimensional drawings und sheets, are often error-prone and can lead to loss of information at every data exchange.

BIM enables a holistic approach by consistently enriching the components with information during the

entire life cycle of the building. For example - any contamination that may have occurred can be mapped in a so-called facility management model. The planer can later easily use this model and the information it contains for the deconstruction phase. Object-oriented planning also opens a variety of possibilities, such as simulations of various deconstruction scenarios, inspections or visualizations using virtual or augmented reality. Formitas AG specializes in developing solutions for such purposes and has already been able to successfully use them in various construction projects.

However, the BIM method has yet to reach the demolition sector, as most of the building stock is not available as an information model. Therefore, the creation of such models is very often necessary during a demolition or reconstruction project. This presentation will deal with that situation and will show possible solutions and workflows for an efficient and optimized deconstruction planning using BIM.



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SPEAKER

WEDNESDAY 15:00 EN

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SPEAKER

WEDNESDAY 15:30 DE

Martin Rathgeber

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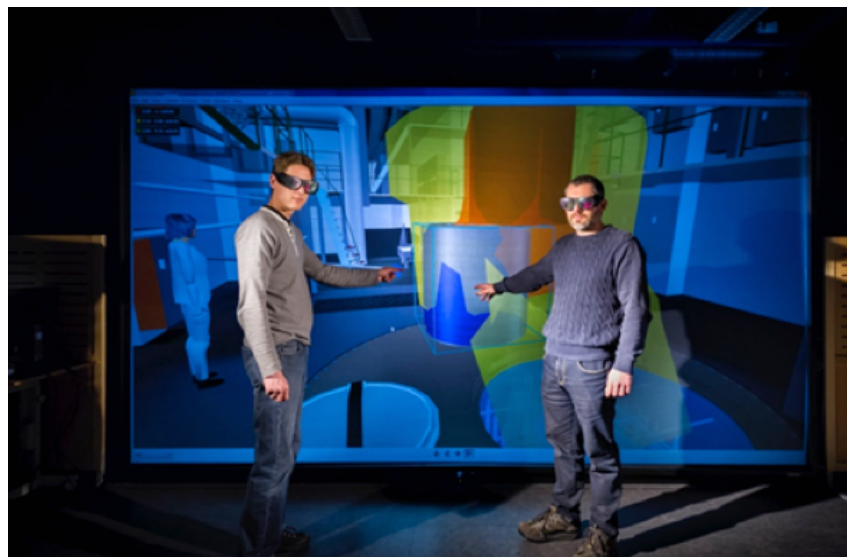
Website www.nuctecsolutions.com

Use of VR in Decommissioning Planning and Training

The Institute for Energy Technology (IFE) has been involved in R&D focused on digitalization since the 1970s. The synergy between research programs, industrial needs and industrial projects has been the key factor for success within digitalization. IFE is hosting the OECD Halden Reactor Project (HRP), an international research project within the OECD NEA, supported by organizations in 20 OECD countries. The aim of the project is ensuring safe and reliable operation of nuclear plants by taking advantage of R&D advances and related technical innovations.

For more than 15 years the OECD HRP has been providing support for a number of decommissioning project teams to take advantage of the VR innovations resulting from the OECD HRP decommissioning research. In support of decommissioning and nuclear knowledge management in Member States, IAEA's Department of Nuclear Energy signed in 2018 an agreement with IFE.

In the middle of the 1990s the Halden Virtual Reality Centre (HVRC) was established. Using this facility, novel applications of virtual reality(VR) and wearable augmented reality(AR) systems have been investigated in order to provide the OECD HRP member organization with recommendations and guidelines to enable decision makers when and if it is appropriate to use these technologies.



Accident with Significant Activity Release – Decontamination and Protection against Nuclear Hazards

In December 2016 a release of high active Se-75 occurred at a service company. The source was used in a non-destructive material testing and was opened by an incorrect assessment. Building and exterior areas of the site were contaminated.

The vacuum system has been installed and is in operation. After a decay phase, the basement area and the screened cell, which still has very high activity, is decontaminated.

After a lengthy decontamination phase of the administration building and the measurement for release in our clearance measuring container, about 5 tons of material were released. Floors, walls and fixtures were measured and released by the authority.

The presentation shows in a short review about the events, the current measures and the future actions. Our measures for nuclear emergency preparedness are presented.



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SPEAKER

THURSDAY 09:00 DE

Dr. Tim Thomas

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

Web www.safetec-strahlenschutz.de



SPEAKER

THURSDAY 09:30 EN

Dr. Grégoire Augé

Company ONET Technologies SAS
36, Boulevard de l'Océan
13009 Marseille - France

Web www.onet-technologies.com

Challenge in Release with the Clearance Measurement System

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

Based on previous experiences the commissioning and operation of the large clearance systems can pose a number of challenges. A major problem with these devices is obtaining nuclide specific detection efficiencies, especially for geometrically complex large waste packages. The standard procedure for estimating detection efficiencies is to device dummy waste packages to which at various positions sources with well-known activities are attached. But, devising such representative test dummies is not always possible and the procedure is time consuming and prone to generating large measurement uncertainties.

In particular, the proper assessment of underlying uncertainties for the determination of characteristic limits can pose additional difficulties. External influences such as climate effects on the shielding factor and background correction must be considered and the associated uncertainties specified during the commissioning process.

In this proceeding we will present selected examples where we introduced probabilistic methods to derive relevant uncertainty parameters and detection efficiencies. These methods allow to determine less conservative problem-dedicated detection efficiencies and a realistic assessment of uncertainties.



Non-Destructive Test Investigation and Characterization of Historic Wastes

ONET Technologies is a French leader in Nuclear Engineering and Services. Backed by a workforce of over 2800 employees, we have over 40 years of experience delivering integrated services that span the entire lifecycle of nuclear and industrial facilities.

Answering to a technical challenge laid down by the French Alternative Energies and Atomic Energy Commission (CEA) we combined the capacities of our own radioactive waste processing and storage facility SO-GEVAL with our expertise in the fields of Radioactive Waste Management and Non Destructive Testing into an innovative method of Investigation and Characterization of Historical Wastes.

For disposing large blocks of waste towards the final national French repository, the content of waste must be characterized as effectively as possible. Because of a non-completeness of data, a loss of traceability of

waste produced in the 1960s, obligation of knowledge of the waste characteristics required some additional investigations. Destructive tests are often the only methods available to get the information needed and the operating cost is also a major problem.

For the characterization of large blocks of nuclear waste we used nondestructive methods and analyzed radar, ultrasounds and gamma spectrometry data acquisition. We present in this communication the different methods, operations and results for characterization of ILW, LLW large blocks. We explain how sludge, wet waste, solid waste can be discriminate with the analysis. We conclude by giving the parameters of this robust strategy.

On the basis of the success and efficiency of this method, we are in the process of promoting it on the radioactive waste management market worldwide.



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SPEAKER

THURSDAY 10:00 DE

Dr. Johannes Kerl

Company Framatome GmbH
Postfach 11 09
91001 Erlangen - Germany

Web www.framatome.com



SPEAKER

THURSDAY 11:00 EN

Dr. Matthias Fritzsche

Company Mirion Technologies (Canberra) GmbH
Walter-Flex-Straße 66
65428 Rüsselsheim - Germany

Web www.mirion.com

Optimization of Waste Packing by Combination of Theoretical Prognosis and Measurement Data

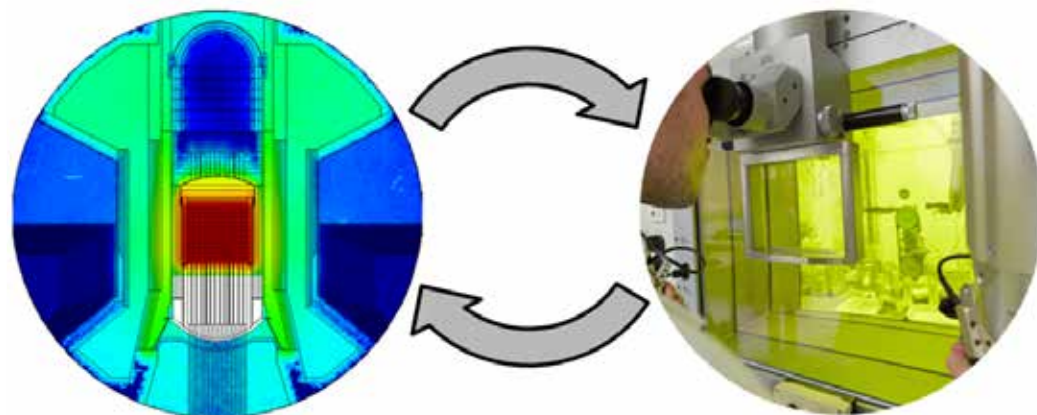
The strategy for the dismantling of nuclear power plants strongly depends on the contamination and activation level, as well as on the depth of activation.

The activity inventory of the overall plant is determined based on a first radiological characterization, consisting of activation calculations and comparisons to obtained data. The packaging concept is established and a first pre-selection of required final disposal casks is performed. Using a selection of sampling analysis methods, the activity inventories are verified. A combination of both calculated and experimental values enables to determine the activity level for the relevant radionuclides, the nuclide ratio and the level of contamination of components, which is a prerequisite for preparing the final disposal documentation.

The sampling process is a multi-step process; starting with the definition of the sampling location, followed by taking, transporting, segmenting, and treating the sample, and finally analyzing it using a pre-specified method. These steps strongly depend on the activity level of the sample – low, medium, or high.

Framatome's accredited radiochemical laboratory in Erlangen is used to handle and prepare the samples for an optimized analysis. The analysis is performed to detect the activity levels of contamination and activation. Chemical and radio-chemical parameters of the analysis have to be defined in close cooperation with all disciplines, customers, and regulators involved.

The decommissioning (dismantling and packaging processes) planning is checked based on the final radiological characterization, ensuring all radiological limits are fulfilled. The main target of the overall approach is to optimize the sampling, to implement the results of the analysis in the radiological characterization, and to create a comprehensive cask declaration. The optimization aims to reduce the required amount of final disposal casks. This presentation will detail this overall optimization process.



Active and Passive Nuclear Fuel Determination

Nuclear waste characterization is a challenging task, especially if the waste contains nuclear fuel and is conditioned in drums where the content is not exactly known with regards to activity and matrix distribution. In addition to that, documentation of old drums is often not sufficient which makes re-characterization necessary.

„Nuclear fuel nuclides“ are hard to detect with standard gamma spectroscopy methods due to the low energy of emitted gammas and the shielding effects of drum and matrix material as well as background radiation. As an add-on to gamma-spectroscopy, neutron counters can be used to detect those nuclides which decay by spontaneous neutron emission. For fuel nuclides, such as ²³⁹Pu, ²⁴¹Pu and ²³⁵U, which do not spontaneously decay by emitting neutrons, neutron emission can be induced using an external neutron generator and by „counting“ the subsequent neutron

decay. For Matrix corrections inside the drum the so-called Add-A-Source technique can be used which allows improving the accuracy.

This presentation gives an overview of the issues of detecting nuclear fuel in nuclear waste drums and introduces the active-passive neutron detection method as a method to determine the amount of fuel inside waste drums. Beside the description of the functionality, the design of a combined neutron and gamma system is introduced highlighting the requirements and challenges of the system.



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SPEAKER

THURSDAY 11:30 EN

Barry Moloney

Company Olenian Ltd.
30 Castle Street, Steventon
Abingdon, OX13 6SR - United Kingdom

Email bpmoloney@olenian.com

NOTIZEN NOTES

Large empty grid for notes.

Recycling of Lightly Activated Components and Contaminated Scrap from NPPs in Europe

Re-use of steel from the nuclear industry by fabrication into shielding blocks has been well established in the USA since 1992. This presentation will summarise recent trends to utilise higher activity scrap in the production of such shield blocks.

High energy physics facilities, such as proton accelerator labs, use iron and steel to absorb neutrons and other particles emitted during beam/target interactions and beam stop events. The steel shielding becomes activated in use, so fabricating the blocks from radioactive steel in the first place makes operational and environmental sense.

Absorption of neutrons requires shield blocks with sufficient mass. EnergySolutions Services Inc.'s facility at Bear Creek, Tennessee, runs a 20t furnace to cast large blocks. To produce the required mechanical strength and metallurgical properties, the input steel is carefully selected and controlled for alloy constituents, impurities and radioactive contents. Blending of input radioactive scrap feedstocks is a necessary feature

of the production process. Co-60 persists in the steel during the melting process and therefore constrains acceptance of scrap. Blending of different feedstocks reduces the concentration where some input streams feature low Co-60 content. The normal acceptance limit is 40Bq/g, with different limits for other nuclides. Output shield blocks previously contained a maximum of 4Bq/g Co-60. Now ESSl produces blocks at 8-9Bq/g which remain IAEA Exempt for shipment. ESSl has developed the operational safety controls to protect its workforce and manage license compliance with higher activity input scrap. Through a long working relationship with GNS, safe packaging, shipping and road transport of scrap have been established.

Consequently, ESSl can now recycle either medium contaminated or lightly activated scrap steel from European NPPs. Decontamination can be offered in Europe or USA. Project examples will be provided of scrap recycled into shield blocks in recent years.



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10TH International Forum of Nuclear Industry Suppliers

13-14 November 2018, Moscow

Gostiny Dvor Exhibition Complex



atomex
2018

ATOMEX is the international networking event of the year for nuclear industry that brings together executives and major stakeholders to discuss current issues and to share knowledge from across the nuclear industry.

- show the products and services of your organization to the target audience;
- negotiate B2B with main major customers' executives, engineering experts and representatives of procurement departments;
 - establish direct contacts at the level of procurement decision makers;
 - present your services and products at the Forum's Business programme.

Organizer  ROSATOM

Operator – Atomexpo LLC



 +7 499 922 89 95

 atomeks@atomexpo.com

 www.atomeks.ru/en

 Atomex

iC&ND

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*heavy transport -
next level!*



Proficiency in Nuclear Engineering

Professional activities in the complex discipline of nuclear engineering demands constant advanced training that takes up after formal studies end. For this reason, we decided to develop a training programme that not only provides instruction in elements of basic knowledge but also facilitates intensive analysis of special subject areas. Our reflections resulted in six training modules that satisfy this requirement.

The training programme by AiNT offers not only a general view of individual topic areas, but also imparts a greater depth of knowledge, e.g. on the issues of radioactive waste disposal or interrelationships in energy policy. The programme is constantly being expanded and refined in response to changes in the field, so that it is possible to address a broad range of technical subjects with internationally recognised speakers.

We are guided strongly by psychological learning principles during the design of our course modules. For example, receptiveness to and retention of the contents of the instruction modules are supported by the structures of the information and a relaxed learning atmosphere. The individual subject areas are introduced by professional, qualified and experienced presenters who have distinguished themselves through exceptional technical skills and teaching qualifications.

Additionally, we offer engineering and consultancy services on the highest scientific level. Especially the development of measurement technologies for the characterization of radioactive waste, the simulation of nuclear process as well as waste management belong to our services. We support our clients in the process of conditioning, characterization and packaging to qualify their waste for the German repository Konrad.



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 route 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 payloads, 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 9001:2008 and SCCP: 2011 Standards.

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



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ASUP GmbH - Ihr Partner für Industrie, Handwerk, Kommunen und Entsorgungswirtschaft

Die ASUP GmbH ist seit fast 20 Jahren spezialisiert auf den Vertrieb von Produkten und Lösungen im Bereich Arbeitsschutz für den sicheren Umgang mit Gefahrstoffen. Als Partner für Industrie, Handwerk, Kommunen und die Entsorgungswirtschaft garantiert ASUP mit mehr als 90 Mitarbeitern an vier Standorten in Deutschland und der Schweiz Top-Service und zuverlässige Sicherheit.

Mit einem eigenen Außendienst ist ASUP in der Lage auf individuelle Kundenwünsche einzugehen und gleichzeitig eine hohe Produktverfügbarkeit und zuverlässige Belieferung sicherzustellen. ASUP hat dabei ein Portfolio von attraktiven Eigenmarken entwickelt und kann als Direktimporteur besonders günstige Einkaufskonditionen für eine Vielzahl von Produkten an seine Kunden weitergeben.



automess GmbH - Nuclear Radiation Measuring Techniques since 1970

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 worldwide sales and service of our products.



The Innovators in Surface Preparation- Surface Preparation Machines and Accessories

Blastrac is the leading international developer and biggest manufacturer worldwide of surface preparation equipment. We have a full range of over 60 different machines for preparing & maintaining floors, walls and other surfaces of all kinds of materials. Our innovation 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)

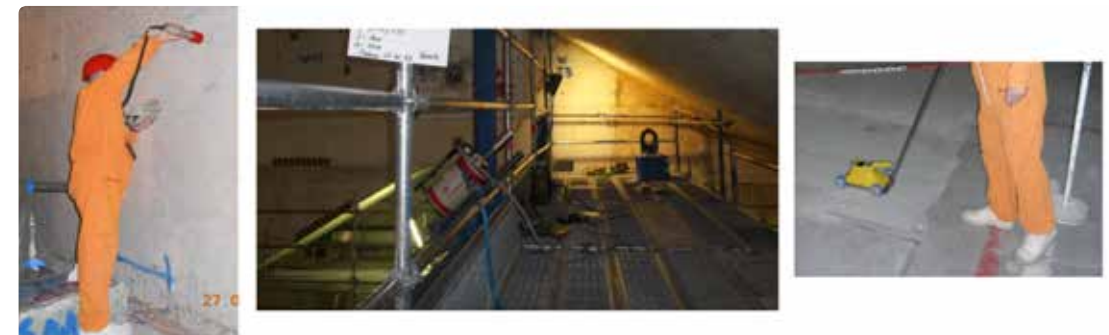
BS has been active in the consultancy business for nearly 40 years now. The services cover the areas of radiation protection, nuclear technology, software development, plant and process engineering as well as radwaste disposal, mining and environmental management. Founded at Aachen, BS has now additional 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.



Bringing Solutions for your Radionuclide Analysis Applications

Baltic Scientific Instruments (BSI) was established in 1994 on the basis of Riga Research and Development Institute for Radio-Isotope Apparatus (RNIIRP, est.1966), which belonged to the Ministry for Atomic Energy of the former Soviet Union. RNIIRP had Union-wide 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 the Soviet Union. 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.



Innovative Nuclear Measurement Systems

CAEN SyS 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 is committed to delivering exceptional nuclear measurement instrumentation, expertise, and technical support. CAEN SyS products and systems will allow operators to maintain online operation with a high degree of quality, safety and security, while minimizing operational expenses via on-time delivery.

CAEN SyS provides nuclear measurement solutions and technical expertise for a wide array of applications:

- Health Physics , Spectroscopy and Radiation Measurements Systems
- Custom Nuclear Measurement Systems: Plant, Waste, Safeguards, Security
- Nuclear Waste characterization products and solutions
- Spectroscopic survey of large surfaces with real-time mapping information
- Detection of gamma and neutron sources; RPM Radiation Portal Monitor
- Identification of gamma radionuclides and SNM detection
- Networking of Radiation detectors and Robotics solutions
- Safeguards and Security products for non-proliferation and threats
- Fuel Cycle process monitoring and Fuel characterization
- Fresh & Spent Fuel Burn-up solutions/measurements
- Nuclear Emergency Preparedness: Training, Products and Systems
- Site Remediation studies; products and solutions for mitigation plans





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 - 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.

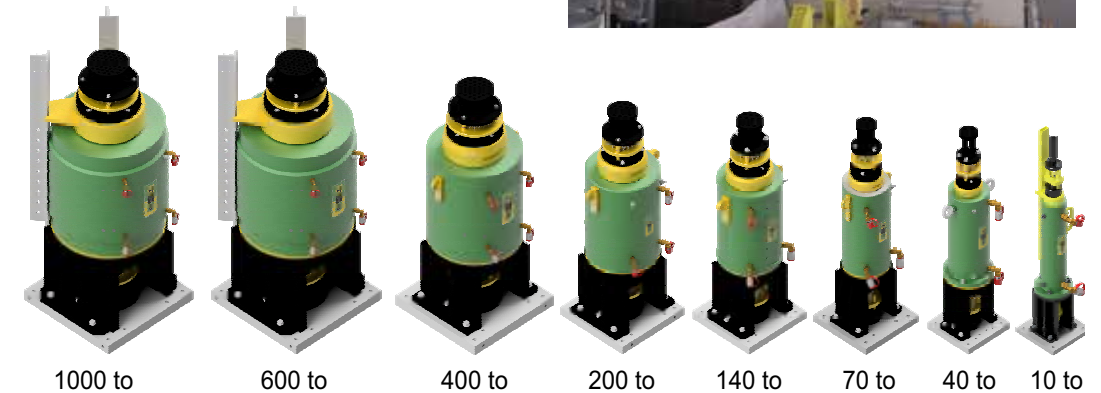
Hebetec places particular importance to provide its equipment in as new condition to construction sites. The quality of the equipment is under permanent improvement. New components are being developed by our in house engineering- and design department.

Assignments often require specialised and tailor-made solutions. Thanks to a large machinery variety Hebetec is in the position to present adequate solutions and is able to react on short terms with high individuality and flexibility.

The lifting engineering market is subject to special outline conditions and is characterised by high mutual trust between client and service provider. Based on a vast experience gained during company history and on a sound corporate base, Hebetec is in the position to offer world-wide competitive services on a top quality level.



Strand jacks by Hebetec Engineering Ltd
 Available capacity of over 110'000 tons



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Automated Transport of Drums, Boxes, Containers or Mineral Bulk Material

The company IEM FörderTechnik GmbH has been located in Kastl (Germany) for 50 years. IEM manufactures among other conveyance, electric-mechanical driven roller- and chain conveyor systems for the transport of bulk and piece goods.

- Handling of Bulk Material, e.g. Concrete Demolition Waste, by Dust Proofed Trough Chain- or Corrugated Belt Conveyors
- Drum-, Skeleton- or Konrad Container Transportation of LLW
- Drum Filling and Waste Compression
- Drum Sealing and Closing
- Weighing and Dimensional Check
- Handover to Rail Transportation- and Automated Guided Vehicles (AGV's)
- Transport by AGV's



Krantz Designs, Manufactures and Sells Filter Systems and Dampers for HVAC Systems

Krantz develops, designs and manufactures air distribution systems, cooling and heating systems for ceiling and façade 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. As a Caverion trademark, Krantz shares the same core values. These values serve as motivation and guidance at the same time (for more information please take a look to our webpage).

Department Filter Systems and Dampers
 Krantz designs, manufactures and sells Filter Systems and Dampers for HVAC systems in areas with highest tightness requirements as nuclear facilities, bio-safety laboratories, isolation wards, decommissioning of chemical weapons etc.

- Filter Systems**
 Krantz offers a wide range of filter systems for applications with high tightness requirements, like:
- HEPA filter systems
 - Re-cleanable HEPA filter systems
 - HEPA filter air outlets
 - Duct filters
 - Filter walls
 - Mobile filter systems
 - In-cell filters
 - Sorption filter systems
 - Sorption filter elements
 - Sorption cartridge filters
- Dampers**
 Krantz offers a wide range of dampers for applications with high tightness requirements, like:
- Gastight dampers acc. DIN 25496
 - Air flow controllers
 - Pressure relief dampers
 - Louver dampers
 - Non-return dampers
 - Pressure surge dampers



LUELF & RINKE Sicherheitsberatung | Experten für die Bemessung von Werkfeuerwehren

Nach der Abschaltung von Kernkraftwerken verändert sich das Risikopotenzial im Zuge des Rückbaus in mehreren Schritten. Der Betrieb und der notwendige Umfang einer Werkfeuerwehr wird durch die möglichen Szenarien, die einen Feuerwehreinsatz bedingen würden, bestimmt.

Um die Werkfeuerwehr an die Meilensteine des Rückbaus anzupassen, ist eine fundierte Bemessung durchzuführen und gemeinsam mit Betreiber und Aufsichtsbehörden zu diskutieren.

Wir beraten seit mehr als 40 Jahren Unternehmen und Organisationen in allen Fragen der betrieblichen Gefahrenabwehrplanung, Brandschutzbedarfsplanung, Organisationsstruktur und Dienstplanorganisation.

Bei der Bemessung von Werkfeuerwehren (bzw. dem betrieblichen operativen Brandschutz) verwenden wir eine eigens entwickelte und in hundert Projekten etablierte Bewertungsmethode.

Die Methode passt sich quasi automatisch den örtlichen Regularien an und berücksichtigt die spezifische Leistungsfähigkeit der öffentlichen Feuerwehr.

Die Bemessung von Werkfeuerwehren für Kernkraftwerke haben wir in mehreren Projekten in verschiedenen Bundesländern durchgeführt. In Stufenkonzepten konnten wir die Entwicklung des Feuerwehrtbedarfs ableiten und erfolgreich diskutieren.

Wichtig ist uns bei allen Projekten der ganzheitliche Beratungsansatz und die Entwicklung von maßgeschneiderten Lösungen, je nach standortspezifischen Leitfragen.



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, Mirion's mission is driven to protect people, property and the environment from the harmful effects of ionizing radiation.

The company delivers high quality, state of the art solutions that constantly evolve to meet the changing needs of its customers.

Mirion has a whole range of sophisticated tools and world-class expertise to solve your most demanding nuclear measurement challenges in Decommissioning & Dismantling (D&D) applications.

Mirion designs, builds, commissions and operates products and provides services to support your D&D projects. This includes a wide range of instrumentation for all stages of D&D project lifecycles.

As well as supplying fixed installed Non-Destructive Assay systems, our Measurements & Expertise team provides full consultancy services as well as field measurements teams to perform on-site measurements. 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.

With the merger of Canberra in 2016, Mirion expanded its portfolio and the breadth of its expertise to bring a new standard of solutions to their customers:

- Fixed and mobile systems for protecting individuals from radiation exposure
- Spectroscopy solutions
- Cameras for extreme environments; measurement & expertise for decommissioning & waste management
- Safety-related fixed & mobile Radiation Monitoring Systems
- Nuclear sensing instrumentation & sealing systems
- Dosimetry services



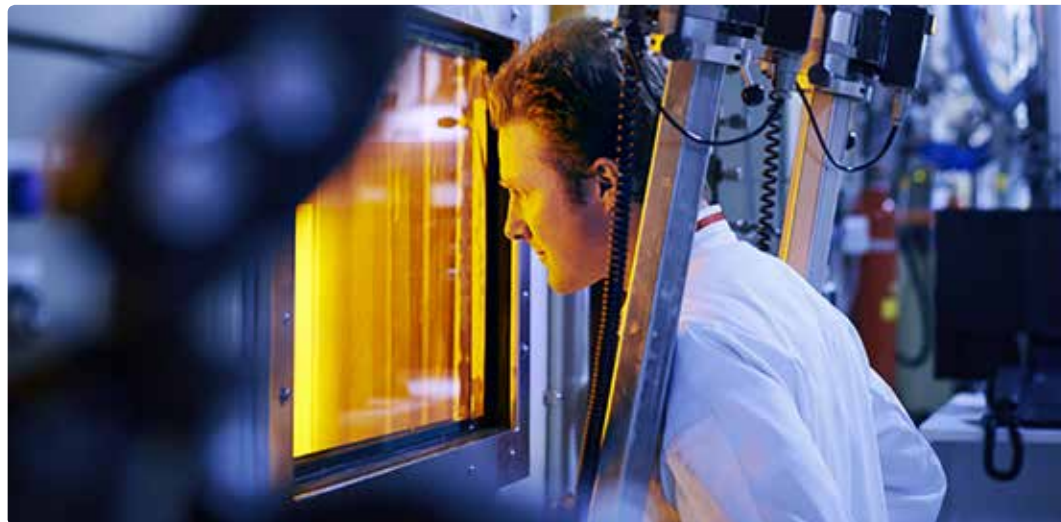
NRG Consultancy and Services (C&S)

NRG Consultancy and Services (C&S), based in the Netherlands, 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. Mid-sized, with 450 highly qualified engineers, consultants, and operational staff, we give customers and partners access to the best expertise and extensive experience.

We have recognized, world class experts. Our unique expertise and history puts us in the position to meet our client's needs in a professional and unbiased way. We are independent from other service providers, utilities or regulatory bodies. Our facilities are unique and encompass in Petten i.e. a high flux reactor, hot cells, radiochemical laboratories and in Arnhem a mock up hall for inspections.

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 expanding our business on an international scale to become a driving force in an international network of innovative nuclear service providers who jointly offer a broad scope of services in their markets and together establish a preferred supplier status.



NucTecSolutions GmbH - Radiation Protection, Decommissioning and Emergency Management

NucTecSolutions GmbH was founded in 2006 as a radiation protection services and demolition company.

As a multidisciplinary company, NucTecSolutions GmbH has the possibility to provide services of all kinds 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.

This combination of theory and practice provides a service in radiation protection, deconstruction and renovation at the highest level of cost effectiveness. Our developments in measurement technology, handling techniques and decontamination processes, together with our own infrastructure, as much analysis and mobile units as a first-class trained team, allow projects to be interlinked and thus save money. A direct connection between planning, radiological actualization, the actual deconstruction, decontamination and measurement for the release is quite useful for small- and medium-sized projects.

This has been consistently implemented by NucTecSolutions GmbH since the company was founded.

For this purpose, NucTecSolutions GmbH has special measuring technology, its own equipment and self-developed decontamination processes, which are also available to the customers as well as to the project success in the efficient operation of the team.

After several incidents, NucTecSolutions GmbH decided in 2014, including nuclear emergency services. The combination of continuous activities in radiation protection, decommissioning activities and nuclear emergency protection is optimal for both parties, since in case of emergency there is sufficient material available, the team with measuring equipment. For the dismantling, a team with emergency protection experience in case of unpredictable events is quite reasonable.

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 worldwide active in the areas of management of radioactive waste and spent fuel, decommissioning of nuclear facilities, engineering and consulting. It belongs to the ROSATOM Group.

The company's engineers develop solutions that are both modern and proven effective. Furthermore, the solutions build upon NUKEM's extensive experience within the nuclear sector, which began over five decades ago. The company's activities comprise a broad spectrum of services ranging concept studies to the delivery of turn-key projects, from partial solutions to complete project and contract management. The company's Engineering and Consulting services play an important role in contributing to innovative design and build.

NUKEM is based in Alzenau, Germany where also the majority of the more than 100 staff is working.

Consistent customer orientation and quality management are essential cornerstones of NUKEM's corporate philosophy. We place a high premium on individualized service, timely project completion, complete and understandable documentation and providing our customers with superior-quality products. A visible sign of our emphasis on quality is NUKEM's quality assurance system based on DIN EN 9001:2015. In addition, we are proud being certified regarding KTA 1401, DIN EN ISO 14001:2015, DIN EN ISO 10006 and OHSAS 18001:2007.



Alpha-tight housings and protective systems from PEDI ensure the personal and environmental safety during dismantling procedures.

For 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 life 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.



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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, which provides full architect engineer and management & operations

(M&O) capability, engineering, project management, project controls, commercial and contract management.

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.

We're well positioned to add value to today's challenges of delivering the next generation of nuclear power plants while at the same time maintaining the existing generating fleet and safely decommissioning legacy facilities. We're now looking to the future, working with SMR developers to advance new designs and developing digital applications for the nuclear industry.



Stäubli Tec-Systems GmbH – Connectors Complete tailor-made solutions

Founded in Horgen on the shores of Lake Zurich in 1892, Stäubli is today an international group headquartered in Pfäffikon, Switzerland. More than 5,000 employees work in the three business units; Textiles, Robotics and Connectors. With a global presence of 12 manufacturing sites, sales and service offices in 29 countries, and further representatives in 50 countries, Stäubli is close to the customer all over the world. This global network guarantees short delivery times and optimum customer service.

The branch office for Germany and Austria is Stäubli Tec-Systems GmbH. Its Connectors business unit is one of the world's leading manufacturers of quick couplings and multi-coupling systems. In addition, high-quality Quick-Mould changing solutions for the rapid change of injection moulds as well as automatic tool changing systems for robots are part of the product portfolio. Operating and functional safety, service life, efficiency, as well as economic viability and sustainability are top priorities in research and development at Stäubli.

The company, headquartered in Bayreuth, developed a unique concept for its customers. In

accordance with the requirements of each project, Stäubli offers tailor-made and individual complete system solutions from simple mono-coupling, through multi-couplings and quick-release systems to fully automatic tool changing systems. The innovative Quick-Mould changing solutions for the plastics industry combine the shortest tool change times with maximum process safety.

Stäubli Fluid Connectors produces its own modular mono- and multi-coupling systems for various media and working environments. The quick coupling systems meet the highest safety standards. The proven Stäubli sealing technology ensures a clean workplace and environment. Typical applications are compressed air, breathing air, hydraulics, alternative energies, vacuum, liquids and gas. Stäubli Electrical Connectors develops and produces high-quality electrical connectors of all types for energy and data as well as fibre optic connections and photovoltaics.

Stäubli's innovative solutions and services are used in a wide range of industries: automotive, railway, mechanical, steel, chemical, aerospace, defence, electronics cooling, nuclear, plastics, energy, motorsport and many more.



ABOUT ICOND

PROGRAM

ABSTRACTS

COMPANY PROFILES

Nuclear Service Provider, Experienced in D&D

Tecnubel has over 30 years of experience in providing advanced solutions for the nuclear industry.

Together with its subsidiaries Transnubel, ECS and Tecnubel GmbH, its expertise covers a wide range of activities in nuclear decommissioning, going from resource operations to engineered tailor made solutions.

It has provided services to various nuclear sites in Belgium and abroad, from nuclear power plants to nuclear fuel cycle facilities and from nuclear research centers to waste treatment facilities. This strong presence in the nuclear industry enables it to provide practical and technical services with high added value delivered with the greatest care and respect for quality, safety and environment.

Tecnubel is well positioned, within the ENGIE Group, to offer the preparatory studies and hands-on practical solutions to help minimize risks and resolve problems of accidental or accumulated contamination, the removal or replacement of

ageing or contaminated components, radioactive or toxic waste treatment and more. In its further geographical expansion, Tecnubel GmbH was founded in 2016 in Germany and is developing successfully with currently decommissioning and dismantling projects at research centers, radioactive waste management facilities and nuclear power plants.

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. It gained a lot of experience in D&D due to its active participation in planning and successful execution of large Belgian decommissioning projects, such as the nuclear fuel factories Belgonucleaire and Framatome FBFCi. It disposes of 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:
 - Selection of decommissioning techniques;
 - Drafting of decontamination and decommissioning procedures;
 - 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;
- Cost-benefit analysis & Schedule Optimization;
- Evaluation of quantities of waste generated;
- Decommissioning Plans, Safety Analysis Reports, Environmental Impact Reports;
- Development of Decommissioning Radiation Protection/ALARA Program.



Support in all Phases of Decommissioning and Dismantling

Since its founding in 1872, TÜV Rheinland has been synonymous with safety worldwide. Thanks to new ideas, internal developments, profound expertise and a global network, we can make products, services, systems and people safer and thus more competitive from the outset as well as promote people and train them to become experts.

Since the civilian use of nuclear energy began in Germany, TÜV Rheinland has been gathering comprehensive expertise in all areas of nuclear technology – be it for research reactors, pressurized water reactors, boiling water reactors, fast breeder reactors, high-temperature reactors or uranium enrichment facilities.

TÜV Rheinland helps companies to observe and comply with safety and quality standards while taking national and international regulations into

consideration. Our customers benefit from expertise resulting from a wide range of national and international projects.

TÜV Rheinland has been continuously involved in decommissioning and dismantling nuclear systems for more than 20 years. Based on the experience we have acquired, we can perform a wide range of activities for you that include services such as consulting in approval and supervisory procedures, support in the development of decommissioning and dismantling concepts and the underlying technical reports to practical on-site activities in the area of radiation protection. As a result of company acquisitions and the appointment of experienced employees from the industry in particular, we can provide comprehensive services in the area of dismantling and disposal for the industry.

Integrated Planning From Residual Material to Released Final Storage Containers

Founded in 1963, the VPC Group now operates internationally and enjoys an excellent reputation in the energy industry. It provides engineering services, consultancy, technical services and system integration for electricity and heat generation facilities and for transmission and distribution systems.

The VPC Group is based on four strong pillars, each with a clear focus:

- VPC GmbH (engineering for energy plants and systems)
- Conwico GmbH (turnkey plant construction)
- VPC International GmbH (with international subsidiaries)
- VPC Renewables

VPC has been involved in the design, engineering, construction supervision and commissioning of generation facilities with a total capacity of over 70,000 MW, with a highly diverse range of technologies and different operating times. VPC draws on a combination of engineering know-how and

experience as an operator, and always focuses on minimizing total life cycle costs. In addition, VPC is engaged in power and heat generation from all kinds of renewables, above all in biomass, hydro power, solar energy (PV and CSP), geothermal energy and wind.

After its foundation in Vetschau, East Germany, in 1963, VPC was known there as the "Institute for Power Plants" for many years. The company initially belonged to various power plant operators, and from 2002 to 2014 was a member of the Vattenfall Group (VPC originally stood for "Vattenfall Europe PowerConsult").

Since 2014, the VPC Group has been owned by the investment company palero, based in Luxembourg and advised by palero capital GmbH of Munich. Consequently, since 2014, VPC has been independent – of both supplier and operator interests. Our only commitment is to the needs of our customers. The main customers include suppliers of electricity and heat, and network operators. Prestigious power plant equipment suppliers and EPC contractors, ministries, research institutes and international funding banks are among the established customers of the company.

The staff of around 1,000, spread among six locations in Germany and one in each of Serbia and India, are key to the success of VPC.

Services of TÜV Rheinland Industrie Service GmbH and ISTec GmbH for the industry in the area of decommissioning

Consulting Services	Products	On-Site-Services & Laboratory
<ul style="list-style-type: none"> • Services regarding Waste Management • Services regarding Licensing and Supervising Procedures • Services for final and interim storages • Decommissioning Concepts • Technical Services (e.g. Radiation & Fire Protection) • Training • Project Management • Quality Management 	<ul style="list-style-type: none"> • ReVK (Program system for tracking and controlling radioactive waste) • ADAS (System for the acquisition and evaluation of activity data for collecting radiological measured values and process data) • VerBA (Improved fire alarm system due to consistent documentation of all events relevant to fire protection and permanent monitoring) 	<ul style="list-style-type: none"> • Providing radiation protection engineers and technicians for On-Site-Services • Radiological Characterization • Clearance • Supervising of On-Site staff (rad. Prot.) • In-House Laboratory <ul style="list-style-type: none"> - Gamma-Spectroscopy - Various measurement equipment (e.g. ISOCS, Inspector 1000)

Our Services for Nuclear Power Plants



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 und besuchen Sie 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.

