



Special IRPA-2018 issue of the
Dutch Journal for Radiation Protection

IRPA 2018



5th European IRPA Congress
4 - 8 June 2018
The Hague, The Netherlands

Encouraging Sustainability
in Radiation Protection

SUSTAINABILITY IN RADIATION PROTECTION



SECURITY AND EMERGENCY PREPAREDNESS

DEVELOPMENTS IN MEDICAL APPLICATIONS

Colofon

Het *Nederlands Tijdschrift voor Stralingsbescherming (NTvS)* is een uitgave van de Nederlandse Vereniging voor Stralingshygiëne (NVS) en verschijnt minimaal drie keer per jaar.

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About your Host

The Dutch Society for Radiation Protection (Nederlandse Vereniging voor Stralingshygiëne NVS) is your host for the 5th European IRPA Congress, which will take place in The Hague, Netherlands from 4-8 June 2018.



NVS was founded more than 55 years ago, in 1960, as a scientific society to enhance knowledge of radiation protection in medicine, industry and research. Today the society is recognized as the professional society for radiation protection professionals.

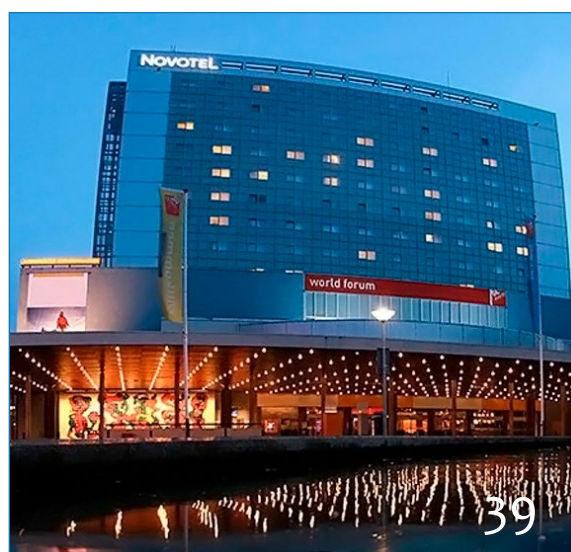
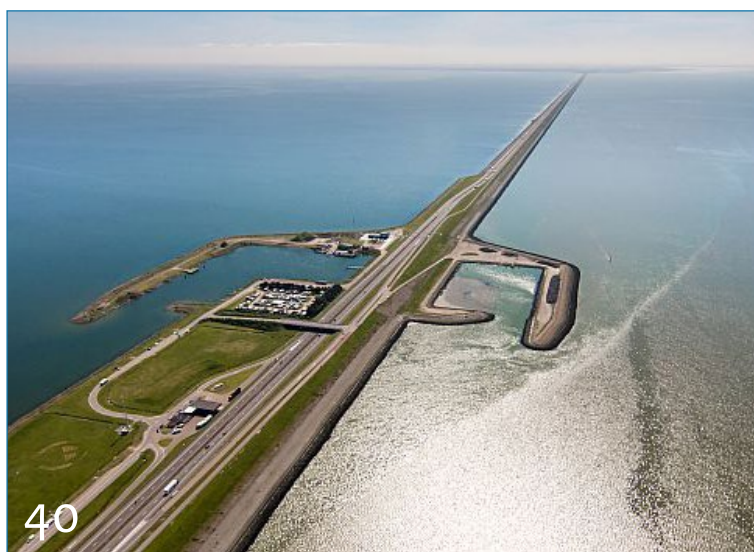
NVS aims to promote the professional development of our members through scientific conferences, thematic groups, our journal, refresher courses and our website. In order to encourage young professionals in radiation protection the society awards the Joh Aten Grant, to be used for participation in IRPA congresses.

NVS recognizes the importance of providing means for members to learn from each other on a regional, national and international scale. We therefore promote the involvement of our members in national, European and international activities such as workshops, committees and conferences. After being your host for the regional congresses in Amsterdam (1975) and Utrecht (2003) we are honoured to welcome you in the World Forum in The Hague.

With the theme “Encouraging Sustainability in Radiation Protection” the congress aims to focus on the challenges of maintaining high professional standards and ensuring adequate resources in radiation protection in a rapidly changing world. I hope you will be able to actively participate in the congress and share your knowledge.

CAROLIEN LEIJEN

President Dutch Society for Radiation Protection



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Introduction to the congress programme from the Congress President

HIELKE FREERK BOERSMA

Congress President

After a long period of preparation, the 5th European IRPA Congress is about to start soon. From 4 – 8 June, 2018 the Dutch Society for Radiation Protection (NVS) will host this regional IRPA Congress in the city of The Hague, The Netherlands. With this digital issue of the Dutch Journal for Radiation Protection I am happy to present you the extended programme of our congress.



With the theme “Encouraging Sustainability in Radiation Protection”, the congress will focus on the various aspects needed to make sure that we have, and will continue to have, adequate equipment, staff and resources to protect human health and our environment adequately against the adverse effects of ionising and non-ionising radiation. One of the key elements will therefore be a wide range of activities for the young generation,

starting with a dedicated series of refreshers on Monday morning, continuing with a School Event on Wednesday afternoon for high school students, the Young Professional Award Competition on Thursday, and finishing with the awarding of two Young Professionals during the closing ceremony. Another essential element is the concluding key note of the congress, presented by our IRPA President, Roger Coates, who will comment on the achievements of the congress.

With about 350 contributions, IRPA2018 will offer you a series of high quality key notes, parallel and poster sessions on a wide variety of topics. A novelty in the scientific program of this IRPA congress will be the poster pitches, held during the poster sessions. For this two digital screens will be available that will also facilitate you studying all other posters if no poster session is going on. At the same time, all posters will be available in the ‘old-fashioned’ way as well.

Special attention deserve the refresher courses. For the first time at a European regional IRPA congress – if not at any IRPA congress, these refreshers will be clustered, on Monday morning – immediately preceding the congress, and on Wednesday morning. Out of 25 refresher courses, nine topics will be addressed with two lectures each: one on a more basic level, a second one either discussing the topic more in-depth or focusing on recent developments. With no extra fee required and learning outcomes and recommended reading available, I am confident that these refresher courses will

contribute to the success of the congress. And even that is not all about the refreshers: an excellent series of technical visits has been established during which in most cases one or even two refresher courses will be offered. The only problem left to you is choosing either the appropriate refresher courses and / or technical visit...

We are very happy with the support of various international organisations like the European Commission, the World Health Organisation (WHO), International Commission on Radiological Protection (ICRP), International Commission on Non-Ionising Radiation Protection (ICNIRP) and the International Atomic Energy Agency (IAEA), who will address recent developments in their respective key notes. Special thanks go to our UK colleagues from the Society for Radiological Protection (SRP) and the European NORM Association (ENA) for contributing very significantly to the scientific programme. Furthermore, we are very proud to have the European Training and Education in Radiation Protection (EUTERP) foundation organising a workshop during the congress.

An IRPA congress would not be complete without a wide range of companies presenting their equipment, products and services to generate, measure or protect against ionising radiation.

The congress offers radiation protection professionals the opportunity to interact and exchange experiences among each other. Maybe even more important: you will have plenty of opportunities to meet old friends and make new ones. The reception, the congress diner and the guided jogging tracks in the early morning are only a few of these opportunities. Or, alternatively, meet each other at the art exhibition of Arie van ‘t Riet, an artist whose work addresses the beauty of life by means of X-ray imaging. You might even consider extending your stay in The Netherlands by joining the post congress tour to Leeuwarden / Fryslân, the European Culture Capital of Europe 2018.

With all this, I hope to have convinced you that we will offer you a great programme. We owe the members of the Scientific Programme and Local Organizing committees many thanks for all the work they did so far! Hopefully you share my enthusiasm and have already decided to come to The Hague. If you have not yet registered, please do so as soon as possible and save money – the deadline for normal registration ends at April 30. Of course, we would appreciate dissemination of this congress programme to anyone who might be interested. I am looking forward to welcome you shortly in The Hague!

Registration and further information

Registration

Registration for this congress can be done via www.irpa2018europe.com/registration.

Social media

- Please join the IRPA2018 LinkedIn group to stay informed on all the congress information
<https://www.linkedin.com/groups/8633053>
- Follow us on our Twitter-account: #IRPA2018

Further information

You will find further detailed information on our website:

- www.irpa2018europe.com
General Congress News
- <http://www.irpa2018europe.com/registration>
Registration – Note the deadline for normal fee registration: May 1st, 2018
- For questions, please contact our congress secretariat at info@irpa2018europe.com



Organisation

Steering committee

From left to right: Bert Gerritsen, Jan Kops, Lars Roobol, Hielke Freerk Boersma, Anita Buiteman, Gert Jonkers, Carel Thijssen

Registration Fee		
Normal fee	€ 880.00	until May 1 st 2018
Last minute + onsite fee	€ 1040.00	
Refresher Course	no extra fee	registration is obligatory
Technical visit	€ 40.00	only with sufficient participation further information on website
Congress Dinner for participants	€ 30.00	
Accompanying person fee	€ 80.00	
Congress Dinner for accompanying persons	€ 95.00	
Post Congress Tour	€ 469.00	€ 599.00 for single occupancy until May 1 st 2018



We invite you to participate in the **5th European IRPA Congress** which will take place in:
The Hague, The Netherlands, 4-8 June 2018



The overall theme of this Congress is 'Encouraging Sustainability in Radiation Protection' and will feature

- » Dedicated sessions for Young Professionals
- » 24 Refreshers Courses
- » 11 Technical Visits
- » Poster sessions (partially digital) and elevator pitches
- » Scientific sessions on the following topics:
 - Medical
 - NORM
 - Security and Emergency Preparedness
 - Non-ionising Radiation
 - Decommissioning
 - Education & Training
 - Research & Applications
- » An all-round technical exhibition programme

More information

- » You will find further detailed information on our website: www.irpa2018europe.com
- » Please join the IRPA2018 LinkedIn group to stay informed on all the Congress information <https://www.linkedin.com/groups/8633053>
- » Follow us on our Twitter-account: #IRPA2018

Registration for this Congress can be done via www.irpa2018europe.com/registration
We hope to welcome you on June 4, 2018 in The Hague!

5th European IRPA Congress
4 - 8 June 2018
The Hague, The Netherlands
**Encouraging Sustainability
in Radiation Protection**



Congress Programme¹

The basis for the scientific programme is the Congress Theme:

Encouraging Sustainability in Radiation Protection

The congress will focus on aspects needed to make sure that we have, and will continue to have, adequate equipment, staff and resources to protect human health and our environment against the adverse effects of ionising and non-ionising radiation.

Therefore, the programme guarantees sufficient time/space to share practical and theoretical knowledge, highlight new challenges and how to handle these optimally at all times with the sustainability in radiation protection in focus.

The scientific sessions within the programme will cover a broad range of areas within radiation protection:

- NORM: regulations, building materials, radon, exposure of workers and the public.
- Medical: eye and skin dose, radiation therapy, training, justification and decommissioning
- Occupational exposure: general topics, radon and eye lens dosis, equipment and software, dose estimation, NORM.
- Security and Emergency preparedness: general topics, communication and risk management.
- Environmental remediation: communication and technical challenges, general issues, NORM.
- Non-ionising radiation: general topics.
- Fundamental issues: physics, chemistry and biology, education and training, radiation protection culture.
- Industrial applications: radiological protection challenges by the decommissioning of nuclear and non-power generating facilities both large and small, education and training.
- Regulation and Legislation: general topics, implementation of BSS radon regulations.

The programme will feature a series of keynote plenary presentation sessions, parallel topical sessions, poster sessions, plenary summaries, and provide focused forums:

- The plenary sessions, featuring world-leading radiation scientists and radiation protection practitioners, will highlight the current state of key topics.
- The final plenary session will identify the principal conclusions and outcomes from the Congress, highlighting the role and activities of IRPA.
- Some 40 topical sessions, organised in groups of five parallel sessions, will provide oral presentations of submitted papers and selected keynote presentations, reflecting the scientific and practical areas defined by the topics and subjects specified above.
- There will be digital and conventional poster boards and delegates can seek contact with authors through the conference app to make appointments for poster discussion and analysis.

¹) Disclaimer

The information on the congress program as provided in this journal dates from 8 April 2018. The congress organisation reserves the right to make further changes and/or adjustments. The most up-to-date information can be found on our website.

Programme outline

Monday June, 4					
am	<i>Refresher 1</i> YP: How to write a scientific paper	<i>Refresher 2</i> Patient Dose & Reference Levels	<i>Refresher 3</i> Radioactive Sources – Security Culture	<i>Refresher 4</i> Identification of NORM cases and existing regulatory context	<i>Associate Societies Forum (09:00h-12:00h)</i>
	<i>Refresher 5</i> YP: History, evolution and rationale of the RP system and in particular dose restrictions	<i>Refresher 6</i> Procedures for monitoring the dose to the lens of the eye, the skin and the extremities	<i>Refresher 7</i> Radioactive Source Security – Mitigating the Insider Threat	<i>Refresher 8</i> NORM Characterisation and Applied Metrology	
	<i>Refresher 9</i> YP: The Young Generation in Radiation Protection: Current Situation, Possibilities and Challenges	<i>Refresher 10</i> Computational Dosimetry and Modelling in support of Radiation Protection	<i>Refresher 11</i> Enhancing radiation safety culture in older nuclear installations	<i>Refresher 12</i> The presence of radon in indoor air	<i>Refresher 25</i> Occupational health physicians
pm	<i>Plenary session</i> - Opening ceremony - EU-Commission - New ways to optimization of radiation exposure in radiology - Medical - NORM: Radiological Protection from NORM in Industrial Processes: ICRP TG76 working progress				
	<i>Parallel sessions</i> Medical - Eye and skin dose	<i>Parallel sessions</i> Regulations & NORM (Exposure)	<i>Parallel sessions</i> Occupational - General	<i>Parallel sessions</i> Regulation & Legislation	
	<i>Parallel sessions</i> Medical – Radiation therapy	<i>Parallel sessions</i> Environet NORM Project	<i>Parallel sessions</i> Occupational - General	<i>Parallel sessions</i> Communication and technical radiological protection challenges in Environmental Remediation	
	Reception				

YP = Young Professional

Programme outline

Tuesday June, 5					
am	Parallel sessions Medical - Training	Parallel sessions Building Materials & Exposure	Parallel sessions Occupational – Radon and Eye lens dose	Parallel sessions Non-Ionising Radiation	
	Plenary session - Medical - Decommissioning - World Health Organization - ICNIRP: Non-Ionising Radiation				
					Young Professional Get Together
pm	Parallel sessions Emergency Preparedness	Parallel sessions Natural Radiation Environment and radon	Parallel sessions Occupational – Equipment and Software	Parallel sessions Communication & Risk Management	
	Parallel sessions Medical – Justification and Decommissioning	Parallel sessions NORM – Tutti Frutti	Parallel sessions Physics, Chemistry & Biology	Parallel sessions Education & Training - Implementation EU-BSS	

Wednesday June, 6						
am	TV2 - European Space Agency TV3 - Mineralz & COVRA TV5 - Philips Medical Systems TV7 - SCK CEN TV8 - Urenco TV9 - DAGO & ECW TV10 - Kernfysisch Versneller Instituut TV12 – Agentschap Telecom		Refresher 13 Applied radiological risk communication for the 21st century	Refresher 14 Optical Radiation – Eye protection	Refresher 15 From fundamental safety principles to operational radiation protection programmes	Refresher 16 Residential radon lung cancer risk estimation
			Refresher 17 Applying the content-form- source framework to risk perception	Refresher 18 Intelligent technical approaches to the reduction of CT patient dose	Refresher 19 Early and late deterministic effects of ionizing radiation: concepts and variables	Refresher 20 Decommissioning of non-nuclear sites
			Refresher 21 From power lines to mobile phones: are non-ionizing electromagnetic fields hazardous?	Refresher 22 Industry initiative on CT dose optimization in cooperation with HERCA	Refresher 23 Low dose radiation effects: mechanisms and dose-responsive curves	Refresher 24 Environmental remediation: from site characterization to the end state
pm	TV2 - European Space Agency TV3 - Mineralz & COVRA TV5 - Philips Medical Systems TV7 - SCK CEN TV8 - Urenco TV9 - DAGO & ECW TV10 - Kernfysisch Versneller Instituut TV12 – Agentschap Telecom	TV1 – Reactor Instituut Delft TV4 - Harbor Customs TV11 - TATA steel		Side Event: Training for Rad. workers		
				Side Event: Evaluation Training Impact		
				Social Event EUTERP		

Programme outline

Thursday June, 7					
am	<i>Parallel sessions</i> Emergency Preparedness	<i>Parallel sessions</i> Radiological protection challenges by the decommissioning of Nuclear and Non-Power generating facilities both large and small	<i>Parallel sessions</i> Occupational – Dose estimation	<i>Parallel sessions</i> Education & Training - Miscellaneous	
<i>Plenary session</i> - NORM: EU Directive Implications beyond EU Borders - Emergency Preparedness: advancement and still open gaps in Europe - Sustainability of the ICRP Recommendations - ICRP: The Ethics of Radiological Protection: From Core Values to Practical Wisdom - IAEA					
pm	Young Professional Presentations <ul style="list-style-type: none"> ▪ Cristian Candela-Juan (SEPR) ▪ Daria Yu Usupzhanova (Russian Society) ▪ Joanne van Abbema (NVS) ▪ Sara Vichi (AIRP) ▪ Marion Piepenbrock (FS) 				
	Young Professional Presentations <ul style="list-style-type: none"> ▪ Hannah Wiedner (ÖVS) ▪ Anna Kellaranta (Nordic Society) ▪ Alex Nicholson (SRP) ▪ Nadia Benabdallah (SFRP) ▪ Anna Michaelidesová (Czech Society) 				
					Young Generation Event
Congress Dinner					

Friday June, 8					
am	<i>Parallel sessions</i> Regulation & Legislation	<i>Parallel sessions</i> Environmental & NORM Remediation	<i>Parallel sessions</i> Occupational – Dose estimation	<i>Parallel sessions</i> Waste management	<i>Parallel sessions</i> IRPA workshop on Public Understanding of Radiation Risk (not yet confirmed)
	<i>Parallel sessions</i> Security	<i>Parallel sessions</i> Environmental & NORM Exposure	<i>Parallel sessions</i> Occupational – Miscellaneous		
end 14:15	<i>Plenary session</i> - New developments in the production of radionuclides - Advances in personal dosimetry - IRPA: Encouraging sustainability in Radiation Protection - Summary of IRPA2018 - Closing Ceremony				

Refresher courses

The Refresher Course programme provides delegates with the opportunity to update their knowledge in specific areas of radiation protection science and practice. The courses are aimed at providing a broad overview of the current state of a given topic, thereby giving delegates not directly working in that field a sound understanding of the current status, and at giving experienced practitioners a more detailed understanding of up-to-date developments in a field.

In our preliminary schedule, we have arranged for 25 refresher courses to be held, on Monday and Wednesday. The first courses will start at 8:30 a.m. and will be offered in four parallel sessions. The courses will be delivered by selected instructors according to their outstanding expertise and competence in teaching. Some will be at the beginner level, some at a more

advanced level, and some courses will be aimed at young professionals.

Course details will be available to facilitate accreditation by Associate Societies or National Regulatory Bodies for relevant Continuing Professional Development (or equivalent) schemes.

There will be NO EXTRA FEE for the refresher courses. However, registration for the refreshers is obligatory. The list below presents outline information on the course schedule; the latest course details will be available on the Congress website and will be clearly indicated in the registration system.

The following courses have been scheduled:

Monday 08.30

- RC1** How to write a scientific publication on Radiation Protection (Young Professionals, YP1)
- RC2** Patient Dose & Diagnostic Reference Levels
- RC3** Radioactive Sources - Security Culture
- RC4** Identification of NORM cases and existing regulatory context – basic course

Monday 09.45

- RC5** History, evolution and rationale of the RP system and in particular dose restrictions (YP2)
- RC6** Procedures for monitoring the dose to the lens of the eye, the skin and the extremities
- RC7** Radioactive Source Security – Mitigating the Insider Threat
- RC8** NORM Characterisation and Applied Metrology

Monday 11.00

- RC9** The Young Generation in Radiation Protection: Current Situation, Possibilities and Challenges (YP3)
- RC10** Computational Dosimetry and Modelling in support of Radiation Protection
- RC11** Enhancing Radiation Safety Culture in Older Nuclear Installations
- RC12** The Presence of Radon in Indoor Air
- RC25** Health Physicians: Medical Surveillance with Focus on Periodic Examination of the Eye

Wednesday 08.30

- RC13** Applied radiological risk communication for the 21st century
- RC14** Optical Radiation – Eye Protection
- RC15** From Fundamental Safety Principles to Operational Radiation Protection Programmes
- RC16** Residential Radon Lung Cancer Risk Estimation

Wednesday 09.45

- RC17** Applying the Content-Form-Source framework to Risk Perception
- RC18** Intelligent Technical Approaches to the Reduction CT Patient Dose
- RC19** Early and Late Deterministic Effects of Ionising Radiation: Concepts and Variables
- RC20** Decommissioning of Non-Nuclear Sites

Wednesday 11.00

- RC21** From Power Lines to Mobile Phones: Are Non-Ionising Electromagnetic Fields Hazardous?
- RC22** Industry Initiative on CT Dose Optimization in Cooperation with HERCA
- RC23** Low Dose Radiation Effects: Mechanisms and Dose-Response Curves
- RC24** Environmental Remediation - from Site Characterization to the End State

Refreshers courses in detail

RC1 How to write a scientific publication on Radiation Protection

by dr Adrie J.J. Bos (*Editor-in-Chief of Radiation Measurements*)

Monday June 4th, 8:30 h

Learning objectives

Participants will learn:

- about the ever increasing number of manuscripts submitted for publication
- why people like to publish
- to select the appropriate publication outlet
- to select the type of manuscript
- the importance of the 'Guide for Authors'
- to pay attention to ethical standards
- that the "Quality of a publication" is a relative understanding
- most common errors in manuscript language
- how to structure a research article
- that the sequence of writing is not the same as reading it
- the importance of the cover letter
- key aspects about the peer-review process

RC 2 Patient Dose & Diagnostic Reference Levels

by professor Hilde Bosmans (*University of Leuven*)

Monday June 4th, 8:30 h

Learning objectives:

Participants will be able

- to explain how patient doses are measured and calculated in radiology
- to illustrate the opportunities of patient dose monitoring
- to explain how patient doses can be further personalized
- to explain how diagnostic reference levels (DRLs) are obtained
- to illustrate how the DRLs can be used to improve the radiological practice

Participants will learn about

- the necessary next steps and expected benefits for patients and population

RC 3 Radioactive Sources - Security Culture

by dr Chris Englefield (*Kings College London*)

Monday June 4th, 8:30h

Learning Objective

- to provide an insight into the concept of security culture and an overview of the importance of an effective radiological security culture in a premises such as a hospital or a university to deter the adversary by:
 - understanding how people influence each other's behaviour
 - understanding the role of leadership in modelling the desired behaviors
 - using day-to-day operations to disrupt hostile surveillance

Participants will be able to:

- explain the differential application of the "need-to-know" and the "need-to-share"
- devise strategies for influencing colleagues from Chief Officers to Parking Attendants
- work towards sustainability of their security culture

Participants will also be informed about:

- sources of information and international best practice on security and in particular security culture

RC 4 Identification of NORM cases and existing regulatory context - basic course

by dr Boguslaw Michalik (*Silesian Centre for Environmental Radioactivity, Katowice*)

Monday June 4th, 8:30 h

Learning objectives

Participants will learn about:

- physical phenomena leading to the presence of natural radionuclides in environment
- properties of natural radionuclides influencing possible exposure scenarios
- industrial activities involved in NORM

Participants will be able:

- to identify generic situation when presence of natural radionuclides may be important from radiation protection perspective
- to understand crucial parameters determining occupational exposure and environmental impact related to the presence of natural radionuclides
- to define generic legal requirements

Lecture content :

- Rudiments of radiation physics (types of decay and radiation, successive decay , decay series, equilibrium/ disequilibrium),
- Identification of processes leading to NORM creation,
- Exposure to humans/environment scenarios including building materials,
- Differences between NORM contaminated materials and contaminated materials with artificial radionuclides,
- Applied terminology and existing definitions,
- Development of existing regulation in historical context.

RC 5 History, evolution and rationale of the RP system and in particular dose restrictions

by dr Jean-François Lecomte (*IRSN, France*)

Monday June 4th, 9:45

Learning objectives

- To present the main evolutions of the international system of radiological protection. This system has been built by the International Commission on Radiological Protection (ICRP). Information will be provided on the setting of the basic principles, the elaboration of a model for risk tolerability for practices and the rationale of the dose limits.
- To provide explanation about the shift in the ICRP recommendations from a process-based approach (practices versus interventions) to a unified protection approach based on the characteristics of three types of radiation exposure situations: existing, planned and emergency exposure situations.
- To discuss the application of this new approach in particular as far as existing exposure situations are concerned (e.g. radon, cosmic rays in aviation, NORM industries, post-accident situations...) as well as the challenges still to be dealt with to consolidate the system of radiological protection and make it readable.

RC 6 Procedures for monitoring the dose to the lens of the eye, the skin and the extremities

by dr. Mercè Ginjaume (Universitat Politècnica de Catalunya [UPC])

Monday June 4th, 9:45 h

Learning objectives

- To be aware of the latest changes regarding individual monitoring regulation, in particular the reduction of annual workers' limit on the equivalent dose for the lens of the eye.
- To learn how to identify the workplaces requiring monitoring of the extremities, the skin and the lens of the eye.
- To be able to decide which is the best monitoring procedure for a given workplace: type of dosimeter, location of the dosimeter.
- To be able to interpret the results of the monitoring and to define radiation protection measures to optimize the workers' procedures and to reduce doses, when appropriate.

Course introduction

Monitoring the extremities, the skin and the lens of the eye presents several practical challenges. As a result, monitoring is often not done as it should be. In particular, the monitoring of the dose to the lens of the eye is not usually performed on a regular basis. In 2015, the International Organization for Standardization (ISO) published a new version of ISO 15382 to provide guidance on how and when this monitoring should be done, for all the different types of workplace fields.

The content of the refresher course "Procedures for monitoring the dose to the lens of the eye, the skin and the extremities" is based on the recommendations of ISO 15382:2015 and on the requirements on personal dosimetry established by the EURATOM 2013/59 Directive.

Course content

- Introduction: scope, objectives
- Regulation in individual monitoring
- Assessment of dose levels prior to monitoring
- Individual monitoring procedures, performance of personal dosimeters
 - Extremity and skin dosimetry
 - Eye lens dosimetry
- Interpretation and management of results
- Basis for setting a monitoring program
 - application in a medical workplace
 - application in an industrial workplace

RC 7 Radioactive Source Security – Mitigating the Insider Threat

by Pierre Legoux, (World Institute for Nuclear Security [WINS])

Monday June 4th, 9:45 h

Learning Objectives:

- To identify and discuss the most common motivations that may lead an individual to undertake malicious acts
- To provide some guidance for identifying individuals with malicious intent
- To recognise the need for a balanced insider mitigation programme combining effective cost effective security provisions and operational needs
- To review some security practices and policies that can be implemented to help mitigate the insider threat
- To explore interactions between security culture and security practices.

Participants will be able to:

- explain what an insider is and what motivates people to do harm
- list the key elements of an insider mitigation programme
- explain why keeping a balance between employee morale and security expectations is important
- describe the process for obtaining senior management support and engaging all staff into security matters
- suggest some possible improvement in their day to day operations and reduce the insider threat in their own organisation.

RC 8 NORM Characterisation and Applied Metrology

by dr Leo van Velzen

Monday June 4th, 09.45 h

Learning Objective:

- To learn about the applicability of instruments and methods for the radiological characterization in NORM generating industries in order to assess:
 - instruments and methods that may be applied during daily routine (e.g. normal operations) or special circumstances (e.g. maintenance) to prove to be in compliance with National Regulations based on EC 2013/59 EURATOM;
 - elevated radiological health risks and to assist in the decision making process to take adequate countermeasures;
 - the level of the radiological contamination of materials (e.g. materials to be processed, products and residues).
- Participants will be able:
- to define/set up a list of requirements for on-site and laboratory equipment. With special attention to handheld radiation monitors and gamma spectroscopic systems;
- to balance the applicability of instruments for radiological characterization and methods for the participant's challenges.

Participants will also be informed about:

- NOR concentrations that may be expected in ores, beneficiated materials, processed (by)products and/or residues/wastes, both during operations and maintenance.

RC 9 The Young Generation in Radiation Protection: Current Situation, Possibilities and Challenges (presentation and discussion based on a survey)

by Sylvain ANDRESZ (CEPN, France)

Monday June 4th, 11:00 h

Learning objectives

Participants will learn about:

- Process of elaborating a survey: what to do (and not);
- Possible channels of distribution that can be used;
- Presentation of some of the results of a survey;
- Potential statistical misunderstandings, for example:
 - About the size of the sample;
 - The use of the "mean" value;
- The results of the survey specifically addressed to the international "young radiation protection generation" and possible subsequent actions.

Course introduction

The background of this session is a survey specifically addressed to the international "young radiation protection generation" (professionals and scientists) initiated by the Youth Club of the French Society of Radiation Protection (SFRP) and the Rising Generation Group of the UK Society for Radioprotection (SRP).

The survey was designed to gather elements of information about the young radiation protection generation (background etc.), identify ways to secure and foster it and also collect ideas for further development. The survey ran from July to December 2017 and was widely distributed – in particular, the IRPA YGN contacts list was activated.

Moreover, this refresher will be an opportunity to launch a dialogue with the public to discuss openly the results and possible associated actions.

RC 10 Computational Dosimetry and Modelling in support of Radiation Protection

by professor Pedro Vaz (*University of Lisbon*)

Monday June 4th, 11:00

Learning Objectives

- To develop the awareness about the importance of computational methods in modern Dosimetry and Radiation Protection, namely in order to quantify and evaluate medical and occupational doses and exposures and to perform radiological risk assessment
- To strengthen the knowledge, skills and competences in computational methods (Monte Carlo, deterministic and hybrid methods) used in Computational Dosimetry
- To analyse the shortcomings and pitfalls of the international System of Radiation Protection and to discuss the importance of state-of-the-art computational and modelling methods to overcome them
- To get acquainted with:
 - Monte Carlo, deterministic and hybrid simulation programs and tools, representative of the state-of-the-art in Computational Dosimetry
 - The state-of-the-art of computational phantoms (voxel, hybrid, etc.) and associated methodologies
 - Challenges faced by Computational Dosimetry
- To present prospective views about emerging and hot topics such as:
 - the future System of Radiological Protection,
 - the evolution of the concept of effective dose,
 - the future of medical dosimetry, with individual risk analysis using patient specific and patient dependent phantoms

Case studies will be presented and discussed with the participants. The paradigm of the international system of radiological protection will be challenged, in view of on-going computational developments, namely the development of patient dependent phantoms for internal and external dosimetry in multiple exposure situations. Hot topics and future trends in computational dosimetry will be analysed.

RC 11 Enhancing radiation safety culture in older nuclear installations

by ir. Folkert Draaisma (*Nuclear Research and consultancy Group, NRG, Petten*)

Monday June 4th, 11:00 h

Learning objectives:

Participants will be informed about:

- safety issues in older nuclear installations that occur due to aging and (necessary) changes, like maintenance, replacement, renovations, new businesses
- safety culture aspects, in particular in relation to how to improve radiation safety culture
- learning from events, based on the determining underlying risk factors (TRIPOD method)
- examples of a research reactor, hot cell laboratories, decommissioning and waste treatment facilities

Participants will be able

- to recognize issues in older nuclear installations that introduce safety risks
- to know basic aspects of (radiation) safety culture
- to determine underlying risk factors in order to learn from events
- to be aware of developing a questioning attitude to improve safety
- to recognize pitfalls regarding safety issues to older nuclear installations
- to improve (radiation) safety culture in their daily job.

RC 12 The presence of radon in indoor air

by professor Hans Vanmarcke (UNSCEAR president)

Monday June 4th, 11:00 h

Learning objectives

The participants will learn:

- The inhalation of the decay products of the radioactive noble gas radon is the largest single contribution to the population exposure to natural sources of ionising radiation
- Radon is part of the uranium series
- How to measure radon and its decay products
- How does radon get into a building
- Sources of indoor radon
- How to reduce the radon concentration in a building
- Radon surveys in dwellings
- Radon prone areas

RC 13 Applied radiological risk communication for the 21st century

by dr Tanja Perko (Studie Centrum Kernenergie / Centre d'Étude d'Énergie Nucléaire - SCK • CEN)

Wednesday June 6th, 8:30 h

Learning objectives

Participants will learn to develop a state-of-the science understanding of the individual, psychological, interpersonal and societal factors that influence the:

- communication of radiological risk information during emergency and non-emergency periods;
- impact of radiological risk communications on public's risk perceptions, knowledge, attitudes, and behaviors;
- apply this knowledge to designing effective risk communication and develop citizen-centered communication with the goal to empower citizens to make informed decisions in situations related to radiological risks;
- become familiar with and practice methods for evaluating radiological risk communication efforts.

Course introduction

Whether you are dealing with radiation protection or application of ionising radiation, it's crucial to be able to communicate effectively to both the public and the media about risks, benefits of ionising radiation or protection measures against radiation.

This refresher course will provide the latest science of radiological risk communication and skills needed to design effective radiological risks communication that improves outcomes, help key stakeholders make informed decisions, increase trust among stakeholders and cope with public anxiety. Good and bad communication examples, state-of-the-art ideas and ways to use them in radiation protection practice will be introduced.

RC 14 Optical Radiation – Eye Protection

by Per Söderberg (Uppsala University)

Wednesday June 6th, 8:30 h

Learning objectives

The participant

- gets insight into the biological effects and health risks of optical radiation and
- learns that application of the ICNIRP exposure guidelines will avoid adverse health effects.
- Understands the importance of the protection of the eye against the dangers arising from optical radiation and is able to understand the importance of eye protection measures.

RC 15 From Fundamental Safety Principles to Operational Radiation Protection Programmes

by Amgad Shokr (IAEA)

Wednesday June 6th, 8:30 h

Learning objectives

The general objective is to provide the participants with an overview of operational radiation protection programmes for nuclear installations. The participant will learn:

- Issues and channels of operational radiation protection in nuclear facilities;
- Radiation protection principles;
- Basis for establishing an operational radiation protection programme;
- Elements of operational radiation protection programme;
- Practical aspects of dose control on site (source, physical, and administrative control);
- Practical aspects of off-site dose control;
- Facility, individual, and environmental monitoring;
- Quality assurance aspects of operational radiation protection programme, including radiation protection procedures.

RC 16 Residential Radon Lung Cancer Risk Estimation

by professor James Mc Laughlin (University College Dublin)

Wednesday June 6th, 8:30 h

Learning Objectives

- To learn about of the fundamental elements of radon progeny lung dosimetry (i.e. lung models, radon progeny deposition in the lung, and dosimetric modelling of alpha particles interactions with target cells).
- To understand the current situation regarding radon progeny dose conversion factors.
- To gain insight into the current knowledge of the estimated radon attributable lung cancer risk obtained from residential radon epidemiological studies.

RC 17 Applying the Content-Form-Source framework to risk perception

by dr Jop Groeneweg (Leiden University)

Wednesday June 6th, 9:45 h

Learning objectives:

Participants

- understand the various factors influencing risk perception
- understand the important role communication plays in shaping risk perception
- understand that a focus on the factual Content of information is not sufficient to change peoples perception but that a focus on the way it is communicated (Form) and the person (Source) is crucial for shaping risk perception
- get insight into ways to manage Form and Source effectively
- are able to judge the effectiveness of their own campaigns using the Content-Form-Source framework

RC 18 Intelligent Technical Approaches to the Reduction CT Patient Dose

by Prof.dr. Willi Kalender (Institute of Medical Physics, University of Erlangen)

Wednesday June 6th, 9:45 h

Learning objectives:

Participants

- Know typical values of patient dose in clinical CT today
- Learn about intelligent technical approaches for dose reduction
- Understand the possibilities for sub-mSv CT scans

RC 19 Early and Late Deterministic Effects of Ionising Radiation: Concepts and Variables

by dr Jan Wondergem (*Leiden University Medical Center*)

Wednesday June 6th, 9:45 h

Learning Objectives

Participants will be able:

- to recognize and classify different types of radiation-mediated normal tissue effects
- to distinguish between early and late normal tissue effects
- to understand different concepts regarding radiation-mediated normal tissue responses
- to memorize organ/tissue variables influencing radiation sensitivity

RC 20 Decommissioning of Non-Nuclear Sites

by André Bloot (*Applus RTD*)

Wednesday 6th June, 9:45 h

Learning Objectives

Participants will have:

- more insight into the process of decommissioning, not meaning on a technical level, but on the process of the inventory, the decommissioning plan, licensing, demolition, release and closure of the site.
- insight into the role of the radiation protection expert in the project organization during the process of the decommissioning project (e.g. technical level, licenses and supervision).
- Knowledge about possibilities of a variety of decommissioning techniques.

An overview will be presented of non-nuclear sites, where decommissioning can play a role.

RC 21 From power lines to mobile phones: are non-ionising electromagnetic fields hazardous?

by dr Eric van Rongen (*ICNIRP / Health Council of the Netherlands*)

Wednesday June 6th, 11:00 h

Learning objectives

The participants

- get insight into the biological effects and health risks of electromagnetic fields and
- learn that application of the ICNIRP exposure guidelines will avoid adverse health effects
- learn about the implementation of the ICNIRP guidelines in EU directives.

RC 22 Industry Initiative on CT Dose Optimization in cooperation with HERCA

by Roy Irwan (*Toshiba Medical Systems Europe*)

Wednesday 6th June, 11:00 h

Learning Objectives

Participants

- should be able to understand what matters in CT dose optimization and
- learn how to characterize system performance through standardized test methods and conditions.

Course introduction

In this refresher course, the role of CT manufacturers in Radiation Protection will be highlighted. The progress of industry's self-commitments will be presented and discussed in depth. These self-commitments include standardized benchmarking protocols to provide transparency and easily understood values for the end user, next to radiation protection principles, and education for the end user. Furthermore, the state of the art of objective image quality assessment based on model observer will be presented.

RC 23 Low Dose Radiation Effects: Mechanisms and Dose-Response Curves

by dr Dik van Gent (*Erasmus Medical Center, Rotterdam*)

Wednesday June 6th, 11:00 h

Learning Objectives

The participant

- understands basic biological processes underlying radiation responses, especially DNA damage responses
- can describe and explain differences in dose-response curves for different processes induced by ionising radiation
- understands various aspects of DNA double strand break repair that determine outcomes of low and high dose radiation

RC 24 Environmental Remediation – from Site Characterization to the End State

by dr Christian Kunze (*IAF-Radioökologie, Dresden-Radeberg*)

Wednesday 6th June, 11:00 h

Learning objectives

Participants

- Acquire systematic knowledge on the stages of environmental remediation
- Become familiar with the process of site characterisation including historical site information
- Develop awareness of the time required for proper implementation of the various stages of environmental remediation
- Learn which radiological and non-radiological factors may be used to justify remediation
- Understand the drivers and constraints that are relevant in determining the site end state
- Appreciate the need for interim states in environmental remediation

RC25 Medical Surveillance with Emphasis on Surveillance of the Eye Lens

by Bart Goessens (*Occupational Health Physician, Radboud University Medical Centre, Nijmegen*)

Monday June 4th, 11:00 h

Learning Objectives

Participants will have

- Insight and overview on medical surveillance as part of occupational care for radiological workers:
 - Legal and instrumental aspects of medical surveillance in general
 - Practice in the Netherlands of medical surveillance of radiological workers
 - Background of (radiation induced) cataract of the eye.
 - Proposed surveillance of the risk of the eye in radiological health surveillance.

Participants will learn about:

- Latest insights on the interaction of radiation and the human eye lens, diagnostic aspects and treatment
- The outline of the NCS publication on prevention of radiation induced aberrations of the eye lens

Participants will be able

- To integrate surveillance of the eye into their regular medical surveillance of radiological workers.
-

Refresher Courses during Technical Visits Wednesday June 6th

TV1: Reactor Institute Delft, Delft

RC_TV1 Neutron Tomography

by Lambert van Eijk (RID)

Learning Objectives

- no learning objective received yet

TV3 and TV6: Mineralz, Maasvlakte & COVRA, Vlissingen

RC_TV3&6A NORM Reuse & Waste Disposal

by Kees Oranje (Mineralz B.V.)

Learning objectives:

Participants will acquire insight into

- the Dutch waste disposal philosophy for registered NORM related to environmental aspects
- a practical option for a reuse application for licensed NORM
- specific clearance of NORM in Dutch practice

Participants will learn about

- the necessary steps in NORM reuse/waste management

RC_TV3&6B Radioactive Waste Management

by Jeroen Welbergen (COVRA)

Learning objectives:

Participants will be able

- to understand radioactive waste philosophy: Isolation, Controlling and Monitoring
- to comprehend Dutch Classification of radioactive waste
- to know about transportation rules for radioactive waste
- to explain benefit of minimalisation of radioactive waste
- to experience predisposal of radioactive waste

Participants will learn about

- the necessary steps in radioactive waste management

TV5: Royal Philips, Best

RC_TV5A Radiation Exposure of Patients and Staff during Interventional Radiology

by dr Cecile Jeukens (Department of Radiology and Nuclear Medicine, Maastricht University Medical Center)

Learning Objectives

Participants will learn about

- Characteristics of scattered radiation fields and available means of personal shielding in an interventional radiology suite
- Radiation exposure of patient and staff during interventional radiology procedures and influencing factors
- Optimizing the radiation exposure of staff by providing feedback

RC_TV5B Magnetic Resonance Safety – Bioeffects of Static Field, kHz, and MHz Exposures

by dr ir Johan van den Brink (*Philips, MRI R&D*)

Learning objectives:

Participants will be able

- to explain the basic principles of Magnetic Resonance Imaging (MRI)
- to provide rationales for frequencies and exposure levels in MRI of Electromagnetic Fields (EMF)
- to explain the source of acoustic noise in MRI
- to explain biophysical effects of EMF on patients, volunteers and workers
- to identify applicable regulations in Europe concerning EMF and MRI

Participants will learn about

- the necessary steps to meet the conditions for the EMF exemption for MRI workers

TV7: Studie Centrum Kernenergie / Centre d'Étude d'Énergie Nucléaire (SCK • CEN), Mol, Belgium

RC_TV7AD&RPT Low Dose Effects of Ionising Radiation

by dr. Marjan Moreels (*SCK-CEN*)

Learning objectives:

Participants will be able to

- State the origin of, exposure to, and applications of low-dose ionizing radiation
- Identify the main health risks related to exposure to low doses of ionizing radiation
- Explain the Linear-Non-Threshold (LNT) model and uncertainties in extrapolation of radiation risk at low doses

Participants will learn about

- Natural and man-made exposure to low-dose ionizing radiation
- Biological effects of ionizing radiation

RC_TV7B History & Future: 4 Generations of Nuclear Research Reactors

by dr. Fernand Vermeersch (*SCK-CEN*)

Learning objectives:

Participants will be able to

- describe and design a radiation protection programme covering the needs of a research center operating different types of research reactors and nuclear research labs.
- Participants will learn about:
- the elements of the radiation protection program including dosimetry, area and workplace monitoring, zoning, emergency preparedness, record keeping and the training program
- the ALARA program as a cornerstone of the radiation protection and a building block of safety culture
- managing the radiation protection program and finetuning it to a research environment characterized by a succession of different experiments in different installations

RC_TV7C Demonstration of long-term safety of radioactive waste disposal

by dr. Janez Perko (*SCK-CEN*)

Learning objectives:

Participants will be able to

- Identify different types of waste and appropriate disposal options
- Explain components and the evolution of a safety case
- Distinguish between different scenarios to assess the long term safety
- Outline major components of a disposal system

Participants will learn about

- What a safety case is
- How to demonstrate long-term safety and how to treat uncertainties therein
- Barriers and their role in safety

TV8: URENCO Nederland BV, Almelo

RC_TV8 Principles of Enrichment of (Radio)isotopes by Means of Centrifuge Technology

by Frank Tuentler (*URENCO Netherlands BV*)

Learning Objectives:

Participants learn about:

- Principles of enrichment of uranium and other isotopes
- Requirements for enrichment of isotopes.
- Radiological risks and protection measurements associated with enrichment of uranium.

Participants will be able to:

- Explain the fundamentals on how isotopes can be separated by means of the centrifuge technology.
- List isotopes which can be produced by means of centrifuge technology and its applications.

TV9: Dutch Association of Geothermal Operators (DAGO) and Energie Combinatie Wieringermeer (ECW)

RC_TV9 Geothermal Operations & NORM

by Lonneke van Bochove (*Stralingsupport BV*)

Learning Objectives

- no learning objective received yet

TV10: Rijks Universiteit Groningen - Kernfysisch Versneller Instituut / Center for Advanced Radiation Technology (KVI-CART), Groningen

RC_TV10 Cyclotron Radiation Protection

by dr. ir. Hans Beijers (*University of Groningen*)

Learning objectives:

Participants will be able

- to explain the generation of prompt and induced radiation by cyclotrons
- to explain the interaction, transport and shielding of cyclotron radiation
- to explain the environmental impact of cyclotrons
- to explain the detection of neutron radiation

TV11: Tata Steel Nederland BV, Velsen-Noord

RC_TV11A The Application of Ionising Radiation in Industrial Process Control

by Martin Lips (*Tata Steel*)

Learning objectives:

Participants will be able

- to explain how ionising radiation is used in industrial process control
- to illustrate the specific differences between several applications
- to explain the risk of ionising radiation, the measures to reduce the risk of radiation and the exposure of staff in industrial process control

Participants will learn about

- the radiation protection organization at Tata Steel IJmuiden

RC_TV11B Protection Measures against the Hazards of Electro-Magnetic Fields

by Peter Vooijs (Tata Steel)

Learning objectives:

Participants will be able

- to explain the appearance of electromagnetic fields in the steel industry
- to illustrate the specific differences between several applications
- to explain the risk, the measures to reduce the risk and the exposure of personnel to electromagnetic fields in the steel industry

Participants will learn about

- the risk assessment on electromagnetic fields in the steel industry

TV12: Agentschap Telecom (Ministry of Economic Affairs and Climate), Amersfoort

RC_TV12 Communicating Risks and Uncertainties

by Yvonne Trenning (Antennebureau – Ministry of Economics and Climate)

Learning objectives

Participants will learn how:

- to identify and discuss the most important factors that affect risk perception
- to recognize and discuss the most important theories about risk perception
- to identify the most important developments in risk communication
- to recognize and discuss different strategies of, and tools in risk communication

Participants will be able to:

- explain what risk perception and risk communication is
 - list which factors affect risk perception, especially in case of Radio Frequent Electromagnetic Fields
 - describe which theories explain risk perception, especially in case of Radio Frequent Electromagnetic Fields
 - list the factors and tools that are most important in communicating about risks and uncertainties, especially in case of Radio Frequent Electromagnetic Fields
-

Technical visits (TV)

A range of interesting technical visits has been planned showing the wide range of radiation related applications and aspects of (non-)ionising radiation present in the Netherlands. The visits are scheduled at Wednesday (afternoon) during the congress.

- **The fee for the technical visits will be € 40 per person per visit.**
- It should be noted that for each of these visits there is a **minimum number of participants** required, while in case the **maximum** number of participants is reached subscription to the relevant visit will be closed. Based upon the number of subscriptions and in close deliberation with the receiving party May 1st, 2018 it will be decided if these visits actually will take place. Congress participants, who subscribed to a TV that unfortunately cannot take place will be offered the option, either subscribe to another TV, or a refund of the TV participation fee.

- Furthermore, for some of the TV's there will be special security requirements like for instance **a valid photo identification** card or document (for Dutch citizens a driver licence or ID-card may do, but for non-Dutch citizens the passport will be required). Once it is decided that a TV will actually take place, you will be contacted by the congress secretariat to furnish a copy of your photo-ID card/document, so that the organisation will be able to prepare a visitors list with the required data. Generally, you have to **carry the valid photo identification document** with you during the visit. Further special requirements are listed in the text describing the TV.

Currently, the following Technical Visits have been confirmed and are open for subscription by congress participants:

- TV1** Research - Nuclear Research Reactor / RID, Delft: reactor and neutron beam lines.
- TV2** Research - Outer Space / ESA, Noordwijk: outer space radiation doses.
- TV3** Industry - NORM Depository/Reuse Site, Maasvlakte: very low activity / NORM waste.
- TV4** Industry - Container Scanning / Customs, Rotterdam Harbour: scans of containers / nuclear detection.
- TV5** Medical - Health Care / Philips, Best: medical scanning equipment and non-ionising radiation.
- TV6** Industry - Waste Management / COVRA, Vlissingen: (medical) waste management.
- TV7** Studie Centrum Kernenergie / Centre d'Étude d'Énergie Nucléaire (SCK/CEN): nuclear energy, radionuclide laboratories, reactor technology, decommissioning and decontamination, waste management.
- TV8** Industry - Uranium Enrichment / URENCO, Almelo: uranium enrichment.
- TV9** Industry - Geothermal NORM / ECW, Middenmeer: NORM resulting from application of geothermal energy.
- TV10** Applied Science – KVI-CART, Groningen: applied nuclear physics, accelerator physics.
- TV11** Industry - Application of (Non-)Ionising Radiation: process control by means of X-ray sources and (narrative) on measures to minimize NIR exposure
- TV12** Non-Ionising Radiation - Telecom providers: deliberations still ongoing.

Technical Visits in detail

TV 1: Technical University Delft (TUD) / Research Institute Delft (RID)

- Area:** Research & Applications
- Topics:** Nuclear Research Reactor, Neutron Beam Lines
- Security:** passport or for Dutch citizens a valid driver license; no photo- or video-equipment, incl. GSM allowed
- Transport:** Bus leaves 12:15 h and returns ± 17:30 h at the World Forum
- Nota Bene:** Wednesday morning **Refresher Courses** (three sessions) **may be attended**
- Lunch:** lunch box offered by the IRPA 2018 organisation
- Program:** Schematic
- Reception Coffee/Tea
 - Introduction RID
 - Guided RID Tour
 - Coffee/Tea pause
 - Refresher Course: Neutron Tomography
by: Lambert van Eijk



Information:

RID together with the department Radiation, Science & Technology (RST) has been the Dutch knowledge centre for radiation-related research and education for over 50 years. RID plays an important knowledge/expertise role in fundamental and applied scientific research.

Research energy, materials and health: the research is in various fields, such as sustainable energy, materials and health, both nationally and internationally. One may think of research in the field of solar cells and batteries and medical isotopes for diagnosis and treatment of cancer.

Nuclear reactor and facilities: RID operates a unique research facility viz. the HOR nuclear reactor. This is a small pool-type research reactor

(2 MW). The reactor is not built to produce electrical power, but is a source of neutrons and positrons for research purposes. In addition, RID operates several radiochemical laboratories. RID is an expert in safe handling of radiation. Through consultations and courses at all levels this knowledge is shared.

Higher Education/Onderwijs Reactor (HOR): The HOR is an open pool-type research reactor, using MTR-fuel assemblies and low-enriched (^{235}U < 20%) uranium as fuel. The core is composed of 20 fuel assemblies and 4 control assemblies. It is equipped at three sides with a row of Be-reflector assemblies acting as neutron reflectors. The reactor provides neutron radiation to a variety of facilities for radioisotope production and neutron activation analysis. It is also equipped with six horizontal beam-tubes in two sets of three at opposite sides of the core mainly used for neutron scattering experiments. The two larger beam tubes are equipped with stacked-mirror neutron guides (neutron guide system) to obtain clean beams of thermal neutrons with low contamination by fast neutrons and gamma rays. One neutron guide system provides two beams for experiments in the reactor hall. The other neutron guide system provides 4 neutron beams to the experimenting hall, adjacent to the reactor hall. Measuring 25 × 40 m, this experimenting hall provides ample space with low radiation background for beam experiments. Finally, one of the beam-tubes is used by the source of variable-energy positrons (POSH). These positrons are led into the hall as well.

TV 2: European Space Agency, European Space Research and Technology Centre (ESA/ESTEC), Noordwijk

- Area:** Research & Applications
- Topics:** European Space Missions, ESTEC Radiation Applications
- Security:** passport or for Dutch citizens a valid driver license
- Transport:** Bus leaves 09:30 h and returns ± 17:30 h at the World Forum
- Nota Bene:** There is **no option** to attend Wednesday morning refresher courses
- Lunch:** offered by ESA/ESTEC
- Program:** Schematic
- Reception/Security Coffee/Tea
 - Introduction ESA/ESTEC and radiation aspects at ESTEC
 - Subdivision of visitor group: guided tour to three distinct ESTEC locations
 - Coffee/Tea pause
 - No Refresher Courses



Information:

ESTEC is ESA's technical heart - the incubator of the European space effort - where most ESA projects are born and where they are guided through the various phases of development. Developing and managing all types of ESA missions: science, exploration, telecommunications, human spaceflight, satellite navigation and Earth observation.

At ESTEC, staff are simultaneously working on the defining of future missions, technology development, space projects under development and spacecraft that are in operation.

Many things are incorporated into the design of spacecraft, making trade-offs between the latest technologies available, mission requirements, systems engineering and launcher capacities. Lessons from

past experience are also some of the main design 'drivers'.

ESTEC operates an environmental test centre for spacecraft, with supporting engineering laboratories specialised in systems engineering, components and materials, and working within a network of other facilities and laboratories. ESA supports European space industry and works closely with other organisations, such as universities, research institutes and national agencies from ESA Member States, and cooperates with space agencies all over the world.

TV 3/6
(combi): **Mineralz, Hazardous Waste (incl. NORM) Repository, Maasvlakte and Centrale Organisatie voor Radioactief Afval (COVRA), Vlissingen**

Area: Industry
Topics: NORM Reuse and Waste, Radioactive Waste Conditioning and Storage
Security: passport or for Dutch citizens a valid driver license or ID card
Transport: Bus leaves 08:30 h and returns ± 18:30 h at the World Forum
Nota Bene: There is **no option** to attend Wednesday morning refresher courses
Lunch: lunch box offered by the IRPA 2018 organisation
Program: Schematic

- Reception/Security Coffee/Tea
- Refresher Course: *NORM Reuse & Waste Disposal* by: Kees Oranje
- Guided bus tour over landfill
- Lunch time bus ride from Maasvlakte via Eastern Scheldt Delta Works to Vlissingen
- Reception/Security Coffee/Tea
- Introduction to COVRA (3D film)
- Refresher Course: *Radioactive Waste Management in the Netherlands* by: Jeroen Welbergen
- Guided tour to Low Level Waste (LOG) and High Level Waste (HABOG) storage buildings
- Coffee/Tea pause



Hazardous Waste Repository, Maasvlakte



Bus Ride Maasvlakte>Vlissingen
via Delta Works



COVRA Vlissingen

Information:

There are many producers of 'radioactive waste' varying from mineral and-or ore processing industries (NORM) to nuclear reactor operators. Radioactive waste must be prevented from contaminating our environment. So it is important that both NORM and radioactive waste is professionally collected, processed and stored.

Mineralz B.V. operates a hazardous waste repository at the *Maasvlakte*, a patch of land reclaimed from the *North Sea*. The repository accepts NORM with extremely low concentrations of naturally occurring radionuclides (NOR's). If the NORM possesses the right chemical/physical properties and texture, it may be reused for landfill construction purposes. NORM may be reused as stabiliser for non-stable waste to construct a stable landfill without the risk of landslides. If NORM cannot be reused it either may be directly disposed as waste for final disposal or in case of strongly leaching hazardous waste conditioned then disposed of.

Not all NORM waste may be disposed at the *Maasvlakte* hazardous waste repository. Especially NORM with higher NOR concentrations and waste from the URENCO enrichment plant at *Almelo* has to be transferred to COVRA for storage. Next to this, radioactive waste from nuclear reactors, hospitals, research centres and industry has to be collected, processed c.q. conditioned and stored at COVRA. Refraining from any NORM waste, the total amount of radioactive waste is relatively small: less than a thousand cubic metres annually.

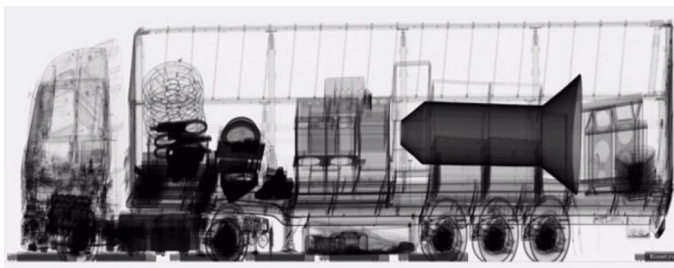
COVRA is the only organisation in the Netherlands that is qualified to collect, process and store radioactive waste. Any company in the Netherlands licensed to work with radioactive materials under the Dutch Nuclear Energy Act is bound by law to tender its waste to COVRA. In order to be able to treat this radioactive waste, COVRA has established a treatment and storage facility near *Vlissingen*. The total amount of radioactive waste produced over the next hundred years can easily be stored at the COVRA site, which in total covers an area of about 20 hectares.

TV 4: Container scanning and nuclear scanning detection, Customs, Rotterdam

- Area:** Industry
- Topics:** Border Control and Security, Container Scanning, Nuclear Detection
- Security:** passport or for Dutch citizens a valid driver license or ID card
- Transport:** Bus leaves 12:15 h and returns ± 18:30 h at the World Forum
- Nota Bene:** Wednesday morning **Refresher Courses** (three sessions) **may be attended**
- Lunch:** lunch box offered by the IRPA 2018 organisation
- Program:** Schematic
- Reception Coffee/Tea
 - Introduction harbour customs
 - Subdivision of visitor group: guided tour to container scanner and nuclear detector
 - Coffee/Tea pause
 - No Refresher Courses



Customs Office and Scanner at the Maasvlakte



Scan Image – Truck with Construction Material

Information:

Being one of the main ports of the World Rotterdam is an entry point for import and transit/export to and from Europe. The port of Rotterdam is the external border of the European Union, which allows goods to travel freely through EU member states after customs clearance in Rotterdam. Dutch Customs is responsible for releasing goods that travel in or out via Rotterdam.

Millions of containers have to be checked annually for contraband: smuggling of forbidden goods and tax evasion. Next to this customs is looking for illegal waste, weapons, fake articles and of course drugs. All kinds of smart smuggling tricks, like double bottoms, hidden space or fuels tanks with surprising contents may counteracted by container scan. Next to collecting import duties, detection of illegally imported or transited goods is customs core business.

Based on risk analysis customs determines if cargo inspection will be required. Since the container scanners have been taken in service the containers do not to be opened anymore. Consequently, much more short duration inspections could be carried out.

TV 5: Philips Innovation Center Eindhoven North

- Area:** Medical Imaging
- Topics:** Health Care Imaging Systems, Interventional X-ray, MRI
- Security:** no photo- or video-equipment, incl. GSM allowed; no participants with pacemakers at MRI factory
- Transport:** Bus leaves 08:30 h and returns ± 18:00 h at the World Forum
- Nota Bene:** There is **no option** to attend Wednesday morning refresher courses
- Lunch:** lunch box offered by the IRPA 2018 organisation
- Program:** Schematic
- Reception Coffee/Tea
 - Introduction to Philips Innovation Center Eindhoven North
 - Refresher Course: *Radiation Exposure of Patients and Staff during Interventional Radiology* by: Cecile Jeukens
 - Refresher Course: *Magnetic Resonance Safety - Bioeffects of Static Field, kHz en MHz exposures* by: Johan van den Brink
 - Lunch
 - Customer Visitor Center/Training Center Philips Service Engineers.
 - Advanced Molecular Imaging, MRI, Cardiovascular Imaging, CT, Conventional X-ray
 - Guided Tours to Factories: *Magnetic Resonance Imaging Systems*
Image Guided Therapy Systems (Interventional X-ray)
 - Coffee/Tea pauses



Information:

From a radiation protection point of view Royal Philips is a health technology company producing all kinds of health care instruments. During this visit the focus will be on techniques c.q. equipment that explicitly uses non-ionising and/or ionising radiation.

For this congress, the scope of Royal Philips technical visit covers the following topics:

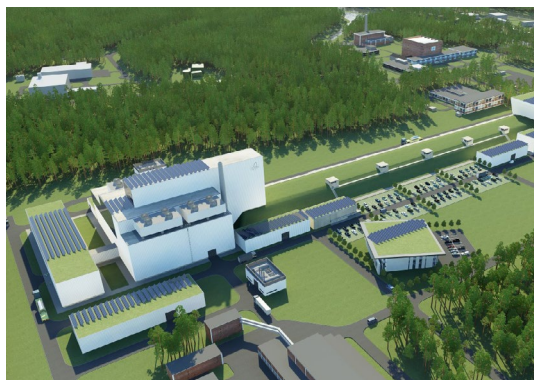
- **Image guided therapy (IGT)** systems: with IGT systems, the way for safer, more effective and better reproducible treatments may be paved by delivering relevant clinical value when it is most needed, notably during the treatment of the patient. IGT Systems is the leading innovator in image-guided interventional solutions. We develop seamlessly integrated systems, including interventional X-ray systems and software solutions, that enable personalized, minimally invasive treatment decisions for every patient and help guide the minimally invasive procedure more effectively
- **Magnetic Resonance Imaging (MRI):** the development of MRI for use in medical investigation has provided a huge forward leap in the field of diagnosis, particularly with avoidance of exposure to potentially dangerous ionizing radiation. With decreasing costs and better availability, the use of MRI is becoming ever more pervasive throughout clinical practice.

TV 7 (4 tours): *4 distinct tours with distinct subjects*
Studie Centrum Kernenergie / Centre d'Étude d'Énergie Nucléaire (SCK • CEN), Mol, Belgium

- Area:** Research & Applications
- Topics:** Nuclear Energy, Reactor Technology, Decommissioning and Decontamination, Waste Management, Low-dose effects, Decontamination and internal dosimetry
- Security:** Passport
- Transport:** Bus leaves 08:30 h and returns ± 18:30 h at the World Forum
- Nota Bene:** There is **no option** to attend Wednesday morning refresher courses, except for the special tour for Radiation Physicians (see TV7 RPT)
- Lunch:** lunch offered by SCK • CEN
- Program:** Schematic
- Reception/Security Coffee/Tea
 - Subdivision in tours A, B, C and D
 - Lunch in between Refresher Courses and Visits
- a. **Tour A** *Radiation Protection of Men and Environment*
Refresher Course: *Low Dose Effects of Ionising Radiation* by: Marjan Moreels
Technical visits: Radiobiology, Microbiology & Radioecology Laboratory
- b. **Tour B** *History & Future: 4 Generations of Nuclear Research Reactors*
Refresher Course: *Radiation Protection Principles in 4 Generations of Nuclear Research Reactors* by: Fernand Vermeersch
Technical Visits: BR1 & Heavy Liquid Metal Technology Complex
- c. **Tour C** *Research Related to Geological Disposal*
Refresher Course: *Demonstration of Long-Term Safety of Radioactive Waste Disposal* by: Janez Perko
Technical Visit: Underground laboratory HADES
- d. **Tour D** *Decontamination and internal dosimetry*
Refresher Course: *Low Dose Effects of Ionising Radiation* by: Marjan Moreels
Technical Visit: Whole-body counting lab & decontamination wing
- Coffee/Tea pause



A) Radioecology Experiments



B) MYRRHA Research Installation

materials and fuels for the current and future generation of nuclear reactors and participates in European projects focused on their design and safety. These future installations make more efficient use of nuclear fuels thereby delivering higher performance and resulting in less radioactive

Information:

SCK • CEN is one of the largest research institutions in Belgium and conducts fundamental and applied nuclear research at an advanced scientific level and in an international context. The activities of SCK • CEN are focused on three main research topics: the safety of nuclear installations, the well-considered management of radioactive waste, and human and environmental protection against ionising radiation. Next to performing research to peaceful applications of radioactivity, SCK • CEN provides specialist services such as consultancy and organises training courses via its SCK • CEN Academy for Nuclear Science and Technology.

SCK • CEN researches a wide range of topics all aimed to the benefit of society: Radiation protection: Exposure to ionising radiation is not risk free. One of SCK • CEN's main objectives is to protect humans and the environment against the damaging effects of ionising radiation, now and in the future. To this end they make their expertise available to governments, the medical establishment and industry. When developing nuclear applications, SCK • CEN also focuses on the impact of radiation on humans and the environment.

The unique knowledge at SCK • CEN about radiation protection is reflected in numerous fields, such as the safe disposal of radioactive waste, the safe operation of nuclear installations, radiation protection in medicine, radiation and contamination in emergency situations and natural radioactivity.

Technological innovation: making the impossible possible. SCK • CEN tests materials and fuels for the current and future generation of nuclear reactors and participates in European projects focused on their design and safety. These future installations make more efficient use of nuclear fuels thereby delivering higher performance and resulting in less radioactive



C) HADES Underground Laboratory



D) Decontamination Room

Source Images: SCK•CEN. Used by Permission

waste. SCK•CEN is actively working on designing and building a new multifunctional research installation: MYRRHA as in Multi-purpose hYbrid Research Reactor for High-tech Applications. This will be the very first prototype in the world of a nuclear reactor driven by a particle accelerator.

Nuclear safety: SCK•CEN plays a significant role in the safe operation of nuclear power plants both in Belgium and abroad. It has built up extensive expertise with respect to the ageing processes of nuclear reactors as a result of their research into fuels and irradiated materials. Ionising radiation in a reactor, for example, can deteriorate structural materials and cause cracks.

The research in this domain is conducted in the BR2 reactor and the laboratory for high and medium level activity (LHMA). Initially, materials are irradiated in BR2 and then analysed at LHMA. The test results can then be used to accurately predict the service life of nuclear reactors.

Radioactive waste and decommissioning: Mankind produces radioactive waste in many nuclear applications. This waste continues to emit ionising radiation for decades, hundreds or even thousands of years. In order to protect humans and the environment from the potentially damaging effects of this radiation, SCK•CEN is searching for long-term management solutions for this waste.

There is a global demand for the dismantling of nuclear installations and this will only increase in future as more and more installations reach the end of their operational life. The main challenge associated with dismantling operations is finding the balance between safety and economic feasibility. The distinctive expertise of SCK•CEN, which was developed during the dismantling of the BR3 reactor, is now available for other nuclear installations at a national and international level.

Extensive options of services and consultancy: technology and services based on a reliable scientific foundation. SCK•CEN is active in three different areas, i.e. scientific research, technological development and services. This enables SCK•CEN to accrue and apply newly acquired knowledge and anticipate the requirements of their stakeholders and customers. The services of SCK•CEN concentrate on analysis and measurements, production of radioisotopes, silicon doping, dismantling and decontamination and material testing.

Education and training: Sixty years of research into peaceful applications of ionising radiation has enabled SCK•CEN to build up a huge amount of in-house expertise and know-how of nuclear science and technology. Passing this on to future generations is one of the key tasks of the Belgian Nuclear Research Centre. Within SCK•CEN, the Academy for Nuclear Science and Technology manages all education and training activities. The SCK•CEN Academy has four key tasks: Provide guidance for young researchers; Organise academic courses and customised training for professionals; Offer policy support with regard to education and training matters; Care for critical-intellectual capacities for society.

TV 7 (RPT): *Radiation Physicians Tour*
Stude Centrum Kernenergie / Centre d'Étude d'Énergie Nucléaire (SCK • CEN), Mol, Belgium

Area: Research & Applications
Topics: Nuclear Energy, Radionuclide Laboratories, Reactor Technology, Decommissioning and Decontamination, Waste Management
Security: passport
Transport: Bus leaves 12:15 h and returns ± 20:30 h at the World Forum
Nota Bene: Wednesday morning **Refresher Courses** (three sessions) **may be attended**
Lunch: lunch box offered by IRPA 2018 organisation (bus ride)
Program: Schematic

- Reception/Security Coffee/Tea
- Tour *Decontamination and Internal Dosimetry* (dedicated to Radiation Physicians)
- Technical visits Whole Body Counting Laboratory & Decontamination Wing
- Coffee/Tea pause
- Transport to Lakehouse for Refresher Course
- Refresher Course: *Low Dose Effects of Ionising Radiation* by: Marjan Moreels



Lung Contamination Investigation
Source Image: SCK • CEN. Used by Permission

Information:

SCK • CEN is one of the largest research institutions in Belgium and conducts fundamental and applied nuclear research at an advanced scientific level and in an international context. The activities of SCK • CEN are focused on three main research topics: the safety of nuclear installations, the well-considered management of radioactive waste, and human and environmental protection against ionising radiation. Next to performing research to peaceful applications of radioactivity, SCK • CEN provides specialist services such as consultancy and organises training courses via its SCK • CEN Academy for Nuclear Science and Technology. For more general information see SCK • CEN under Technical Visits #7 (4 Tours).

In the whole-body counting laboratory direct gamma measurements are performed on people to determine the doses from internal contamination of radionuclides through inhalation, ingestion or via wounds. Typical measurements used are whole-body counting, lung measurements, thyroid measurements, wound measurements, etc. All those measurements must be performed within a low background radiation environment with adjusted calibration.

There is a special space mainly used for decontamination of staff members who were accidentally contaminated by radioactivity (which, fortunately, happens very rarely). To this end, measurement setups, showers, shower tables, a decontamination bath, special detergents, aerosol devices, specific drugs, etc. are available. This infrastructure can also be used for radioactive decontamination of staff members from external companies and even for the general public as part of the Belgian Nuclear Emergency Plan.

TV 8: URENCO Nederland B.V., Almelo

Area: Industry

Topics: Uranium Enrichment; Stable Isotope Enrichment; Ultra Centrifuges

Security: Acceptance after final check by URENCO; no photo- or video-equipment, incl. GSM allowed

Transport: Bus leaves 08:45 h and returns ± 18:30 h at the World Forum

Nota Bene: There is **no option** to attend Wednesday morning refresher courses

Lunch: lunch offered by URENCO Nederland B.V.

Program: Schematic

- Reception/Security Coffee/Tea
- Introduction Urenco
- Refresher Course: *Isotope Enrichment by Ultra-Centrifugation* (preliminary title) by: Frank Tuenter
- Visit facilities in small groups
- Coffee/Tea pause



Centrifuge Cascade

and non-destructive service providers. Zinc, depleted in ^{64}Zn , is widely used in nuclear reactors to reduce radiation levels to workers. Iridium enriched in ^{191}Ir and Selenium enriched in ^{84}Se are the precursors for high specific activity radioactive sources ^{192}Ir and ^{85}Se applied in non-destructive testing studies.

Information:

URENCO's site in the Netherlands operates two separation plants, SP4 and SP5, of which the newest plant SP5 - operational since 2000 - houses over 80% of total site capacity. The Almelo site is unique because besides uranium enrichment also stable isotopes are enriched *c.q.* produced. Stable isotopes are applied all around the world in nuclear medicine for the treatment of hundreds of thousands of patients.

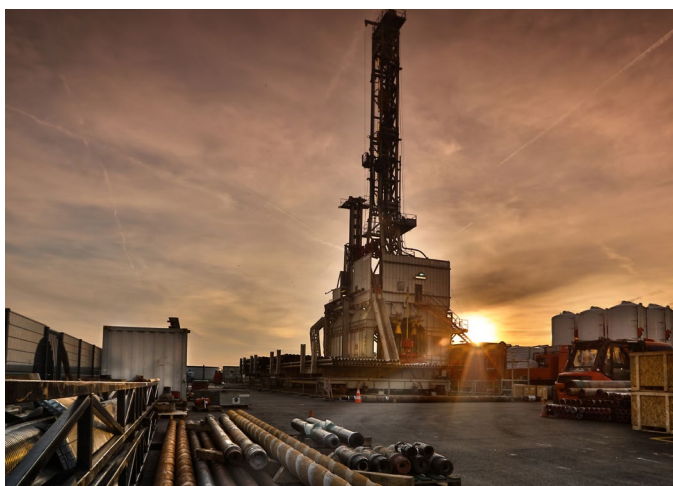
Since 1990 URENCO Stable Isotopes has employed centrifuge technology to separate isotopes of elements like iridium, xenon, germanium and zinc for a number of commercial purposes, supporting the medical industry and other key industrial applications. Financially spoken this is not a major part of URENCO's business, but it is of considerable value from commercial, social and environmental perspectives.

While the separation of elements other than uranium has presented many new challenges, the development committed to stable isotopes is now delivering value in two specific segments of the medical market: diagnostics (gamma cameras can accurately detect disease progression and staging in vital organs) and brachytherapy (allow production of high specific activity sources for cancer irradiation).

Industrial applications of stable isotopes focus on the nuclear market

TV 9: Dutch Association of Geothermal Operators (DAGO) and Energie Combinatie Wieringermeer (ECW), Middenmeer

- Area:** Non-Nuclear Industry
Topics: Unwillingly Produced Natural Radioactivity, Naturally Occurring Radioactive Material (NORM)
Security: no special demands
Transport: Bus leaves 09:00 h and returns ± 18:30 h at the World Forum
Nota Bene: There is **no option** to attend Wednesday morning refresher courses
Lunch: lunch box offered by the IRPA 2018 organisation
Program: Schematic
- Reception Coffee/Tea
 - Presentation: *General Overview of Dutch Geothermal Projects* by: Martin van der Hout
 - Lunch offered by DAGO
 - Visit ECW Geothermal Wells and Greenhouse Heating
 - Coffee/Tea pause
 - Refresher Course: *Natural Radioactivity in Geothermal Projects* by: Lonneke van Bochove



Drilling a Geothermal Well (cf. Oil & Gas)



Drilling a Geothermal Well in a Greenhouse Area

Information:

Agriport A7 is the most modern Agropark in the world for large-scale greenhouse horticulture. “Energy Combination Wieringermeer” (ECW) is a multi-utility energy company in the Agriport A7 area. ECW’s objective is to contribute optimally to the most sustainable energy supply in the area. Through cooperation within the supply chain, supply chain integration and cross-overs between different chains creates good opportunities for the use of waste products (heat, process water, CO₂) of businesses in the area. This is not only good for the environment, but also an excellent opportunity to reduce costs and enhance competitiveness.

To make the production of greenhouse products (e.g. tomatoes, bell peppers) even more sustainable, ECW started exploring and exploiting geothermal energy. After well completion hot water is pumped up, the heat is exchanged and transported via an independent secondary system of heating pipes to the greenhouses, while the cooled-down water is reinjected to the same geological stratum from which the hot water has originally been pumped up.

Unfortunately, with the pumping up, cooling and degasification of the hot water in combination with construction materials applied chemical processes occur leading to deposition of chemical substances one way or the other contaminated with naturally occurring radionuclides. Such contaminated deposits are generally known as Naturally Occurring Radioactive Material. The occurrence of NORM was a “surprise” to the first geothermal operators in *the Netherlands* in 2010.

Dutch geothermal operators set up an association to promote the collective interest and to contribute to the safety and effectivity of geothermal energy, viz. *Dutch Association of Geothermal Operators* (DAGO). DAGO members share their experiences and knowledge of geothermal in an open and equal manner, particularly to new projects. Through pooling and sharing of these experiences, DAGO improves and accelerates the opportunities in creating a standardization policy, a higher efficiency and the accessibility of information within the geothermal industry. In this respect DAGO developed NORM guidelines and standardised NORM operating procedures. Together with NOGEP (North sea Oil & Gas Exploration and Production Association), DAGO develops specific geothermal standards and policies implementing Dutch and European Union regulations.

TV 10: **RijksUniversiteit, Groningen (RUG) / Kernfysisch Versneller Instituut - Center for Advanced Radiation Technology (KVI-CART), Groningen**

Area: Research & Applications

Topics: Particle Accelerator, Accelerator Physics, Nuclear Physics, Astrophysics, Medical Physics

Security: No additional requirements

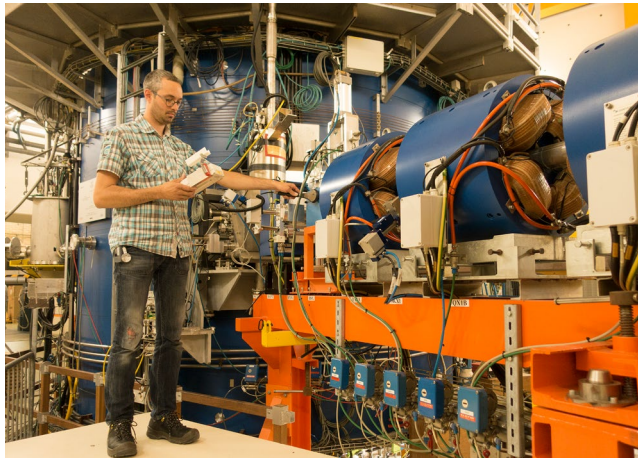
Transport: Bus leaves 08:45 h and returns ± 19:45 h at the World Forum

Nota Bene: There is **no option** to attend Wednesday morning refresher courses

Lunch: lunch offered by KVI-CART

Program: Schematic

- Reception/Security Coffee/Tea
- Presentation: *KVI Introduction* by Hans Beijers
- Lunch
- Tour KVI-CART
- Coffee/Tea pause
- Refresher Course: *Radiation Protection and Particle Accelerators* by: Hans Beijers



Inspecting a Beam Line

Information:

Since 1996 the AGOR (Accélérateur Groningen-ORsay) cyclotron - result of a cooperation and co-design of KVI, Groningen and IPN, Orsay, France - has been operational. AGOR is a superconducting cyclotron that can deliver a large variety of beams e.g. 190 MeV protons, 90 MeV/nucleon alpha's and carbon and 600 (Q/A)² MeV/nucleon heavy ions. With Q/A the charge over mass ratio.

KVI-CART performs basic research on subatomic and astroparticle physics and application-driven research on accelerator physics and physics in medicine working in close collaboration with the scientific community, healthcare and industry, on long-term solutions for science and society. Through the development of state-of-the-art detection techniques, KVI-CART fosters the cross-fertilization between basic and application-driven research.

Along these lines KVI-CART developed advanced detection systems and detection technologies which can be applied in science and society:

- The AGOR accelerator group has three main areas of research: Accelerator Physics, Ion Sources and Irradiations and Radiobiology
- Research in the field of Astroparticle Physics focuses on the study of the sky map of the high-energy Universe, addressing the unknown origin of cosmic rays at the highest energies as the acceleration mechanism(s) leading to ultra-high energies ($E > 10^{16}$ eV) and their sources are largely unknown. Another subject studied is lightning as the details of the lightning mechanisms are still unknown. Newly developed detection instruments allow precision measurements of the initial steps in lightning initiation and propagation.
- At the atomic level, the chemical properties of the elements are predominantly governed by the electromagnetic forces. At a smaller scale, the properties of atomic nuclei are governed by two more interactions: the strong and the weak interactions. The mass of all visible matter stems primarily from the strong interaction giving rise to nucleons, and more generally, hadrons. Research is focused on how matter at the scale of nuclei and hadrons is being formed from its constituent elements and their underlying forces.
- Radiotherapy with photons has improved significantly in the last decades. Doses to the healthy tissues have decreased by using techniques intensity modulation of the radiation field. However, radiation induced complications are still a serious issue. One possible route towards a further reduction of the radiation dose to the surrounding healthy tissues, and thus of the complications, is the use of heavy charged particles (protons and other ions) instead of photons. However, the finite penetration depth of ions and the high dose deposit at the end of their path, which make it possible to substantially reduce the radiation dose to the surrounding healthy tissue, are not only a benefit. They also cause the dose distribution to be rather sensitive to small errors in the modelling of the tissue composition or patient anatomy and density, based on X-ray imaging, used to predict the energy loss of the protons. These issues call for research into combining advanced X-ray and proton imaging techniques, methods for in-vivo verification of the irradiation dose and standards for dosimetry in proton therapy.

TV 11: Tata Steel Nederland, Velsen-Noord

Area: Process Industry

Topics: Ionising Radiation Applications, Non-Ionising Radiation Applications

Security: Copy of a valid photo identification card or document; no photo- or video-equipment, incl. GSM allowed

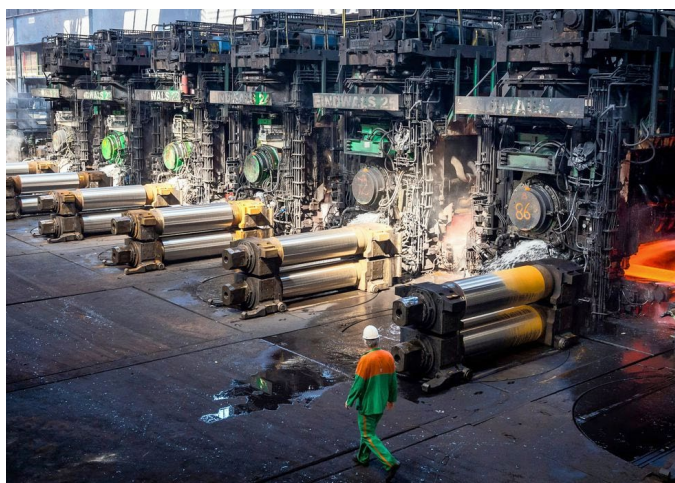
Transport: Bus leaves 12:15 h and returns ± 17:45 h at the World Forum

Nota Bene: Wednesday morning **Refresher Courses** (three sessions) **may be attended**

Lunch: lunch box offered by the IRPA 2018 organisation

Program: Schematic

- Reception/Security Coffee/Tea – *Congrescentrum Dudokhuis*
- Tata Steel Introduction by IJmuiden Visits
- Refresher Course: *Tata Steel Ionising Radiation Applications* by: Martin Lips
- Refresher Course: *Tata Steel Non-Ionising Radiation Applications* by: Peter Vooijs
- Coffee/Tea pause
- Bus tour Tata Steel premises
- Dependent on Production Circumstances Visit to *Direct Sheet Plant (DSP)*, *Hot Rolling Mill 2 (HRM2)* and/or *Coated Products (CPR)*



Hot Rolling Mill 2 - Thickness Measurement



Hot Dip Galvanizing - Induction Furnace

Information:

Tata Steel applies various X-ray and/or radioactive sealed sources for process control (e.g. steel thickness or coating thickness measurements). Next to this strong electro-magnetic fields may exist near e.g. induction furnaces. With a visit to this site the participants may have a view to the application of ionising radiation sources, while protection measures against the hazards of electro-magnetic fields will be elucidated in a presentation.

Some examples of ionising radiation applications are given below:

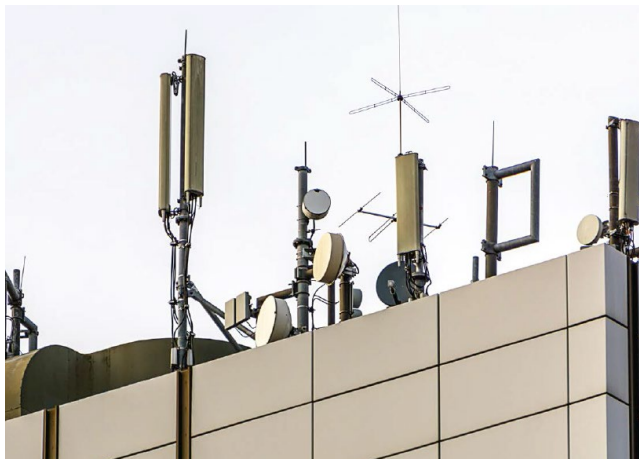
- The flow rate of molten steel into a continuous casting mould, that produces long strips of steel (called slabs, blooms or billets). The molten steel, fresh from a basic oxygen furnace, is poured in at one end and cools and solidifies as it passes through the mould. The pressure of the molten steel in the mould pushes the steel out of the bottom. A radioactive source monitors the level of steel in the mould and its signal is taken up in the process control system.
- The thickness of a flat strip of steel can be measured by the attenuation of radiation experienced by a beam of high energy ionizing radiation directed perpendicular to the planar surface of the strip. Typically, the plane of the strip is oriented horizontally with the source and detector mounted above and below the strip. The source of radiation to measure a strip of steel is normally an X-ray tube, or a sealed source with an artificial radionuclide, e.g. ^{241}Am (gamma rays).

An example of non-ionising radiation application is given below:

- Induction furnaces are used in process lines to heat for example steel strips or to heat a bath of molten zinc. A variable magnetic field of high frequency is created within an inductor (coil). According to the law of induction, any electrical conductor placed in a magnetic field is the site of electromotive forces and, thus, of induced currents known as EDDY currents. These currents dissipate the heat in the same substance where they were created, and thus the heat is generated directly in the metal being heated.

TV 12: **Agentschap Telecom (Ministry of Economic Affairs and Climate), Amersfoort**

- Area:** Non-Ionising Radiation
Topics: Electro-Magnetic Fields, Protection Measures, Communication with the (educated) Layman
Security: no special requirements
Transport: Bus leaves 11:00 h and returns ± 18:30 h at the World Forum
Nota Bene: Wednesday morning **Refresher Courses** (only two sessions) **may be attended**
Lunch: lunch box offered by Agentschap Telecom
Program: Schematic
- Reception/Lunch
 - Introduction Agentschap Telecom – Erik Lucas
Antenne Bureau – Yvonne Trenning
 - Technical Information Electro-Magnetic Fields
 - Workshop – some practical exercises
 - Coffee/Tea pause
 - Refresher Course: *Risk Communication and Risk Perception* by: Yvonne Trenning



"A forest of antennas"

measurements, in public places, to conclude whether or not the EMF of the antennas poses a risk to the health of Dutch citizens.

The "Antennebureau" (Ab: 'Antenna Agency') – the information agency of the Dutch government concerning antennas – provides factual information on the placement of antennas, its potential health effects in the nearby environment and – on request – may carry out electric and/or magnetic field measurements. The Ab is the custodian of the antenna register. Next to this the Ab organises courses on new developments in telecommunication, most recent scientific studies on electromagnetic fields and its health consequences, communication on health effects with the public, measuring electromagnetic fields.

For potential health effects of Non-Ionising Radiation the "Rijks Instituut voor Volksgezondheid en Milieu" (RIVM: 'National Institute for Public Health and the Environment') forms the scientific conscience, where the "Gezondheidsraad" (GR: 'Health Council') advises the government on Non-Ionising Radiation regulations for both workers and the public at large.

Information:

The "Agentschap Telecom" (AT: 'Radiocommunications Agency') is responsible for obtaining and allocating frequency space and monitoring its use. The work of the agency covers the entire field of wireless and wired communication, like licensing events, for example the Tour de France, monitoring of these events, operators), capturing trends in the electronic communication domain (e.g. 5G development), market surveillance for electric products to ensure that these products are in compliance with the European legislation etc. Through these activities AT ensures the availability and reliability of the IT and communication networks, to make sure that the Netherlands is safe and connected.

AT is also responsible for the monitoring of the EMF of antennas that are put into service. Inspectors of the agency perform EMF-

Young Professional Award at 5th Regional European IRPA congress 2018

Introduction

The Young Professional Award (YPA) was established in 2010 as an integral part of the IRPA congresses in order to motivate young professionals and to stimulate them to contribute to IRPA congresses thus exchanging their ideas with both young and more experienced radiation protection professionals. **IRPA thus promotes young professionals and scientists to develop their careers in the field of radiation protection.** Participation in the YPA competition offers the young professional an unique opportunity to present their work to an audience of radiation protection experts and peers.

The YPA competition

Every European Associate Society (AS) was invited to nominate one candidate for the YP competition (for achievements in radiation protection). Nominees are all in the first decade of their career and preferably not older than about 35 years. A total of ten young professionals have been nominated by their respective societies.

Every nominated YP is invited to timely send a paper of 4-8 pages describing his/her work or research. These papers will be made available to the participants as regular full papers. He or she will give an oral presentation on Thursday, 7 June during a scientific session dedicated to the YPA competition. In order to give the young pro-

fessionals all the attention they deserve, there will in principle be no parallel sessions on Thursday afternoon.

The assessment and awarding

In order to ensure objective and serious assessment of the young professionals the Associate Societies established a jury consisting of representatives of the Societies. Each society was invited to nominate two jurors – one experienced and one younger member. Seven Associate Societies are represented in the jury. The IRPA Executive Council is represented in the jury by Dr Alfred Hefner.

The jury will evaluate the written paper and oral presentations, taking account of the relevance of the work for the profession, its (scientific) quality, the creativity of their (contribution to the) work and the presentation of their work, each of the four criteria being equally important. In the final judgement process every society in the jury will have only one vote.

The winner of the YPA competition will be awarded during the closing ceremony. Furthermore, a public prize will be awarded to one of the competitors.

School Event



During the 5th European IRPA Congress, the first Dutch School Event will be organised by the NVS.

The objective of the School Event is to introduce high school students to different aspects of ionising and non-ionising radiation and what is needed to protect people from the possible adverse effects resulting from exposure to (non-) ionising radiation.

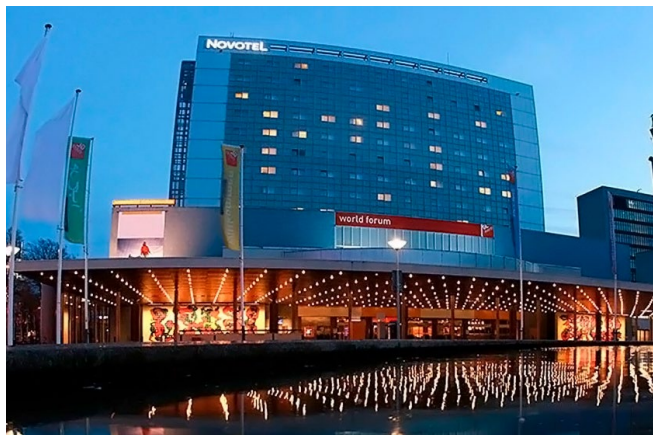
The School Event organisation tries to achieve this by offering an inspiring, interactive explanation of the subject of radiation protection in combination with appealing, practical examples and small practical setups.

The exhibitors program is filled with a wide variety of organisations and companies, while the preceding theory session promises to be interesting and interactive. For those interested it is possible to follow the preparations on facebook.

Registration takes place through the schools that can sign up their students for this event. The School Event will be held in the World Forum as a side event of the IRPA congress. The School Event will take place on Wednesday afternoon June 6th, parallel to the EU-TERP meeting and various technical visits.

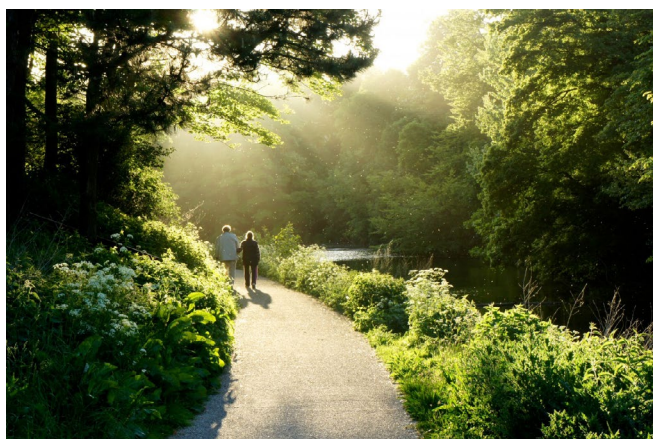
Social Programme

During the Congress there are several events to meet each other in an informal way.



Monday Welcome Cocktail Reception at the World Forum

Directly after the first Congress day a cocktail reception will be held for all participants and guests of IRPA 2018. Accompany persons are also welcome.



Tuesday Early Run through The Hague

Wednesday

Thursday

A nice opportunity for all participants to join the morning charity run in the nearby “Scheveningse Bosjes”.

This run, near and around The World Forum, will provide you with an Energy boost for the Congress.



Thursday Congress Dinner at the World Forum

The Congress Dinner on Thursday evening is to celebrate IRPA 2018.

All Congress participants, guests and accompanying persons are welcome to join the diner.

(Fee: Participant € 30,- ; accompany persons € 95,-)

Post Congress Tour 8-10 June 2018



The Local Organizing Committee is happy to offer you a unique two-day extension of your congress.

The programme of this post congress tour has been prepared in combination with activities in the framework of Leeuwarden Cultural Capital of Europe.

Leeuwarden-Friesland (or Ljouwert-Fryslân) is European Capital of Culture in 2018. Cultural Capital of Europe is an international cultural project and one of Europe's most ambitious events. According to the European jury, the Frisian mienskip (community) was the reason that Leeuwarden-Friesland was chosen as Cultural Capital of Europe in 2018. The unique involvement of Frisians with their immediate surroundings, family, neighbours, associations and corps made a big impression. The iepen mienskip - open community - is the theme of the programme with more than 800 projects.

Programme



Friday, June 8th

A visit to the Afsluitdijk

Directly after the closing ceremony your bus will leave for the Afsluitdijk. The Afsluitdijk is a unique causeway over a length of 32 kilometers, running from the province of North Holland to the province of Friesland. It is a fundamental part of the larger 'Zuiderzee Works,' damming off the former Zuiderzee, a salt water inlet of the North Sea, and turning it into the fresh water lake of the IJsselmeer.

Short city walk and dinner

Around 6.00 PM you will arrive in Leeuwarden. After arrival at the hotel there is a short city walk and dinner in Leeuwarden.

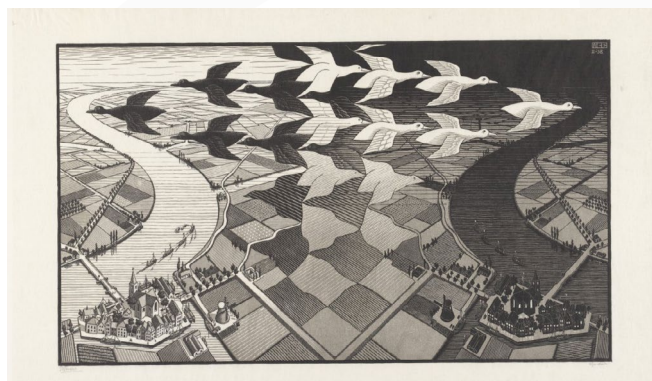
Overnight stay in Leeuwarden.

Saturday, June 9th

In the morning, you can explore the city of Leeuwarden on your own

Some suggestions:

- Exhibition of M.C. Escher at the Fries Museum



M.C. Escher is perhaps Leeuwarden's most famous resident, a fact unknown to a large number of Escher fans. He was born in 1898 in the city palace on the Grote Kerkstraat, the building that now houses the Prinsessehof National Museum of Ceramics. The Museum of Friesland is organising a major exhibition about M.C. Escher for 2018. In the exhibition visitors accompany Escher on his physical and intellectual journeys. His unique development is mapped out with more than 50 early and late original prints. The exhibition shows how travelling and stays in Spain and Italy influenced his artistry. Visitors meet Escher the person, and walk in his footsteps. The exhibition is designed as a three-dimensional biography: it truly feels as if you enter into Escher's headspace.



- Discover the 11 fountains of Friesland
Eleven of the world's leading artists were linked to the eleven Frisian cities and their residents. Each of them has designed a fountain that fits a city and its history. Not just fountains, but exceptional contemporary works of art that uniquely highlight the rich history and culture of the Frisian cities. The Spanish sculptor Jaume Plensa created an overwhelming piece of art in front of the Leeuwarden railway station.



- Visit the curved Tower of the Oldehove
Construction of this leaning, curved and unfinished tower began in 1529. The original plan included attaching a new church to the tower, which would replace the old Saint Vitus church, but this was never realized. Master builder Jacob van Aken was unlucky from the start, because the tower began to sink during construction. In an effort to compensate for the tilt, it was decided to continue to build perpendicular on top of the leaning bottom. Because of this the tower is also curved. Construction was subsequently halted in 1533 and has never been resumed. The tower never reached its intended height of about 120 m. Although the Oldehove has never been used for special purposes, it acquired a symbolic status nevertheless.

- Pay a visit to the Boomsma Beerenburger Museum.

Beerenburg is a typical Frisian drink, made by adding herbs to jenever. The Boomsma Museum, is a traditional distillery, completely refitted in nineteen thirties style. An interactive film shows the origins of Boomsma Beerenburger and how it's made. And of course you can enjoy the taste of the famous Beerenburger.

Boat trip on the Frisian lakes

Lake Sloten from the city of Sloten

In the afternoon you will enjoy the Frisian scenery on board a classic salon boat. You will make a boat trip on the Frisian lakes, through narrow Frisian streams and the picturesque villages of Woudsend and Sloten.



Oranjewoudfestival

The Oranjewoudfestival is a festival with classical music, jazz and music theatre originally presented on magnificent locations in Oranjewoud. From 12 to 22 hours short classical and cross-over performances continuously take place in the free accessible festival heart De Proeftuin.

Optionally you can book tickets for two events:

1. Jean Guihan Queyras playing a program with the epicentre around Bach's Cello Suites.
This concert is given from 20.00 – 21.00 hours.
2. Night of the Park from 22.30 – 01.00 hours. The fairytale-lit Overtuin is the setting for a fantastic night program. Step into a fairytale world in which light is displaced by darkness, dream and reality blend together and the silence now and then makes for wonderful sounds. The Night of the Park consists of two parts:
 - a. Sheherazades Dream from 22.30 to 23.50 hours. Short, continuous performances scattered throughout the Overtuin, magically illuminated.
 - b. Midnight concert from 0.00 to about 1.00 hours

Overnight stay in Oranjewoud or nearby Heerenveen

Saturday, June 10th

Oranjewoud

The morning is free to spend as far as time allows

- *Walk through Oranjewoud*

The forested area around the small village of Oranjewoud is ideally suited for a one or two-hour stroll. Enjoy the magnificent 18th century villa's in this area, which once was the summer residence of members of the royal family. Walking around you might also:

- *Visit museum Belvédère – museum of modern and contemporary art*

Departure by train from Heerenveen to Schiphol – time of departure depending on your individual travelling schedule.



Additional information & Registration

Minimum number of participants: 6

Maximum number of participants: 20

Fee: (double occupancy of double bedrooms): € 469

Fee: (Single occupancy): € 599

Ticket Jean Guihan Queras: € 30

Ticket Night of the Park: € 30

Included: all transfers, stay in 4-star hotels in Leeuwarden and Oranjewoud or Heerenveen including breakfast, dinner on Friday, June 8th (drinks not included), boat trip, lunch a board on Saturday, June 9th.

Deadline for registration is May 1st – registration is ONLY possible by direct email to the congress office info@irpa2018europe.com. From May 1st onwards, the tour will be subject to availability of the options. Changes to programme and/or the fee might apply.