

## CONSULTATION / TECHNICAL SUPPORT TEACHING / TRAINING

### Services provided by A.N.T. International

#### A.N.T. International's Network of Experts

The Experts of A.N.T. International will be very happy to provide an independent analysis of operation issues and evaluation of reports or analysis to provide a second opinion of suggestions or recommendations made by others and, provide technical support services (reports, seminars, workshops), education and training in the following areas:

- FUEL DESIGN • ACCIDENT TOLERANT FUEL • MANUFACTURING
- IN-REACTOR PERFORMANCE • INTERIM DRY STORAGE
- BWR, PWR, VVER CHEMISTRY, CORROSION AND MATERIALS



*[Read more about our Network of Experts](#)*

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More specifically, A.N.T. International can assist you in the following areas:



#### **Basic Zr Knowledge**

- » Metallurgy of fuel cladding and bundle hardware
- » Hydrogen – solubility limits, diffusion, mechanical properties including DHC and embrittlement, mitigation;
- » Mechanical properties – including tensile, hardness, fracture toughness testing;
- » Surveillance of components
- » Radiation damage
- » Alloy improvements/development

#### **Fuel Design and Manufacturing**

- » Licensing of fuel
- » Review of
  - Mechanical and Materials design
  - Thermal-Hydraulic Analysis of Steady-State and Transients Conditions, Review of Critical Heat Flux Correlation Development and Validation)
  - New fuel designs or fuel design changes for neutronic, thermal-hydraulic, and fuel reliability impacts
- » Fuel fabrication audit
- » Fabrication, properties and performance of fuel and control rod assemblies, including
  - Zirconium alloys
  - High strength nickel alloys and stainless steels,
  - Control rod absorbers and burnable absorbers

#### **In-reactor Performance During Normal Operation, Anticipated Operational Occurrences and Design Basis Accidents**

- » Fuel Reliability
- » Fuel Channel/Assembly bowing
- » Irradiation creep and growth
- » Corrosion and hydrogen pickup
- » Pellet Cladding Interaction
- » Radiolysis of the primary coolant

#### **Fuel Performance During Interim Dry Storage and Cask Transport**

#### **Testing/Examinations**

- » Mechanical testing of un-irradiated and irradiated components
- » PIE of irradiated components
- » Root cause investigation for failure of in-reactor components
- » Testing and irradiation planning for development of new alloys for in-reactor use
- » Planning and execution of irradiation experiments; and PIE of irradiated coupons/samples

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## PIE of ATF cladding and fuel materials

- » Independent evaluation of laboratory tests performed on unirradiated (Accident Tolerant Fuel) ATF samples
- » Consulting during (Post Irradiation Examination) PIE of irradiated ATF LTRs
- » Independent evaluation of PIE data and resulting reports.



## BWR Chemistry and Corrosion

- » Hydrogen water chemistry (HWC) implementation, HWC benchmark test design and data evaluation
- » NMCA and OLNC implementation, SCC mitigation effectiveness and data evaluation
- » Implementation of Non-hydrogen Technologies for SCC Mitigation and Their Effectiveness
- » Impact of Water Chemistry Transients on SCC Mitigation Effectiveness and Root Cause Analysis
- » ECP Sensor Performance, ECP Data Evaluation, ECP Trouble Shooting and Mitigation Effectiveness
- » BWR Shutdown/Drywell Dose Rates, Iron and Zinc Control for Effective Dose Rate Mitigation
- » Water Chemistry and Crud Impact on Fuel Performance & Fuel Failure Root Cause Analysis
- » BWR Decommissioning and Decontamination Approaches Leading to License Termination



## PWR and VVER Chemistry and Corrosion

- » Primary Chemistry
  - Dose Rate reduction
  - Zinc addition
  - Crud management
  - Chemistry optimisation
  - Enriched Boric Acid evaluation
  - Root cause analysis for fuel performance degradations (cladding corrosion, AOA)
- » Secondary chemistry
  - Chemistry optimisation
  - Mitigation of Steam Generator tubing Corrosion
  - Steam Generator fouling and remedies
  - Film Forming Amines addition
  - Dispersant addition
  - Condensate Polishing Plant operating mode
  - Steam generator chemical cleaning
- » Chemistry management and monitoring
  - Chemistry Specification advices
  - Monitoring and sampling





## BWR and PWR Material Degradation

- » NSSS Component Degradation and Materials Field Experience;
  - Remedies in case of crack formations in austenitic stainless steel and in low alloyed steel (LAS) piping systems of BWR
  - Ageing management strategies in BWR and PWR
  - Measures to reduce dose rate in BWR and PWR
  - Assistance in resolving corrosion problems in the structural components of PWR fuel assemblies,
  - High strength alloys used for springs, bolts and valve stems SCC Mitigation
  - Destructive examination monitoring/advice
  - SCC and IASCC of core internals
  - Operations monitoring and measures to ensure the component performance in BWR and PWR

## Meet our Experts

### Fuel Material



*Dr. Charles  
Patterson*



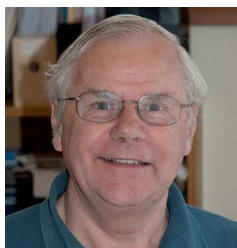
*Dr. Sheikh  
Tahir Mahmood*



*Dr. Albert  
Machiels*



*Dr. Ron  
Adamson*



*Dr. Kit  
Coleman*



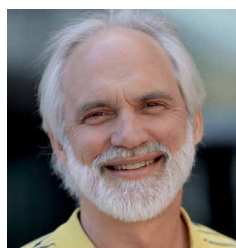
*Mr. Peter  
Rudling*



*Mr. Friedrich  
Garzarolli*



*Dr. Malcolm  
Griffiths*



*Mr. Kenneth  
Epperson*



*Dr. Clément  
Lemaignan*



*Dr. Audrius  
Jasiulevicius*

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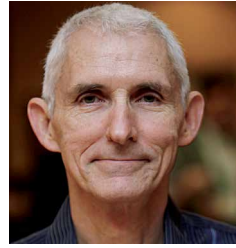
## Structural Material Degradation



*Dr. Ulf  
Ilg*



*Prof. Gary  
Was*



*Mr. François  
Cattant*

## Coolant Chemistry and Corrosion



*Dr. Francis  
Nordmann*



*Dr. Suat  
Odar*



*Dr. Samson  
Hettiarachchi*



*Mr. Dewey  
Rochester*

For further inquiries and questions please contact **Mikaela Strand** at e-mail:  
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We are looking forward to hearing from you.  
With best regards,



Mikaela Strand  
Marketing and Sales Director

Peter Rudling  
President



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