



A.N.T. INTERNATIONAL®



CONSULTATION / TECHNICAL SUPPORT TEACHING / TRAINING

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:



- BASIC ZR ALLOY KNOWLEDGE
- FUEL DESIGN AND MANUFACTURING
- LICENSING OF NUCLEAR FUEL
- IN-REACTOR PERFORMANCE DURING NORMAL OPERATION, ANTICIPATED OPERATIONAL OCCURRENCES AND DESIGN BASIS ACCIDENTS
- FUEL PERFORMANCE DURING INTERIM DRY/WET STORAGE
- TESTING EXAMINATIONS OF CLADDINGS AND FUEL MATERIALS
- THERMAL-HYDRAULIC ANALYSIS
- BWR/PWR/VVER COOLANT CHEMISTRY/CORROSION
- RADIOCHEMISTRY
- NUCLEAR DECOMMISSIONING & DISMANTLING
- STRUCTURAL MATERIAL DEGRADATION

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

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/advices
 - SCC and IASCC of core internals
 - Operations monitoring and measures to ensure the component performance in BWR and PWR

OUR EXPERTS

Through our independent World Class Network of Experts we can provide unique knowledge and experience in the nuclear field. ANT International and the Network do not rely on fuel vendors and the information provided in our products and services is unbiased and analysed with a bird eyes view on the business. The Network is involved in all the ANT International products and services



A.N.T. INTERNATIONAL®

*Boosting your Excellence through
Knowledge and Training*

CUSTOMER FEEDBACK

Based upon the A.N.T. International updated knowledge and international experience, A.N.T. International is the strategic partner in Materials Technology to manage material reactor vessel internal issues and develop material degradation models for service and evaluate the structural integrity of the reactor vessel materials.

A.N.T. International gives fast feedback on our questions and can support in solving plant problems and assist in different research projects because of their experienced team of Experts. In particular, they helped us in developing specific methodologies to assess material degradation for Long Term Operation, LTO.

Mr. Juan Ramos Nervi
Materials and Micromechanics Division Head
Nucleoeléctrica Argentina S. A.



Juan Ramos coordinates the characterization and material degradation modeling programs. His expertise areas are micromechanics, pressure vessel embrittlement and zirconium alloys. Nucleoeléctrica has a CANDU power plant and two PHWRs.



For further inquiries and questions,
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We are looking forward to hearing from you.

Best regards,



Mikaela Strand
President



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