



A.N.T. International Academy

ONLINE EDUCATION

PWR Fuel Advanced

COURSE DESCRIPTION

This course covers in-depth topics relevant to PWR fuel engineers to become experts in their field. The course provides background information related to structural material degradation and PWR coolant chemistry & corrosion necessary to understand fuel and material behaviour as related to practical design, operational, reliability and safety issues.



The course involves reading technical reports, watching lectures and participating in online assessments (tests). The course material, including the online content, can be accessed at times convenient for practicing engineers and managers. Assessments are done online, with an understanding of the current material (i.e., 70% required correct answers) needed to proceed to the next part of the course. After passing the final online test, a certificate will be issued to the student.

The course comprises three technical areas: Structural material degradation, coolant chemistry and fuel materials. The principal focus of this course, fuel materials, covers the entire lifespan of fuel assemblies from design and manufacturing through operation and post-irradiation interim storage.

Background information is provided on coolant chemistry and the degradation of plant materials because the primary coolant chemistry affects fuel performance, but is generally targeted towards minimising corrosion of structural materials and minimising the buildup of plant activity.

The content is described more in the [Appendix](#).

COURSE MATERIAL

The course material was developed by A.N.T. International and consists of earlier recorded A.N.T. International Seminars and associated Reports published by A.N.T. International.

Parts of the following Reports are being used in this course:

- Fuel Design Review Handbook (FDRH) [Sample](#)
- Fuel Fabrication Process Handbook Rev 1 (FFPH) [Sample](#)
- Microstructure of Zirconium Alloys and Effects on Performance (ZIRAT20/IZNA15 STR) [Sample](#)
- Impact of Manufacturing Changes on Zr Alloy In-Pile Performance (ZIRAT14/IZNA9 STR) [Sample](#)
- Impact of Irradiation on Material Performance (ZIRAT10/IZNA5 STR) [Sample](#)
- Welding of Zirconium Alloys (ZIRAT12/IZNA7 STR) [Sample](#)
- Corrosion Mechanisms in Zirconium Alloys (ZIRAT12/IZNA7 STR) [Sample](#)
- CRUD in PWR/VVER Coolant. Volume I — Sources, Transportation in Coolant, Fuel Deposition and Radiation Build-up (LCC10 STR) [Sample](#)
- CRUD in PWR/VVER Coolant Volume II — Control of CRUD in the PWR/VVER Coolant and Mitigation Tools (LCC11 STR) [Sample](#)
- Effects of Coolant Chemistry on Fuel Performance (LCC9 STR) [Sample](#)
- Effect of Hydrogen on Zirconium Alloy Properties — Volume I (ZIRAT13/IZNA8 STR) [Sample](#)
- Effect of Hydrogen on Zirconium Alloy Performance (Normal Operation, LOCA/RIA and Dry Storage) — Volume II (ZIRAT13/IZNA8 STR) [Sample](#)
- Dimensional Stability of Zirconium Alloys (ZIRAT7/IZNA2 STR) [Sample](#)
- In-Reactor Creep of Zirconium Alloys (ZIRAT14/IZNA9 STR) [Sample](#)
- Pellet–Cladding Interaction (ZIRAT11/IZNA6 STR) [Sample](#)
- Fuel Reliability (ZIRAT20/IZNA15 STR) [Sample](#)

<ul style="list-style-type: none"> • High Burnup Fuel Design Issues and Consequences (ZIRAT17/IZNA12 STR) 	<i>Sample</i>
<ul style="list-style-type: none"> • Hot Cell Post-Irradiation Examination Techniques for Light Water Reactor Fuels, Volume I (ZIRAT19/IZNA14 STR) 	<i>Sample</i>
<ul style="list-style-type: none"> • Hot Cell Post-Irradiation Examination Techniques for Light Water Reactor Fuels, Volume II (ZIRAT21/IZNA16 STR) 	<i>Sample</i>
<ul style="list-style-type: none"> • Mechanical Testing of Zirconium Alloys, Volume I (ZIRAT18/IZNA13 STR) 	<i>Sample</i>
<ul style="list-style-type: none"> • Mechanical Testing of Zirconium Alloys, Volume II (ZIRAT18/IZNA13 STR) 	<i>Sample</i>
<ul style="list-style-type: none"> • Loss of Coolant Accidents, LOCA, and Reactivity Initiated Accidents, RIA, in BWRs and PWRs (ZIRAT9/IZNA4 STR) 	<i>Sample</i>
<ul style="list-style-type: none"> • Processes going on in Nonfailed Rod during Accident Conditions (LOCA and RIA) (ZIRAT15/IZNA10 STR) 	<i>Sample</i>
<ul style="list-style-type: none"> • Control Assembly Technology Report (FMTR Vol III) 	<i>Sample</i>
<ul style="list-style-type: none"> • Dry Storage Handbook – Fuel Performance in Dry Storage 	<i>Sample</i>

AUTHORS/LECTURERS

The lecturers, World Class Experts in their fields, are as follows:

Structural Material Degradation:

Peter Ford, Peter Scott and Pierre Combrade.

Coolant Chemistry and Corrosion:

Francis Nordmann, Suat Odar and Dewey Rochester.

Fuel Material:

Alfred Strasser, Tahir Mahmood, Richard Collingham, Kit Coleman, Charles Patterson, Friedrich Garzarolli, Ron Adamson and Peter Rudling.

[*Read more about the Experts*](#)

COURSE DURATION

- Total time: around 3 weeks of full-time studies
- Literature: 90 h
- Lectures: 15 h
- 2 Exams: 2 h

More time may be needed to digest the information provided in this course.

CERTIFICATE

You will automatically receive an email with your certificate that you can print or share on social media. If you need a printed certificate, please don't hesitate to contact us and we can send it to you via regular mail. You reach us at support@antinternational.com.

CONTACT

For more information and/or an offer welcome to contact us at sales@antinternational.com

Please also visit our website for the latest updated information, www.antinternational.com



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Appendix: Course outline and topics covered

1. Fuel design
2. Fuel fabrication
3. Fuel material performance during normal operation and anticipated operational occurrence
4. Other topics



A.N.T. INTERNATIONAL®

www.antinternational.com

Advanced Nuclear Technology International,
Spinnerivägen 1, Fack 5035, SE-448 50 Tollerød, Sweden. Phone: +46 (0)31-88 16 00.
info@antinternational.com www.antinternational.com