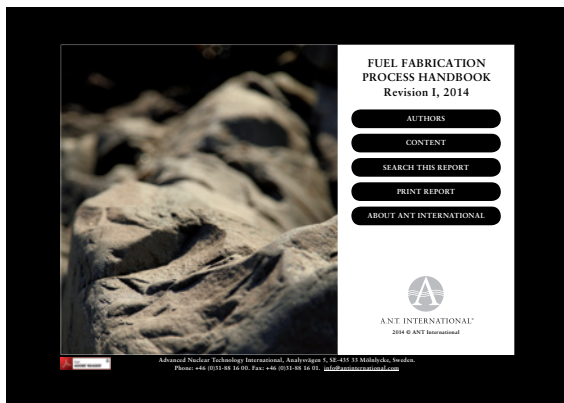




HANDBOOKS & REPORTS

Fuel Fabrication Process Handbook Revision I, 2014



Deliverables:
Handmade, hardcover report printed
in four-colour, searchable CD rom with
high resolution pdf files.



Objective

ANT International, is publishing the Fuel Fabrication Process Handbook Revision I 2014, becoming available during the first part of 2014. The objective of the Fuel Fabrication Process Handbook is to provide guidance for a cost effective audit which uses audit time on areas which are most likely to affect the performance of the PWR/VVER and BWR fuel. The Fuel Fabrication Process Handbook focuses on a “Process Audit” procedure, the audit of the fabrication process parameters for making high quality fuel. The FFPH provides the ”what, why and how” to look at in an audit by:

- Listing the generic fabrication process steps for all components and their assembly (what to look for).
- Identifying important audit points and the attendant potential effect of deviations on performance (why to look).
- Assess the fabrication and QC process control at critical points (how to look).

Contents

The Handbook covers the following topics

1. Structure and components of the fuel assembly
2. Utility audit procedures
3. Quality assurance systems and standards
4. Qualification programs
5. Fuel and pellet fabrication
6. Zirconium alloy component fabrication
7. Fuel rod assembly
8. Spacer grid assembly
9. End fitting fabrication and assembly
10. Fuel bundle assembly
11. BWR channel assembly
12. Statistical quality control
13. Software quality assurance

This Handbook is an updated and expanded version of the previous FFPH Handbook published in 2005. More than 35 organisations worldwide bought this Handbook. The expansion constitutes two sections on Statistical Quality Control and Software Quality Assurance. Statistical QC is a vital part of process control, the establishment of sampling plans and the qualification of inspection methods. The QA of software is important for auditing the software for the expanding automation of fabrication methods.

Authors

The lead author and chief editor of the Handbook is Mr. Alfred Strasser.



Mr. Alfred Strasser, President of Aquarius Services Corporation, provides over 50 years of experience in the nuclear industry, specifically in the nuclear fuel and core technology area. Mr. Strasser's experience in the fuel fabrication area started at the United Nuclear Corporation where he was Manager of the Plutonium Fuels Department responsible for the fabrication and quality control of the fuel. He wrote the first Quality Assurance Manual for the Company. Subsequently, at the S.M Soller Corp., consultants to nuclear utilities, he audited fuel production and trained utility personnel to do auditing. He audited every fuel and zirconium production plant in the US and in Europe, including Russian plants. As the auditing business increased, he trained staff to handle the increased workload.



Mr. Peter Rudling, president of ANT International, managing the ZIRAT/IZNA/LCC Programmes as well as providing Seminars and Handbooks on various fuel related topics to the nuclear industry. Peter was until ten years ago a senior consulting scientist at Vattenfall, the largest Swedish power company. Earlier he has also been a Specialist of Fuel Materials at ABB Atom (now Westinghouse) and a Project Manager at EPRI.

Peters's areas of Expertise are:

- Fuel performance during normal and accident conditions as well as during wet and dry storage
- Impact of water chemistry on fuel performance
- Zr alloy material development.
- Fuel assembly manufacturing.



Dr. Charles Patterson retired from Global Nuclear Fuel in 2008 as a Consulting Engineer for Fuel Engineering. During 44 years with GE Nuclear Energy/GNF, he was actively engaged in the development of fuel manufacturing processes, fuel materials, thermal-mechanical and fuel performance models and in the improvement of fuel reliability. This activity involved irradiation and hot cell Programs in Asia, Europe and the United States to identify in-core material behaviour, validate

analytic models and improve fuel reliability. Chuck holds patents in the areas of fuel and cladding materials, fuel assembly design and fuel inspection technology. Dr. Patterson has particular interest and experience in the thermal and mechanical behaviour of fuel, cladding and structural materials, the development of analytic models to describe their behaviour and in the improvement of fuel reliability.



Dr. Graham Walker, professor of Mechanical Engineering at Manhattan College and an independent consultant. He teaches courses in quality engineering, manufacturing processes, instrumentation, and system dynamics. He has consulted as a forensic engineer for a wide range of engineering companies in the areas of statistical analysis, system failure, and design practices. In addition, he has published many papers in the area manufacturing system control and inspection.

He was the author of the Statistical Product Control section in the FFPH, revision I, 2014.



Mr. Kenny Epperson, independent consultant, previously a Principal Engineer with Duke Energy, performed fuel assembly thermal-hydraulic analysis, fuel performance evaluations, and operating plant support of fuel performance issues. Involved directly in four fuel product transitions for seven units as well as four first of a kind LTA programs for new fuel designs. Performed software installation and maintenance for computer codes related to fuel design and analysis.

He was the author of the Software QA sections in the FFPH, revision I, 2014.

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