



# Nuclear Fuel Manufacturing Oversight

**2019 is here...**

**The elimination of manufacturing related defects still remains on the list of challenges. We dedicate oversight resources to watch the supplier in the hope of improving supplier performance and product quality, but...**

**FOR MORE INFORMATION  
PLEASE CONTACT:**

**Mike McMahon**  
+1 301-310-4637  
mmcmahon@nacintl.com

**John Rivera**  
+1 770-595-4929  
jrivera@nacintl.com



## **Does your oversight have the right focus ?**

Maybe not. With NAC's training in performance-based oversight of nuclear fuel manufacturing you will understand the factors that directly affect fuel performance. You will be better positioned to focus your resources in the right areas and on the right things. This is essential for achieving effective oversight and meeting zero-defect goals.

## **How effective is the manufacturer?**

Some manufacturers claim to have Six Sigma programs. Most claim to have the best processes and practices. When it comes to critical fuel reliability attributes, you need to know if the supplier lives up to its claims. With NAC's training, you will become more effective in identifying the strengths and weaknesses in your manufacturer's shop using engineering, quality, and Six Sigma statistical tools and techniques.

## **What does the training cover?**

Nuclear fuel is complex and the relationships between design, manufacturing, and performance can be complicated. To address this, the 3 day training begins by reviewing basic fuel mechanical design, materials, and performance considerations. It uses this foundation and

draws on proven methods to define the elements and approach for building a performance-based oversight program. Manufacturing processes are reviewed in detail using flow diagrams, and performance-based attributes are identified and ranked. Six Sigma tools and other statistical techniques used to evaluate equipment capability and inspector/inspection effectiveness are discussed. Methods for handling and trending non-conformances are reviewed. The roles of Engineering and QA oversight staff and implementation methods for achieving effective oversight are discussed.

Concepts and tools learned in the class are reinforced through group breakout sessions that simulate the manufacturing environment and demonstrate some of the challenges in the manufacture and oversight of safety-related products.

## **Who can benefit from the training?**

Engineers, technical personnel, and Quality Assurance (QA) oversight staff at the manager or individual contributor level that are involved with nuclear fuel design, manufacturing, receiving-inspection, handling, performance and reliability will benefit from this training. The training is applicable to individuals at all levels of experience, from new hires to your most seasoned nuclear fuel staff.

## About the Instructor:



*Mr. John Rivera* is NAC's Director of Fuel Performance Consulting. He has more than 30 years of experience providing nuclear fuel design, materials, manufacturing

oversight, performance, procurement, and quality assurance services to the nuclear utility industry. He has developed nuclear fuel mechanical design expert programs and software tools, and has developed fuel performance models for the assessment of fuel ramp rates, growth and creep behavior, and corrosion. He has substantial on-site power plant experience that includes pool-side inspections, design of tooling, and repair of fuel and core components. He has authored numerous programs for performance-based oversight of BWR and PWR fuel manufacturing. He is Six Sigma and Lead QA Auditor certified. Mr. Rivera holds advanced degrees in Nuclear Engineering and Nuclear Materials. Prior to joining NAC, Mr. Rivera held management positions at Yankee Atomic Electric Company, Duke Engineering and Services, and Florida Power and Light.

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## COURSE CONTENTS

### Fuel Mechanical Design Considerations

- Fuel assembly component basic functions
- PWR/BWR fuel assembly designs
- Safety classification determination
- Pertinent design criteria and sources
- Materials and irradiation effects

### Fuel Performance Considerations

- Fuel failure causes and mechanisms
- Non-failure performance issues

### Performance-based Oversight Program Development

- Performance-based approach
- Ranking system for key attributes (critical, major, minor)
- Description of key performance categories
- General manufacturing processes and equipment
- Process details and basic process flow maps
- Identification of critical attributes (activities/processes/parts)

### Statistical Techniques in Manufacturing

- Basic statistics and sampling
- Process Capability
- Inspection and Measurement System Analysis
- Statistical Process Control
- Acceptance Sampling Plans

### Nonconforming Process or Product

- Evaluation and disposition
- Trending and Corrective Action Program

### Approaches for Implementation

- QA Programs and 10 CFR 50 Appendix B Primer
- ISO Gap Analysis
- Split Scope and Interfaces
- Control of Suppliers
- Roles for QA and Technical Staff
- Surveillance Planning
- Surveillance Implementation
  - Graded Approach
  - Shared Approach

*Examinations and Course Completion Certificates  
provided at customer request*

