

February 24, 2006

UNITED STATES OF AMERICA  
NUCLEAR REGULATORY COMMISSION

DOCKETED  
USNRC

February 24, 2006 (4:12pm)

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

OFFICE OF SECRETARY  
RULEMAKINGS AND  
ADJUDICATIONS STAFF

In the Matter of: )

Louisiana Energy Services, L.P. )

(National Enrichment Facility) )

Docket No. 70-3103-ML

ASLBP No. 04-826-01-ML

**APPLICANT'S PREFILED TESTIMONY IN MANDATORY  
HEARING CONCERNING THE COMPATIBILITY OF URANIUM  
HEXAFLUORIDE AND HYDROGEN FLUORIDE WITH CENTRIFUGE  
PLANT MATERIALS (OCTOBER HEARING QUESTIONS 6.c and 6.d)**

**I. WITNESS AND PROCEDURAL BACKGROUND**

**Q1.** Please state your name, occupation, and by whom you are employed.

**A1.** My name is Rod M. Krich ("RMK"). I am Vice President of Licensing, Safety, and Nuclear Engineering for Louisiana Energy Services, L.P. ("LES"), the license applicant in this matter. LES is seeking authorization from the U.S. Nuclear Regulatory Commission ("NRC") to construct and operate a gas centrifuge uranium enrichment facility -- designated the National Enrichment Facility ("NEF") -- in Lea County, New Mexico. I am presently "on loan" to LES from Exelon Nuclear, where I am Vice President, Licensing Projects, and lead Exelon Nuclear's licensing activities relative to future generation ventures.

My name is Daniel G. Green ("DGG"). I am a Senior Consulting Engineer with EXCEL Services Corporation, which is headquartered in Rockville, Maryland.

2:27 PM

My name Allan J. Brown ("AJB"). I am the Design and Licensing Consultant for Urenco (Capenhurst) Ltd., as well as the Urenco Assistant Project Manager with respect to the NEF project (also referred to as the LES-2 project).

My name is Scott M. Tyler ("SMT"). I am a Manager in the Fire, Safety, & Risk Services group of AREVA (Framatome ANP) in Naperville, Illinois.

**Q2.** Please describe your responsibilities relative to the NEF project.

**A2.** (RMK) As Vice President of Licensing, Safety, and Nuclear Engineering for LES, I have the overall responsibility for licensing and engineering matters related to the NEF project. In this capacity, I oversaw preparation and submittal of the NEF license application, as well as the engineering design of the facility processes and safety systems. As a result, I am very familiar with the NEF license application, and NRC requirements and guidance related to the contents of such an application. This includes familiarity those portions of the NEF Safety Analysis Report ("SAR") and the NEF Integrated Safety Analysis ("ISA") that relate to chemical process safety, including the interaction of  $UF_6$  and plant construction materials.

(DGG) As an engineering and regulatory consultant to LES, I supported the development, review, and submittal of the NEF license application. In this capacity, I helped to ensure that the application complied with the applicable guidance set forth in NUREG-1520, "Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility." Subsequent to the submittal of the NEF application, I have had a lead role in responding to NRC Staff Requests for Additional ("RAIs") on various aspects of the licensing submittal, and in preparing and/or reviewing any necessary revisions to the application. I also am member of the ISA team, and am thus familiar with those portions of the ISA and SAR relating to chemical process safety, including the interaction of  $UF_6$  and plant construction materials.

(AJB) As Urenco Assistant Project Manager for the NEF project, I serve as the core technology/design manager for the project. Urenco is the originator of the gas centrifuge enrichment technology and general plant design to be utilized by LES. I am responsible for overseeing all non-architectural/engineering design work that will be done to support the NEF. Among other things, this work includes preparing the reference design for the NEF, providing technical assistance and consultation relative to the NEF during the design and early operational phases of the facility, and conducting technical reviews of design activities to ensure that the NEF design is consistent with the Urenco reference design information. I also am a member of the ISA team for the NEF project.

(SMT) My employer, Framatome ANP, has served as a primary contractor on the NEF project. As a member of the NEF project team, I contributed to the preparation and review of key portions of the NEF application. Specifically, I authored the chemical process safety chapter of the SAR (Chapter 6), acted as and continue to serve as a chemical process and fire safety expert on the ISA team, and prepared the baseline fire/emergency response needs assessment. I am currently conducting International Building Code/International Fire Code analysis for the proposed facility in conjunction with detailed design development.

**Q3.** Please summarize your educational and professional qualifications.

**A3.** (RMK) I hold a B.S. degree in mechanical engineering from the New Jersey Institute of Technology and an M.S. in nuclear engineering from the University of Illinois. I have over 30 years of experience in the nuclear energy industry covering engineering, licensing, and regulatory matters. This experience encompasses the design, licensing, and operation of nuclear facilities. A full statement of my professional qualifications is attached hereto.

(DGG) I hold B.S. and M.S. degrees in nuclear engineering from Kansas State University. I have approximately 25 years of experience in engineering, licensing, and

regulatory matters involving the nuclear energy industry. I have been a consulting engineer with EXCEL Services Corporation since 1991, and have provided consulting services to a large number of utilities. Prior to 1991, I was employed principally as a licensing engineer at Florida Power Corporation and Kansas Gas and Electric Company. A full statement of my professional qualifications is attached hereto.

(AJB) I hold a B.S. degree (with Honors) from the University of Liverpool, where I also undertook several years of graduate research in nuclear structure physics. I have 30 years of commercial experience relating to the enrichment of uranium by the gas centrifuge process. I was employed with BNFL from 1975 to 1991. During my tenure at BNFL, I held a number of positions relating to centrifuge plant design and operations management. From 1989 to 1991, I served as Design Liaison Officer for the LES1 (Claiborne Enrichment Center) project. Since 1991, I have been employed with Urenco, where I have also held a number of key design-related positions, including my current position as Design and Licensing Consultant. Also, from 1991 to 1995, I served as Decommissioning Manager for the first green field decommissioning of pilot and commercial demonstration gas centrifuge plants at Urenco's Capenhurst, U.K. site. A full statement of my professional qualifications is attached hereto.

(SMT) I hold a B.S. degree in Fire Protection and Safety Engineering Technology from Oklahoma State University. I have 20 years of design, analysis, and consultation experience in the industrial, institutional, and commercial fields. This includes project/staff management experience and technical expertise in loss prevention, including fire protection design and analysis; occupational and environmental safety; process safety/risk management; and code consultation. A full statement of my professional qualifications is attached hereto.

**Q4.** What is the purpose of your testimony?

**A4.** (RMK, DGG, AJB, SMT) We are providing this testimony on behalf of LES in accordance with the Licensing Board's Memorandum and Order (Memorializing Board Questions/Areas of Concern for Mandatory Hearing) of January 30, 2006 ("January 30th Order"), and Memorandum and Order (Administrative Matters Relative to Mandatory Hearing) of February 8, 2006 ("February 8th Order"). In those issuances, the Board "memorialized" a series of questions or "areas of concern" upon which the Board has required presentations from LES and/or the NRC Staff in the context of the mandatory hearing in this proceeding. This testimony is intended to respond specifically to the safety questions set forth in paragraphs 6.c and 6.d of Attachment A to the Board's February 8th Order. Those questions, which the Board originally posed in October 2005, concern the interaction of hydrogen fluoride ("HF") with (1) the aluminum used in constructing the centrifuges and other plant components, and (2) the various seals that will be present in the facility.

**Q5.** Please briefly describe your understanding of the findings to be made by the Board relative to the Staff's safety review of the license application.

**A5.** (RMK, DGG, AJB, SMT) As we understand it, the Board is required to conduct a "sufficiency" review of uncontested matters. According to the Commission, the Board should confirm that the NRC Staff "has performed an adequate review and made findings with reasonable support in logic and fact." In doing so, the Board is to decide whether the overall safety record is sufficient to support license issuance. Accordingly, this testimony is intended to facilitate the Board's review by presenting technical information and discussion relevant to the HF compatibility issues raised by the Board.

## II. RESPONSE TO BOARD QUESTIONS

Q6. Please describe the specific issues raised by the Board in paragraphs 6.c and 6.d, as identified above.

A6. (RMK, DGG, AJB, SMT) As set forth in Attachment A to the February 8th Order, paragraphs 6.c and 6.d pose the following questions:

- c. Provide a discussion of the interaction of hot hydrofluoric acid with the aluminum fluoride layer on the aluminum tubes in the case of significant water vapor intrusion. Will the aluminum fluoride in the presence of water vapor transform to aluminum oxide plus hydrogen fluoride? Will any resulting aluminum oxide flake off or will it continue to adhere as a different type of passivating layer?
- d. Provide a discussion of the interaction of hydrogen fluoride with the various seals that are present. Are they attacked and degraded or are they made of some form of fluorinated compound (*e.g.*, Teflon) that is impervious to attack?

A. The Interaction of Uranium Hexafluoride and Hydrogen Fluoride With Aluminum (Question 6.c) and its Safety Significance

Q7. Does the NEF SAR address the compatibility of plant construction materials, particularly aluminum, with the various chemical compounds with which those materials will come into contact?

A7. (RMK, DGG, AJB, SMT) Yes. NEF SAR Section 6.2.1.3 discusses in general terms the compatibility of plant construction materials with  $UF_6$  and HF. It states, in pertinent part, that:

[Uranium hexafluoride]  $UF_6$  and some of its reaction products are potentially corrosive substances, particularly HF.  $UF_6$  is a fluorinating agent that reacts with most metals. The reaction between  $UF_6$  and metals such as nickel, copper, and *aluminum* produces a protective fluoride film over the metal that inhibits further reaction. These materials are therefore relatively inert to  $UF_6$  corrosion after passivation and are suitable for  $UF_6$  service. *Aluminum* is used as piping material for  $UF_6$  systems because it is especially resistant to corrosion in the presence of  $UF_6$ . Carbon steels and stainless steels can be attacked by  $UF_6$  at elevated temperatures but are not

significantly affected by the presence of  $UF_6$  at the operating temperatures for the facility. Light gas impurities such as HF and air are removed from  $UF_6$  during the purification process. *Although HF is a highly corrosive substance when in solution with water as aqueous hydrofluoric acid, it contributes very little to metal corrosion when in the presence of  $UF_6$ . This is due to the fact that  $UF_6$  reacts with water so rapidly that HF remains anhydrous when in the presence of  $UF_6$ .*

LES Exh. 132-M at 6.2-5 to 6.2-6 (emphasis added).

**Q8.** Both Board question 6.c and the SAR refer to the process of "passivation." Please describe this process and its relevance to plant system performance.

**A8.** (RMK, DGG, AJB, SMT) Passivation refers to the deposition of a thin film or coating on the surface of a metal that tends to inhibit further chemical reactivity between the metal and chemical agents that come into contact with the metal. Of relevance here,  $UF_6$  reacts slowly with most metals and alloys at room temperature to form a fluoride compound comprising the metal and a poorly volatile/nonvolatile lower-valence uranium fluoride. The reaction occurs somewhat faster at higher temperatures. Because the resulting fluorides are not volatile, they form deposits on the metal/alloy surfaces, depending on the reaction conditions, and can hinder further reaction. See LES Exh. 134-M at 14.

As stated in the SAR, many metals are relatively inert to  $UF_6$  corrosion after passivation and are suitable for  $UF_6$  service. These include, for example, clean aluminum, steel, Monel, nickel or alloys containing 60% or more nickel, aluminum, bronze, copper, and Teflon.<sup>TM</sup> See LES Exh. 133-M (International Atomic Energy Agency, INFCIRC/254, Rev.3, Part 1, 16 September 1997, "Explanatory Note to Section 5.2"). Nickel and nickel-plated steel, Monel, copper and some aluminum alloys are generally used for enrichment facility processing equipment. See LES Exh. 134-M (United States Energy Corporation, *The  $UF_6$  Manual, Good Handling Practices for Uranium Hexafluoride*, USEC-651, Rev. 8 (Jan. 1999), Section 4.2). Teflon is commonly used in the packing and cap gasket for cylinders storing depleted  $UF_6$ . See

LES Exh. 18 (U.S. Department of Energy, *Final Programmatic Environmental Impact Statement for Alternative Strategies for the Long-Term Management and Use of Depleted Uranium Hexafluoride* (DOE/EIS-0269) (Apr. 1999)), Appendix A at A-4.

**Q9.** The Board has inquired about the interaction of hot hydrofluoric acid with the fluoride layer on the aluminum tubes "in the case of significant water vapor intrusion." As a practical matter, do you expect significant water vapor intrusion events, and the concomitant formation of aqueous hydrofluoric acid, to occur at the NEF? Please explain.

**A9.** (RMK, DGG, AJB, SMT) No. Light gas impurities, such as HF and air, are removed from the UF<sub>6</sub> feed cylinders during the feed purification process prior to connection to the centrifuges. Venting the feed cylinders prior to connection to the centrifuges minimizes HF in the Separations Plant. Moisture is minimized by degassing the Separations Plant prior to the initial introduction of UF<sub>6</sub> and by maintaining a high vacuum standard within the Separations Plant during operation. The Separations Plant process gas system is inherently dry due to its vacuum operation, which, together with the absence of water connections in the process gas pipework, precludes the possibility of the formation of aqueous liquid HF.

Urenco's European enrichment facilities provide a real-world example. The Urenco gas centrifuge process operates under high vacuum, and the plant is tested to the applicable vacuum standard prior to the introduction of UF<sub>6</sub>. Similarly, vacuum standards are maintained during routine component connection and disconnection to the plant (e.g., UF<sub>6</sub> cylinders) and during maintenance change out (e.g., vacuum pumps). These processes and procedures have been used at Urenco for some 30 years without significant corrosion to centrifuges or Separations Plants and without loss of vacuum. In fact, no incident of HF corrosion of the Separations Plant process gas pipework, leading to failure of the pipe, has ever



occurred at any of the Urenco plants, nor has any aluminium pipework ever needed to be replaced due to HF corrosion. See Answer 11, *infra*, for further discussion on this point.

Additionally, in the event of significant air in-leakage into the Separations Plant (and the resulting water intrusion), the process would abruptly shut down, confining the in-process  $\text{UF}_6$  to pipe sections between successive isolation valves. A typical such confined inventory would consist of some few hundred grams of  $\text{UF}_6$  contained within a couple of hundred feet of pipe. Assuming full hydrolyzation of the  $\text{UF}_6$  due to significant in-leakage, some tens of grams (no more than 100 grams) of anhydrous HF would be produced. Since the resulting amount of HF will be anhydrous, no impact to aluminium piping integrity due to corrosion would result.

**Q10.** Notwithstanding these considerations, *assuming* that there is a "significant water vapor intrusion," how would any aqueous hydrofluoric acid that might result react with aluminum surfaces or fluoride layers (from passivation) that come in contact with it?

**A10.** (DGG, AJB) Even assuming full hydrolyzation of the anhydrous HF, the amount of aqueous HF would be small relative to the amount of aluminium in the pipe. As discussed above, this is due to the fact that the process would shut down in the event of significant air in-leakage into the Separations Plant. Therefore, while the small quantity of aqueous HF present might impact the passivation layer, it would not be present in sufficient quantities to corrode the aluminum, *i.e.*, the integrity of the aluminium piping would be maintained.

**Q11.** You mentioned above Urenco's operational experience. Is there any other historical evidence which supports the position that significant HF corrosion is unlikely to occur at the NEF?

**A11.** (AJB) Yes. First, prior to enrichment plant construction, Urenco investigated the  $\text{UF}_6$ -resistance of construction materials by performing exposure tests of the relevant materials at

different elevated temperatures in a  $\text{UF}_6$  atmosphere. Specifically, Urenco used at least one of the following methods to evaluate the  $\text{UF}_6$  corrosion behavior of metal material: (a) determination of the weight increase of the metal material resulting from  $\text{UF}_6$  corrosion reactions that form non-volatile uranium products on the metal surface, or (b) decontamination of the corroded material so as to determine the corrosion rate. An assessment of corrosion of the metal materials at actual operating temperatures was then made. The results of these exposure tests were used to qualify the materials of construction used in the Separations Plant.

In addition, aluminium, the major metal used in both the centrifuge plant and the centrifuge machines, has proved to be corrosion-resistant to the conditions encountered in an operating plant. The aluminium specification used by Urenco has been proven over many hundreds of plant operating years within the Urenco group. Aluminium and aluminium alloys are also widely recognized as suitable material for  $\text{UF}_6$  service by U.S. operators and U.S. and international regulatory agencies. *See, e.g.*, LES Exhs. 133-M and 134-M.

Finally, additional evidence of the appropriateness of the process gas system materials of construction is available from centrifuge plant decommissioning efforts, which have been undertaken within the Urenco group. Specifically, Separations Plant pipework opened after approximately 20 years of operation was found to show no visible corrosion. Where occasionally an in-leakage may have occurred, a dusting of uranyl fluoride powder was visible, but there were no signs of corrosion.

**B. The Interaction of Hydrogen Fluoride With Enrichment Plant Seals and Its Safety Significance (Question 6.d)**

**Q12.** With respect to the Board's second question (Question 6.d), do you expect any of the seals that will be used in various NEF systems or equipment to degrade as a result of exposure to hydrogen fluoride? Please state the basis for your conclusion.

**A12.** (RMK, DGG, AJB, SMT) No. The seals installed at the NEF will be like those used in Urenco's operating enrichment plants. The Urenco seals specification requires the use of materials that are compatible with  $UF_6$  (e.g., fluoroelastomers such as Viton, fluorinated polymers such as Kel-F). Significantly, as used under the vacuum conditions encountered in the Separations Plant,  $UF_6$  is *far more reactive than* HF. Additionally, fluoroelastomers are recognized for anhydrous HF ("AHF") service by HF industry trade group guidance documents. See LES Exh. 135-M (*Hydrogen Fluoride Industry Practices Institute – a Subsidiary of the American Chemistry Council, Materials of Construction Guideline for Anhydrous Hydrogen Fluoride*, Updated: 12/27/04, Last Revision: January 2000, Expiration Date: 12/31/05). For the reasons set forth above in Section II.A, aqueous hydrofluoric acid is not expected to be present in the various plant systems.

In addition, as with metal construction materials, prior to constructing its European enrichment facilities, Urenco evaluated seal materials for  $UF_6$  resistance by one or more of the following methods: (a) visual inspection of the material after exposure; (b) determination of the amount of uranium deposits formed on the material (either by weight of the material or weight of the decontamination products) after exposure; (c) measurement of seal mechanical properties (e.g., hardness, elongation, compressibility) after exposure. An assessment of degradation of the seal materials caused by  $UF_6$  exposure at actual operating temperatures was then made. The results of those exposure tests were used to qualify the seal

materials used in the Separations Plant. Again, the operational history of Urenco's European enrichment facilities further demonstrates the resistance of plant seals to corrosion or degradation.

**Q13. Does this conclude your testimony?**

**A13. (RMK, DGG, AJB, SMT) Yes.**

## RESUME

Rod M. Krich  
6395 Twin Oaks Lane  
Lisle, IL 60532  
(H) 630 428 1967  
(W) 630 657-2813

## EDUCATION

MS Nuclear Engineering - University of Illinois - 1973  
BS Mechanical Engineering - New Jersey Institute of Technology - 1972

## EXPERIENCE

1998 to  
Present

### Exelon (formerly Com Ed)

Vice President, Licensing Projects for Exelon Nuclear, with the overall responsibility for leading Exelon Nuclear's licensing activities on future generation ventures, predominantly leading the licensing effort for a U.S. gas centrifuge enrichment plant. In addition, I have been assisting with the Yucca Mountain project licensing effort and served as the lead on strategic licensing issues with the responsibility of working with the Nuclear Regulatory Commission and the Nuclear Energy Institute on the development of a new approach to licensing new reactors.

Vice President-Regulatory Services responsible for interface with the NRC and State regulatory agencies, and regulatory programs. This responsibility covers all 12 ComEd nuclear units and the Nuclear Generation Group headquarters. With respect to regulatory programs, responsibilities include programs such as the change evaluation process (i.e., 10 CFR 50.59, "Changes, tests and experiments), the operability determination process, and the Updated Final Safety Analysis revision process). In this capacity, I was responsible for improving the relationship with the regulatory agencies such that, taken together with improved plant performance, the special scrutiny applied to the ComEd operating plants will be replaced with the normal oversight process. The Regulatory Services organization consists of a group located at the Nuclear Generation Group headquarters and a Regulatory Assurance group at each plant that has a matrix reporting relationship to the Vice President-Regulatory Services.

1994 to  
1998

### Carolina Power & Light Company

As Chief Engineer from November 1996 to April 1998, I was head of the Chief Section of the Nuclear Engineering Department. In this capacity, I was responsible for maintaining the plant design bases and developing, maintaining and enforcing the engineering processes procedures. In addition to the corporate Chief Section, the Design Control groups at each of the nuclear plant sites reported to me starting in February 1997.

As Manager - Regulatory Affairs at the H. B. Robinson Steam Electric Plant, Unit No. 2 (Westinghouse PWR) from February 1994 to November 1996, the managers of Licensing/Regulatory Programs, Emergency Preparedness, and Corrective Action/Operating Experience Program organizations reported to me. As such, I was responsible for all interface and licensing activities involving the NRC headquarters and regional office, environmental regulatory agencies, and the Institute of Nuclear Power Operations. My responsibilities also included implementation of the Emergency Preparedness program, and administration of the Corrective Action and Operating Experience programs. After assuming my position in Carolina Power &

Light Company, I was instrumental in revising and upgrading the IOCFR50.59 safety evaluation program, and was responsible for its implementation at the plant site. My group was also responsible for leading the team that prepared the NRC submittal containing the conversion to the improved Technical Specifications.

1988 to  
1994

Philadelphia Electric Company

As Manager - Limerick Licensing Branch at the Nuclear Group Headquarters, responsible for all licensing activities for the two unit Limerick Generating Station (General Electric BWR) conducted with the NRC headquarters and all enforcement issues involving NRC Region I, including completion of the final tasks leading to issuance of the Unit 2 Operating License. Special projects included assisting in the development of the Design Baseline Document program, obtaining NRC approval for an Emergency Operations Facility common to two sites, preparation of the Technical Specification changes to extend the plant refueling cycle to 24 months and to allow plant operation at uprated power, and obtaining NRC approval of a change to the Limerick Operating Licenses to accept and use the spent fuel from the Shoreham plant. I was also responsible for the development and implementation of the IOCFR50.59 safety evaluation process used throughout the nuclear organization, development of the initial Updated Final Safety Analysis Report for Limerick Generating Station, and served as the Company's Primary Representative to the BWR Owners' Group.

1986 to  
1988

Virginia Power Company

As the Senior Staff Engineer in the Safety Evaluation and Control section, my activities involved responding to both routine and special licensing issues pertaining to North Anna Power Station (Westinghouse PWR). My duties ranged from preparing Technical Specification interpretations and change requests, exemption requests, and coordinating responses to NRC inspection reports, to developing presentations for NRC enforcement conferences and coordinating licensing activities associated with long-term issues such as ATWS and equipment qualification. I was also the Company representative to the utility group formed to address the station blackout issue, and was particularly involved in developing an acceptable method by which utilities can address equipment operability during station blackout conditions.

1981 to  
1986

Consumers Power Company

During my employment with Consumers Power Company, I worked at the General Office in the Nuclear Licensing Department and the Company's Palisades Plant (Combustion Engineering PWR). While in the Nuclear Licensing Department, I held the position of Plant Licensing Engineer for the Big Rock Point Plant (General Electric BWR), Section I-lead - Special Projects Section, and Section Head - Licensing Projects and Generic Issues Section. My responsibilities while in these positions included managing the initial and continuing Palisades Plant FSAR update effort, developing and operating a computerized commitment tracking system, managing the licensing activities supporting the expansion of the Palisades Plant spent fuel storage capacity, and coordinating activities associated with various generic issues such as fire protection and seismic qualification of equipment. As the administrative point of contact for INPO, I coordinated the Company's efforts in responding to plant and corporate INPO evaluations. At the Palisades Plant, I was head of the Plant Licensing Department. My responsibilities primarily entailed managing the on-site licensing activities, including preparation of Licensee Event Reports and responses to

inspection reports, interfacing with NRC resident and regional inspectors, and serving as chairman of the on-site safety review committee. I also administered the on-site corrective action system and managed the on-site program for the review and implementation of industry operating experience.

1974 to  
1981

General Atomic Company

My positions while at the General Atomic Company were principally concerned with fuel performance development efforts for the High Temperature Gas-Cooled Reactor (HTGR). Specific responsibilities included two assignments to the French Atomic Energy Commission laboratories at Saclay and Grenoble (France) for the purpose of coordinating a cooperative test program. I was also assigned as a consultant to the Bechtel Corporation, Los Angeles Power Division, and worked in the Nuclear Group of the Alvin M. Vogtle Nuclear Project for Georgia Power.

RELATED EXPERIENCE

University of Illinois

As a graduate research assistant, I assisted in both the experimental and analytical phases of a NASA-funded program in the study and modeling of far-field noise generated by near-field turbulence in jets.

PUBLICATIONS

General Atomic Company

"CPL-2 Analysis: Fission Product Release, Plateout and Liftoff."

University of Illinois

"Prediction of Far-Field Sound Power Level for Jet Flows from Flow Field Pressure Model," paper 75-440 in the AIAA Journal, co-authored by Jones, Weber, Hammersley, Planchon, Krich, McDowell, and Northranandan.

MEMBERSHIPS

American Nuclear Society  
Pi Tau Sigma - Mechanical Engineers I-Honorary Fraternity  
American Association for the Advancement of Science

REFERENCES

Furnished upon request

DANIEL G. GREEN  
2726 Edgewood Drive  
Cedar Falls, Iowa 50613  
(319) 277-3182

**EDUCATION:**

Master of Science in Nuclear Engineering, Kansas State University, August 1981.

Bachelor of Science in Nuclear Engineering, Kansas State University, May 1980.

**RELATED EXPERIENCE:**

EXCEL Services Corporation, Louisiana Energy Services (01/04-Present)

Senior Consulting Engineer: Supported the licensing effort for the construction and operation of the National Enrichment Facility, a gaseous centrifuge enrichment plant proposed to be located in Lea County, New Mexico. This involved supporting NRC review meetings and teleconferences, developing responses to NRC Requests for Additional Information regarding the licensing submittal, and revising the licensing submittal, as necessary. Responsibilities during this time also included serving as a member of the Integrated Safety Analysis team and supporting the development and implementation of the Configuration Management program.

EXCEL Services Corporation, Louisiana Energy Services (08/03-12/03)

Senior Consulting Engineer: Supported development and submittal of the Louisiana Energy Services License Application for the construction and operation of the National Enrichment Facility, a gaseous centrifuge enrichment plant proposed to be located in Lea County, New Mexico. This included ensuring applicable regulatory requirements were addressed.

EXCEL Services Corporation, International Access Corporation (IAC) (7/03)

Senior Consulting Engineer: Performed an evaluation of the impact of the new Reactor Oversight Process (ROP) on regulatory burden for the US nuclear industry. The evaluation examined the impact on the US nuclear industry as a whole, as well as the impact on individual US nuclear industry licensees using case studies that show the decreasing or increasing regulatory burden when plant performance trends show improvement or decline, using the new ROP. Research for the evaluation was conducted using NRC public domain resources, Nuclear Energy Institute and US nuclear industry input, and insights from US nuclear plant licensees. Interviews of US nuclear plant licensees were also conducted.



**EXCEL Services Corporation, Entergy - Indian Point 2 (6/03)**

Senior Consulting Engineer: Performed an independent assessment of the submitted Indian Point 2 (IP2) Improved Technical Specifications (ITS) to ensure that the final product was ready for implementation. The focus of the assessment was to perform both a limited "horizontal" review (i.e., looking at the IP2 ITS and Bases in an integrated fashion to ensure overall consistency), and a limited "vertical" review (i.e., looking in some detail at specific IP2 Technical Specifications and Bases, including the associated ITS Conversion Package, which are known in the industry to be especially complex and/or important to safety to ensure that the requisite unity of design/licensing bases are preserved). The results of the assessment were documented in a report provided to Entergy.

**EXCEL Services Corporation, American Electric Power (AEP) - DC Cook (5/03)**

Senior Consulting Engineer: Assisted in the development of the DC Cook Units 1 and 2 Improved Technical Specifications/24 Month Operating Cycle initial draft submittal of the Instrumentation section. The submittal utilized NUREG-1431, Revision 2, as the standard. This involved development of plant specific Technical Specifications, Bases, technical justifications, 10CFR50.92 evaluations, and comparison documents.

**EXCEL Services Corporation, Omaha Public Power District (OPPD) - Fort Calhoun Station (4/03)**

Senior Consulting Engineer: Developed a root cause analysis evaluation associated with the Fort Calhoun Station practice of establishing Allowed Outage Times for systems not included in the Technical Specifications that support the operability of systems in Technical Specifications.

**EXCEL Services Corporation, Omaha Public Power District (OPPD) - Fort Calhoun Station (3/03)**

Senior Consulting Engineer: Performed an assessment of the benefits of options and disadvantages and advantages of upgrading the Fort Calhoun Station (FCS) current Technical Specifications (CTS). The resulting report discussed the options for upgrading FCS CTS, including the option of full conversion to Revision 2 of the Improved Standard Technical Specifications for Combustion Engineering Plants. For each of the options examined, the report provided the estimated cost, advantages, disadvantages, plant impacts, and interface requirements with other planned FCS major projects.

**EXCEL Services Corporation, Australian Nuclear Science and Technology Organisation (ANSTO) (2/03)**

Senior Consulting Engineer: Developed update for ANSTO Replacement Research Reactor (RRR) Safety Analysis Report Chapter 13, "Conduct of Operations. This included providing updates to address the proposed RRR Organizational Structure, Training Program, Review and Audit Functions, Operating Procedures and Instructions, and Maintenance, Testing and Inspection.

**EXCEL Services Corporation, Exelon (1/03)**

Senior Consulting Engineer: Performed an independent review of the Louisiana Energy Services License Application for the construction and operation of a gaseous centrifuge enrichment plant. The review included ensuring compliance with the guidance of NUREG-1520, "Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility."

EXCEL Services Corporation, Australian Nuclear Science and Technology Organisation (ANSTO) (12/02)

Senior Consulting Engineer: Developed a Maintenance and Testing Program Bases Document for the currently under construction ANSTO Replacement Research Reactor (RRR). The program is based on the requirements of 10 CFR 50.65, "Requirements for Monitoring the Effectiveness of Maintenance of Nuclear Power Plants," and the associated implementation guidance.

EXCEL Services Corporation, First Energy Nuclear Operating Company - Davis Besse (11/02)

Senior Consulting Engineer: Supported reconstitution of the Davis Besse Licensing Basis to support restart. This involved research and review of both generic and plant-specific licensing correspondence and documentation of the current licensing basis for the plant.

EXCEL Services Corporation, Wolf Creek Nuclear Operating Company (10/02)

Senior Consulting Engineer: Supported development of on-line training courses for the License Amendment Requests, the Introduction to Technical Specifications and the Use and Application of Technical Specifications courses of the United Services Alliance Regulatory Affairs and Qualification Initiative.

EXCEL Services Corporation, First Energy Nuclear Operating Company - Perry (9/02)

Senior Consulting Engineer: Supported development of training materials for the Licensing Basis Introduction and Miscellaneous Licensing Basis Change Processes courses of the United Services Alliance Regulatory Affairs and Qualification Initiative.

EXCEL Services Corporation, Australian Nuclear Science and Technology Organisation (ANSTO) (11/01-8/02)

Senior Consulting Engineer: Developed Operating Limits and Conditions (OLCs) and Bases for the currently under construction ANSTO Replacement Research Reactor (RRR). The OLCs and Bases were developed using the format and concepts from the U.S. Improved Standard Technical Specifications. This required review of RRR Preliminary Safety Analysis Report and plant specific application of the U.S. Technical Specification criteria to the RRR design and safety analysis. Supported resolution of discrepancies identified during development of the Bases. Supported resolution of comments generated during ANSTO internal reviews.

EXCEL Services Corporation, Vermont Yankee Nuclear Power Corporation (11/01-7/02)

Senior Consulting Engineer: Provided an independent assessment of the Vermont Yankee Nuclear Power Station Technical Specifications and Bases. Identified inconsistent requirements, non-conservative requirements and recommended enhancements. Working with the Operations Department, prioritized recommendations from the assessment and began development and processing of License Amendment requests to adopt the changes from the recommendations.

**EXCEL Services Corporation, Nebraska Public Power District (NPPD) (10/00-9/01)**

Senior Consulting Engineer: Assisted in day-to-day licensing activities for Cooper Nuclear Station (CNS). This involved performing reviews for License Amendment Requests, 10 CFR 50.59 Safety Evaluations, Operability Evaluations, and other changes to licensing basis documents. Supported the development of the presentations for the following NRC/NPPD meetings: a Cooper Nuclear Station Performance Status Meeting and a Regulatory Conference concerning Equipment Qualification Non-conformances. Participated in the development of training materials for the United Services Alliance Regulatory Affairs Training and Qualification Initiative. Also participated on the CNS Condition Review Team for the Significant Condition Report related to weaknesses in the Determination and Documentation of Equipment Operability.

**EXCEL Services Corporation, Commonwealth Edison Company (8/99-9/00)**

Senior Consulting Engineer: Served as project lead licensing engineer responsible for technical oversight and review of the Improved Technical Specifications/24 Month Operating Cycle submittal for the Commonwealth Edison Company Boiling Water Reactors (BWRs). The submittal utilized NUREG-1433, Revision 1, and NUREG-1434, Revision 1, as the standards. This involved review of plant specific application of the Technical Specification criteria, Technical Specifications, Bases, technical justifications, 10CFR50.92 evaluations, and comparison documents. Supported resolution of discrepancies between current Technical Specifications and safety analyses identified during development of the Bases. Supported resolution of comments generated during Commonwealth Edison Company internal reviews. Also, served as the project lead licensing engineer responsible for licensing of the Improved Technical Specifications/24 Month Operating Cycle submittal for Commonwealth Edison Company BWRs. This involved supporting NRC review meetings, developing responses to NRC comments and questions regarding the submittal, and revising the submittal, as necessary. Responsibilities during this time also included developing the Technical Requirements Manuals for the BWRs.

**EXCEL Services Corporation, Commonwealth Edison Company (7/98-7/99)**

Acting Director, Licensing and Compliance - Byron/Braidwood Stations: Provided governance in developing strategies, positions, and responses for federal regulatory programs and issues. Responsible for development and maintenance of policies that support Byron/Braidwood and Corporate Nuclear Generation Group needs while complying with regulations. Planned, directed and provided oversight of the corporate staff. Served as the primary contact with NRR and was responsible for ensuring that NRR requests are satisfied in a timely and quality manner. Other responsibilities included ensuring that the NRR Project Managers were kept informed of significant regulatory issues at Byron/Braidwood and that issues with NRR were addressed in a professional and business-like manner. Also served as the primary contact between Regulatory Services and the Byron and Braidwood Regulatory Assurance Managers.

**EXCEL Services Corporation, Nebraska Public Power District, Cooper Nuclear Station (11/97-7/98)**

Senior Consulting Engineer: Assisted in the licensing of the Improved Technical Specifications submittal for Cooper Nuclear Station. This involved supporting NRC review meetings, developing responses to NRC comments and questions regarding the submittal, and revising the submittal, as necessary.

EXCEL Services Corporation, Baltimore Gas & Electric Company, Calvert Cliffs Nuclear Plant Units 1 and 2 (6/97-7/97)

Senior Consulting Engineer: Assisted in the licensing of the Improved Technical Specifications submittal for Calvert Cliffs Nuclear Plant Units 1 and 2. This involved developing responses to NRC comments and questions regarding the submittal and revising the submittal, as necessary.

EXCEL Services Corporation, Carolina Power and Light Company, Robinson Steam Electric Plant Unit 2 (3/97-8/97)

Senior Consulting Engineer: Assisted in the licensing of the Improved Technical Specifications submittal for Robinson Steam Electric Plant Unit 2. This involved developing responses to NRC comments and questions regarding the submittal and revising the submittal, as necessary. Responsibilities during this time also included developing the Technical Requirements Manual and the associated 10CFR50.59 safety evaluations.

EXCEL Services Corporation, Nebraska Public Power District, Cooper Nuclear Station (2/97-3/97)

Senior Consulting Engineer: Performed an integrated review of the complete Cooper Nuclear Station Improved Technical Specifications submittal to ensure that the final product was ready for submittal to the NRC. The review included ensuring that all changes were appropriately addressed, that the submittal met the NEI guidance for Improved Technical Specifications submittals, and that lessons learned from other Improved Technical Specifications projects were incorporated.

EXCEL Services Corporation, Commonwealth Edison Company, Byron Station Units 1 and 2 and Braidwood Station Units 1 and 2 (11/96-12/96)

Senior Consulting Engineer: Performed an integrated review of the complete Byron/Braidwood Improved Technical Specifications submittal to ensure that the final product was ready for submittal to the NRC. The review included ensuring that all changes were appropriately addressed, that the submittal met the NEI guidance for Improved Technical Specifications submittals, and that lessons learned from other Improved Technical Specifications projects were incorporated.

EXCEL Services Corporation, Carolina Power and Light Company, Robinson Steam Electric Plant Unit 2 (8/96)

Senior Consulting Engineer: Performed an integrated review of the complete Robinson Steam Electric Plant Unit 2 Improved Technical Specifications submittal to ensure that the final product was ready for submittal to the NRC. The review included ensuring that all changes were appropriately addressed, that the submittal met the NEI guidance for Improved Technical Specifications submittals, and that lessons learned from other Improved Technical Specifications projects were incorporated.

EXCEL Services Corporation, Carolina Power and Light Company, Brunswick Nuclear Plant Units 1 and 2 (11/95-7/98)

Senior Consulting Engineer: Served as project lead engineer responsible for development and aiding in the coordination of the Improved Technical Specifications/24 Month Operating Cycle submittal for Brunswick Nuclear Plant Units 1 and 2. The plant specific submittal utilized NUREG-1433, Revision 1, as the BWR/4 Standard. This involved development of plant specific application of the Technical Specification criteria, Technical Specifications, Bases, technical justifications, 10CFR50.92 evaluations, and comparison documents. Supported resolution of discrepancies between current Technical Specifications and safety analyses identified during development of the Bases. Supported resolution of comments generated during Carolina Power and Light Company internal reviews. Also, served as the project lead engineer responsible for licensing of the Improved Technical Specifications/24 Month Operating Cycle submittal for Brunswick Nuclear Plant Units 1 and 2. This involved supporting NRC review meetings, developing responses to NRC comments and questions regarding the submittal, and revising the submittal, as necessary. Responsibilities during this time also included developing the Technical Requirements Manual, revising to Offsite Dose Calculation Manual, and developing the associated 10CFR50.59 safety evaluations.

EXCEL Services Corporation, PECO Energy Company, Peach Bottom Atomic Power Station Units 2 and 3 (10/95-10/96)

Senior Consulting Engineer: Served as project manager responsible for licensing of the Improved Technical Specifications submittal for Peach Bottom Atomic Power Station Units 2 and 3. This involved supporting NRC review meetings and developing responses to NRC comments and questions regarding the submittal. Also, served as project manager responsible for the development of the programs necessary to implement the Peach Bottom Atomic Power Station Units 2 and 3 Improved Technical Specifications. This involved revising and updating the Technical Requirements Manual, Offsite Dose Calculation Manual, UFSAR, Design Basis Documents, and the QA Program and also included development of 10CFR50.59 evaluations and 10CFR50.54(a) evaluations, as applicable. This effort also included development of matrices to implement the Safety Function Development Program.

EXCEL Services Corporation, Philadelphia Electric Company, Peach Bottom Atomic Power Station Units 2 and 3 (5/93-9/95)

Senior Consulting Engineer: Served as lead engineer responsible for development and aiding the coordination of the Improved Technical Specifications submittal for Peach Bottom Atomic Power Station Units 2 and 3. The plant specific submittal utilized NUREG-1433 as the BWR/4 Standard. This involved development of plant specific application of the Technical Specification criteria, Technical Specifications, Bases, technical justifications, 10CFR50.92 evaluations, 10CFR50.59 evaluations, and comparison documents. Supported resolution of discrepancies between current Technical Specifications and safety analyses identified during development of the Bases. Supported resolution of comments generated during Philadelphia Electric Company internal reviews.

EXCEL Services Corporation, Commonwealth Edison Company, Zion Nuclear Power Station Units 1 and 2 (3/91-4/93)

Consulting Engineer: Responsible for development of license amendment requests needed for Unit 1 and 2 refueling outages. This included supporting licensing of the microprocessor based Westinghouse Eagle 21 Process Protection System replacement, safety analyses upgrade for Westinghouse Vantage 5 fuel, and Setpoint Methodology upgrades. Supported resolution of discrepancies between current plant design and procedures and the safety analyses identified during the development of these license amendment requests. Also, supported daily licensing activities including development and submittal of Temporary Waivers of Compliance, UFSAR updates, and numerous short-term Technical Specification improvement license amendment requests. Served as lead engineer responsible for development of the Zion Station Units 1 and 2 Improved Technical Specifications initial draft submittal. This involved development of plant specific application of the Technical Specification criteria, Technical Specifications, Bases, technical justifications, 10CFR50.92 evaluations, and comparison documents.

EXCEL Services Corporation, Washington Public Power Supply System, WNP-2 (3/90-3/91)

Consulting Engineer: Responsible for development and aiding the coordination of the draft Improved Technical Specifications submittal for WNP-2. The plant specific submittal utilized the NUMARC/NRC negotiated BWR Standards. This involved development of plant specific application of the Technical Specification criteria, Technical Specifications, Bases, technical justifications, 10 CFR 50.92 evaluation, and comparison documents. Supported resolution of discrepancies between WNP-2 current Technical Specifications and safety analyses identified during development of the Bases.

Impell Corporation, Systems Engineering Department (11/89-2/90)

Lead Senior Engineer: Served as lead engineer on projects which involved preparation of FSAR change requests and 10CFR50.59 safety evaluations for the North Anna and Surry plants, the Turkey Point plant, and the Calvert Cliffs Nuclear Power Plant. The purpose of these projects was to correct FSAR discrepancies and inaccuracies discovered during FSAR verification and design basis documentation efforts.

Florida Power Corporation, Nuclear Department (8/84-11/89)

Licensing Engineer: Responsible for activities related to maintenance of the operating license for Crystal River Unit 3. The activities included the development and coordination of Technical Specification change requests, and implementation of a Technical Specification Interpretation program. Also participated in the Atomic Industrial Forum Subcommittee on Technical Specification Improvements and was Vice Chairman of the Babcock & Wilcox Owners Group Technical Specification Committee. Responsible for the development and coordination of the Technical Specification Improvement Program for Crystal River Unit 3 (lead plant for the Babcock & Wilcox Owners Group) from initiation through submittal to the NRC. Coordinated licensing resolution of design problems including the Emergency Diesel Generator overload concerns. Responsible for the initiation and development of the nuclear industry Snubber Utility Group.

Kansas Gas & Electric Company, Nuclear Department (5/81-8/84)

Licensing Engineer: Responsible for facilitating activities related to obtaining the Wolf Creek Generating Station operating license in addition to interfacing with the NRC. These activities included the development and coordination of technical reports and documents as well as responses to NRC concerns. Also responsible for licensing issues related to seismology and plant Technical Specifications. Coordinated licensing resolution of design and construction deficiencies.

Kansas State University, Nuclear Engineering Department (5/80-5/81)

Thesis Research: Involved in designing an iodine collection system. Research procedure included the use of neutron activation analysis to determine amount of iodine in a resin bed.

Kansas State University, Nuclear Engineering Department (6/79-9/79)

Research Assistant: Assisted with radiation shielding project. Responsible for collecting and reducing data on the effects of shielding, source-strength, wall thickness, and angle, in order to determine penetration through ducts.

## Curriculum Vitae for Allan James Brown

2 Burland Road  
Bailey's Reach  
Halewood  
Merseyside, L26 9YS  
United Kingdom

### Employment Experience:

Period	Company	Position Held
1972 – 1975	University of Liverpool	Research Student Nuclear Structure Physics
1975 – 1980	BNFL	Shift Manager Gas Centrifuge Pilot Plant and First Gas Centrifuge Commercial Demonstration Plant <ul style="list-style-type: none"><li>▪ Responsible for managing one shift comprising shift supervisor and seven shift operators</li><li>▪ Responsible for yearly operating budget of £600,000</li></ul>
1980 – 1982	BNFL	Day Operations Manager Gas Centrifuge Commercial Demonstration Plant <ul style="list-style-type: none"><li>▪ Responsible for management of five shift teams, comprising shift supervisor and seven shift operators per shift and responsible for day to day operation of the plant</li><li>▪ Responsible for yearly operating budget of £3.16 million</li></ul>
1982 – 1985	BNFL	Design Liaison Officer for second generation plant, Commissioning Manager and subsequently Operations Manager <ul style="list-style-type: none"><li>▪ In design liaison role working individually, in Commissioning Manager and Operations Manager roles responsible for five shift teams of shift supervisor and seven shift operators per shift and responsible for five professionals during commissioning and for two professionals during operation</li><li>▪ Responsible for yearly operating budget of £3.2 million</li></ul>
1985 – 1988	BNFL	Commissioning Manager for all Capenhurst Centrifuge Plants <ul style="list-style-type: none"><li>▪ Responsible for five shift teams comprising shift supervisor and five shift operators per shift and responsible for three professionals</li><li>▪ Responsible for yearly operating budget of £2.2 million</li></ul>



Period	Company	Position Held
1988 – 1989	BNFL	<p>Quality Assurance Manager for British Nuclear Fuels Capenhurst</p> <ul style="list-style-type: none"> <li>As Quality Assurance Manager responsible for a section of five Quality Engineers and Auditors and for a quality control section of one professional, a supervisor and six technicians</li> <li>Responsible for yearly operating budget of £1.4 million</li> </ul>
1989 – 1991	BNFL	<p>Design Liaison Officer for LES1</p> <ul style="list-style-type: none"> <li>Working individually as the LES1 Design Liaison Officer</li> <li>Responsible for yearly operating budget of £130,000</li> </ul>
1991 – 1995	Urenco (Capenhurst) Ltd (Urenco (Capenhurst) Ltd formed 1993)	<p>Decommissioning Manager for first green field decommissioning of pilot and commercial demonstration gas centrifuge plants</p> <ul style="list-style-type: none"> <li>As Decommissioning Manager responsible for a core decommissioning management team of three professional engineers and for the management of decommissioning contracts</li> <li>Responsible for yearly operating budget of £370,000 plus £6 million of contracts spread over 3 years</li> </ul>
1995 – 1998	Urenco (Capenhurst) Ltd	<p>Commissioning Manager for latest generation gas centrifuge plant at Capenhurst</p> <ul style="list-style-type: none"> <li>Responsible for a commissioning team of five professional engineers and for 1998 five shift teams comprising shift supervisor and eight shift operators per shift</li> <li>Responsible for operating budget of £600,000 and for a budget of £2.9 million in 1998</li> </ul>
1998 – 2003	Urenco (Capenhurst) Ltd	<p>Urenco Projects Department Design Manager, with particular involvement in the LES2 project.</p> <ul style="list-style-type: none"> <li>Design Manager for all plant design work within the Urenco Plant Design and Projects office</li> <li>Responsible for management of the core design and engineering team within Urenco Projects Department of some 40 professional engineers working in a multi-project matrix environment</li> <li>Responsible for operating budget of £3.5 million per year servicing projects spending £100 million per year</li> </ul>

Period	Company	Position Held
2003 – today	Urenco (Capenhurst) Ltd	Design and Licensing Consultant and Assistant Project Manager LES2 Project. <ul style="list-style-type: none"> <li>▪ At the time of writing responsible for three professional engineers in the UK</li> <li>▪ Responsible for an operating budget of £450,000</li> </ul>

### **Education**

- **Sir William Turners Grammar School**  
O Levels 1967 in Maths, Physics, Chemistry, English, French, Biology, Geography, History.
- **Sir William Turners Grammar School**  
A Levels 1969 in Physics, Maths, Chemistry
- **The University of Liverpool**  
Degree of Bachelor of Science with Honours 1972
- **The University of Liverpool**  
Research student Nuclear Structure Physics 1972 to 1975

## **SCOTT M. TYLER, P.E.**

### **SUMMARY**

---

Twenty years design, analysis, and consultation experience in the industrial, institutional, and commercial fields. Project/staff management and technical expertise in loss prevention including fire protection design and analysis, occupational and environmental safety, process safety/risk management, and code consultation.

### **PROFESSIONAL EXPERIENCE**

---

**AREVA (Framatome ANP)**  
*Naperville, IL*

*Oct. 95 - Present*

Mr. Tyler is a Manager in the Fire, Safety, & Risk Services group. He has broad technical and PM responsibilities in fire protection engineering; hazards and consequence analysis; occupational/environmental health & safety; process safety/risk management; and code/regulatory consultation and permitting in these technical areas.

**AcuTech Consulting, Inc.**  
*San Francisco, CA*

*Feb. 94 - Oct. 95*

Mr. Tyler was a Senior Engineer with AcuTech specializing in engineering services for process safety and hazardous material control programs. This included preparation of chemical accident prevention programs in accordance with federal and state statutes. Provided OSHA and model building/fire code consultation for hazardous materials compliance.

**ABB Impell Corporation**  
*San Ramon, CA*

*Jun. 85 - Feb. 94*

Mr. Tyler held various engineering positions culminating in supervisor responsible for technical oversight and management of five junior engineers. Mr. Tyler was involved in over 50 design and analysis projects in a host of industrial and institutional occupancies serving in both managerial and technical roles for fire protection, hazardous materials, process and occupational safety, and related areas.

## EDUCATION

---

B.S., *Fire Protection and Safety Engineering Technology*, 1986  
Oklahoma State University

## PROFESSIONAL AFFILIATIONS/REGISTRATION

---

Registered Professional Fire Protection Engineer, State of California # FP1390  
Member, American Institute of Chemical Engineers  
Member, Society of Fire Protection Engineers  
Member, NFPA 30 - Flammable and Combustible Liquids Code Committee  
National Fire Protection Association, Industrial Section  
Certified Fire Service Instructor and Firefighter

## PRESENTATIONS/MISCELLANEOUS

---

Primary Contributing Author – *"Emergency Management Guidelines for the Water Industry"*,  
American Water Works Association Research Foundation, to be published in 2006

Authored Chapter 3 – Methods of Reducing Fire Flow Requirements, *"Impacts of Fire Flow on  
Distribution System Water Quality, Design, and Operations"*, American Water Works  
Association Research Foundation, 2002

*"Strategies for RMP Development and Implementation"*, RMP Rule Workshop cosponsored by  
Metropolitan Washington Council of Governments and The Chlorine Institute,  
Washington, DC, 2/99

Peer Reviewer for USEPA Publication *"Risk Management Program Guidance for Ammonia  
Refrigeration"*, 8/98

*"Fire PRA for Fossil Utilities"*, Edison Electric Institute - Fire Protection Task Force, Rochester,  
NY, 10/97

*"OSHA PSM/EPA RMP - A Management Primer"*, Oregon Assn. of Clean Water Agencies,  
Portland, OR, 10/95

*"Case Study: PHA/PRA Techniques applied to a Chemical Distribution Facility"*, H.S. McGee and  
S.M. Tyler - AIChE Summer National Meeting, 8/93

## **KEY PROJECTS**

---

This is a synopsis of key representative projects; a comprehensive list of projects is available upon request.

### **Fire Protection Design/Program Development**

*Meriden Gas Turbines, LLC* – Led fire protection design team for dual fuel combustion turbine combined-cycle power plant. Project included water storage tank, electric/diesel fire pumps, sprinkler and water spray systems, and fire alarm.

*New United Motor Manufacturing Inc.* - Led fire protection design team for addition of truck assembly line (\$350M). Design included water storage tank, diesel fire pump, 14 ton low pressure CO<sub>2</sub> system, foam suppression, extra hazard sprinkler and water spray systems, proprietary and special hazard alarm systems, underground main and hydrant system. Served as construction liaison for engineering (mech., elec., HVAC, and fire prot.) during 18-month construction phase.

*DOW Chemical* - Design of process plant water spray and sprinkler systems protecting structures, vessels, loading racks, and buildings including Chlorinated Pyridines (5 systems), Generon Process Bldg. (2 systems), Styrene Facility, MEI Process Structure (5 systems), Propane Storage Tanks (2 systems). Designed fire main replacement project and conceptual design for fire pump repair/replacement.

*Sacramento Municipal Utility District, Rancho Seco Nuclear Generating Station* - PM/Design Engineer for numerous projects including plant proprietary fire alarm system replacement, EDP facility pre-action sprinkler system and sub-floor Halon system, Fire Pump controller replacement, and other FP system modifications. Prepared fire alarm/annunciator response procedures, fire protection system surveillance and maintenance procedures, combustible materials and ignition source control program, and pre-fire planning.

### **Analysis/Compliance**

*Uranium Disposition Services* – Led fire hazards analysis for two uranium hexafluoride deconversion sites per DOE criteria. Suggested and led hydraulic analysis of alternate water supply for fire water resulting in >\$2M project savings.

*Louisiana Energy Services* – Authored chemical process safety chapter of license application (USNRC) for proposed uranium hexafluoride centrifuge enrichment facility. Acted as chemical process and fire safety expert on integrated safety analysis team. Prepared baseline fire/emergency response needs assessment and IBC/IFC analysis for facility.

*Duke/Fluor Daniel* – Managed project to develop Occupational Safety program template for rollout to four fossil power plants. Work included building a safety management system and technical procedures for 39 individual safety topics.

*Metropolitan Water District of Southern California* - Prepared alternate materials and methods recommendations for bulk chlorine operations for conformance with UBC/UFC hazardous material control requirements.

*Dow Chemical* - Prepared UBC/UFC code reports as acting AHJ for facility and hazardous material projects including MEI process, chlorine system relocation (90 ton railcars), HCl manufacturing, and Generon Bldg. second story addition.

### **Process Safety Management/Risk Management Plans**

*Duke Energy North America* - Prepared federal (PSM/RMP) and state chemical accident prevention programs (CalARP) for aqueous ammonia systems supporting Selective Catalytic Reduction at gas-fired power plants.

*ConAgra/Armour Swift-Eckrich* - Prepared PSM programs including P&IDs, PSI validation/update, PHAs, SOPs, PM procedures, and others program elements for ammonia refrigeration systems at nine meat processing plants.

*International Rectifier* - Prepared CalARP for semiconductor manufacturer including PHA, dispersion modeling and consequence assessment. Systems included chlorine, ammonia, silane/phosphine; nitric, sulfuric, and hydrofluoric acids.

*Sacramento Area Water Works Association* - Prepared state chemical accident prevention program (RMPP) for seven water utilities covering chlorine systems at over 200 facilities including water/sewer treatment plants and well sites.

*Hill Brothers Chemical* – PSM/state program development for four facilities (L.A., San Diego, San Jose, Phoenix). Processes included NH<sub>3</sub> and Cl<sub>2</sub> repackaging/distribution, NH<sub>4</sub>OH mfg., NaOCl mfg. and several bulk acid systems.

UNITED STATES OF AMERICA  
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of:	)	Docket No. 70-3103-ML
	)	
Louisiana Energy Services, L.P.	)	ASLBP No. 04-826-01-ML
	)	
(National Enrichment Facility)	)	

CERTIFICATE OF SERVICE

I hereby certify that copies of the "APPLICANT'S PREFILED TESTIMONY IN MANDATORY HEARING CONCERNING THE COMPATIBILITY OF URANIUM HEXAFLUORIDE AND HYDROGEN FLUORIDE WITH CENTRIFUGE PLANT MATERIALS (OCTOBER HEARING QUESTIONS 6.c and 6.d)" in the captioned proceeding has been served on the following by hand-delivery on February 24, 2006 as shown below.

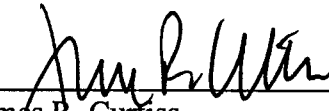
Administrative Judge  
G. Paul Bollwerk, III, Chair  
Atomic Safety and Licensing Board Panel  
Mail Stop T-3F23  
U.S. Nuclear Regulatory Commission  
Washington, DC 20555-0001  
e-mail: gpb@nrc.gov

Administrative Judge  
Paul B. Abramson  
Atomic Safety and Licensing Board Panel  
Mail Stop T-3F23  
U.S. Nuclear Regulatory Commission  
Washington, DC 20555-0001  
e-mail: pba@nrc.gov

Administrative Judge  
Charles N. Kelber  
Atomic Safety and Licensing Board Panel  
Mail Stop T-3F23  
U.S. Nuclear Regulatory Commission  
Washington, DC 20555-0001  
e-mail: cnkelber@aol.com

Office of the Secretary  
Attn: Rulemakings and Adjudications Staff  
U.S. Nuclear Regulatory Commission  
Mail Stop O-16C1  
Washington, DC 20555-0001  
(original + two copies)

Lisa B. Clark, Esq.  
Office of the General Counsel  
Mail Stop O-15D21  
U.S. Nuclear Regulatory Commission  
Washington, DC 20555-0001

  
\_\_\_\_\_  
James R. Curtiss  
Counsel for Louisiana Energy Services, L.P.