A Lifetime of Learning

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Discussion Topics
- NWI
- Commercial Nuclear Power
  - Statistics & US-World Performance
- GT Memories & “Lessons Learned”
- Summary / Questions
NWI – Who We Are…

- **NWI Consulting, LLC (Nuclear Worldwide Inc.)**
  - Commercial Nuclear Power Consulting Since 2003 with a client base in North America and Asia (Offices Located in Knoxville, TN)
  - Experienced personnel
    - **Consortium of over 50 professionals with extensive utility & regulatory expertise** (> 700 years of combined expertise)
    - **Consulting Support** Areas: Operations, Training, Maintenance, Engineering, Outage & Work Control, Radiation Protection/Chemistry, Performance Improvement (CAP), Oversight (NSRB, NOS)
    - **Diverse Projects** include: Safety Culture/Leadership Assessment, Training Accreditation Support/Probation Recovery, EPU Engineering, ILT Throughput Assessment/Exam Development, NRC 95-003 Collective Evaluation, CBT (WAN deployed), Simulator (new build integration), Causal Analyses, Safety Analysis (50.59), New Reactor Training Design (Human Factors Engineering / Task Analysis)
General Commercial Nuclear Power Statistical Information

- **Number of US operating reactors:** 104 (35 boiling water reactors, 69 pressurized water reactors)
  - 14 BWR plants have one reactor; nine have two reactors; one has three reactors
  - 15 PWR plants have one reactor; 24 have two reactors; two have three reactors
  - Companies licensed to operate nuclear reactors: 32
  - Number of states with operating reactors: 31
  - Longest Operating Period Between Refuelings: LaSalle 1 (Illinois); 739 days; February 2006
  - Most Electricity Generated: South Texas Project 2 (Texas); 11.8 billion KWh; 2007

- **Nuclear energy provides 19.2 percent of the United States’ electricity** generation in 2011: 790.2 billion kilowatt-hours (bkWh) and No. 1 source of emission-free electricity.

- **Percent of worldwide electricity:** 12.3% or 2,518 billion kilowatt-hours (2011).
  - As of August 2012, 30 countries worldwide are operating 435 nuclear reactors for electricity generation and 66 new nuclear plants are under construction in 14 countries.
Snapshot of U.S. Nuclear Performance

- **2011:** Low natural gas prices, coal-fired plant retirements coming, nuclear plant performance must be sustained at a high level.

- The average capacity factor for U.S. plants in operation in 1980 was 56.3 percent; in 1990, 66 percent; and in 2011, 89.0 percent.

U.S. Nuclear Capacity Factor, Percent
- 89.3% in 2005
- 89.6% in 2006
- 91.8% in 2007
- 91.1% in 2008
- 90.5% in 2009
- 91.2% in 2010
- 88.9% in 2011

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Steady Output From the Operating Plants

U.S. Nuclear Generation (billion kilowatt-hours)¹

**Highlights**
- 66 refueling outages in 2011 (55 in 2010)
- Crystal River shut down all year, Fort Calhoun shut down since April
- North Anna reactors down 82-89 days (earthquake), Browns Ferry reactors down 22-34 days (tornadoes)

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¹Energy Information Administration, Nuclear Regulatory Commission
Nuclear Power Uprates

The process of increasing the maximum power level at which a commercial nuclear power plant may operate is called a power uprate.

Power uprates at nuclear plants are very common and require additional capital investment (Typically 1 to 15% increase to existing Capacity).

More than 6,800 MW of power uprates have been approved by the NRC since 1977. That is the equivalent of adding another six nuclear reactors.

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1 Nuclear Regulatory Commission, Electric Utility Cost Group
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Vogtle and Summer Projects Well Underway

Vogtle 3 & 4 Photo courtesy Southern Company

Summer 2&3 Photo courtesy SCANA
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Global Nuclear Energy Development

- 63 new reactors under construction
- 156 new nuclear plants on order or planned

- Countries with operating commercial reactors
- Emerging nuclear countries with planned reactors
- Emerging nuclear countries with proposed reactors
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World Electricity Demand Will Rise
(trillion kilowatt-hours)

OECD countries
- 1.2% annual demand growth
- 12 nuclear reactors currently under construction

Non-OECD countries
- 3.3% annual demand growth
- 51 nuclear reactors currently under construction

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2OECD: Organization for Economic Co-operation and Development
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➢ GT Memories & “Lessons Learned”
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➢ Some Historical “GIT-NE Lessons Learned”

➢ No Spoon-Feeding Here...
 ➢ Dr. Eichholz – “Even in the Dark”

➢ Learning: Work Hard and Persevere to the End
 ➢ Role Model: Prepare & Lecture to the very end of the schedule time period (even in power outages)
 ➢ Numerous Opportunities to fill up your “Blue” test booklet (1-2 hr of callus-forming fun; e.g., Tell me all you know about Pu?)

➢ Dr. Poston – “Feeding by Fire Hose”

➢ Learning: Memorization is a Required Skill Set
 ➢ Memorize and Repeat it Back
 ➢ The length of the formula was directly proportional to the available amount of chalk board space
 ➢ LONG descriptive attribute lists, like an energizer battery, kept on going and going and going
Some Historical “Lessons Learned” from GT-NE (Cont.)

No Spoon-Feeding Here...

Dr. Bateman – “1 Credit Hour of Fun”
- Learning: Always Check Your Input
  - 1 credit hour course does not equal minimal effort
  - Assignment given incorrect formula to write computer program

Dr. Carter – “Wrong Rock”
- Learning: Entertain and Keep Their Attention
  - Interesting lectures - like listening to your grandfather sharing life experiences
- Exam Time – Talk Simply, Test Extensively; The heck with the lecture material...Why not try out questions from the CHP exam?
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Other Learnings...
- Leadership – Lead, Follow or Get Out of the Way
- Embrace Change
- Be Self Critical – Don’t believe your own press
- Find and Fix Your Problems
- Teach Yourself
- The Written and Spoken Word Sets Real Leaders Apart (Remember...Everyone in your field is technical)
- Persistence Pays Off...Focus – Stay the Course
- Consult Your Peers through Benchmarking (ID your Gaps to Excellence, so...Don’t Reinvent the Wheel)
  - “Imitation is the Best Form of Flattery” - Charles Caleb Colton (1826)
- Trust But Verify
- Apply the Golden Rule – treat people as you would like to be treated...but even better
- Only Tolerate Loyalty
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- Sometimes what you think you are going to do in your career doesn’t turn out that way
- Start with the “End in Mind”
- Follow your gut
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➢ “The Definition of Insanity” is to continuing to do the same things and expecting different results.

➢ Make a difference – we should and must...

“Carry the Holy Grail”
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Questions or Comments