Sandia National Laboratories

Exceptional service in the national interest

Training Improvements

Nuclear Reactor & Non-Reactor Facilities

Lance Lippert

Nuclear Facility Technical Training Coordinator & ACRR Reactor Supervisor

llippe@sandia.gov

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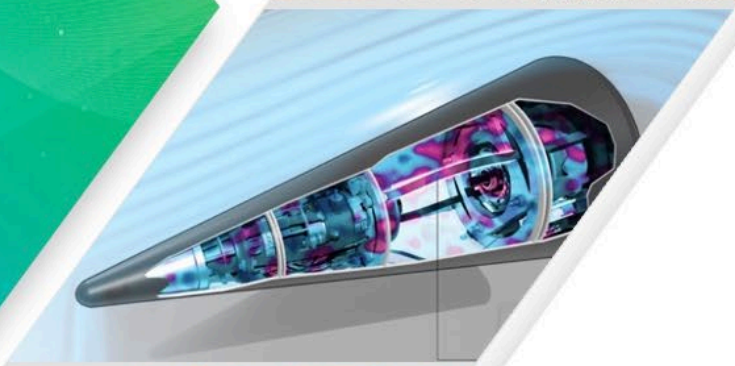

U.S. DEPARTMENT OF ENERGY | NNSA National Nuclear Security Administration

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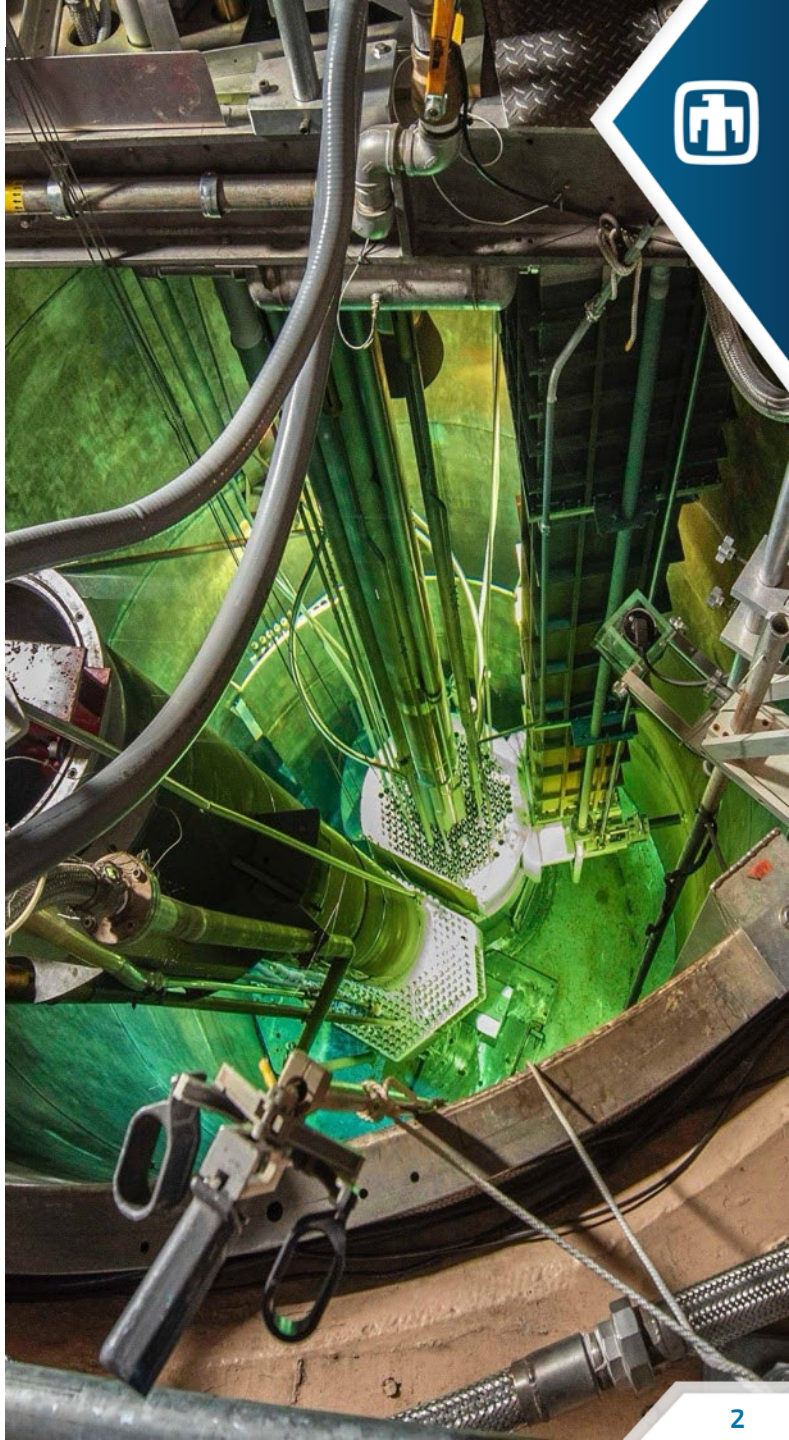
REQUEST ID : 1755285

Attracting Talent

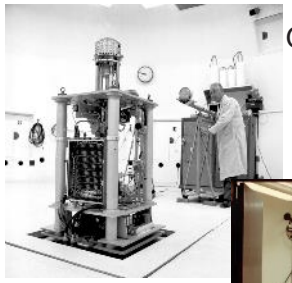
People with "The Right Stuff"

- Nuclear facility operation is a **high stress job requiring thorough knowledge** of the facility, **appreciation for safety-first**, **strict adherence to regulations**, and a **willingness to accept personal responsibility**.

Few people perform well in this environment

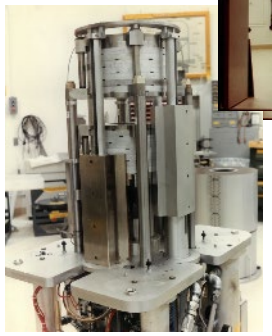


Reactors & Critical Assemblies



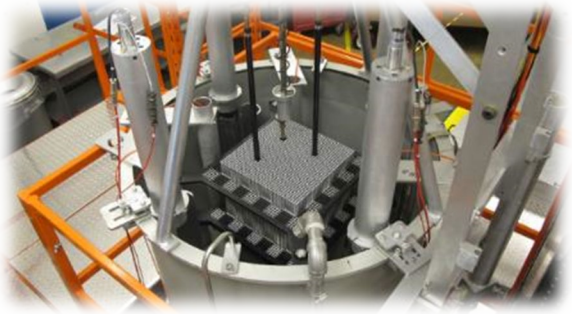
Godiva II(SPR)

(SPR-II)

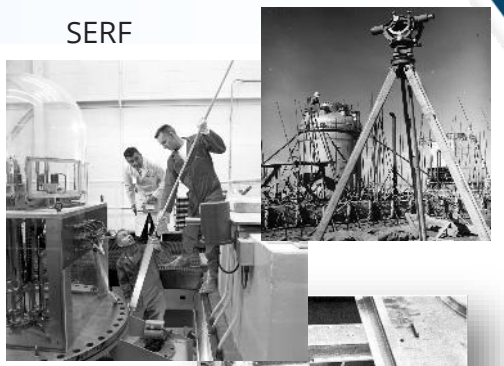


(SPR-III)

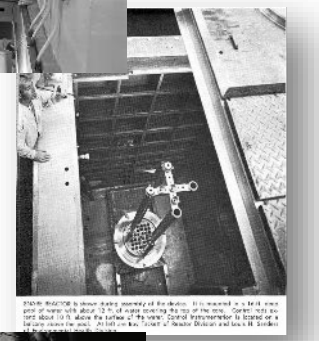
(SPR-CX)



SERF



SNARE



ACPR

ACRR


Gamma Irradiation Facility
AHCF Auxiliary Hot Cell
SPR Critical Assembly
Hot Cell/SER – Cold Standby
Annular Core Research Reactor

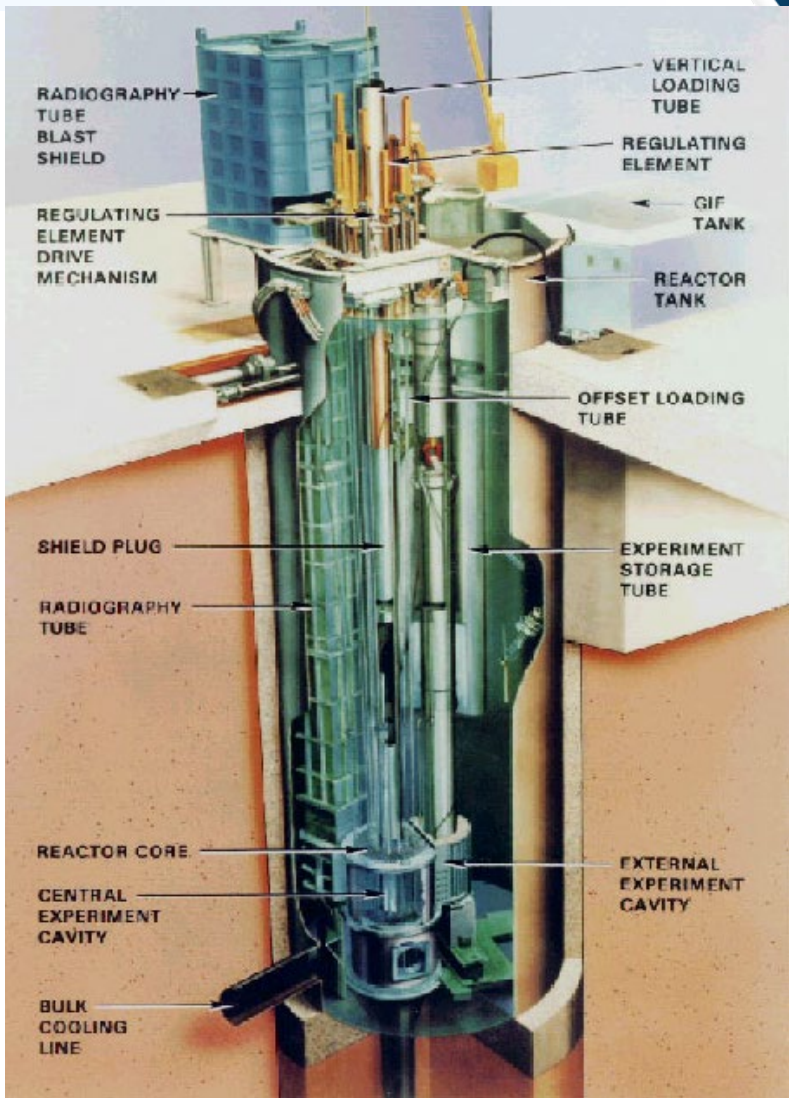
ACRR Control Room

ACPR 1975 – Current

SS
P
PRT
TRW

- TRIGA type research reactor
- Steady state mode 2.4 MW
- Pulse mode 30,000 MW
- tailored transient modes

- Has been used for medical isotope production
- ACRR UO2-BeO fuel, with 35% U-235
- FREC-II U-ZrH fuel, with original 19% U235
- “POOL-TYPE” REACTOR DESIGN



SANDIA PULSE REACTOR (SPR)

Facility now used to house and operate the SPRCX (Critical Assembly)

METAL-REACTOR DESIGN

No Neutron Moderation

Reactor Building Provide Shielding

Auxiliary Cooling w/ Nitrogen Gas

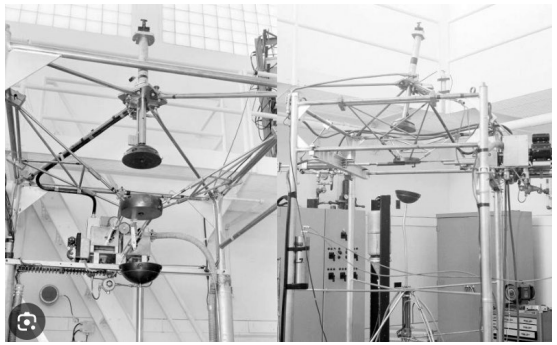
POWER CAPABILITY

15 kW(th) Steady-State

150,000 MW(th) Maximum Pulse

Fast Burst Reactors

1953-1957



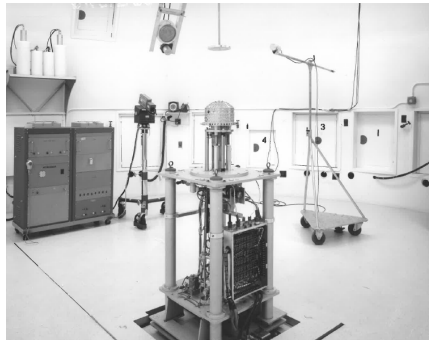
GODIVA-1 through GODIVA -4 (LANL)

50 kg U-235

Good Self terminating property discovered when incorrectly experimenting with the Jemima device in 1952. Jemima operated by remotely lifting one stack of enriched uranium-235 disks up towards another, fixed, stack

1954 & 1957 – Godiva-1 criticality excursion accidents

1962-1967



GODIVA II referred to as GODIVA –III or SPR (fabricated by LANL for SNL)

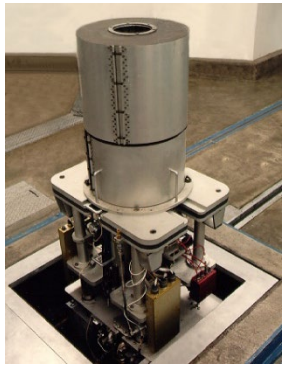
- 57.8 kg 93% U-235
- 0.4 in (1 cm) diameter cavity
- 5600 operations
- Retired in 1967

1967-1975

SPR-II

- Cadmium plated
- 105 kg 93% U-10%-Moly
- 1.5 in. (3.8 cm) ID cavity
- Advanced core design w/central cavity
- >150 °C shock forces broke magnet coupling

1975-2006



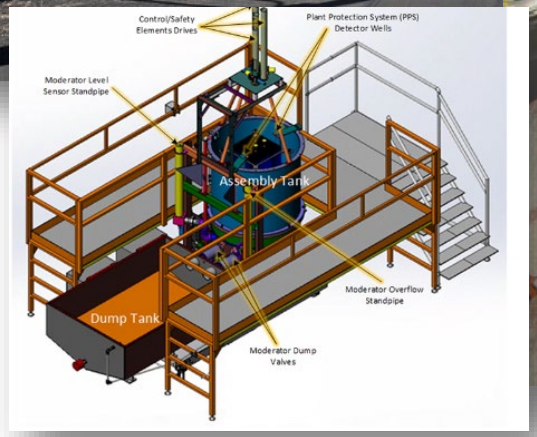
SPR-III

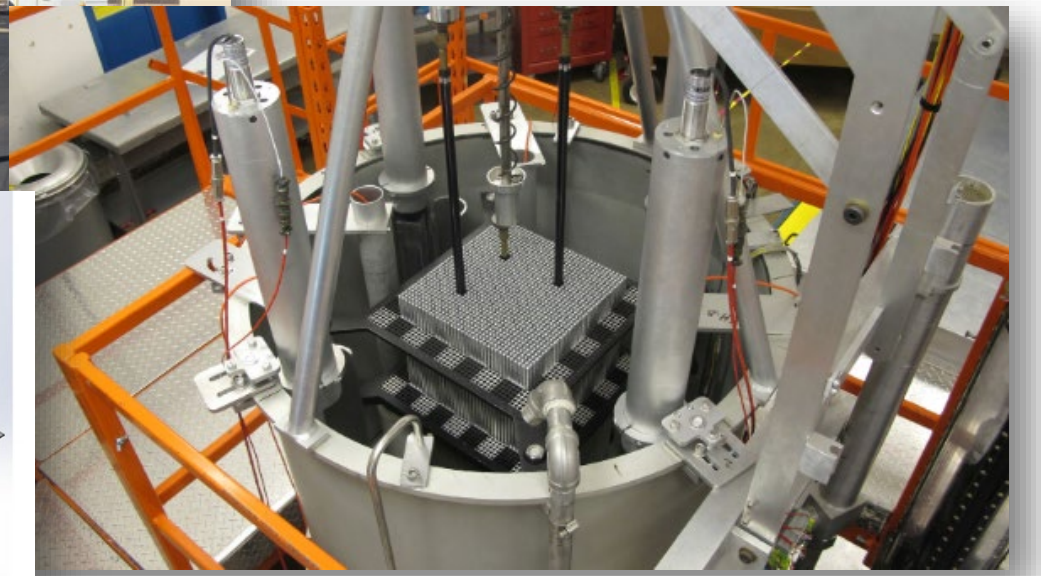
- 252 kg 93% U-10%-Moly
- Incorporated reflector elements
- 6.5 in. (16.5 cm) cavity
- B-10 Shroud/Thimble
- Up to 450 °C.
- Shut down 2006

Named after Lady Godiva > Un-reflected (BARE)

SPR/CX – Critical Assembly

SPR KIVA



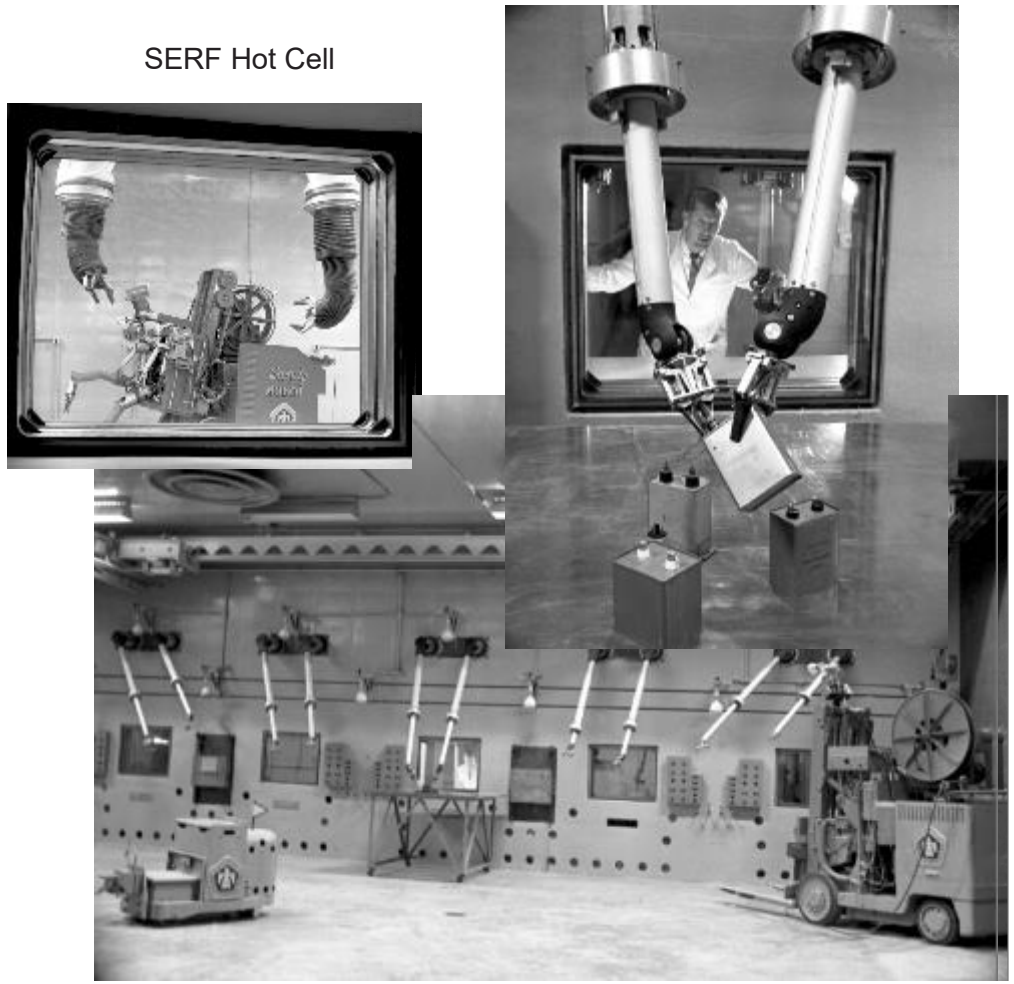


- SPRF KIVA provides a **<u>shielded location</u>** for performing critical experiments that employ different reactor core configurations and fuel types

Non-Reactor Nuclear Facilities

Hot Cell Facilities

SERF Hot Cell



Auxiliary Hot Cell

Radiological Facilities

Gamma Irradiation Facility

The facility is capable of having up to **1.5 Mega Curies** of Cobalt 60.

- **300,000 Ci Cobalt-60** (Sources) – Underwater or In-Cell
- **30 Ci Americium-241 Sources**

Current Staffing

Active Roster - 21 operators, 4 cross-trained, (3-inXT)

Sandia Critical Assembly – Minimum Operations Staff Required (2)

- (3) Operators (3) Operator/Supervisors, (4) cross-trained from ACRFF

Annular Core Research Reactor – Minimum Operations Staff Required (2)

- (9) Reactor Operators , (4) Operator/Supervisors (1) in-training from SPRCX

Gamma Irradiation Facility – Minimum Operations Staff Required (1)

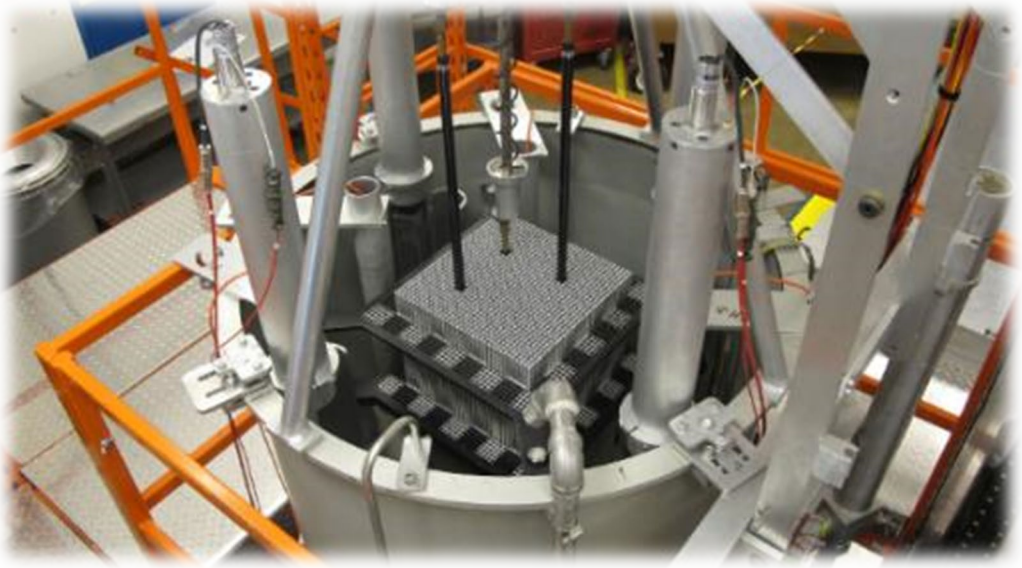
- (3) Operators

Auxiliary Hot Cell Facility – Minimum Operations Staff Required (1)

- (3) Operators, (1) in cross-training from GIF

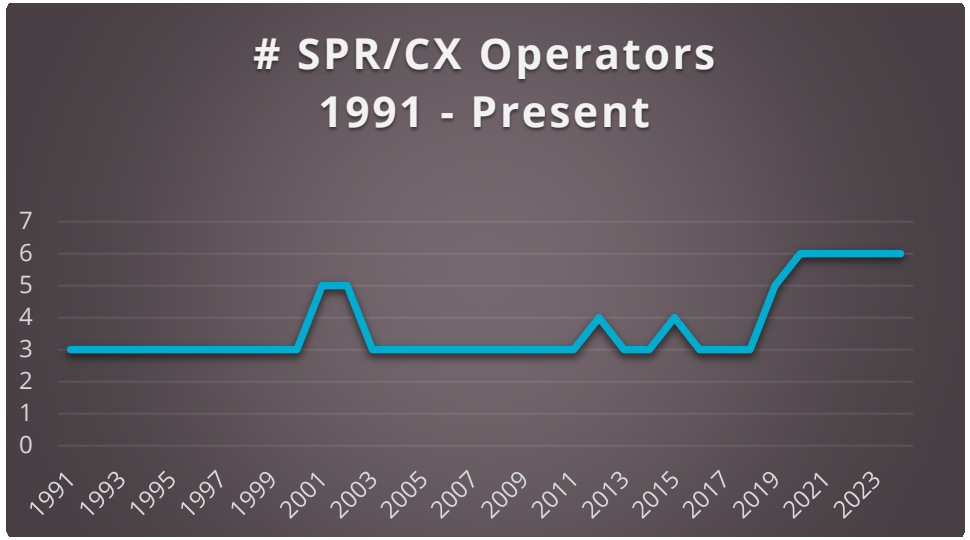
Reactors & Critical Assemblies

SPR-CX



Optimum
5

Minimum
2

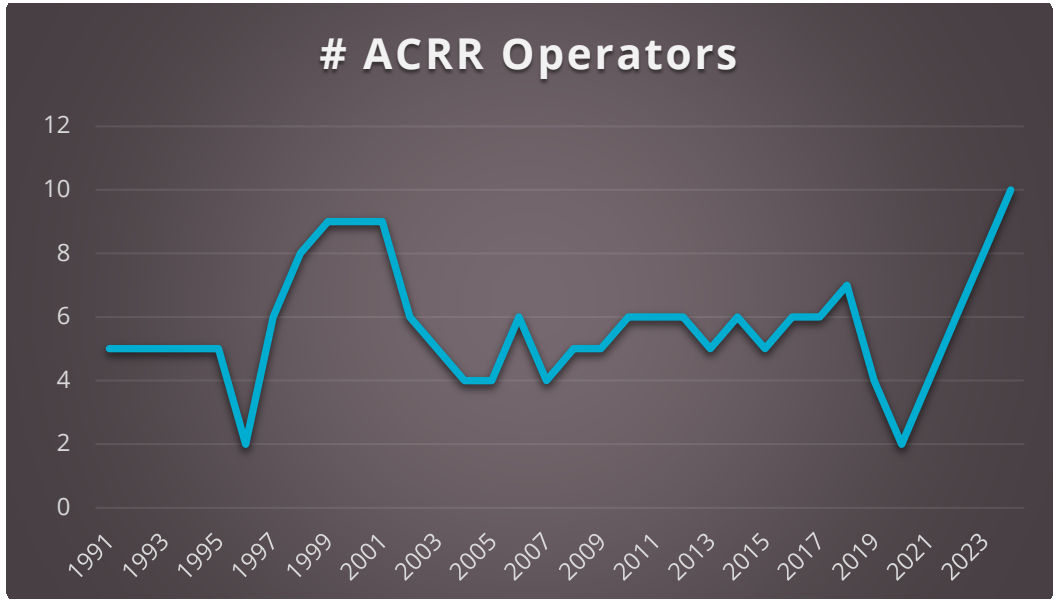


Reactors & Critical Assemblies

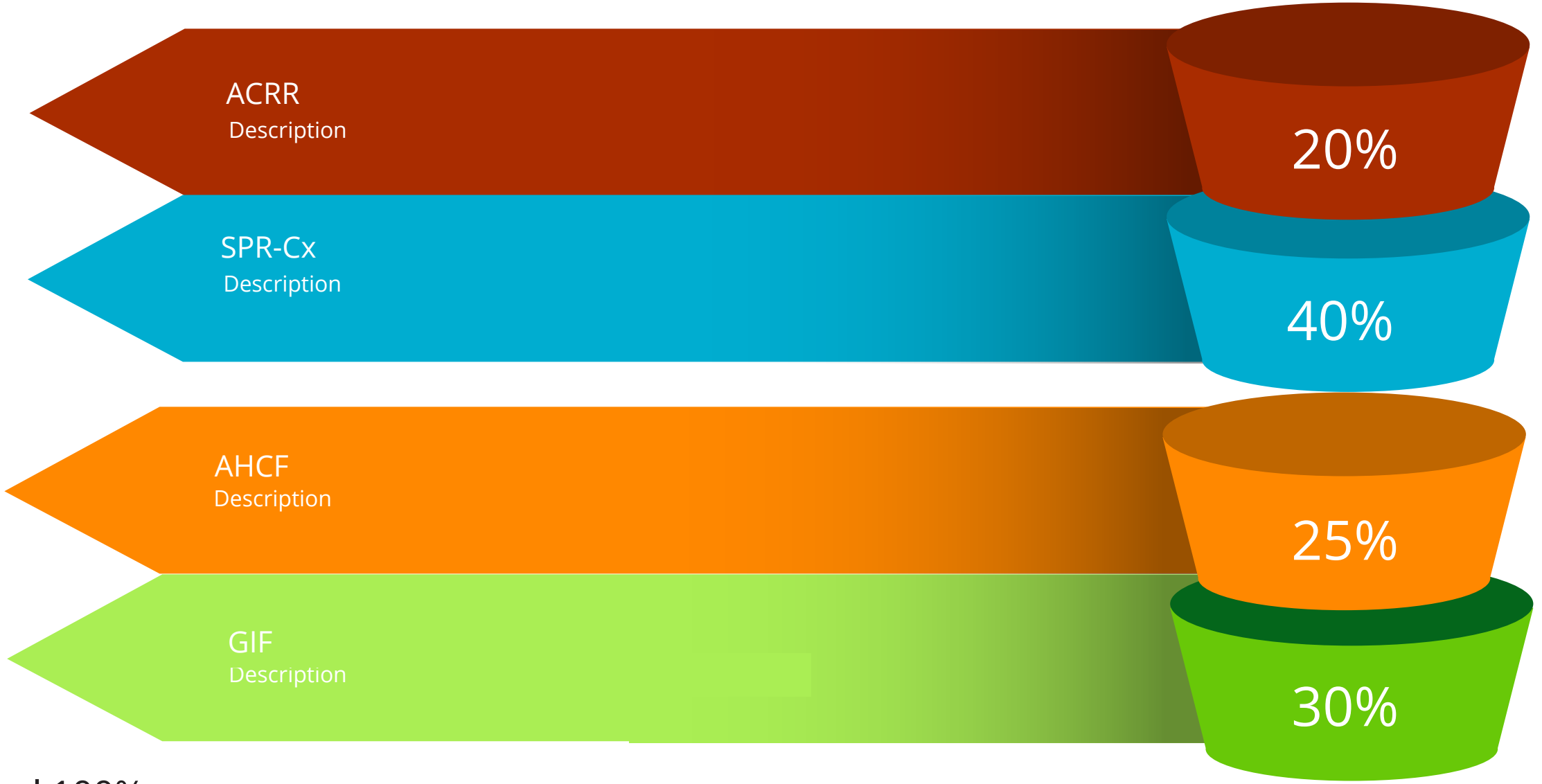
ACRR

Optimum
10

Minimum
2



Cross Training



Goal 100%

Other Facilities and Organizations

- System Engineers
- Quality Engineers
- Emergency Responders
- Facility Supervisors
- Senior Management

The Past

Chasing the Paper

- Developing
- Handouts
- Retrieving
- Grading
- Feedback
- Retaining

Challenges

Old System

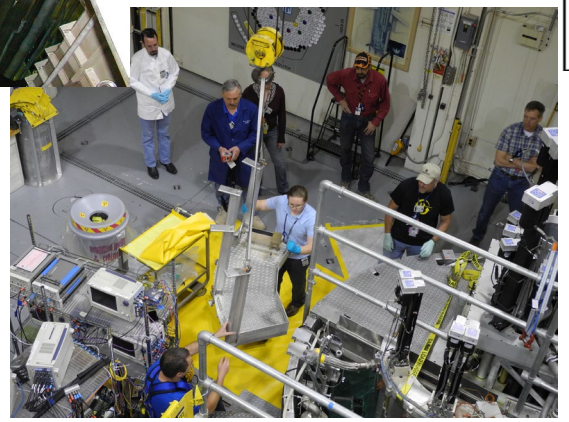
- Lost paper quizzes
- Exceeding due dates
- Late or no review of quiz results
- Long lead times between Oral Board/Exam to certification
- Training material outdated or not refreshed
- Less than relevant feedback process
- Litany of challenges

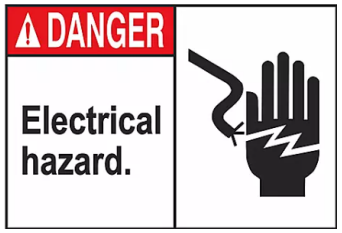
Corporate Training

Over 60 Corporate Training Courses Required for Operators

- Reactor operators and hot cell operators must complete numerous corporate training requirements annually, in addition to their regular continuing training mandated by DOE Order 426.2A. These requirements include:
- Special Nuclear Material Handling
- Criticality Safety
- Explosives Safety
- Cranes and Rigging
- Classified Work
- Forklift Operation
- Fall Protection
- Confined Space Entry
- Export Control
- Purchasing Procedures

60+

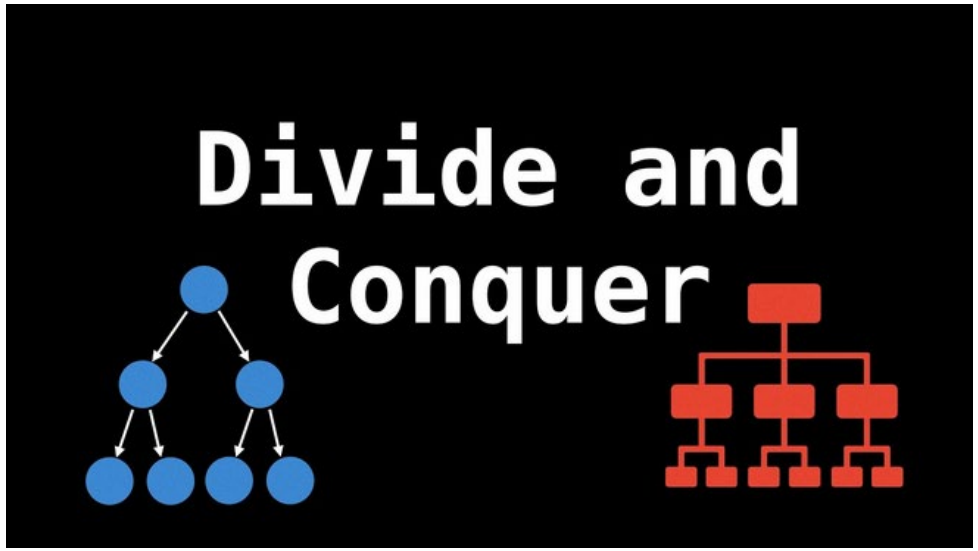




Ancillary Duties

Operations Personnel cover a wide variety of OTHER DUTIES

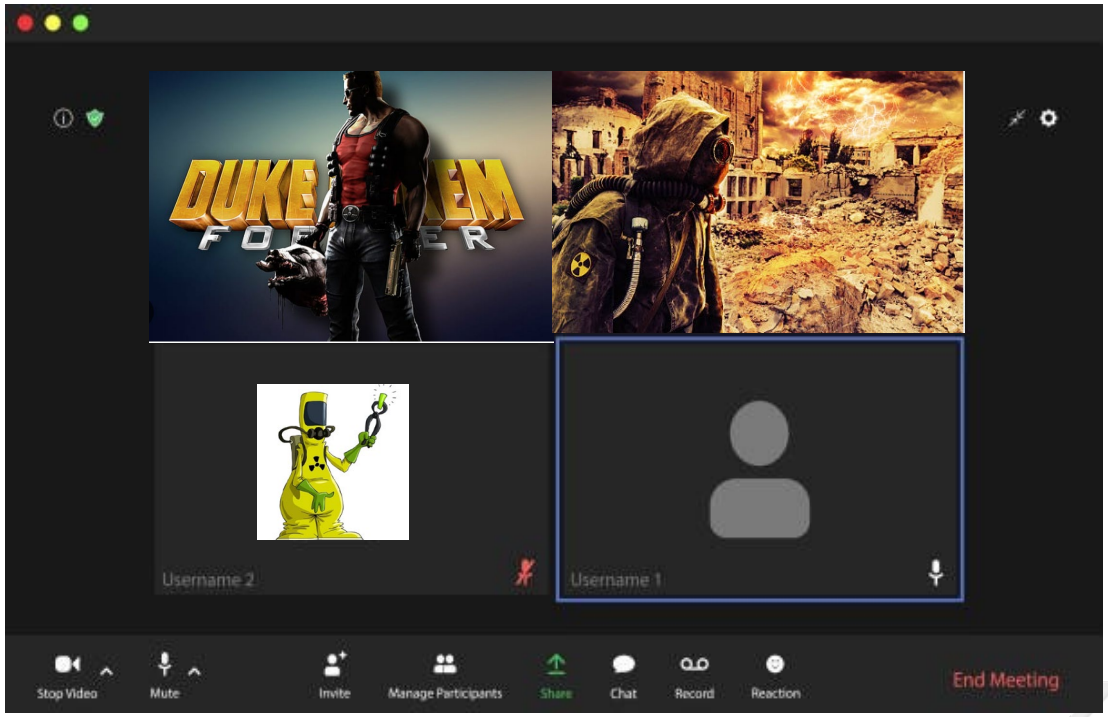
- Purchasing (Statement Of Work, Quality Inspection Criteria Development and Implementation
- Project Management (Sandia Delegated Authority)
- Electrical Safety Representatives
- Preventive Maintenance
- Safety Basis Development
- Emergency Response Team
- Neutron Radiography SME
- Underwater Equipment Operations
- Spare Parts Management
- Chemical Purchase
- Shipping and Receiving (Classified, SNM, Rad.....)
- Environmental Licenses (Wastewater Discharge, Environmental Hazards, Emissions, NEPA)



Covid to Post COVID

Virtual Learning

- Advantages of Virtual Learning
  - Reach remote learners (regulators, engineering, WFH individuals)
- Challenges with Virtual Learning
  - Blank Screens, emojis, villains, and caricatures
  - Speakers inoperable (mouse voice)
  - Background noises (doorbell, construction)
  - Questionable behaviors or gestures on camera
  - Inappropriate comments while unmuted.



Measuring Success

Qualified Instructors

- **Expertise:** Trainers should have a deep understanding of the subject matter.
- **Training Skills:** Instructors should be skilled in delivering content effectively and engagingly.

Engaging Content

- **Relevant Material:** Ensure the content is relevant to the participants' roles and responsibilities.
- **Interactive Elements:** Incorporate activities, discussions, and hands-on exercises to keep participants engaged.

Variety of Training Methods

- **Blended Learning:** Combine different methods such as in-person training, e-learning, and simulators.
- **Adaptive Learning:** Use adaptive learning technologies to personalize the training experience.

Inclusivity and Accessibility

- **Diverse Learning Styles:** Cater to different learning styles and preferences.
- **Accessibility:** Ensure the training is accessible to all participants, including those with disabilities.

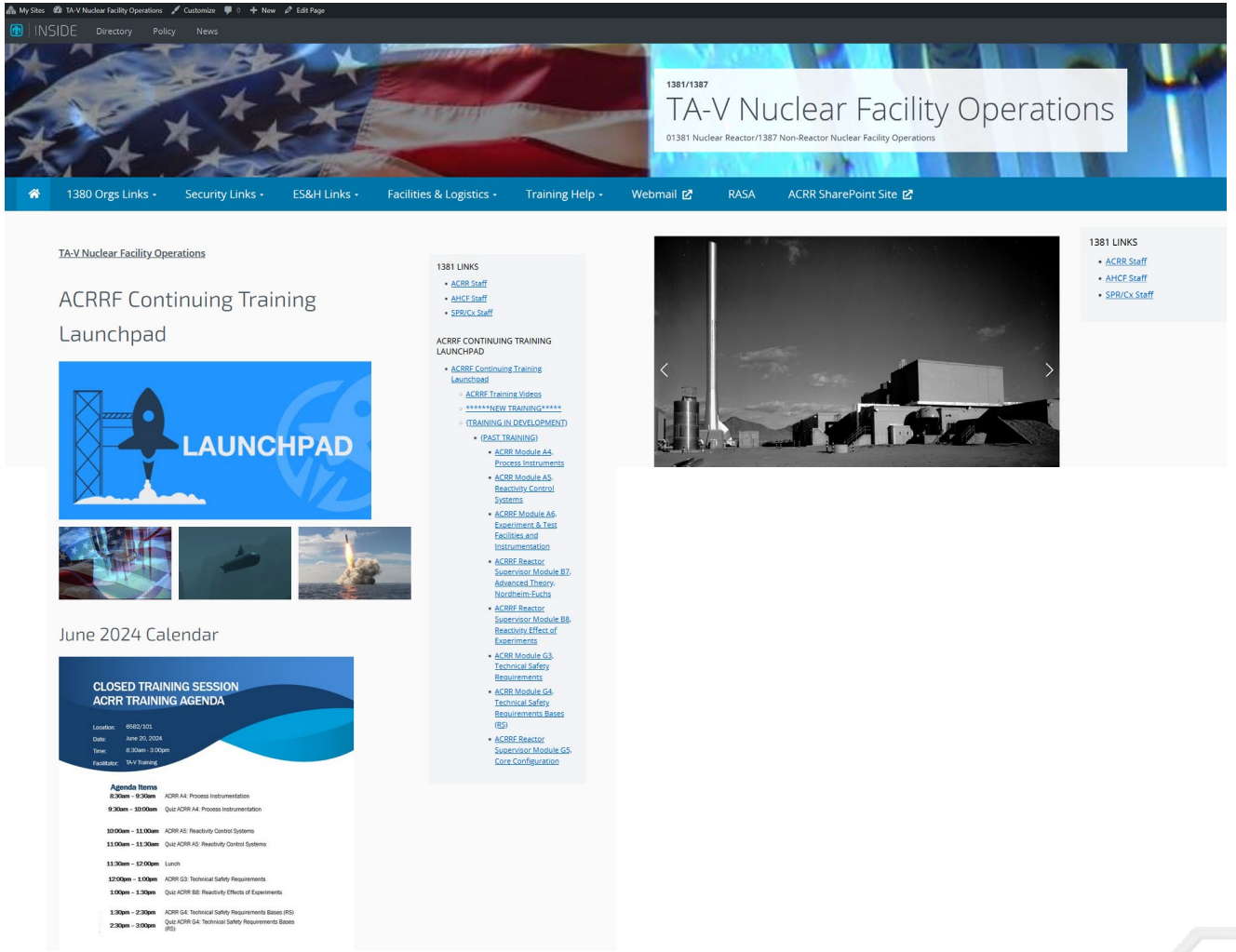
Assessment and Feedback

- **Regular Assessments:** Use quizzes, tests, and practical assessments to gauge understanding and retention.
- **Feedback Mechanisms:** Provide constructive feedback and encourage participants to give feedback on the training program

Current Training Method

Flexibility

- Hybrid or In-Person Learning
- Self-Paced Training & Exam Alternatives
- Automatic Grading
- Feedback
- Recording
- Feedback with Automatic Metrics

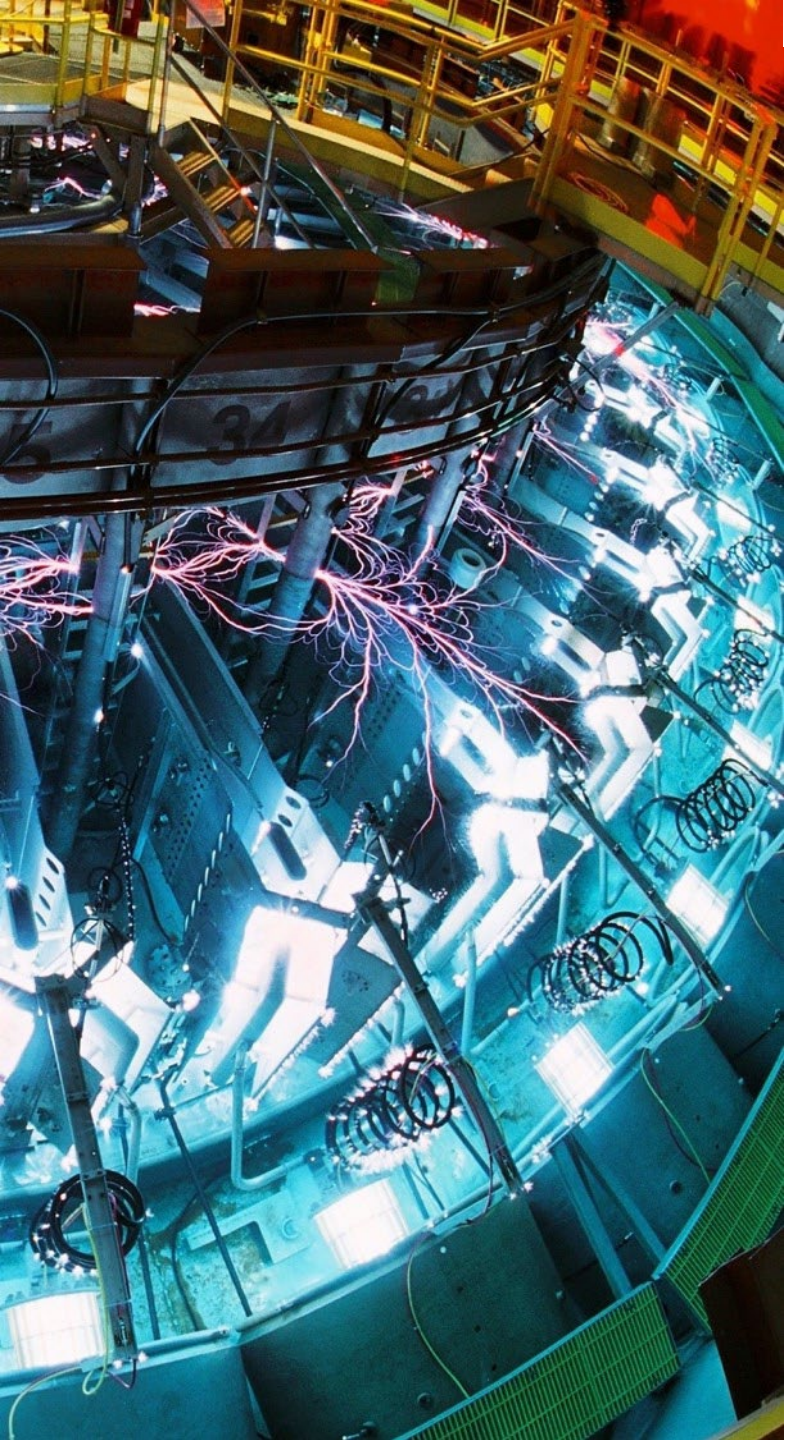


Reactor and Assembly Supervisor Academy

Reactor and Assembly Supervisor Academy

Topics Introduced to fill gaps maximize learning

- **Leadership Skills** (Communications, Emotional Intelligence, Teamworking…..)
- **Facility Lifecycle** (Design Basis, Historical Info)
- **Inspections and Maintenance** (Fuel Handling, Diagnostics)
- **Engineering** (Configuration Management)



Reactor and Assembly Supervisor Academy

Reactor and Assembly Supervisor Academy

- **Experiments** (Planning, Modeling, Dosimetry, Classified Discussions, Explosives)
- **Safety Basis** (Development & Implementation)
- **Material Handling Deep Dive** (Critical Lifts, Radiation Protection)
- **Tours** (Sister and Supporting Facilities)

Retaining Talent

Talent Development

PLUS

- **Positive Work Environment**
- **Career Development**
  - **Growth Potential**
- **Challenging & Exciting Work**

FUTURE

Next Steps

- Finding and Learning Management System that works for us.
- Improved Presentation Format
- Simulator Improvements
- Micro-Learning Techniques
- Virtual Tours for Emergency Responders
- OJT Learning Job Performance Measures for consistent learning
- Dedicated Learning Space
- Integrated Team (Ops/Training)
- Looking for better quiz options (Equations/Symbols)