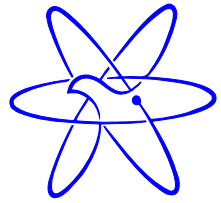


2010 AEC-NRC Bilateral Technical Meeting

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# **Turnover and Pre-operational Test Inspections for Lungmen Nuclear Power Station**

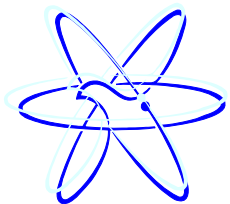
**May 4, 2010**



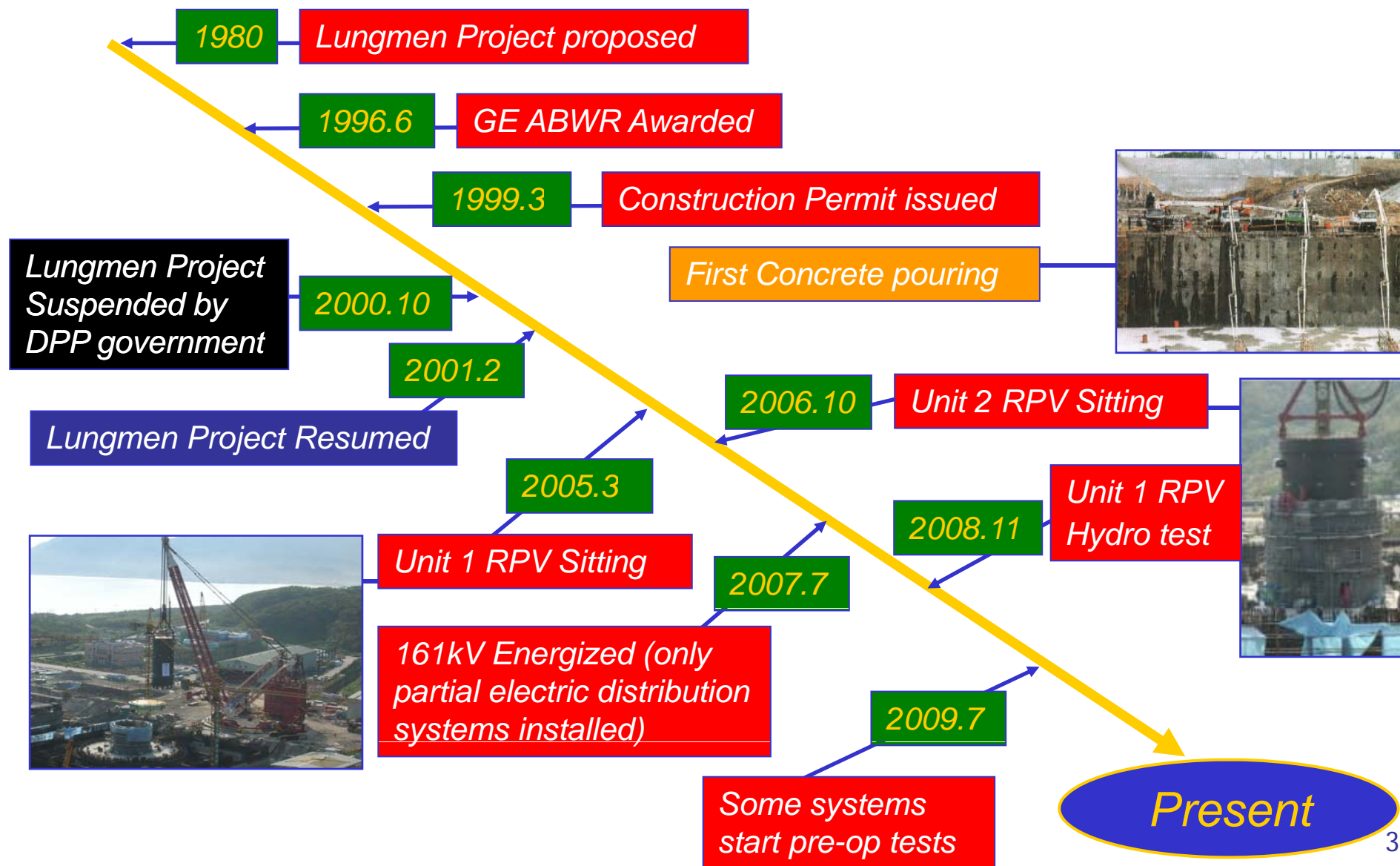
# Contents

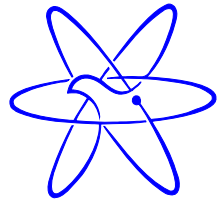
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- Lungmen Project
- Lungmen Initial Test Program
- Current Status of Test Activities
- AEC Inspection Programs
- Major Findings in Turnover Inspections
- Major Findings in Pre-Op Test Inspections
- Conclusion Remarks



# Progress of Lungmen Project

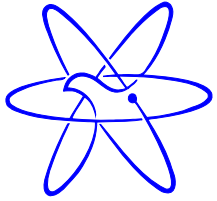




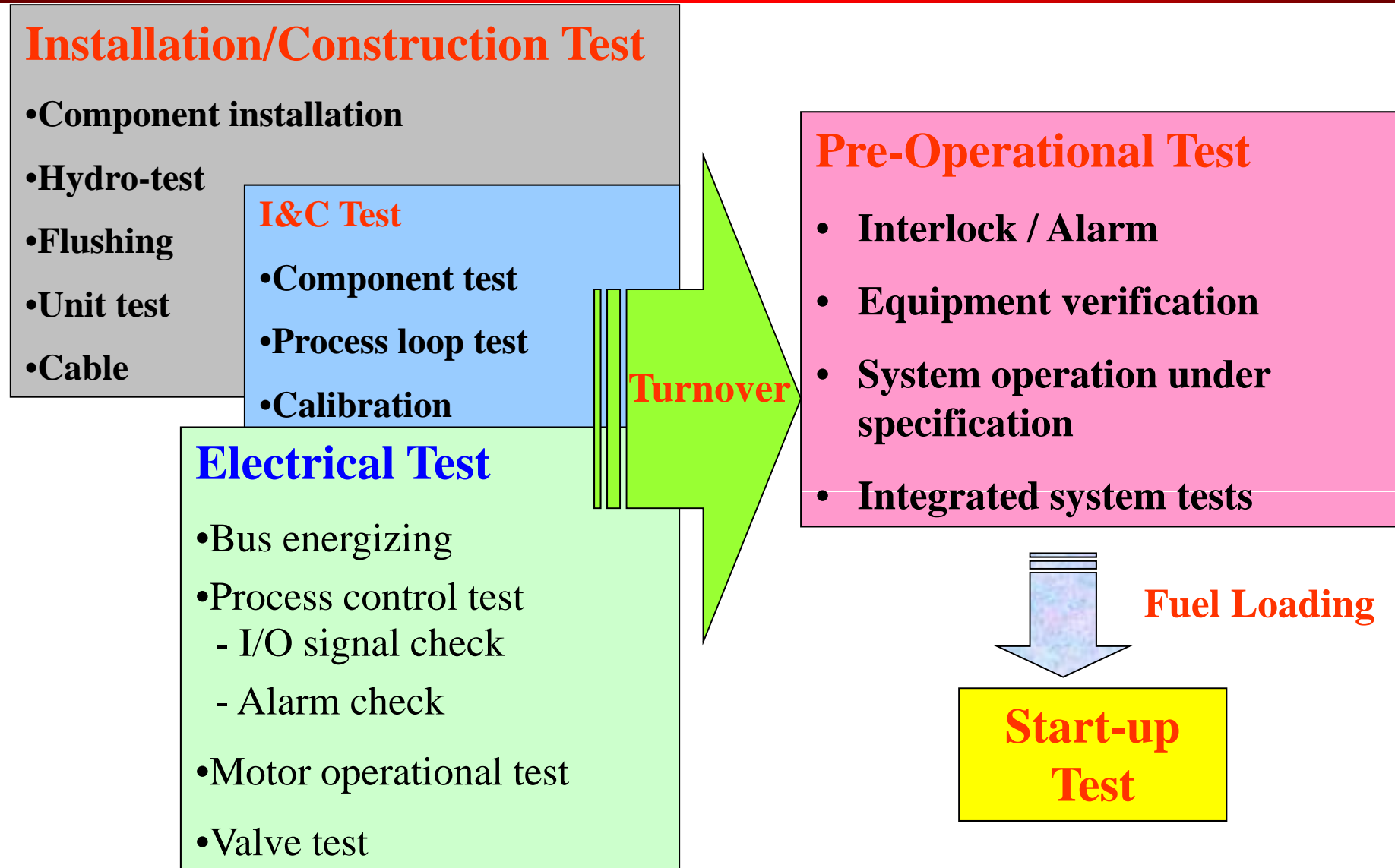
# Lungmen Initial Test Program

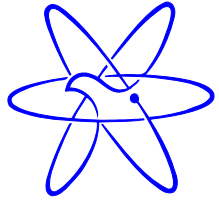
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- Lungmen Initial Test Program (ITP) covers the testing of structures, systems and components
- ITP consists of three major parts:
  - Post Construction Test (PCT) - *component-based test*
  - Preoperational Test (Pre-Op) - *system integrated test, 126 systems, 304 procedures*
  - Start-Up Test - *power test after initial fuel loading*



# Initial Test Program of Nuclear Plant

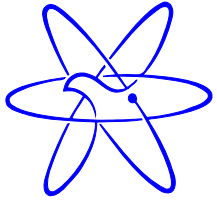




# Current Status of Test Activities

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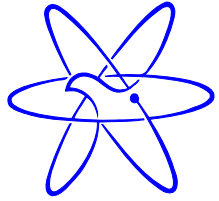
- At Lungmen site, most effort and resources of TPC are put on Unit 1 construction and testing
- Major part of Unit 1 RPV hydrostatic test has been performed in November, 2008
- Most of the electric power system of Unit 1 has been tested and energized
- Piping flushing of Unit 1 was started in early 2008, and has finished recently
- **20.1** systems (except electric systems) have been through turnover process, and have commenced their Pre-Op test procedures, but only one small system has completed Pre-Op test



## **Current Status of Test Activities (cont.)**

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- **Most “Prerequisite” systems are under Pre-Op testing and available to support other tests**
- **Recently, ECCS systems are doing the RPV injection mode and test mode testing**
- **GEH settled the agreement with TPC and provides on-site TA services to support the NI construction and testing activities**
- **TPC enhanced efforts on test procedure review, prerequisite confirmation, test assistance and auditing**

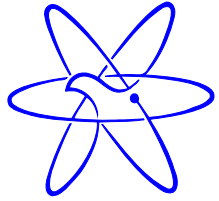


# AEC Inspection Programs

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- In addition to the Lungmen Regulatory Task Force (on construction), Lungmen Commissioning Inspection Task Force has been established in February, 2008
  - Preparing Inspection Programs
  - Reviewing Test procedures
  - Resident inspection / test witnessing
  - Reviewing “System Function Test Reports”
  - .....
- NRC inspection programs and procedures provide a great details and insights for preparing AEC inspection programs and activities

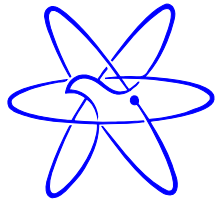




# **AEC Inspection Program (cont'd)**

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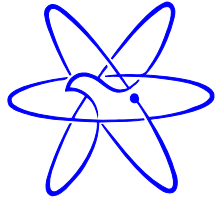
- **Inspection programs for Lungmen initial test program (ITP)**
  - **Post-Construction Test Inspection Plan**
  - **Preoperational Test Inspection Plan**
  - **Plant Readiness Team Inspection Plan**
  - **Start-Up Test Inspection Plan**



# Turnover Inspections

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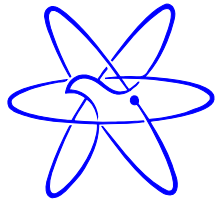
- Deficiency and mistakes found in Lungmen turnover activities
- Three team inspections for the turnover process have been performed
- Emphasis was given to the review of TPC's program and procedures for controlling the turnover of systems from construction office to testing/operation groups
- Recent inspection was focused on turnover program implementation, turnover package and documentation, and actual status of turned systems



# Pre-Op Test Inspection

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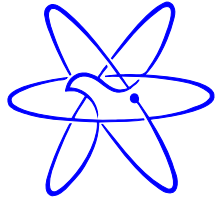
- **Preoperational Test Inspection Plan**
  - **Appendix F of NRC IMC 2504 lists the ABWR Pre-Op test items which must or recommend to perform regulatory inspections**
  - **Many IPs listed in older NRC IMC 2513 have been translated and complied as AEC inspection procedures**



# Pre-Op Test Inspection (cont'd)

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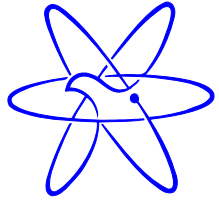
- Two classes for ABWR Pre-Op Test Inspection in Appendix F of NRC IMC 2504
  - Class I: Mandatory tests. 14 were selected
  - Class II: Recommended tests. 9 were selected
- AEC selected totally 27 system tests to perform inspections consisting of
  - test procedure review
  - test witnessing
  - test results evaluation



# **Pre-Op Test Inspection (cont'd)**

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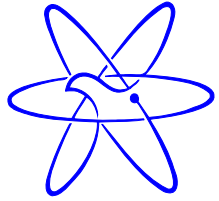
- **Four Pre-Op regulation meetings with TPC have held since 2009**
- **AEC requires:**
  - **Format and necessary items of “Pre-Operational Test Reports”**
  - **Utility (TPC) Q/A auditing enhancement**
  - **Responsible vendor’s test participation and test procedure approval**
  - **Integrated test schedule**
  - **Utility should perform Lungmen readiness self-assessment before AEC inspection**



# Major Findings in TO Inspections

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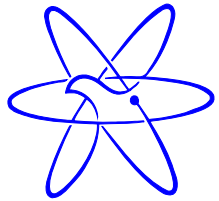
- Incompleteness of turnover documentation
- Incompleteness of post-construction tests
- Lack of a general guide and training of turnover walkdown
- Too long exception list, unreasonable expected handover day and lack of follow-up control & management
- Some out-of-date plots and diagrams
- Insufficient maintenance for turned systems
- Difficulty of independent audit within TPC



# Major Findings in Pre-Op Inspections

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- **Quality of test procedures**
  - Not completely meet vendor test specifications
  - Effectiveness and completeness of the tests
- **Questions in test prerequisites**
- **Experience and expertise of testing crew**
- **Effectiveness of QA/QC**
- **Problems due to construction defects and delay, specially I&C system**
- **“Milestone” testing policy and priority**
- **Lack of a overall testing schedule and practical engineering management**

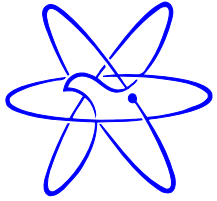


# Concluding Remarks

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- **Current Lungmen Unit 1 initial test activities are moving into Pre-Op test phase**
- **Before the power system fully energizing and I&C system properly functioning, Pre-Op tests are hard to proceed extensively**
- **After 3 turnover inspections, Lungmen turnover activities is back on the track**
- **AEC's inspection efforts and resources will focus on PCT, Pre-Op tests, and operational readiness**
- **NRC is welcomed to Lungmen for observing Pre-Op tests (working item AE-NR-JJ1)**





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**■ Thank you**

**■ for your attention**