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Public Meeting with ASME to Discuss Pump Inservice Testing Issues

NRC Headquarters

OWFN Room 1F22

June 4, 2007

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Topics for Discussion

- Intent of the OM Code
  - Thomas G. Scarbrough, Office of New Reactors
- Pump Design Flow
  - Steven M. Unikewicz, Office of Nuclear Reactor Regulation
- Comprehensive Pump Testing – Instrumentation Issues
  - Robert J. Wolfgang, Office of Nuclear Reactor Regulation
- Purpose of the Group B Pump Test
  - Joel D. Page, Office of Nuclear Regulatory Research

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Intent of the OM Code

- ISTA states:
  - Section IST establishes the requirements for preservice and inservice testing and examination of certain components to assess their operational readiness in light-water-reactor nuclear power plants. Operational readiness is defined in the Code as the ability of a component to perform its specified functions
- Intent established by specific language of Code
- Where intent not clear, Code should be revised as necessary

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History

- In the past, concerns raised regarding IST requirements for pump capability and potential damage
- Sept. 1991 letter from J. Richardson (NRC) requested that
  - ASME revise the requirements to ensure the ability of certain pumps and valves to perform their intended 'hydraulic and mechanical' safety functions
- Nov. 1992 letter from F. Rhodes (ASME OM) stated
  - Major effort [was] underway … to add new requirements for pump testing that would be more related to the design basis for the pumps
- 1995 OM Code Subsection ISTB was result of that effort
- NRC staff supports 1995 ISTB requirements

ASME Code Relief

- 10 CFR 50.55a allows licensees to request relief from ASME Code requirements
- If relief request satisfies 10 CFR 50.55a, relief granted on an individual plant basis
- Code requirements not expected to be reduced to match each relief request
- If all licensees request relief that satisfies 10 CFR 50.55a, Code revision should be considered
- New plants expected to satisfy ASME Code requirements without relief

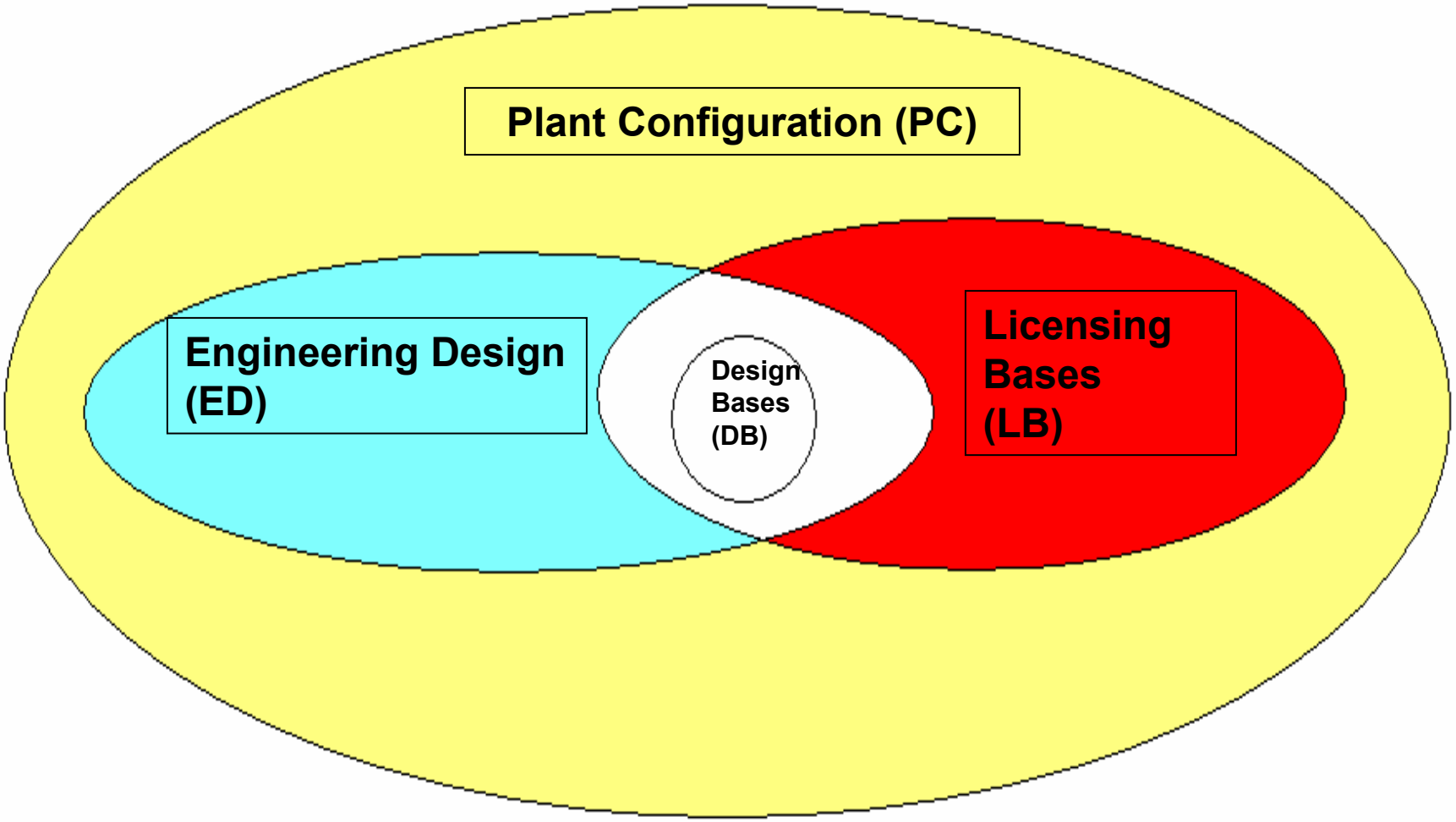
ISTB Requirements

- Preservice Test
  - Detailed assessment of pump performance to establish a baseline pump curve using precision instrumentation
- Inservice Test
  - Group A Pump Test
    - Quarterly test of normally operating pumps including vibration monitoring at high flow rate as practicable
  - Group B Pump Test
    - Quarterly test of standby pumps without vibration monitoring at high flow rate as practicable
  - Comprehensive Pump Test
    - Test every 2 years with precision instrumentation and reference values “within ± 20% pump design flow rate”

Pump Design Flow

- What is “design” flow?
- To Accident Analyst – Chapter 14/15 flow
- To Design Engineer – specified or plant operating flow
- To Pump Engineer – Best Efficiency Point

Relationship Between DB, LB, ED, and PC



Note: Design Bases is a *subset* of the Licensing Bases
(From NUREG 1397, Section 1.4)

Pump Design Flow

- Design Bases
  - Information which identifies specific functions to be performed by structure, system or component (SSC) and specific value or range of values chosen for controlling parameters as reference bounds for design. These values may be either:
    - Restraints derived from generally accepted state of art practices for achieving functional goals
    - Requirements derived from analysis (based on calculation and/or experiments) of effect of postulated accident for which SSC must meet its functional goals

Pump Design Flow

- Engineering Design
  - Design requirements specified in specifications, calculations and drawings that define SSC function. This functional information includes capacities, volumes, flow rates, design capabilities (pressure or temperature limits or ratings), qualification requirements, performance accuracy limits and setpoints.

Pump Design Flow

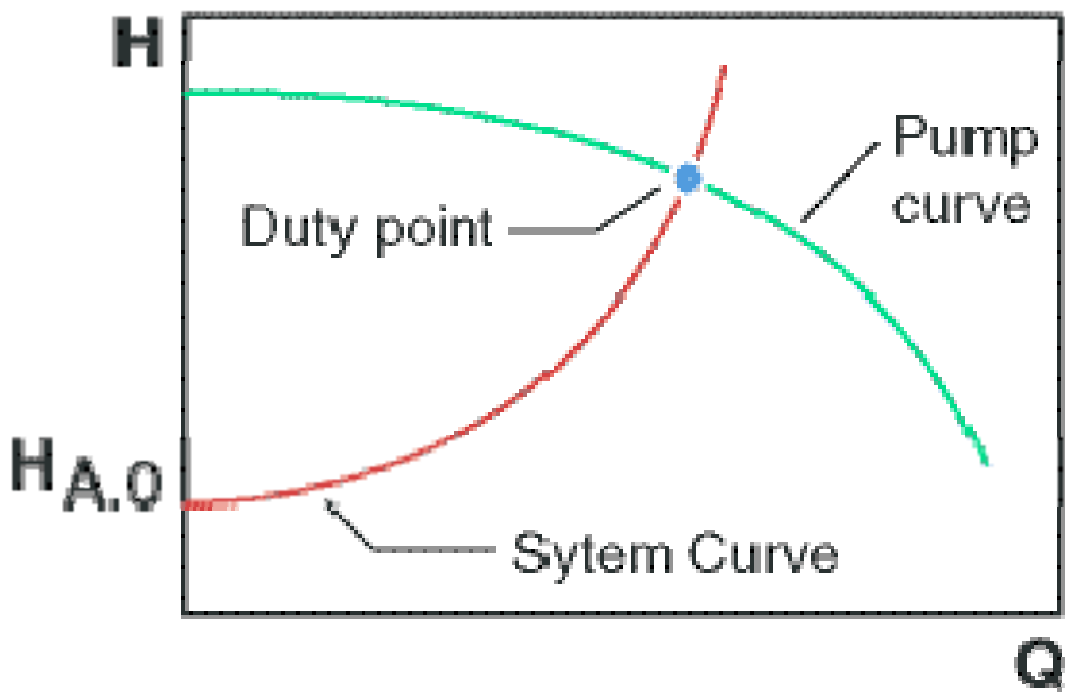
- License Bases
  - Licensing Bases for plant comprised of NRC regulations, plant specific NRC requirements (e.g., Operating License, Orders, Technical Specifications, license conditions, QA Topical Report), plant-specific design bases and other plant-specific information in the Final Safety Analysis Report and Technical Requirement Manual (TRM), and regulatory commitments

Pump Design Flow

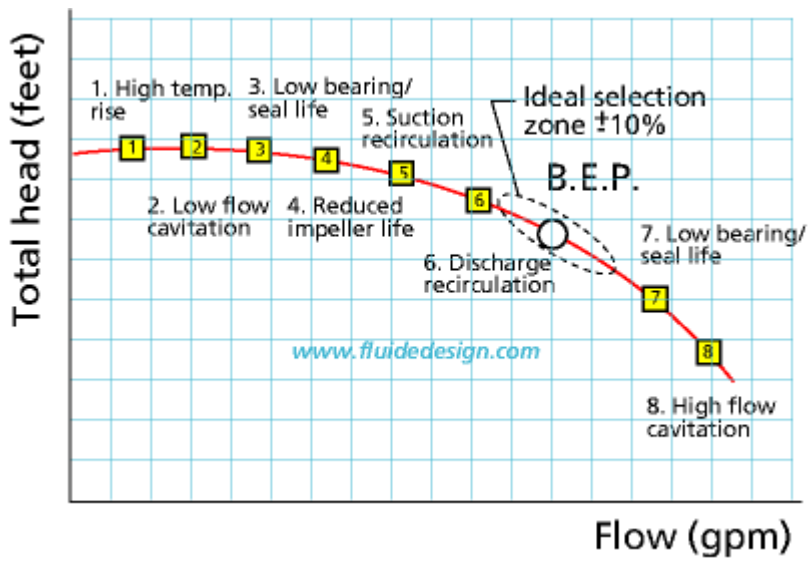
- Plant Configuration
  - Plant configuration is described as the currently existing characteristics of SSC

Pump Design Flow

- Generic Operating Curve



Pump Design Flow



Pump Design Flow

- Design Flow
  - A flow rate within 20% of highest practicably achievable flow rate, and enveloping the licensing bases flow rate(s), and is in a well-sloped portion of the pump performance curve such that it is effective for determining the mechanical and hydraulic operational readiness of the pump. In addition to meeting Code requirements, the pump IST flow must always meet, or be consistent with, licensing-basis assumptions in plant's safety analysis.

- Above definition of design flow supports 2 goals:
  - Considers operational readiness
  - Considers monitoring for degradation

Comprehensive Pump Test – Instrumentation Issues

- CPT requires highly accurate pressure gauge of ± 0.5% accuracy
- ±0.5% accuracy gauges provide better test results, allowing precise assessment of pump performance (operational readiness)
- Alert – Caused by pumps mechanical problem, inaccurate instrumentation or instrument drift
- CPT acceptance and required action range criteria are different from Group A test criteria in order to provide better testing and more precise results every 2 years

Group B Pump Test

- Purpose
  - Code requires a CPT each 2 years supplemented by either Group A or B test quarterly depending on whether pumps are routinely operated. For Group A and B tests, hydraulic acceptance criteria are relaxed.
  - Group B test is for standby pump (not routinely operated) and is to demonstrate that the pump is in the acceptable "hydraulic box" (i.e., ± 10% from reference value) and no vibration testing is required
  - Group B test requirements for establishment of reference values same as for CPT and Group A
  - Group B test is intended to assess pump operational readiness, and to provide trending data of flow or differential pressure
  - Group B test provides repeatable measurements (every 3 months) which permit evaluation of pump condition and allows detection of degradation over time

Group B Pump Test

- Reference Point
  - ASME OM Code Subsection ISTA-2000 defines “reference point” as a point of operation at which reference values are established and IST parameters are measured for comparison with applicable acceptance criteria
  - Some licensees use a procedure that does not verify pump is in the “hydraulic box” (i.e., setting the pump speed to “reference point” and then measuring one hydraulic parameter and using that same parameter as verifying pump operationally ready; and test loop valves could be adjusted to obtain single hydraulic parameter)
  - Little viable operational readiness information can be derived from this procedure and, with valve adjustments, a seriously degraded pump could be acceptable
  - Test procedure needs to demonstrate pump in hydraulic box
  - Code clarification is desirable to avoid confusion