Commonwealth Edison
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Address Reply to: Post Office Box 767
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September 15, 1980

Mr. Paul F. Collins, Chief
Operating Licensing Branch
Division of Human Factors Safety
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Subject: Dresden Station Units 1, 2 and 3
Quad Cities Station Units 1 and 2
Zion Station Units 1 and 2
LaSalle County Station Units 1 and 2
Byron Station Units 1 and 2
Braidwood Station Units 1 and 2
Revised Modules for Reactor
Operator Training Program
NRC Docket Nos. 50-10/237/249, 50-254/265
50-295/304, 50-373/374, 50-454/455, and
50-456/457

Reference (a): March 28, 1980 letter from H. R. Denton to All Power Reactor Applicants and Licensees

Dear Mr. Collins:

Enclosed for your review are preliminary topical outlines of proposed modules on Thermal Hydraulics and Core Damage Mitigation which are to be included in the revised training program for Commonwealth Edison nuclear station operators. This information is provided pursuant to Paragraph A.2.c of Enclosure 1 of Reference (a).

The detailed contents of these modules will be based on the corresponding INPO guidelines, on internal and consultant-assisted research, and on vendor and owners group information. Although a significant portion of the material to be included in these modules is already in Commonwealth Edison's current operator training programs, the proposed modules represent an increase in the scope and depth of coverage.

Curriculum development for the revised operator training program will begin following completion of task analyses for the affected positions. As detailed training material is developed

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for these modules, it will be incorporated into Commonwealth Edison's ongoing training programs.

Please address any questions that you might have concerning this matter to this office.

One (1) signed original and one hundred nineteen (119) copies of this transmittal are provided for your use.

Very truly yours,

W. F. Naughton
Nuclear Licensing Administrator
Pressurized Water Reactors

Enclosure

cc: Resident Office - Dresden
Resident Office - Quad Cities
Resident Office - Zion
Resident Office - LaSalle

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NUCLEAR OPERATOR TRAINING PROGRAM
THERMAL HYDRAULICS MODULE
TOPICAL OUTLINE

GENERAL

A. Measurement and Conversion

- mass, force, pressure, mass/volume flow rates
- MKS, SI, English systems
- temperature: scales, units, conversions

THERMODYNAMICS

B. Thermodynamic Properties, Phases, and States

- terms and concepts
- ideal gas
- liquids
- water/steam systems at saturation

C. Thermodynamics

- First Law
- Second Law
- properties of water/steam systems; steam tables, Mollier diagrams
- enthalpy; entropy

D. Heat Transfer

- modes: convection, conduction, radiation
- heat transfer rates for each mode
- boiling: types of boiling, boiling curve
- DNB
- condensation

E. Applications of Heat Transfer

- Carnot and Rankine cycles; application to plant cycle
- water/steam conditions for major points in plant cycle
- heat exchangers
- energy flow in reactor, steam generator, turbine, condenser

FLUID MECHANICS

F. Properties of Fluids

- definition of terms
- density, specific weight, buoyancy
- compressibility, bulk modulus of elasticity
- viscosity
- vapor pressure
- surface tension

G. Fluid Statics

- pressure; manometry; static head
- principles of hydraulics
- behavior of real gases, vapors
- relationships of pressure, temperature, and volume for liquids
- principle of convection

H. Fluid Dynamics

- flow concepts and characteristics: laminar, turbulent, rotational, streamline, velocity head
- relationships of flow regime to average velocity and viscosity
- Bernoulli's Principle for compressible and incompressible fluids
- fluid friction; head loss; orifices
- flow measurement theory and devices
- two-phase flow

I. Applications of Fluid Mechanics

- pumps: NPSH, cavitation, dead head, efficiency
- positive displacement pumps: characteristics curves
- centrifugal pumps: characteristics curves, operating point
- air ejectors; eductors; jet pumps
- reactor coolant system: recirculation, natural circulation, flow oscillations
- turbines; moisture separators; steam generators
- throttle valves
- gas binding
- water hammer; pressure spikes

NUCLEAR OPERATOR TRAINING PROGRAM
CORE DAMAGE MITIGATION MODULE
TOPICAL OUTLINE

A. Core Cooling Mechanics

- various means available for cooling the core to prevent degradation
- choosing the most effective methods for specific plant conditions

B. Potentially Damaging Operating Conditions

- recognition of operating conditions under which the plant is most vulnerable to multiple failures

C. Binding

- symptoms, probable causes, and effects on core cooling capability of steam/gas binding

D. Recognizing Core Damage

- methods to quickly ascertain whether significant core damage has occurred, including analysis of offgas and coolant chemistry, and use of nuclear and temperature instrumentation.

E. Hydrogen Hazards During Severe Accidents

- sources of hydrogen and oxygen within the primary system and containment
- hazardous concentration ranges of explosive and flammable mixtures of hydrogen and oxygen
- means of concentration measurement and control for hydrogen and oxygen

F. Monitoring Critical Parameters During Accident Conditions

- factors that affect the reliability and potential failure of instrumentation associated with critical parameters

- probable failure modes and degree of accurancy of critical instrumentation exposed to an accident environment (including loss of instrument power)

- alternative means of determining parameter values in the event of instrument failures

G. Radiation Hazards and Radiation Monitor Response

- radiation hazards associated with a damaged core

- effects of an accident environment on radiation monitoring systems

- alternate means of estimating radiation levels within the containment

H. Criteria for Operation and Cooling Mode Selection

- factors and hazards to be considered in selecting a core cooling mode

- emergency procedures and bases for specific actions