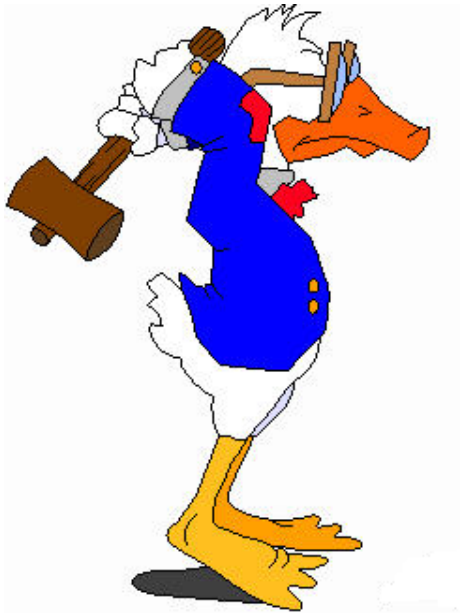
U.S.NRC

United States Nuclear Regulatory Commission

Protecting People and the Environment

Core Damaging Events



HRTD

Human Resources

Training & Development

Objectives

1. State how the following parameters respond to a stuck-open pilot-operated relief valve (PORV) following a reactor trip from 100% power:
   - PORV tail-pipe temperature
   - Reactor coolant system pressure
   - Pressurizer level
   - Reactor vessel level

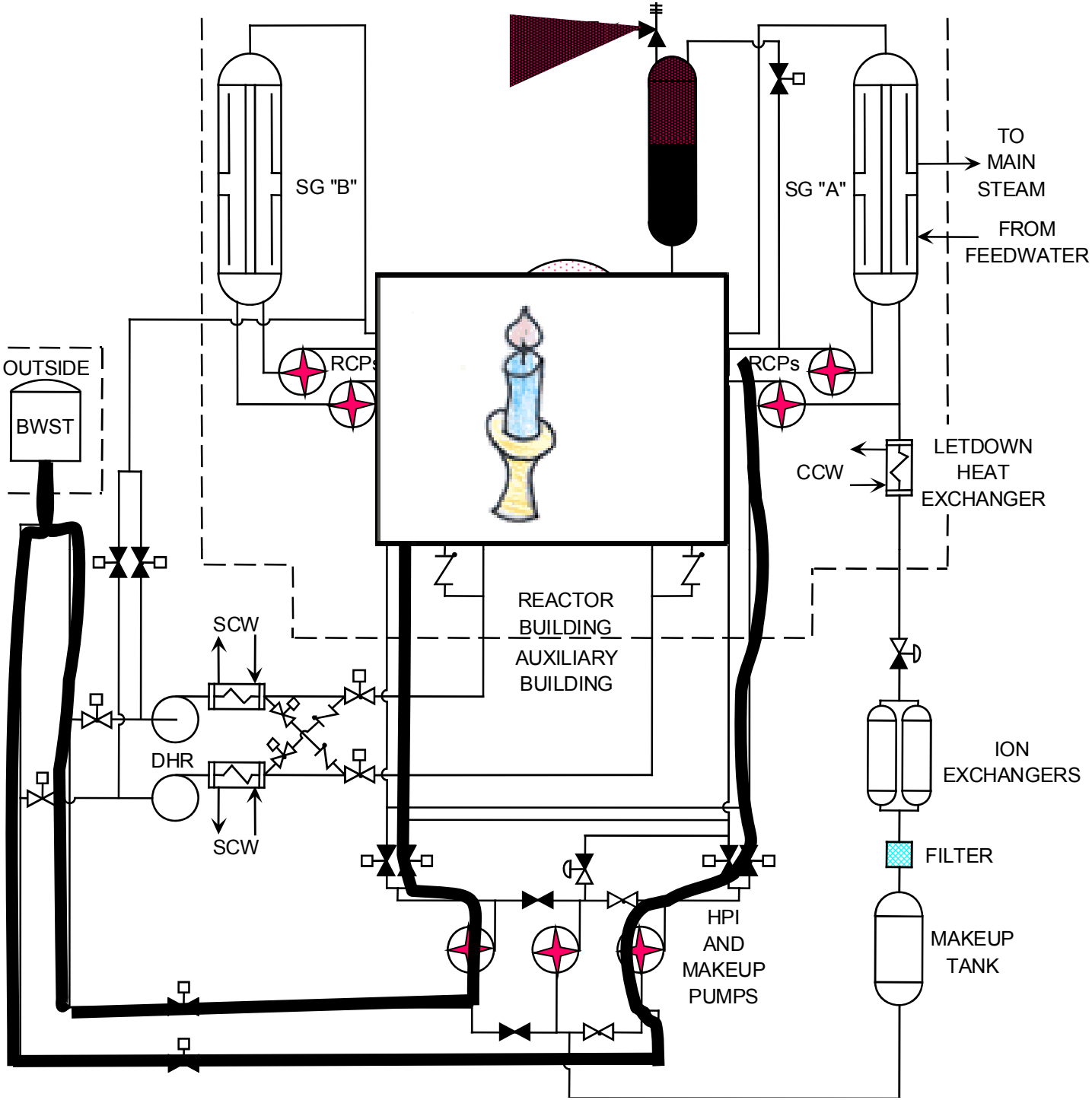
Objectives

2. State the significance of superheated conditions in the reactor coolant system.
3. State the key operator errors that contributed to core damage during the Three Mile Island (TMI) accident.
4. Describe the event that initiated the core damage sequence at TMI.
5. Discuss industry and regulatory changes that resulted from the accident at TMI.
6. Describe the differences in technology that make U.S. commercial reactors not susceptible to an event similar to the Chernobyl accident.

Core Damaging Events

- Three Mile Island Accident

- Chernobyl Accident


SG "B"
SG "A"
TO
MAIN
STEAM
FROM
FEEDWATER
OUTSIDE
BWST
RCPs
RCPs
CCW
LETDOWN
HEAT
EXCHANGER
REACTOR
BUILDING
AUXILIARY
BUILDING
SCW
DHR
SCW
ION
EXCHANGERS
FILTER
MAKEUP
TANK
HPI
AND
MAKEUP
PUMPS

Accident Contributors

- Equipment failure
- Poor design
- Personnnel error

Equipment Failure

- PORV failed to close as required

Poor Design

- PORV position indication
- Poor human factors
- No reactor vessel level indication

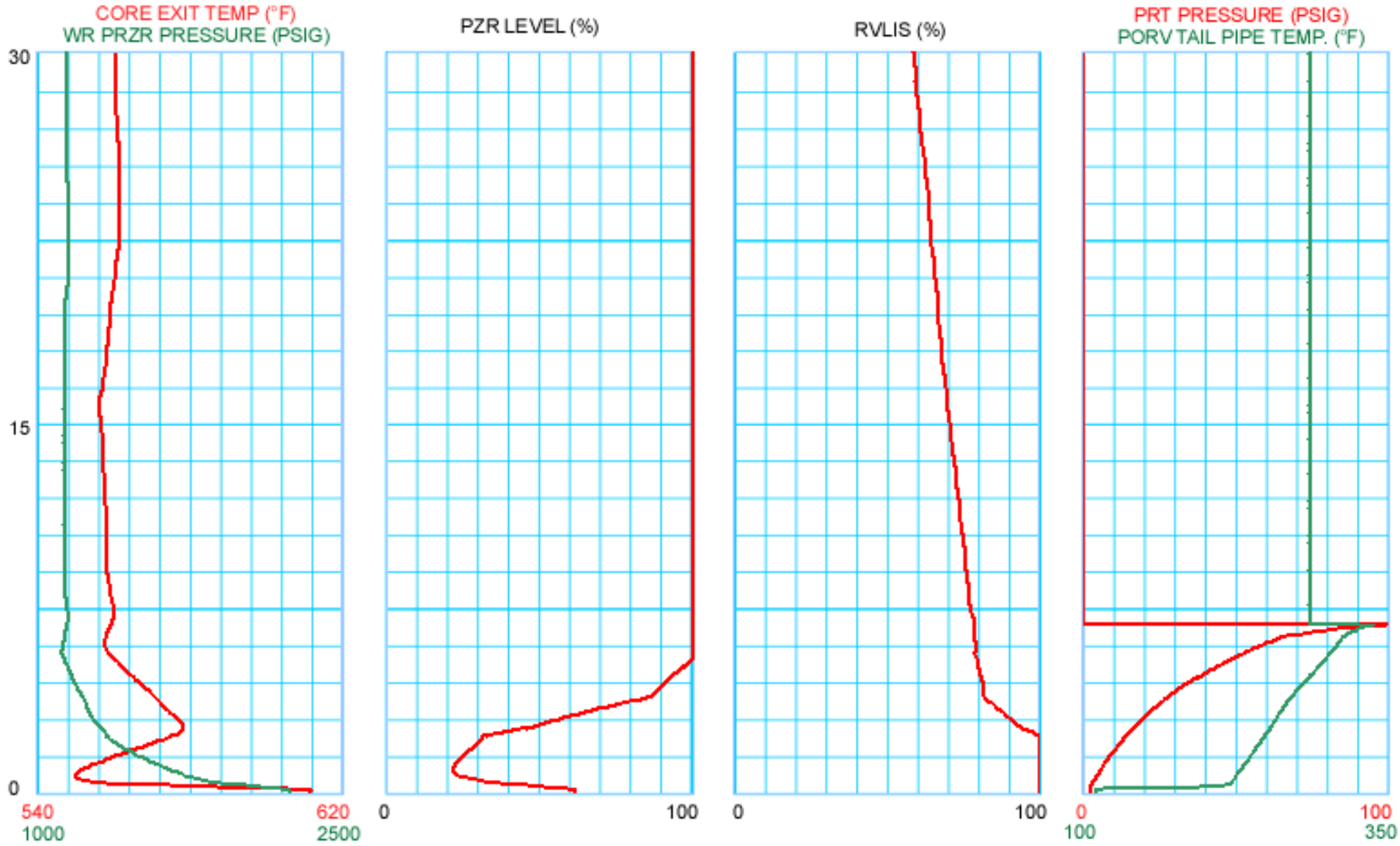
Personnel Error

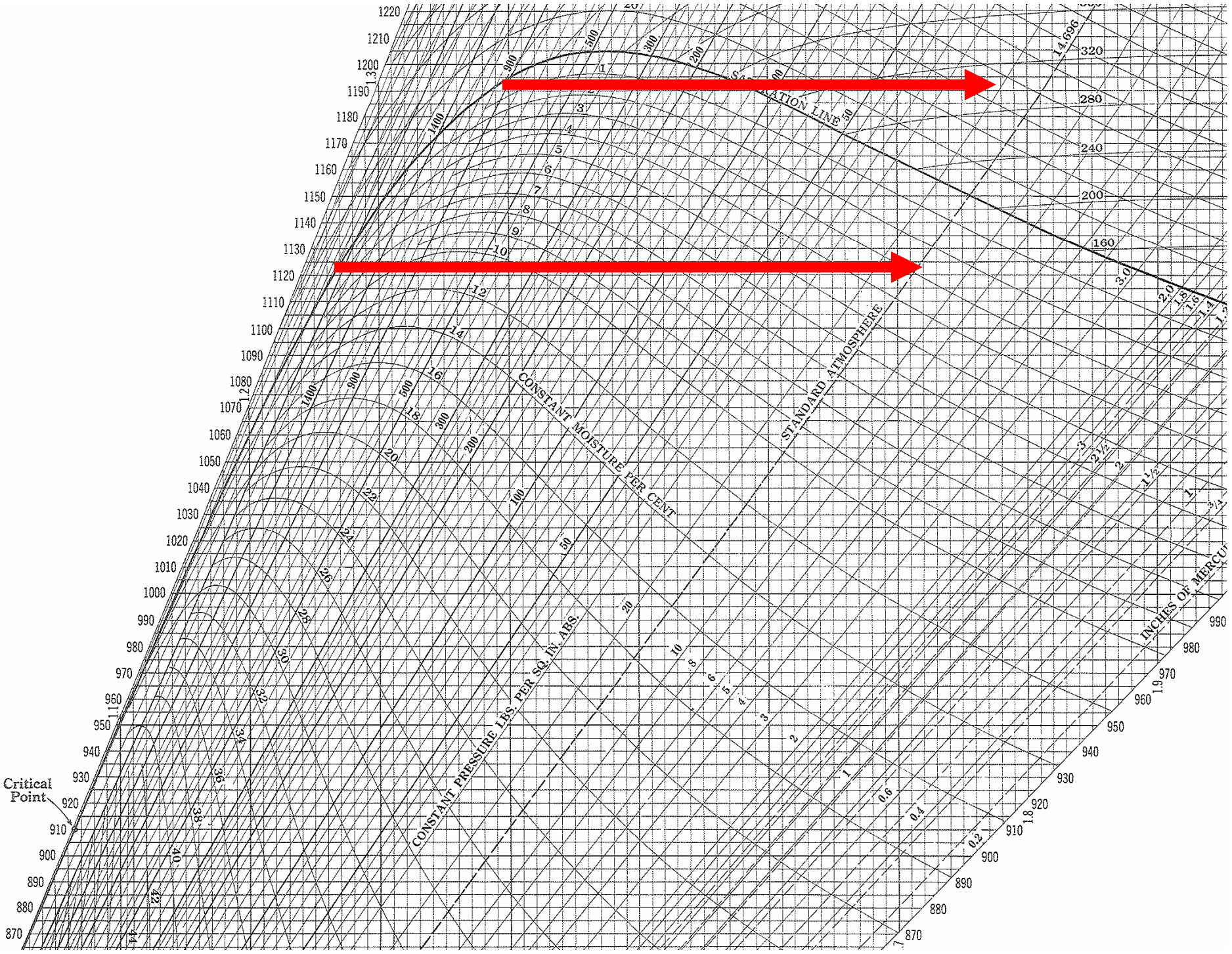
- Failed to isolate the open PORV
- Reduced makeup flow in response to PZR level

Common Sense vs. Uncommon Sense

- Pressurizer level
- PORV tail pipe temperature

Plant Response to Open PORV

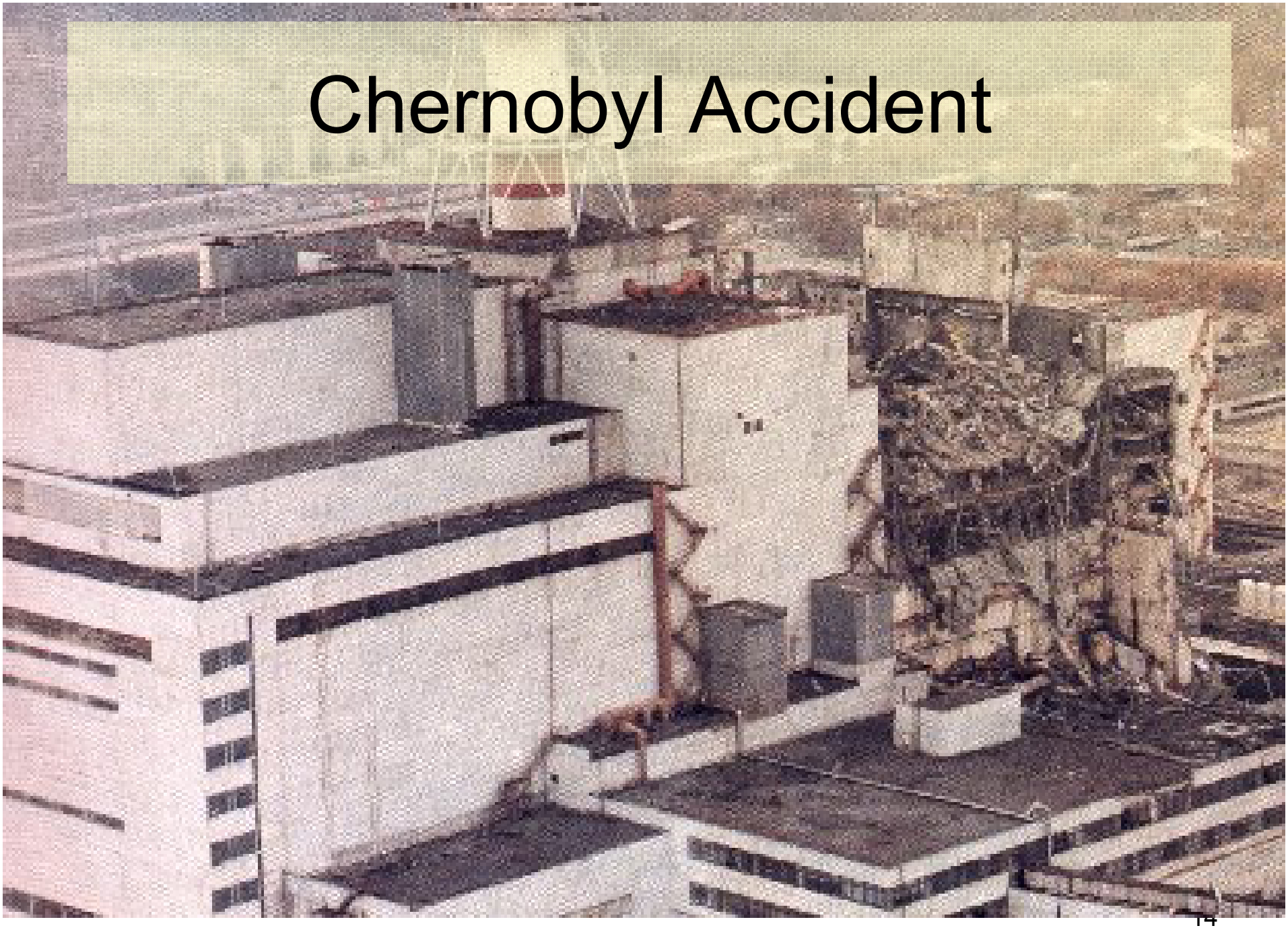


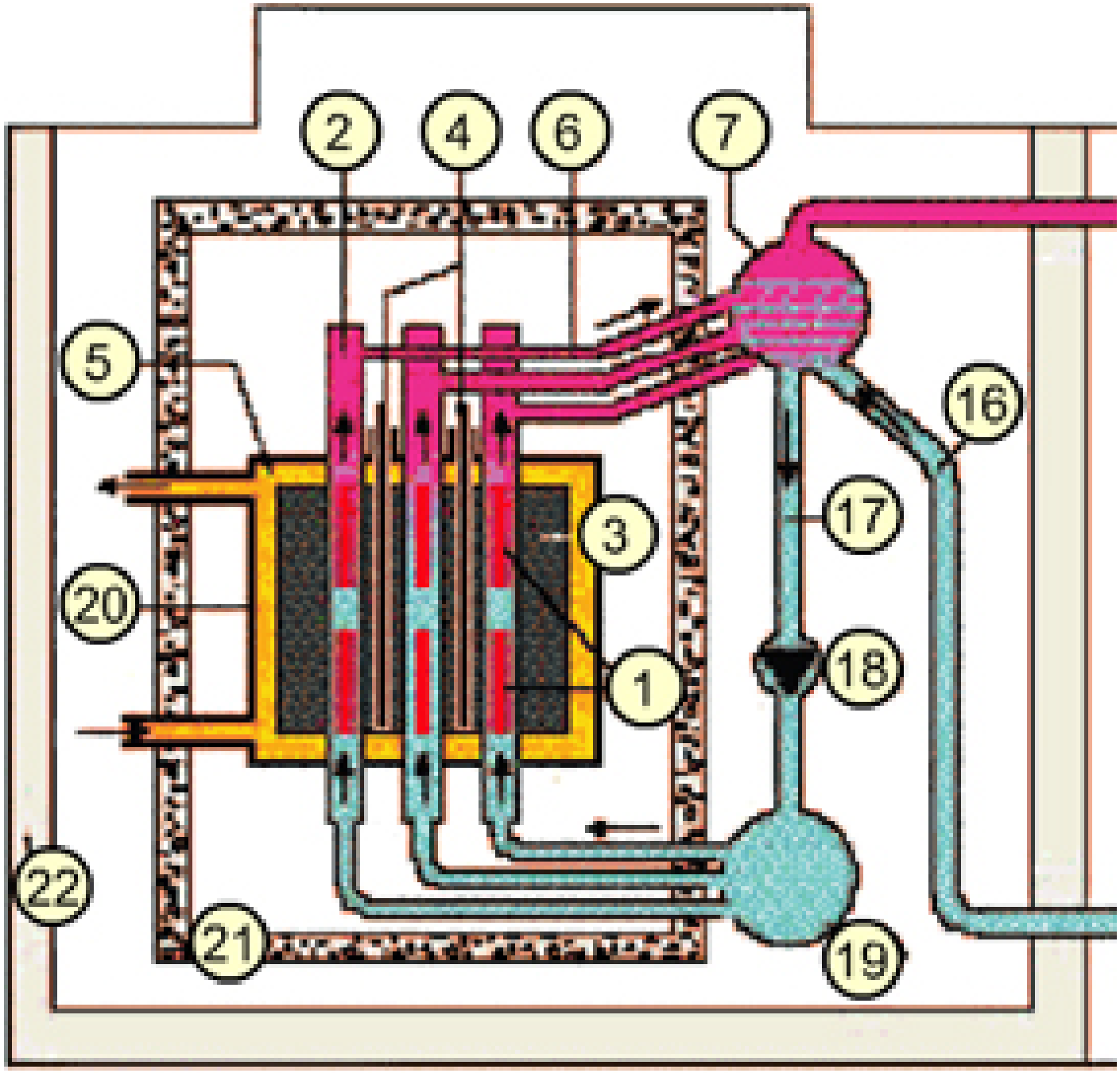

CONSTANT PRESSURE LBS. PER SQ. IN. ABS.
CONSTANT MOISTURE PER CENT
STANDARD ATMOSPHERE
INCHES OF MERCU
Critical Point

Industry and Regulatory Response to TMI accident

- INPO
- Operator training and examination
- EOPs
- E-Plan
- NUREG-0737, “Clarification of TMI Action Plan Requirements”

Chernobyl Accident




2
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19

RBMK-1000

- Graphite moderated
- Boiling water reactor
- Positive void coefficient (water is a poison)
- Total power coefficient usually negative

Transient

- Partial loss of flow (test) with positive power coefficient
- Voiding causes prompt criticality
- Two power peaks – 11,000% and 47,000% of RTP
- Core becomes a large burning crater
- 30 individual fires where graphite was spewed

Why this accident is not possible at U.S. reactors.

- Graphite moderation (moderation continues when coolant leaves)
- Positive void coefficient
- No containment building

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