

FUKUSHIMA DAI-ICHI UNITS 1-6

OBJECTIVES (NOT TESTABLE)

- Recognize the sequence of events that led to fuel damage
- Recognize the consequences of key system failures resulting from the extended station blackout.
- Review the NRC task force recommendations resulting from the event.

IMPORTANT TO REMEMBER

AT THE TIME OF THE NRC'S INITIAL RESPONSE, THE JAPANESE GOVERNMENT AND THE U.S. EMBASSY WERE DEALING WITH:

- An estimated 25,000 foreign and domestic citizens missing or deceased (Latest estimates in Dec. 2011 state 22,000 deceased)
- 250 miles of coastline inundated up to 6 miles inland by a tsunami as high as 125 feet.
- Devastated infrastructure (roads, power, telephone, water, fuel, etc.)

IMPORTANT TO REMEMBER

THEN ON TOP OF THAT, FUKUSHIMA DAI-ICHI, A SIX UNIT NUCLEAR POWER PLANT EXPERIENCED:

- An extended station blackout scenario.
- Limited access due to miles of roadway damage and/or debris.
- Limited communication capability due to infrastructure devastation.
- Hydrogen explosions
- Leaking radioactive debris to the countryside.

THE AFTERMATH



**Over 1,300 Homes
Destroyed**

**Death Toll to
Exceed 10,000
785 Confirmed
Dead**



**Town Destroyed
(Rikuzentakata)**



**Over 1,800
Homes Destroyed**

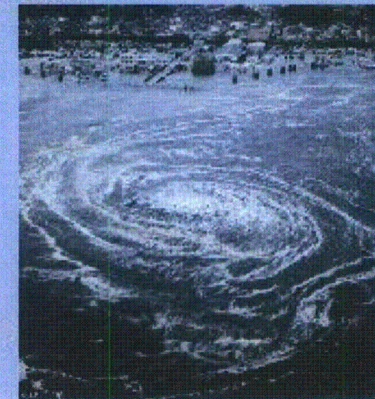
JAPAN



**Epicentre 8.9
Magnitude Quake
11/03/11 2:47PM
Local Time**

**Fukushima
Plant
Explosions
210,000 Evacuated**

**Millions Stranded
in Friday's Subway Shutdown**



INITIAL NRC RESPONSE

- The event timeline started at 1446 JST (0046 EST) on 11 March 2011.
- The NRC Headquarters Operations Center (HOC) entered the Monitoring Mode at 0946 EST:
- The NRC staff population was canvassed for the availability of a multi-disciplinary team to provide support requested by the U.S. Ambassador in Japan.
- The First team of NRC technical experts was dispatched to Tokyo on March 12th.
- The HOC coordinated data gathering, support requests from the Tokyo Team, and providing information to various U.S. Agencies.

MISSION STATEMENT USNRC SUPPORT TO USAID

ORIGINAL MISSION DATED 14 MARCH, 2011:

To support the efforts by the U.S. Embassy in Japan to provide technical assistance to help assess and mitigate the impacts of the March 11, 2011, earthquake and tsunami on Japan's nuclear facilities.

INTEGRAL TO THE MISSION STATEMENT:

Maintain communications with the Japanese and U.S. organizations, as necessary to:

- provide, when asked, authorized U.S. technical advice and support.
- enhance U.S. understanding of the situation on the ground.
- obtain an understanding of the potential radiological impact on people and the environment.

INITIAL NRC RESPONSE

- The Tokyo team:

- Integrated into periodic (government and other agency) meetings to gather information related to support needs.
- Maintained communications with the NRC HOC and briefed the Commission on response status.
- Provided assistance to the U.S. Ambassador, the Japanese, and other U.S. Agencies regarding the design and condition of the units.
- Coordinated developing, gathering and delivering support needs such as:
 - Environmental monitoring and impact assessment.
 - Initial delivery of military jetpumps for fuel cooling.
 - Conceptual description of a more permanent pumping system and placing it into use.
 - Communicating radiological consumable needs to the U.S. industry.

LATER RESPONDERS

- Continued to provide dose assessment and environmental impact support.
- Supported evaluations of core conditions and adverse impacts of contaminant introduction.
- Obtained an understanding of the potential radiological impacts on people and the environment.
- Supported liquid radioactive waste containment issues.
- Collected information to support the NRC domestic response and evaluation.

FUKUSHIMA DAI-ICHI NUCLEAR POWER PLANT

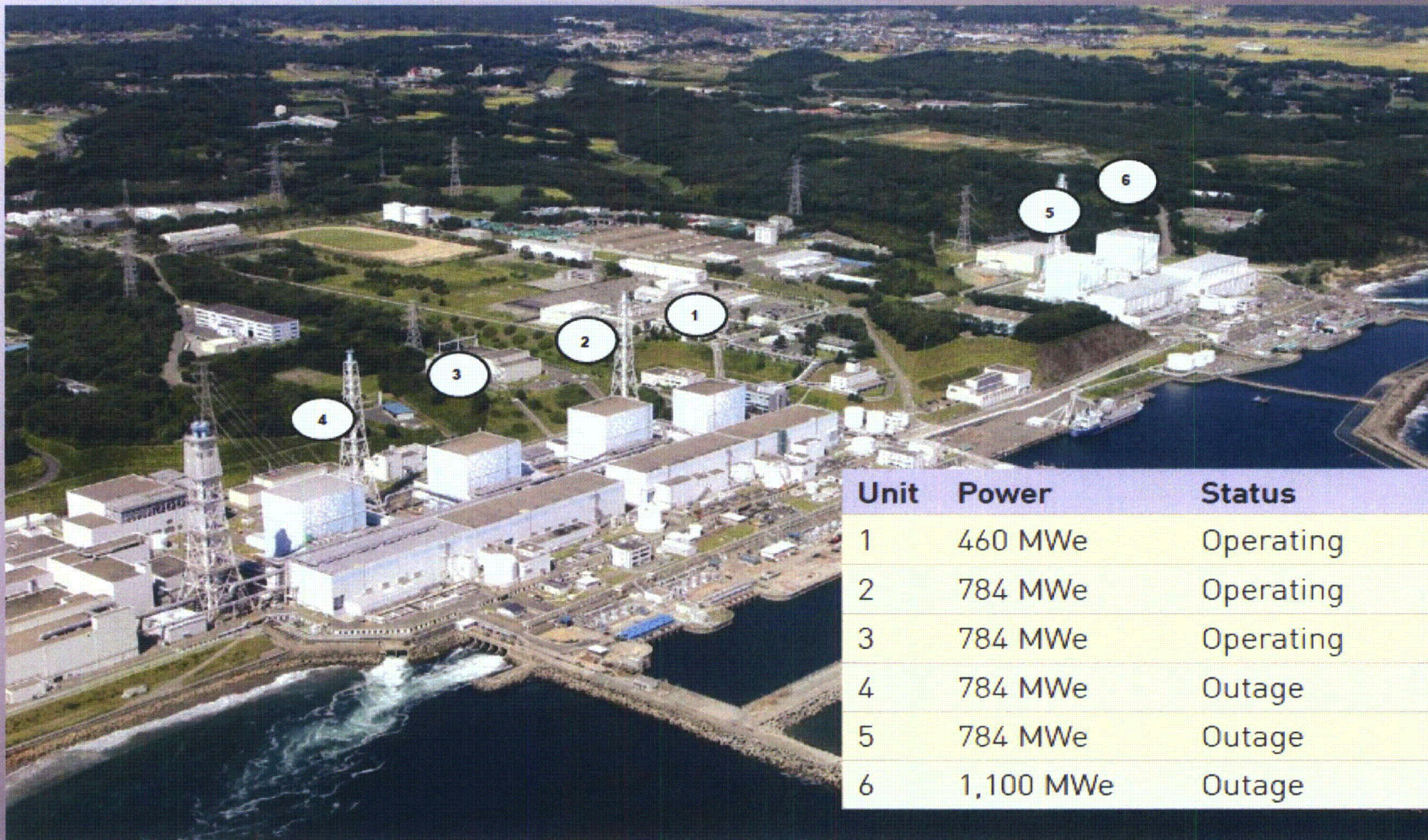
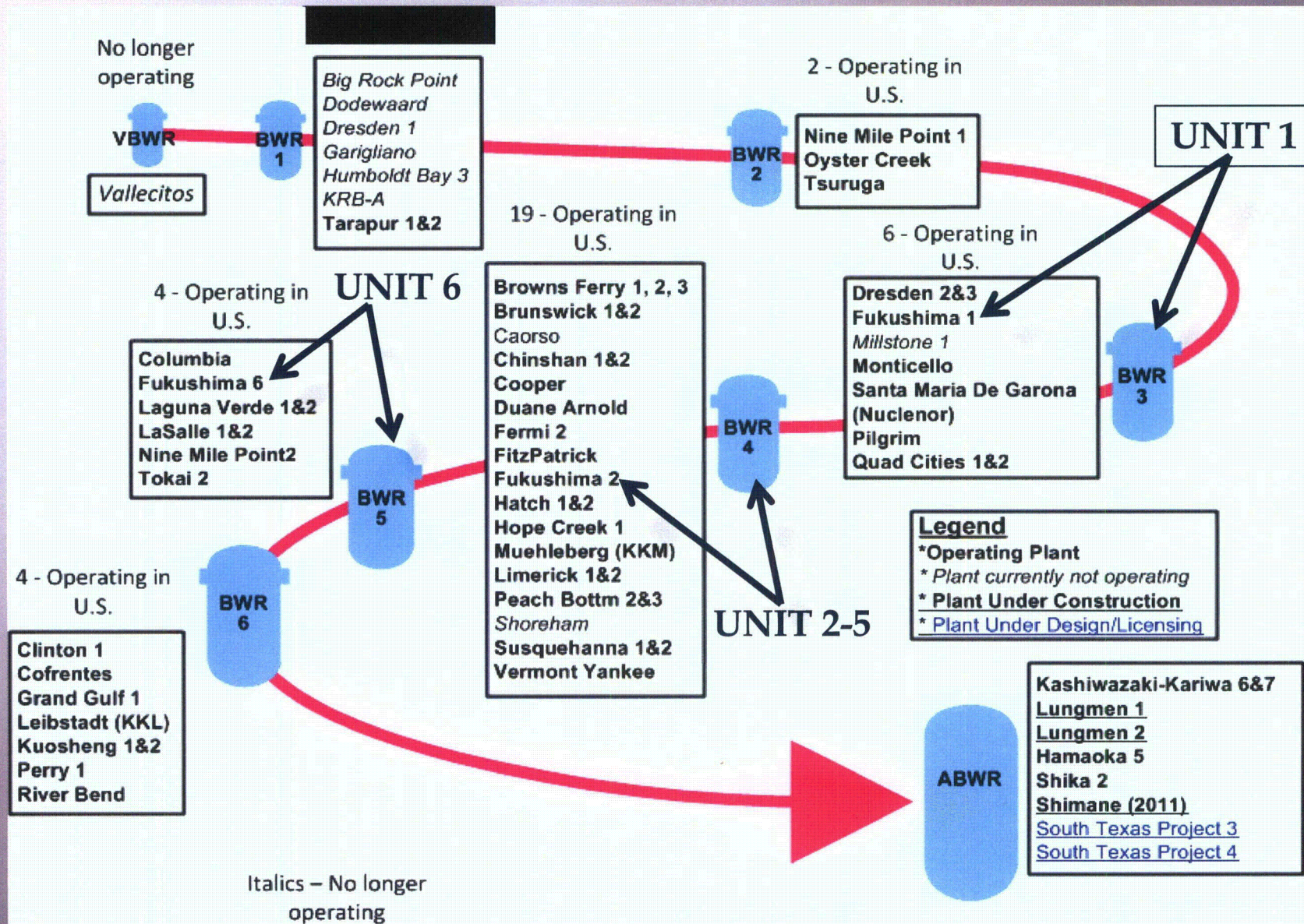
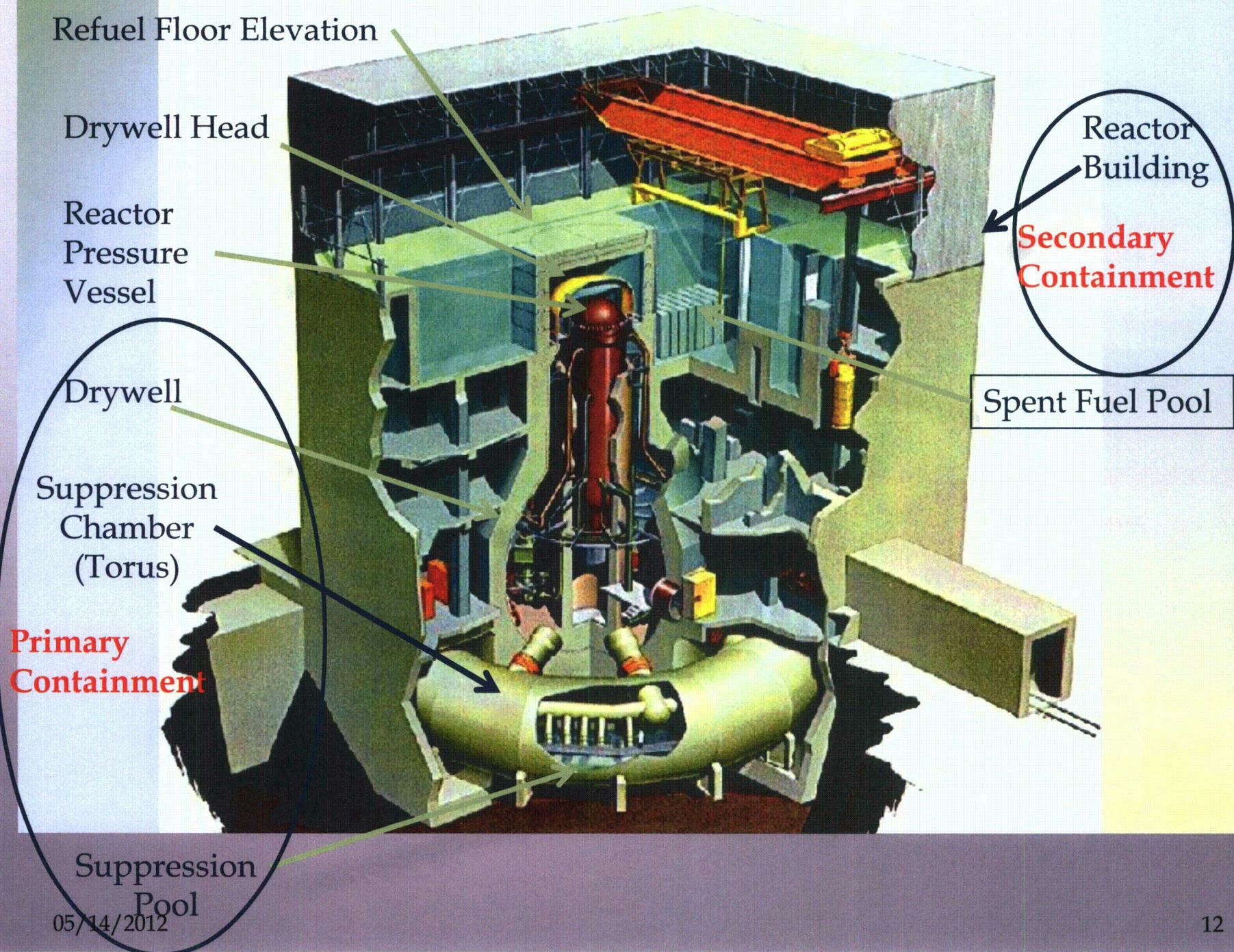
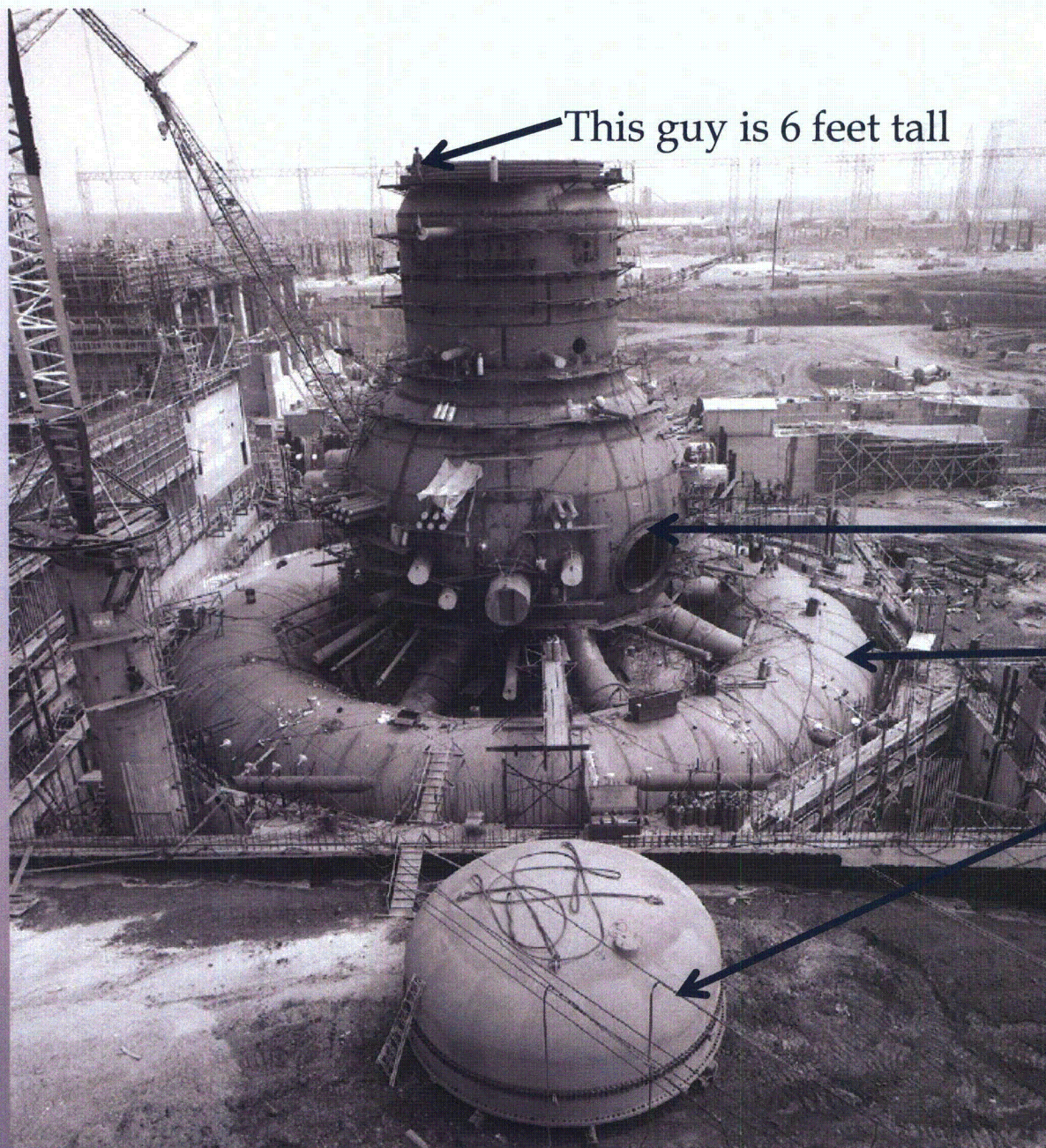


Figure 2: Fukushima Dai-ichi Nuclear Power Plant (status before earthquake)

BWR EVOLUTION







This guy is 6 feet tall

Mark I construction may be either of :

- Free Standing Steel
- Concrete with internal steel liner

Drywell

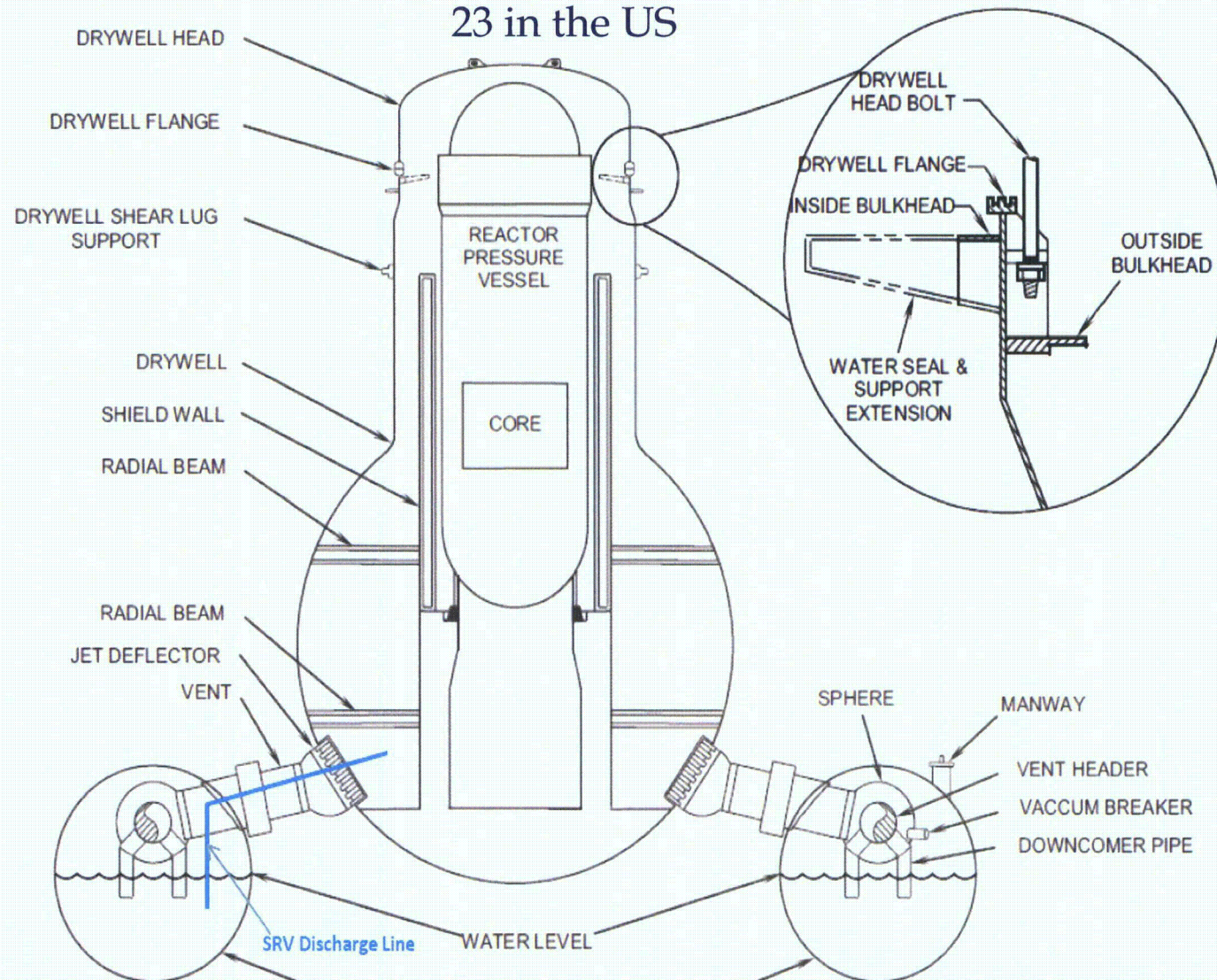
Suppression Chamber (Torus)

Drywell Head

Typical Volumes ~
Drywell: 1.2 Million Gallons
Torus Air: 900,000 Gallons
Torus Water: 800,000 Gallons

TYPICAL BWR MARK 1 CONTAINMENT

23 in the US



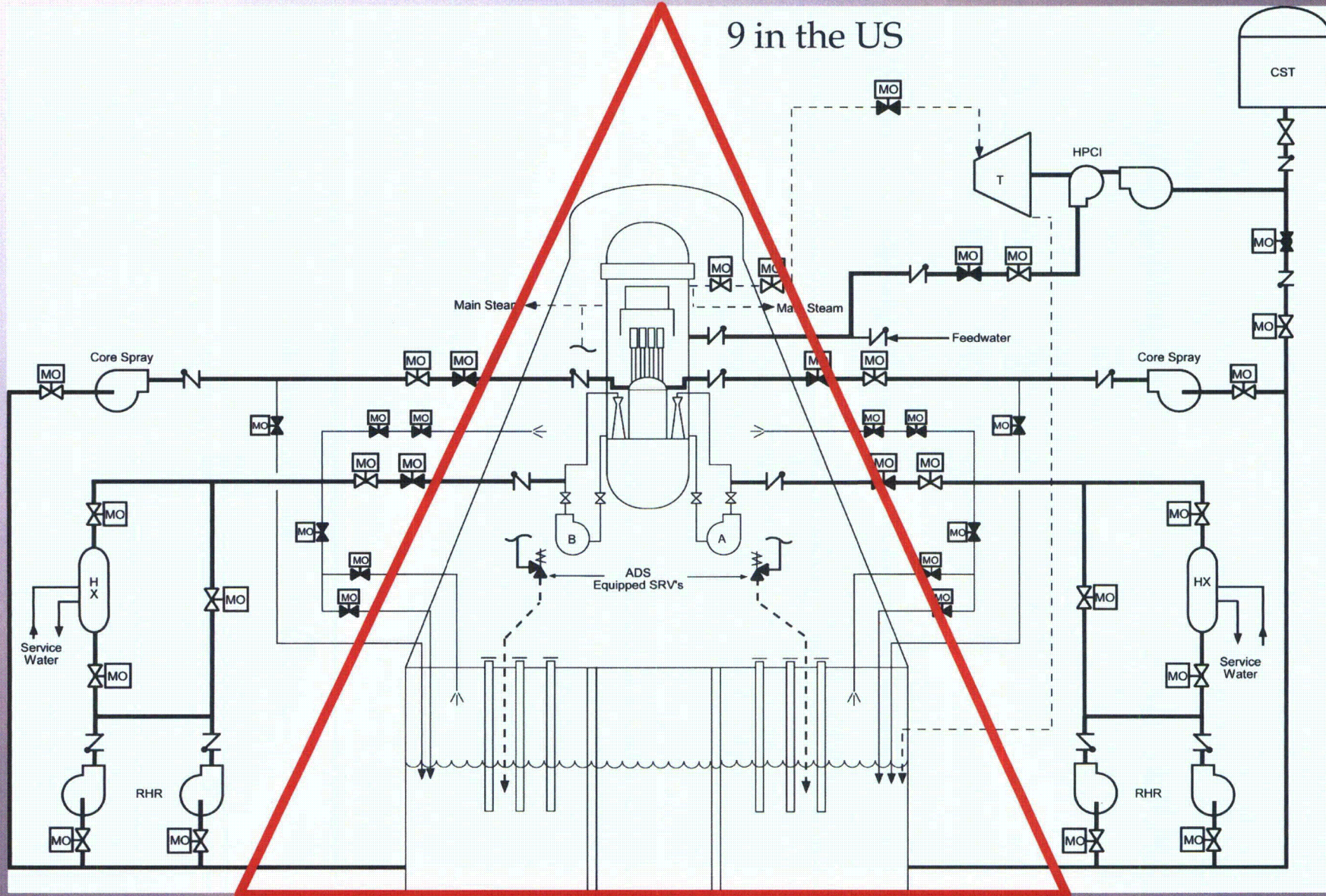
SUPPRESSION CHAMBER
(TORUS)

UNITS 1-5

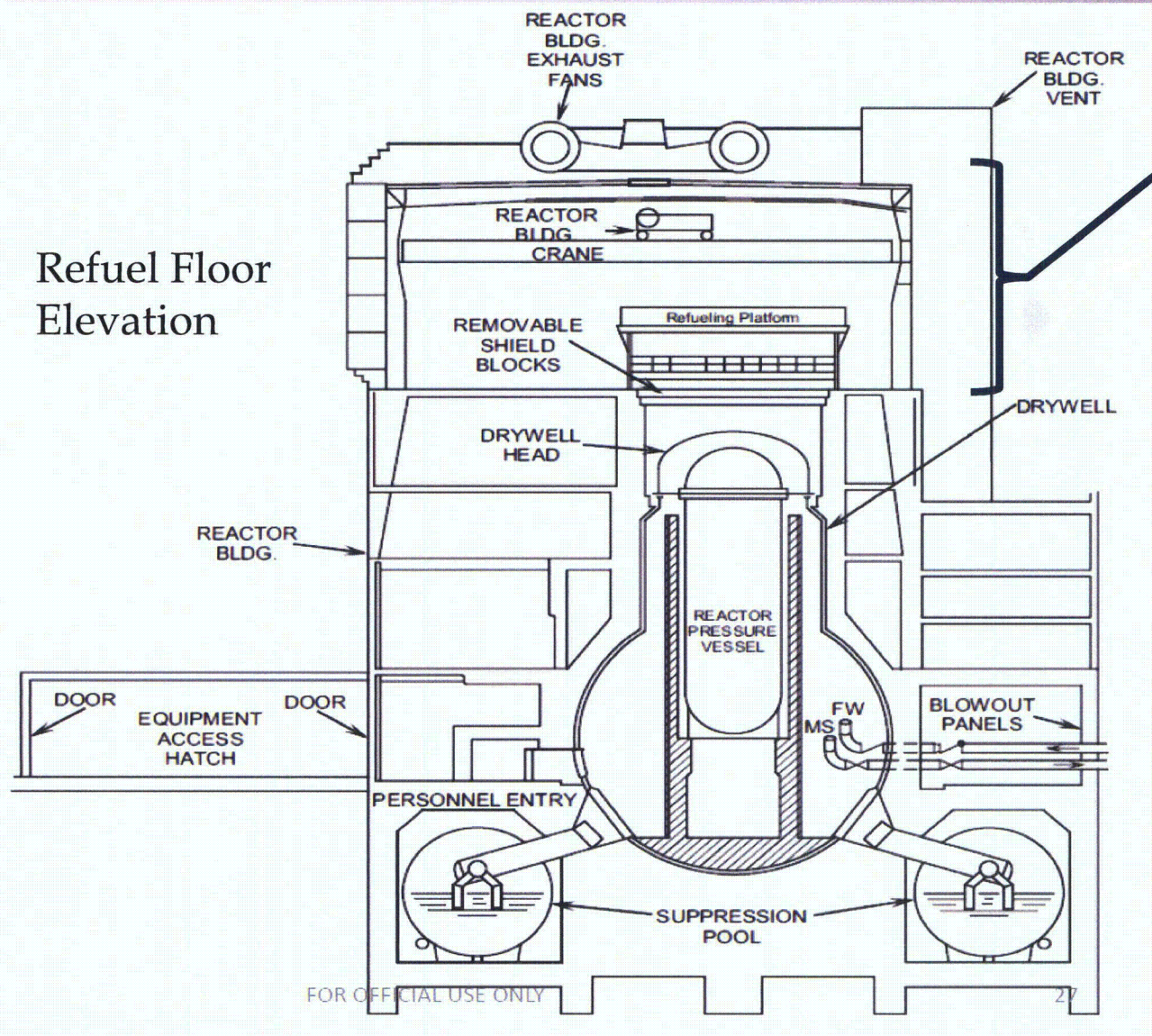
- Pressure Suppression Style
- Nitrogen Inerted Atmosphere
- Floodable to TAF
- Unit 6 is Mark II (next slide)
- All above is the same

MARK II CONTAINMENT

9 in the US



TYPICAL SECONDARY CONTAINMENT REACTOR BUILDING



Refuel Floor
Elevation

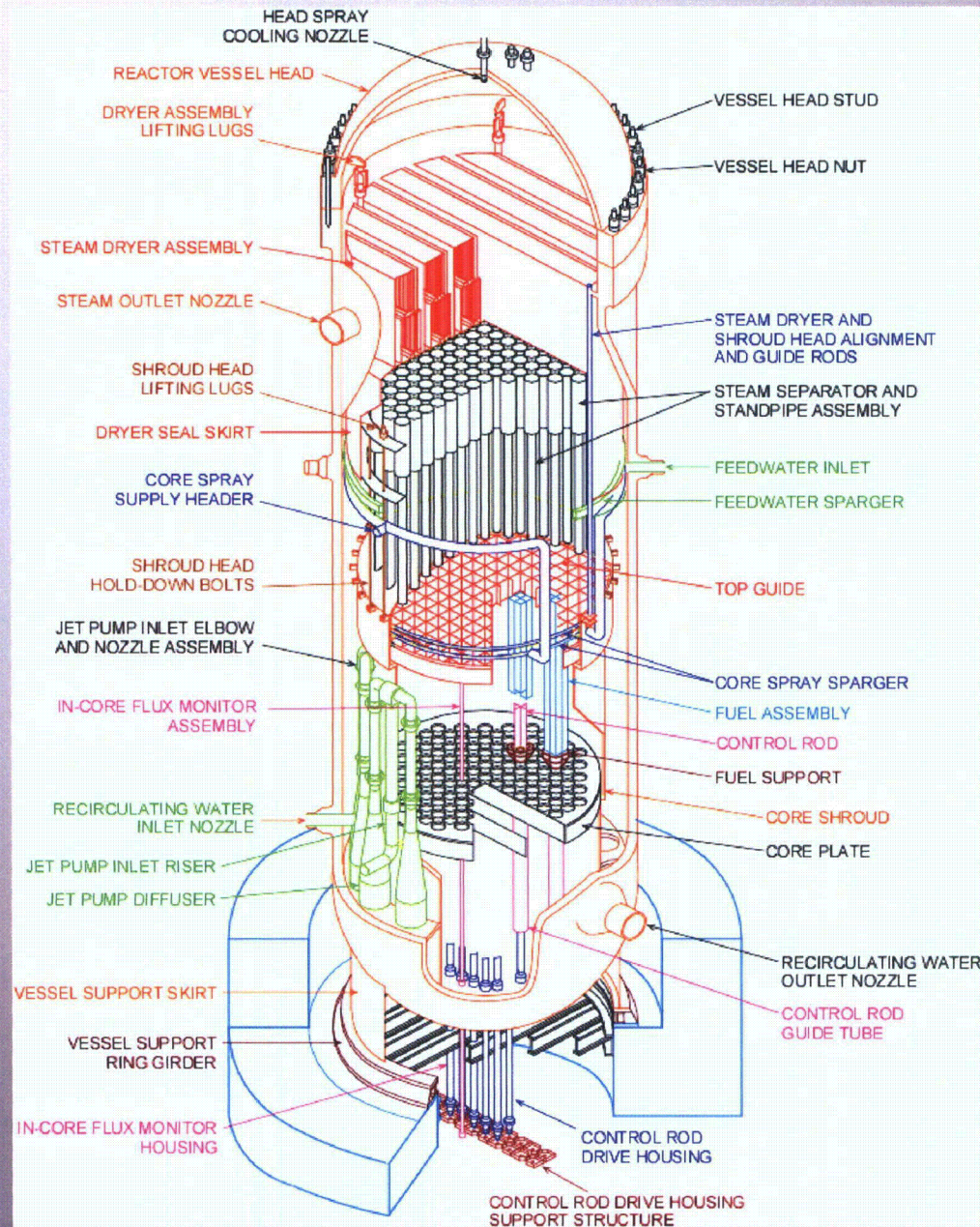
Above the Refuel Floor
Elevation:

- Unit 1 is a metal skeletal structure covered in thin steel siding
- Units 2-4 are fully reinforced concrete

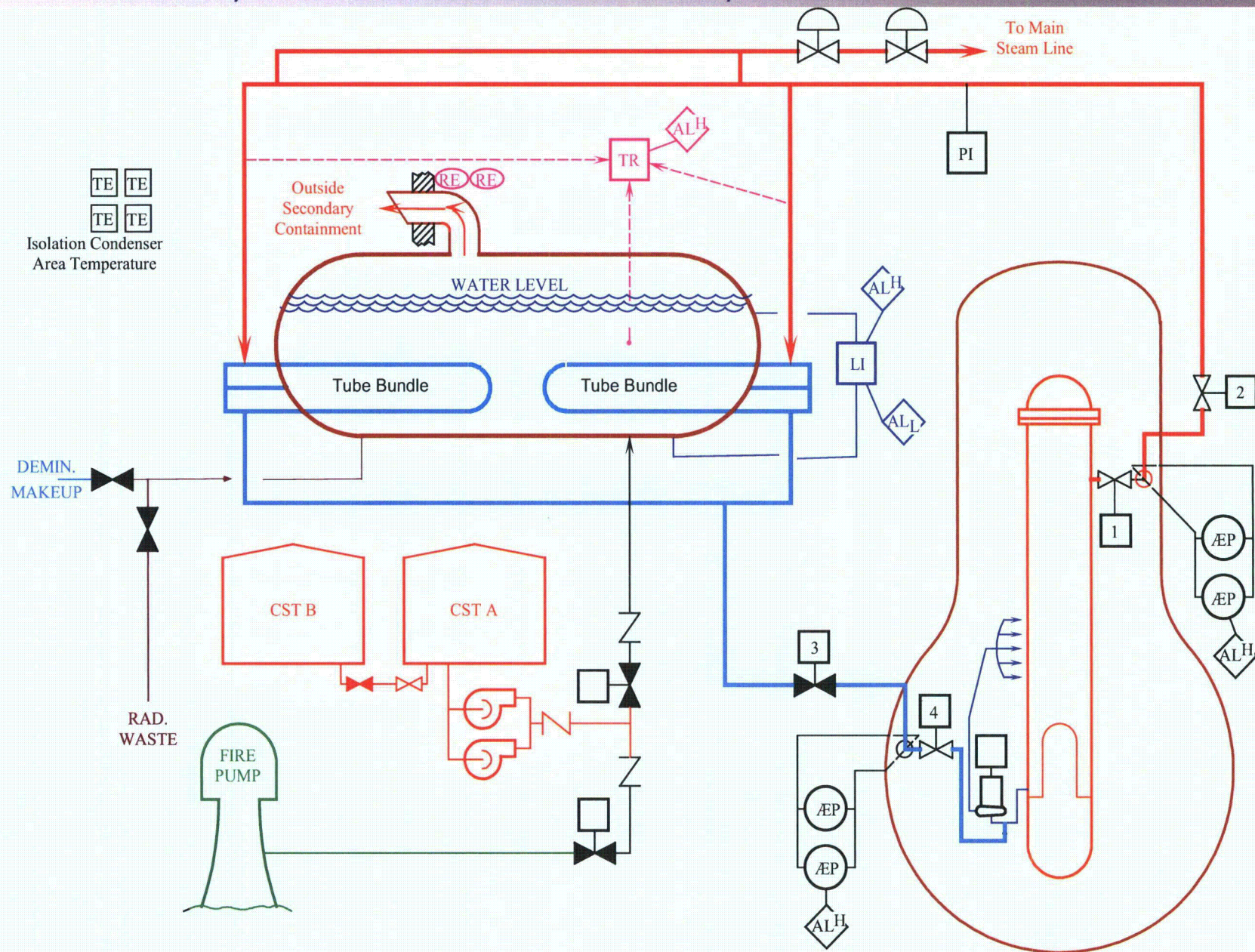
TYPICAL BWR REACTOR PRESSURE VESSEL INTERNALS

RPV DIMENSIONS

- ~ 70 FEET TALL
- ~ 18 FEET INSIDE DIAMETER
- ~ 7 INCH THICK CARBON STEEL



TYPICAL BWR 2/3 DECAY HEAT REMOVAL / CORE COOLING SYSTEMS



6.3-5

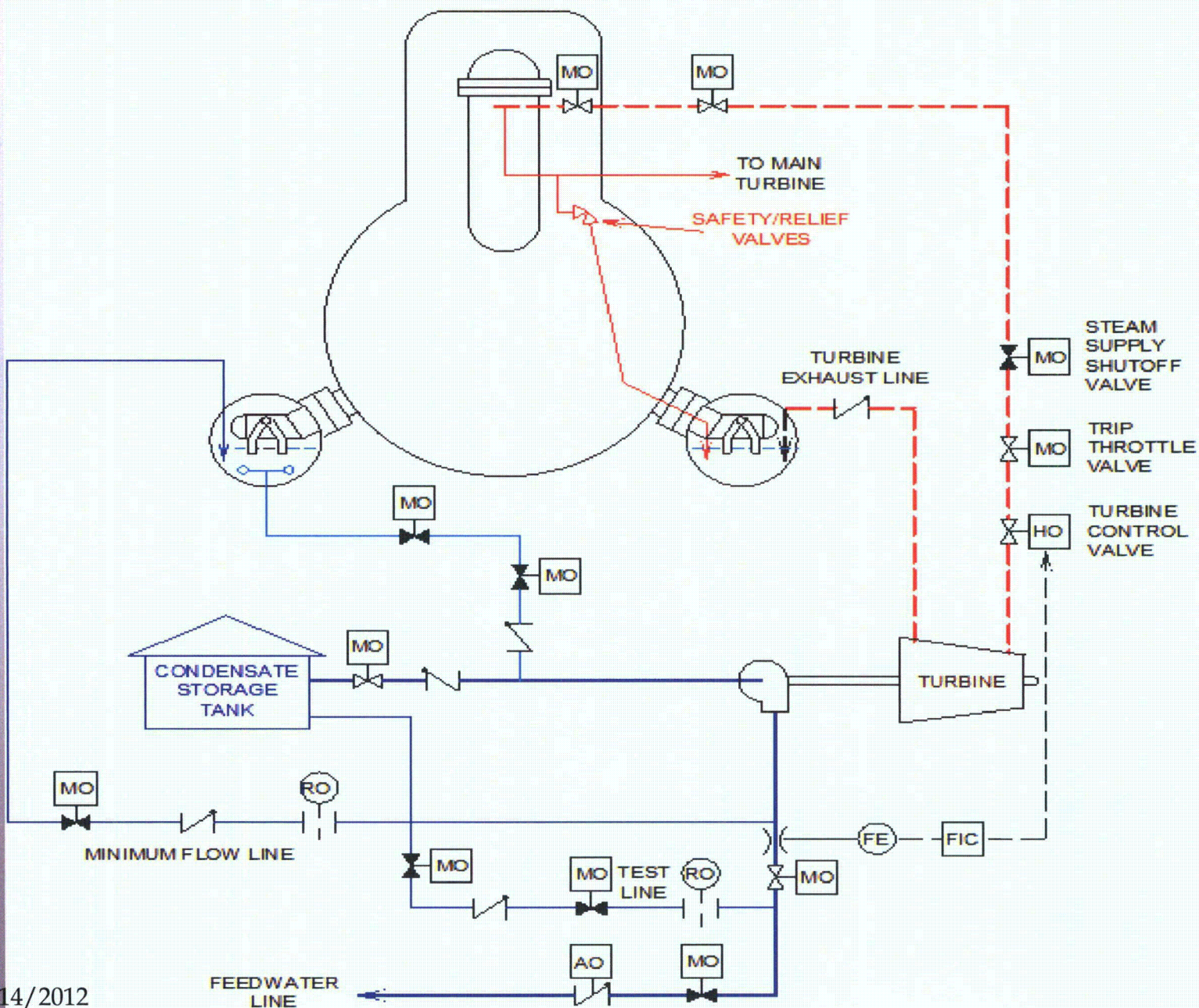
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Figure 6.3-1 Isolation Condenser System (BWR/2/3)

18

497-6

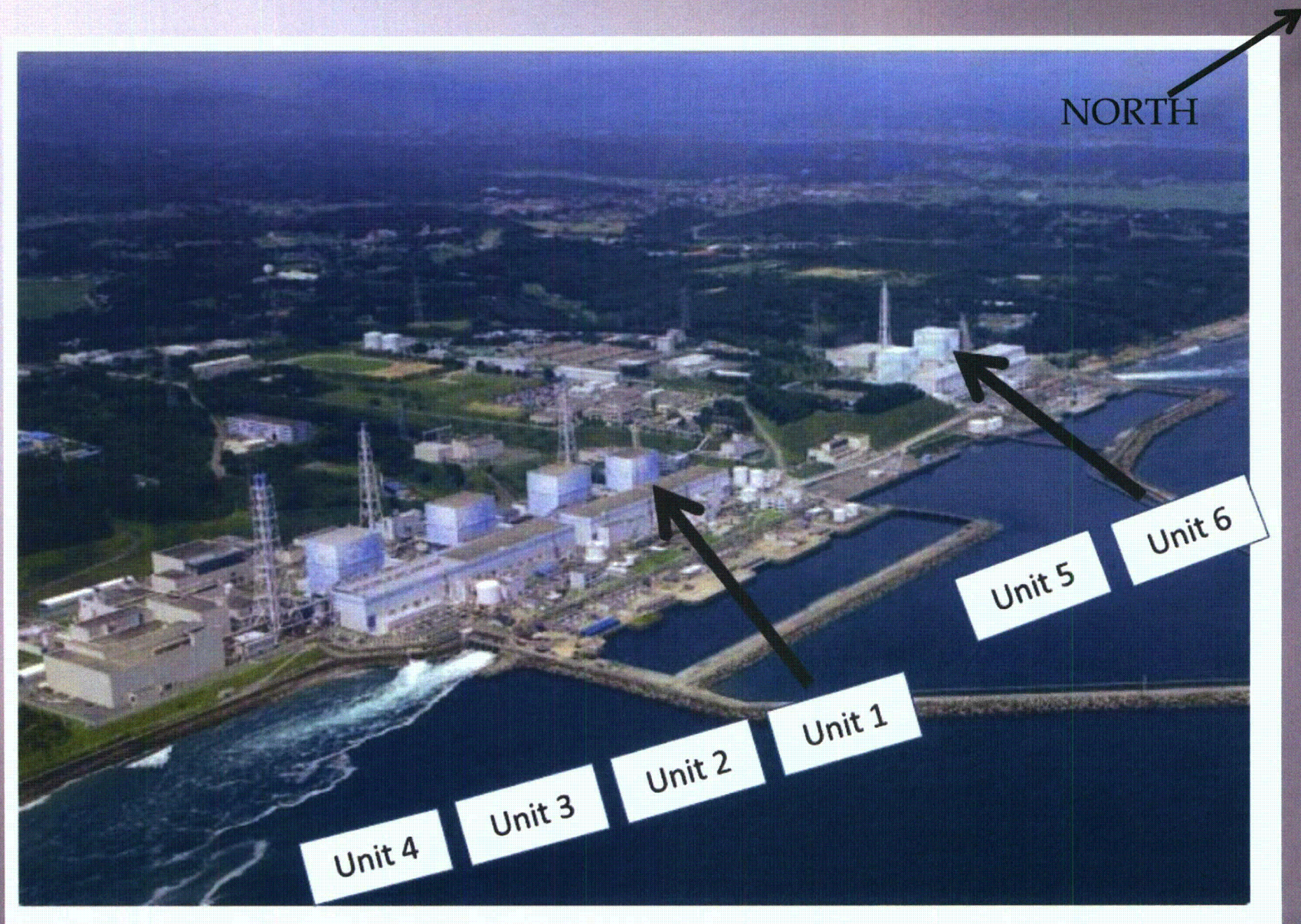
TYPICAL BWR 4 DECAY HEAT REMOVAL / CORE COOLING SYSTEMS



SITE LOCATION



FUKUSHIMA DAI-ICHI SITE BEFORE EVENTS



BASE INFORMATION

	GENERAL ELECTRIC VINTAGE	COMMERCIAL OPERATION	MWth	MWe	FUEL BUNDLES IN CORE	IC or RCIC	STATUS UPON EVENT	FUEL BUNDLES IN SFP
UNIT 1	BWR-3	1971	1380	460	400	IC	FULL POWER	292
UNIT 2	BWR-4	1974	2381	784	548	RCIC	FULL POWER	587
UNIT 3	BWR-4	1976	2381	784	548	RCIC	FULL POWER	514
UNIT 4	BWR-4	1978	2381	784	548	RCIC	OUTAGE	1201 to 1331
UNIT 5	BWR-4	1978	2381	784	548	RCIC	OUTAGE	950
UNIT 6	BWR-5	1979	3293?	1100	764?	RCIC	OUTAGE	876

Note:

- A common spent fuel pool separate from the units contains 6000 bundles
- The site also contains a dry cask storage facility