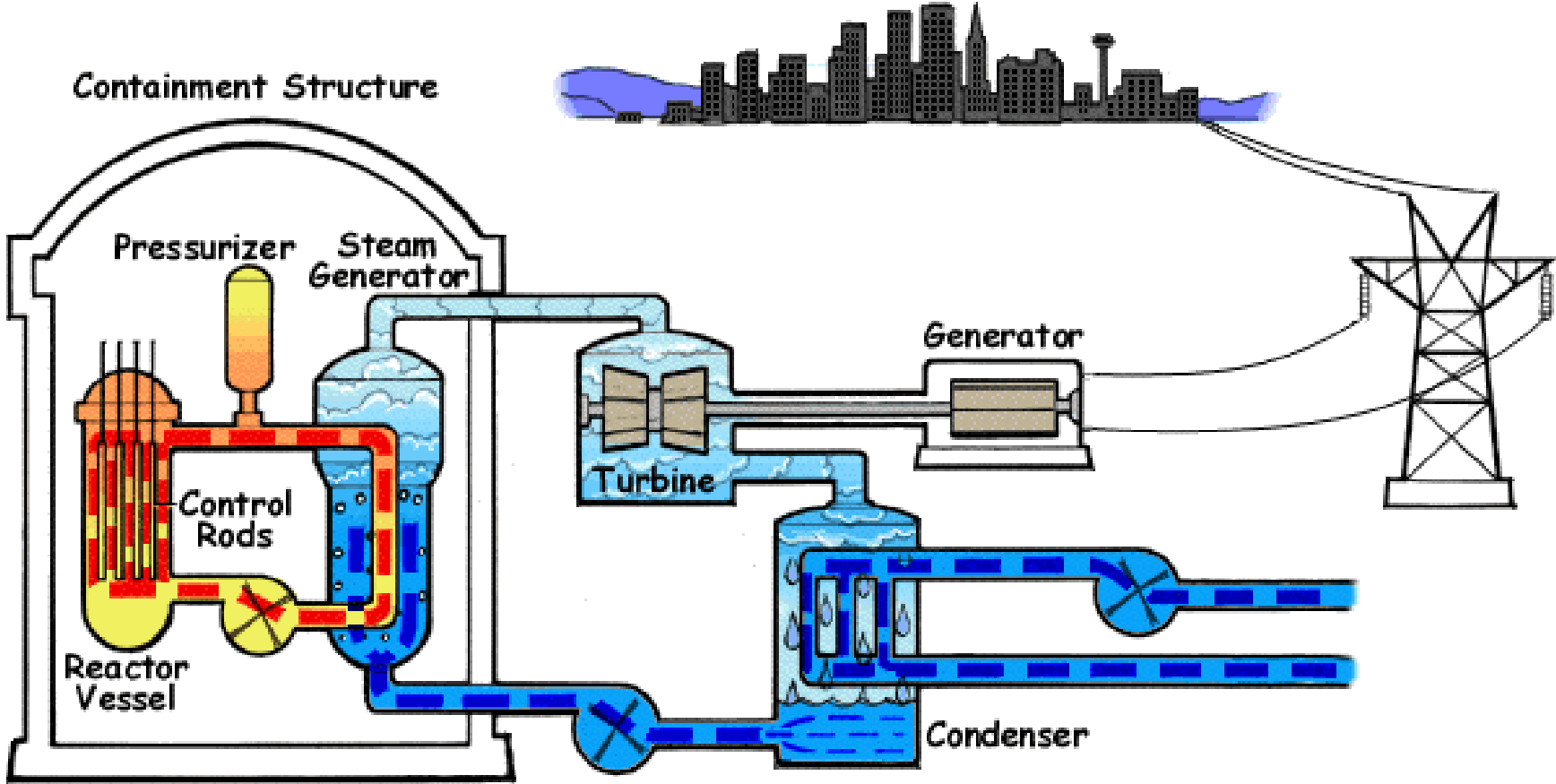


# Introduction to Power Reactor Types

22.312 Lecture 1

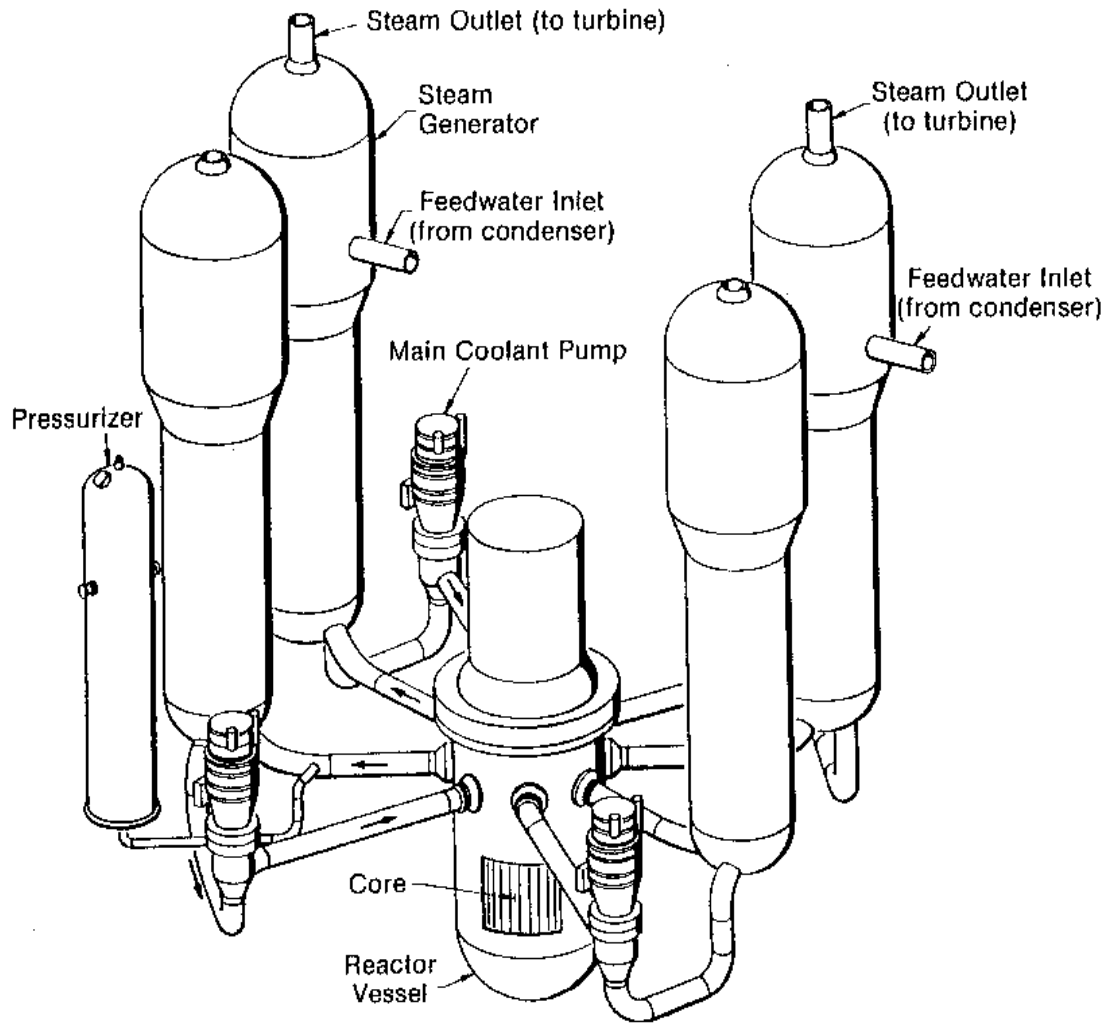
Prof. Jacopo Buongiorno

# Pressurized Water Reactor (PWR)



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# PWR



Primary system for a Westinghouse 4-loop PWR.

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# PWR Vessel, Internals, & Core

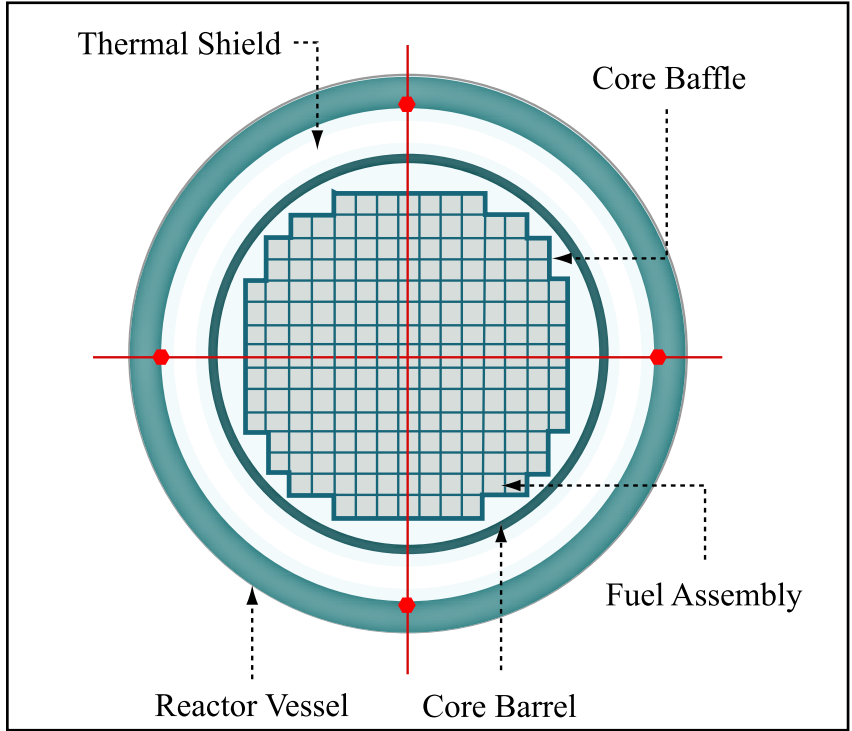
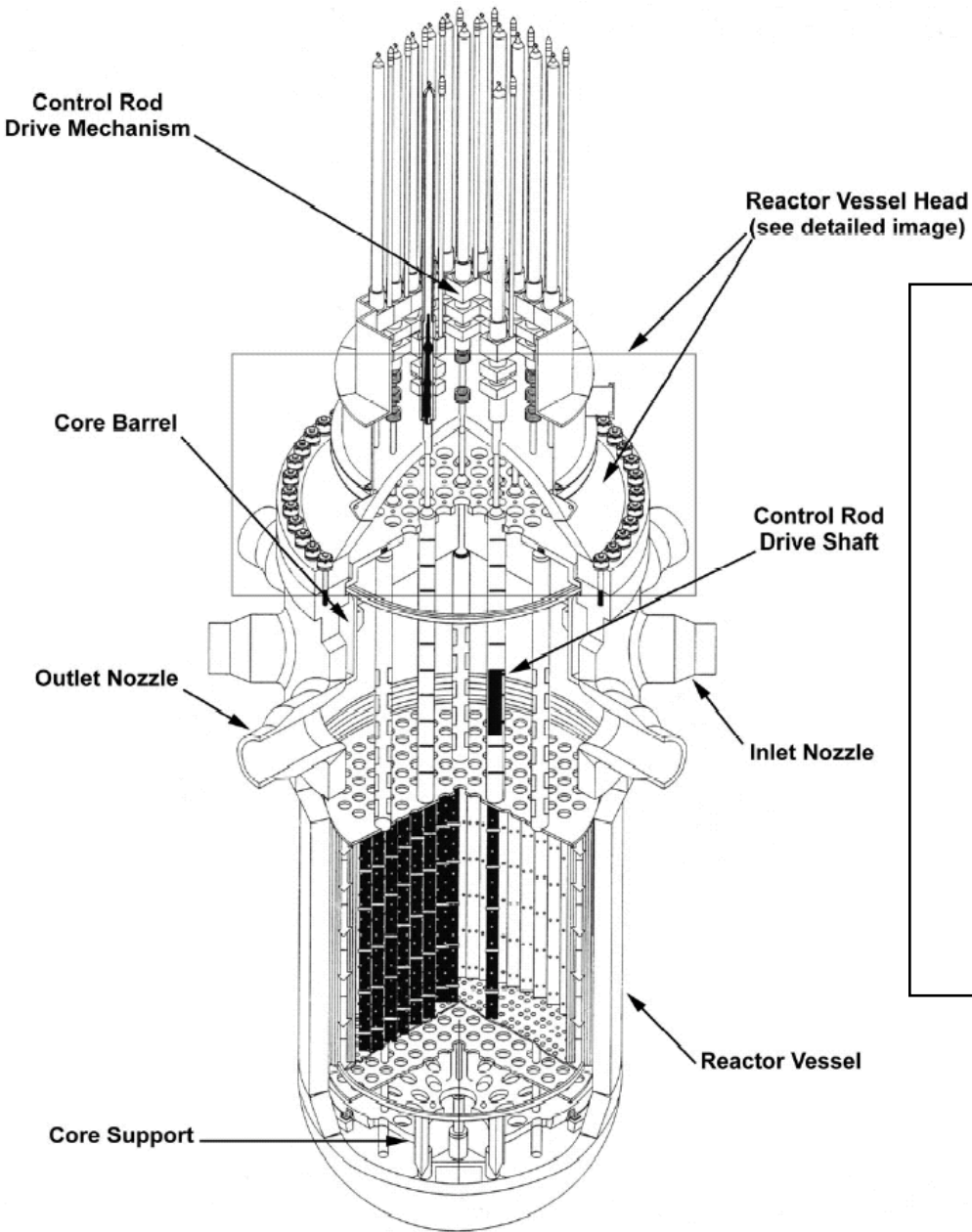
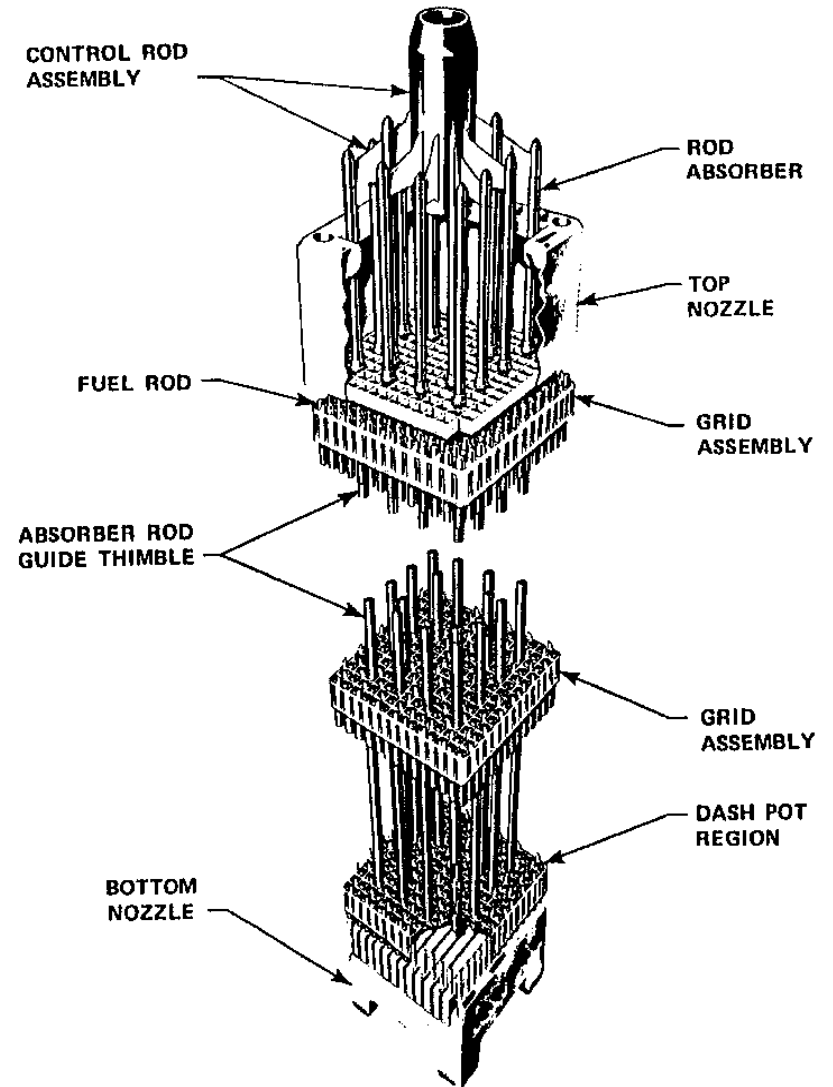
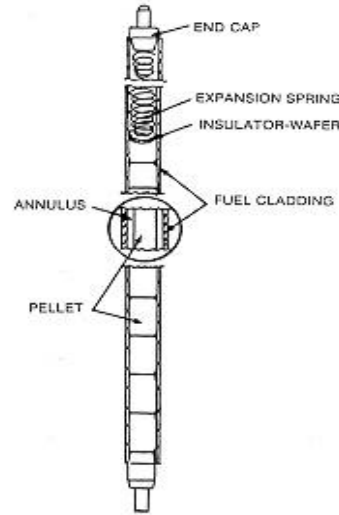
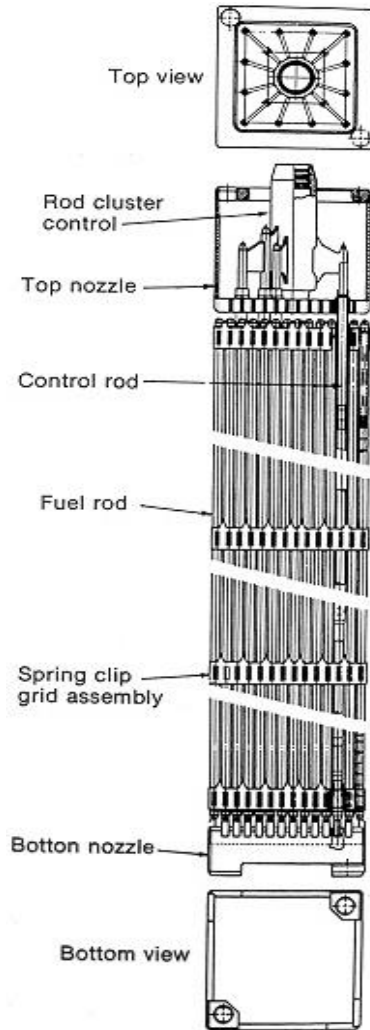


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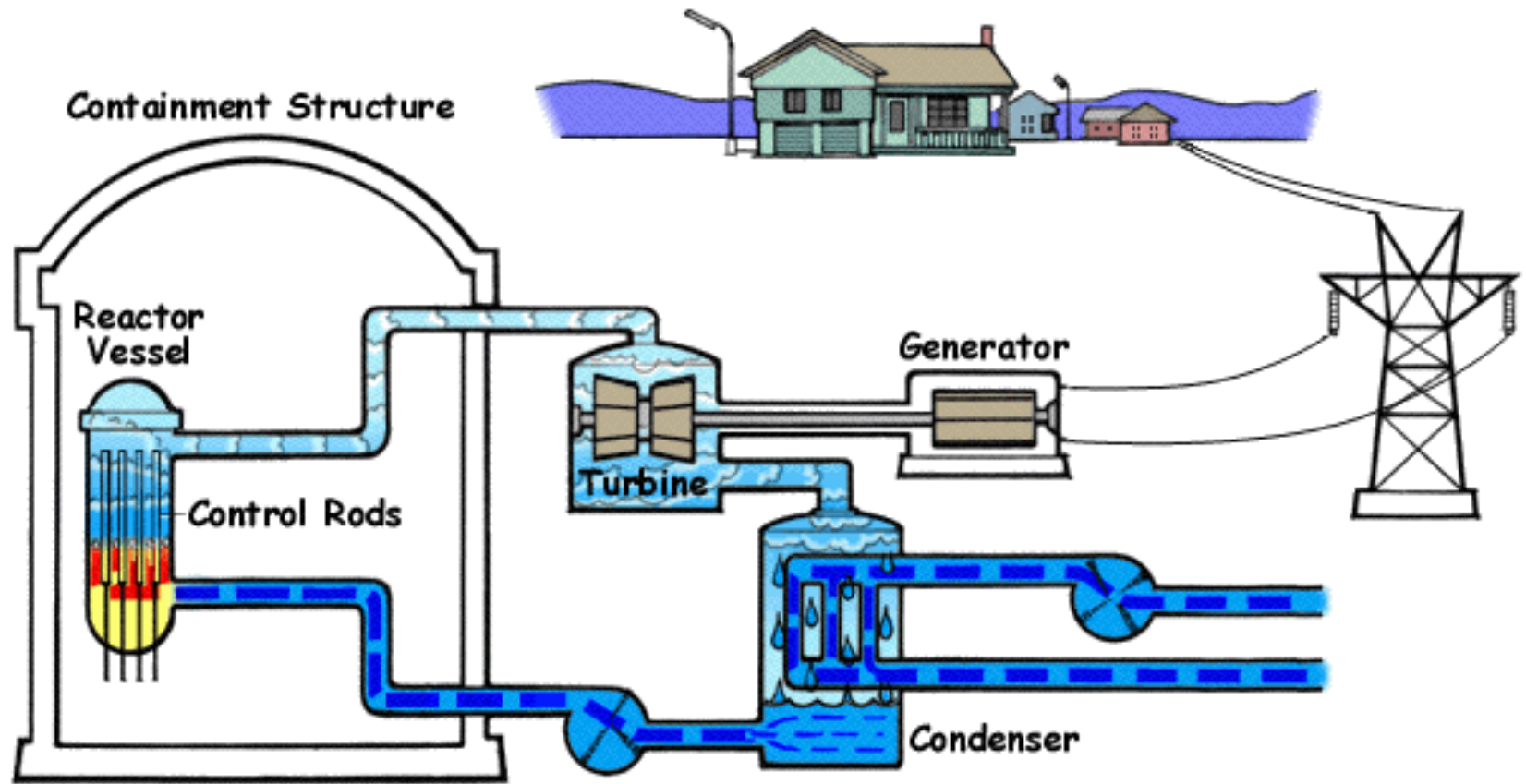
# PWR Assembly and Fuel Pin



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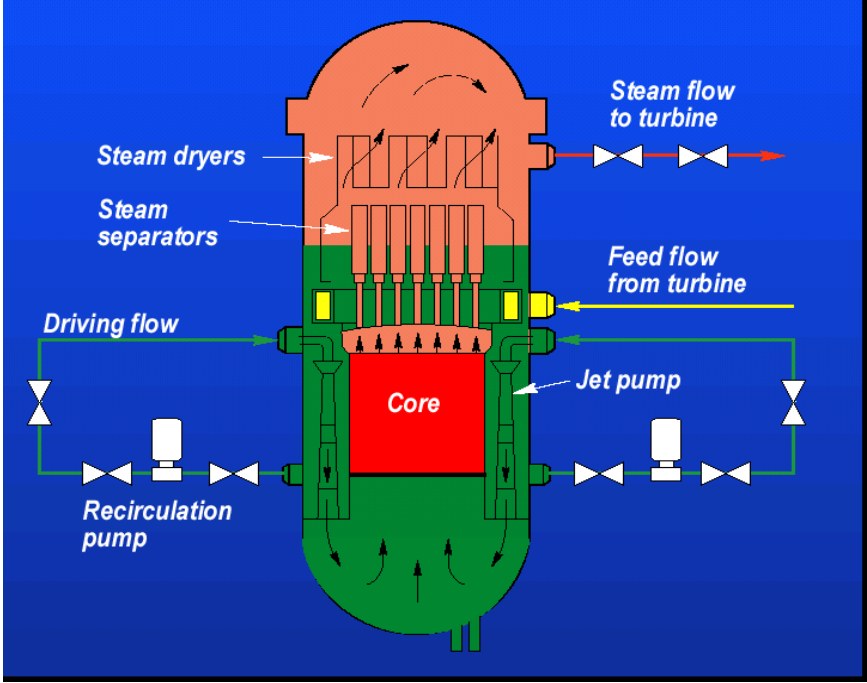
# Boiling Water Reactor (BWR)



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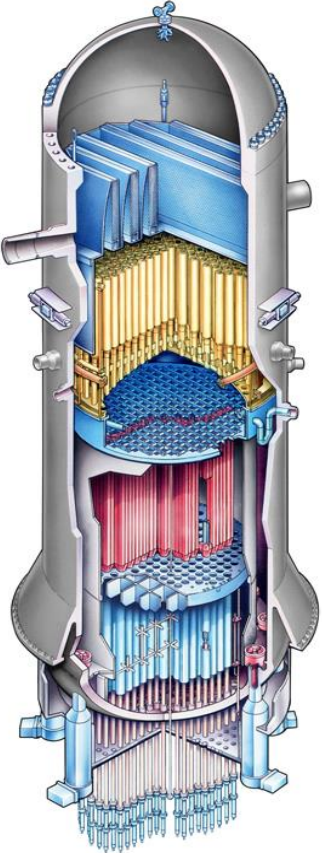
# BWR Recirculation System

BWR/6



External recirculation pumps + jet pumps

ABWR



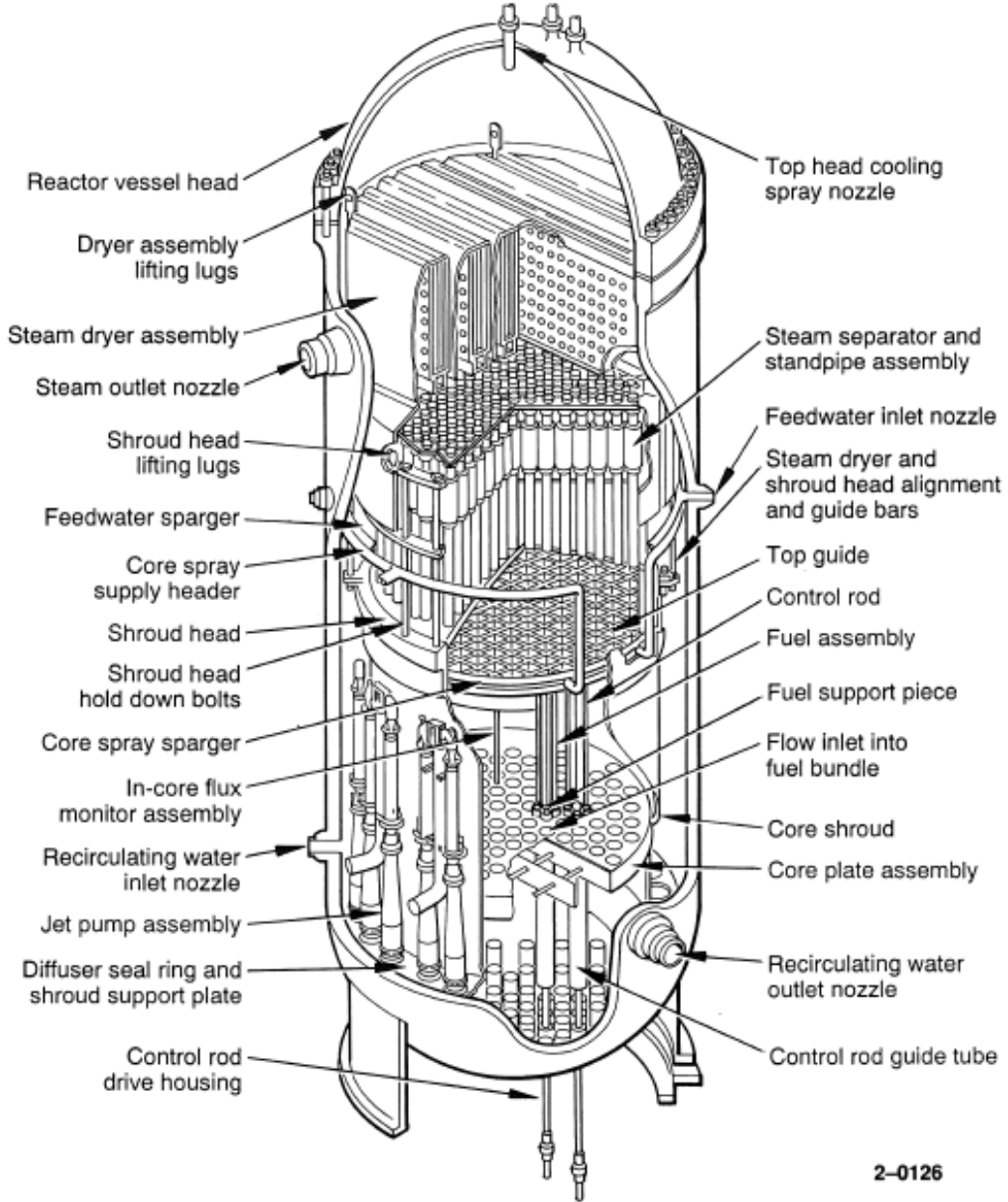
Ten internal recirculation pumps

ESBWR



Relies on natural circulation

Courtesy of GE Hitachi Nuclear Systems. Used with permission.



2-0126

# BWR Rx Vessel, Internals, and Core

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Source: Shah, V. N. and P. E. MacDonald. *Aging and Life Extension of Major Light Water Reactor Components*. Elsevier Science, 1993.



# BWR Fuel and Control Assemblies

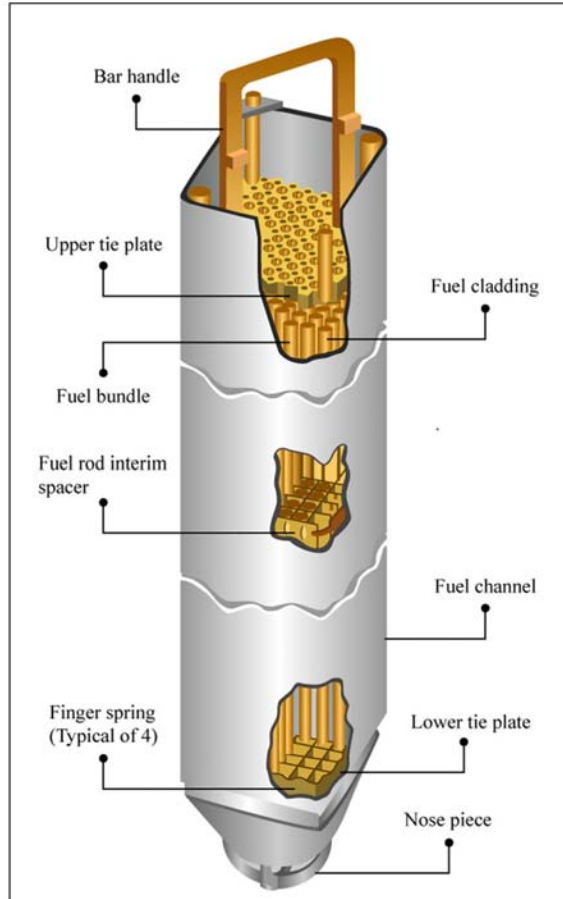


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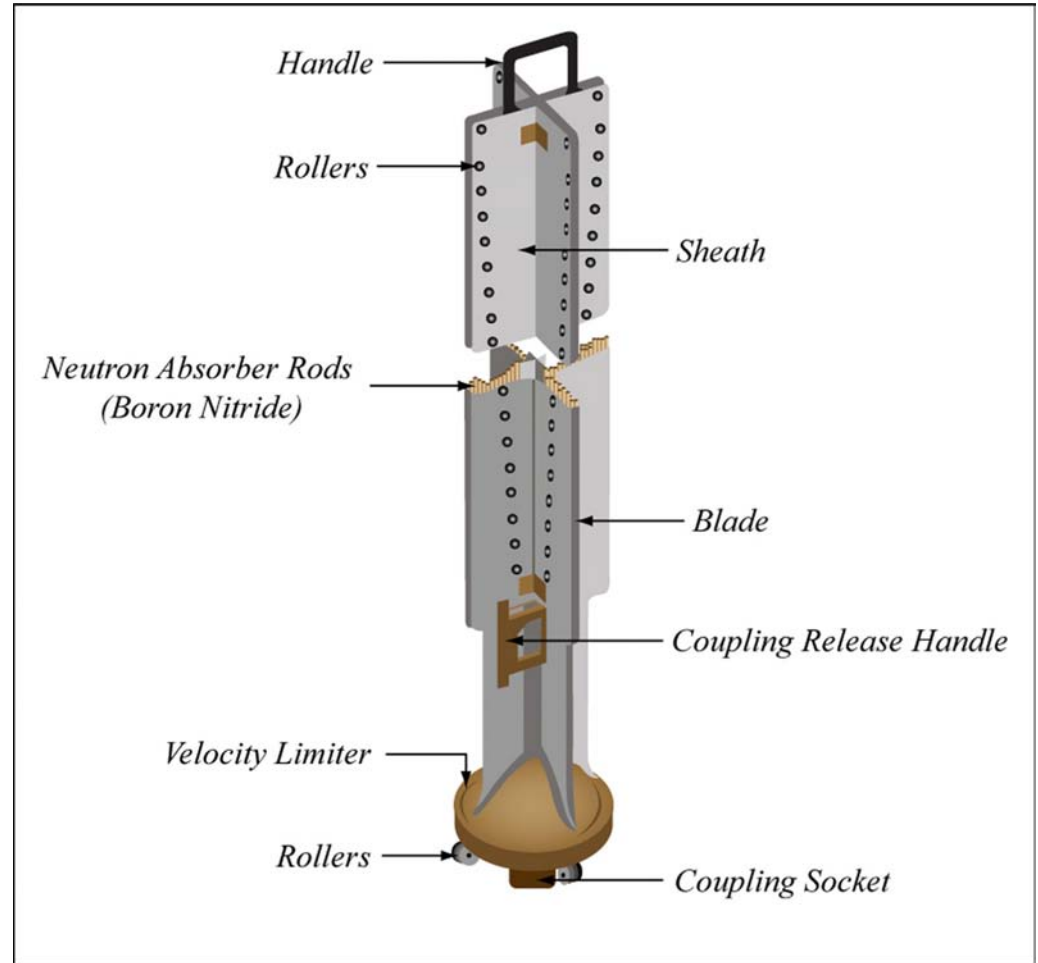


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# CROSS SECTION OF BWR FUEL ASSEMBLIES WITH CRUCIFORM CONTROL ROD

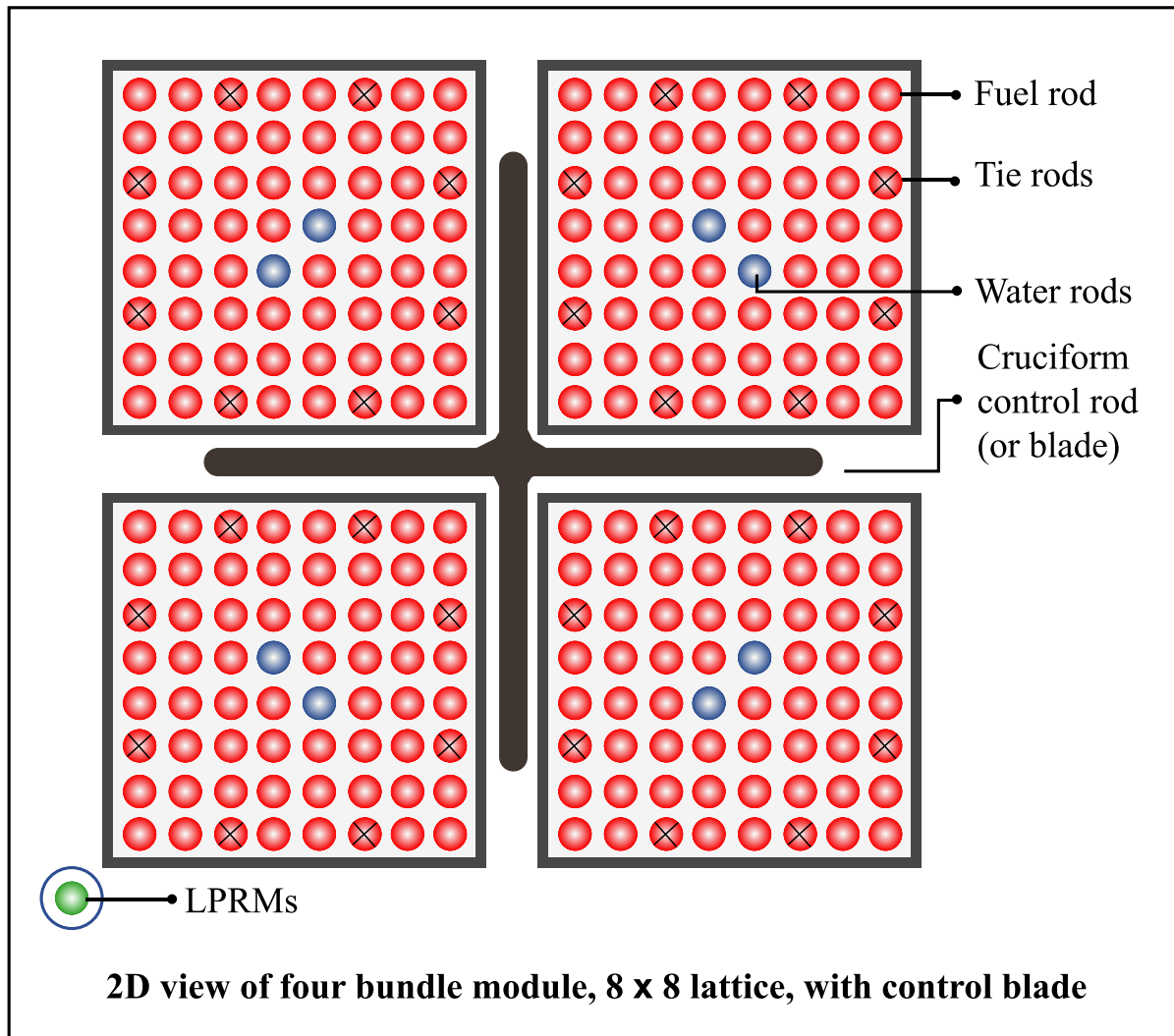
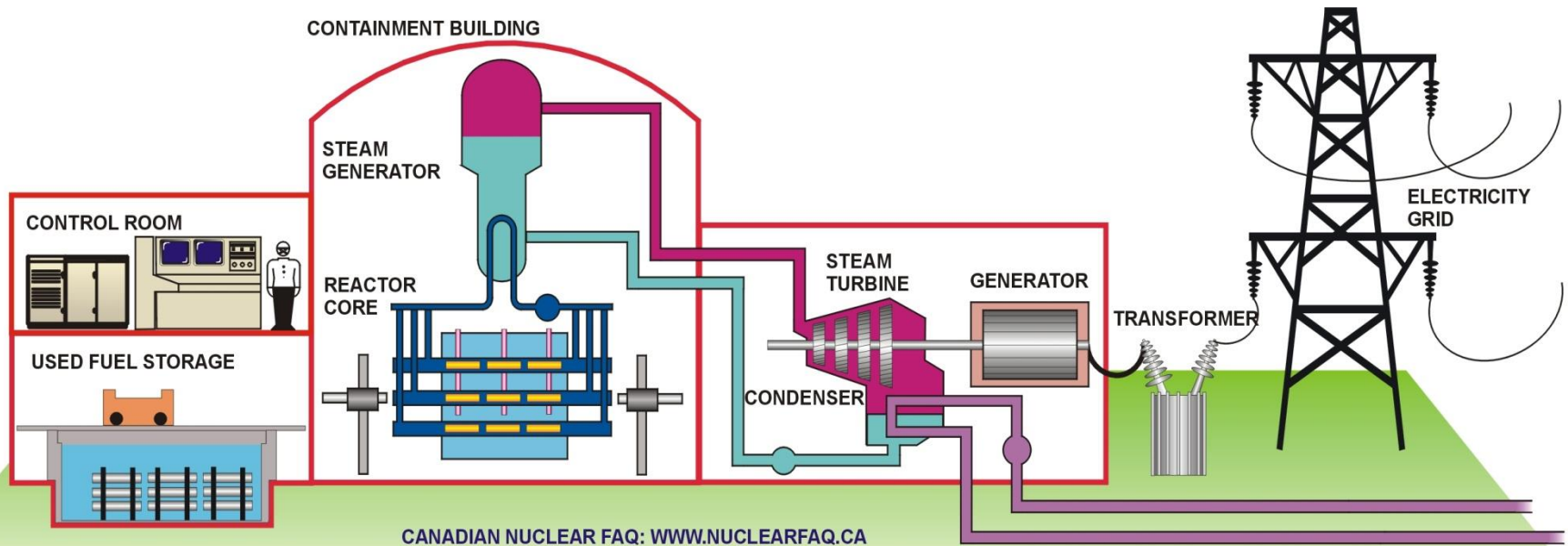


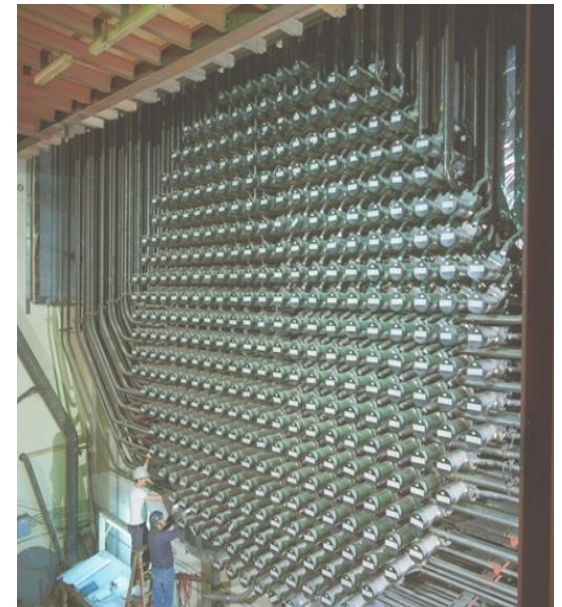
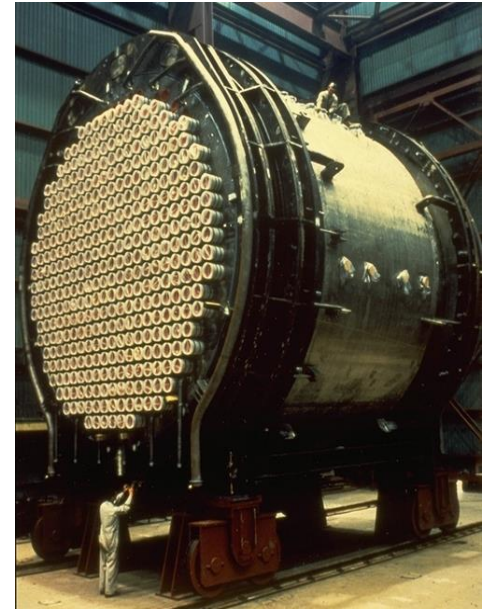
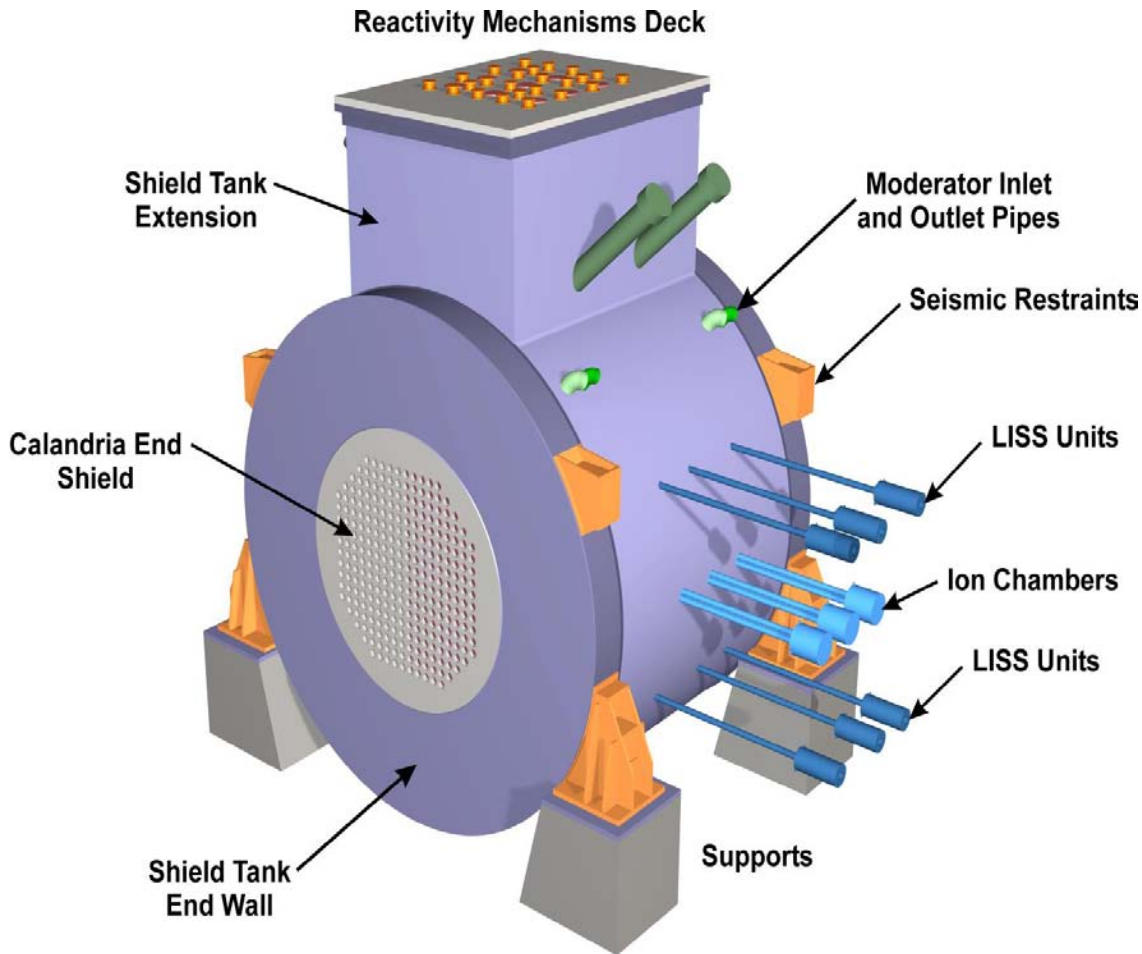
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# CANDU



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# CANDU Calandria Tank

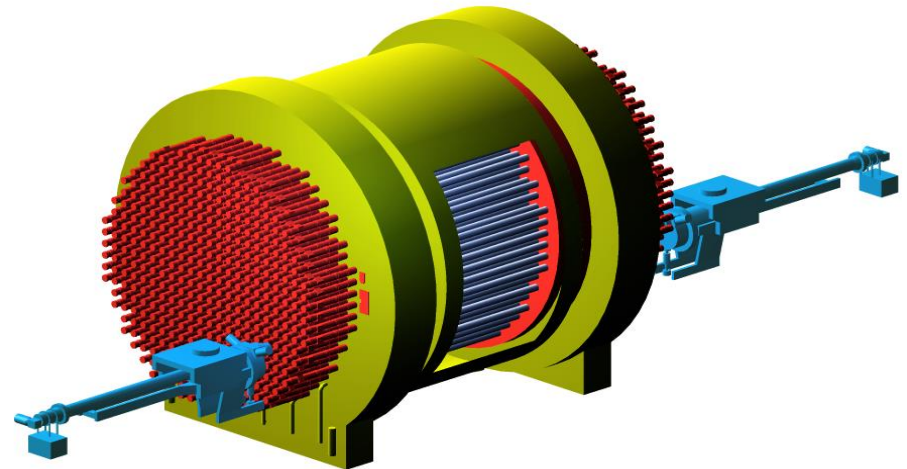
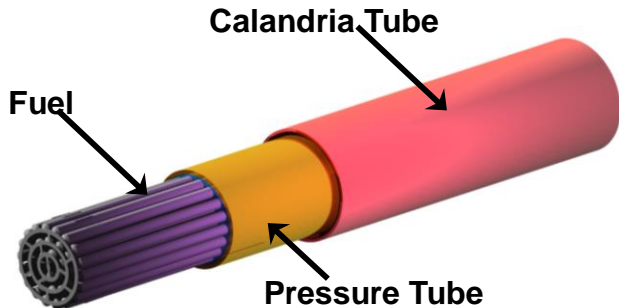
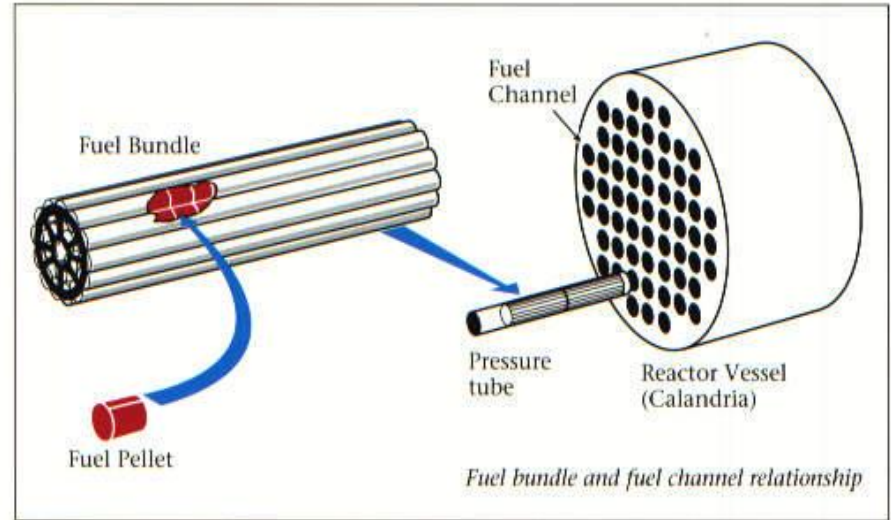


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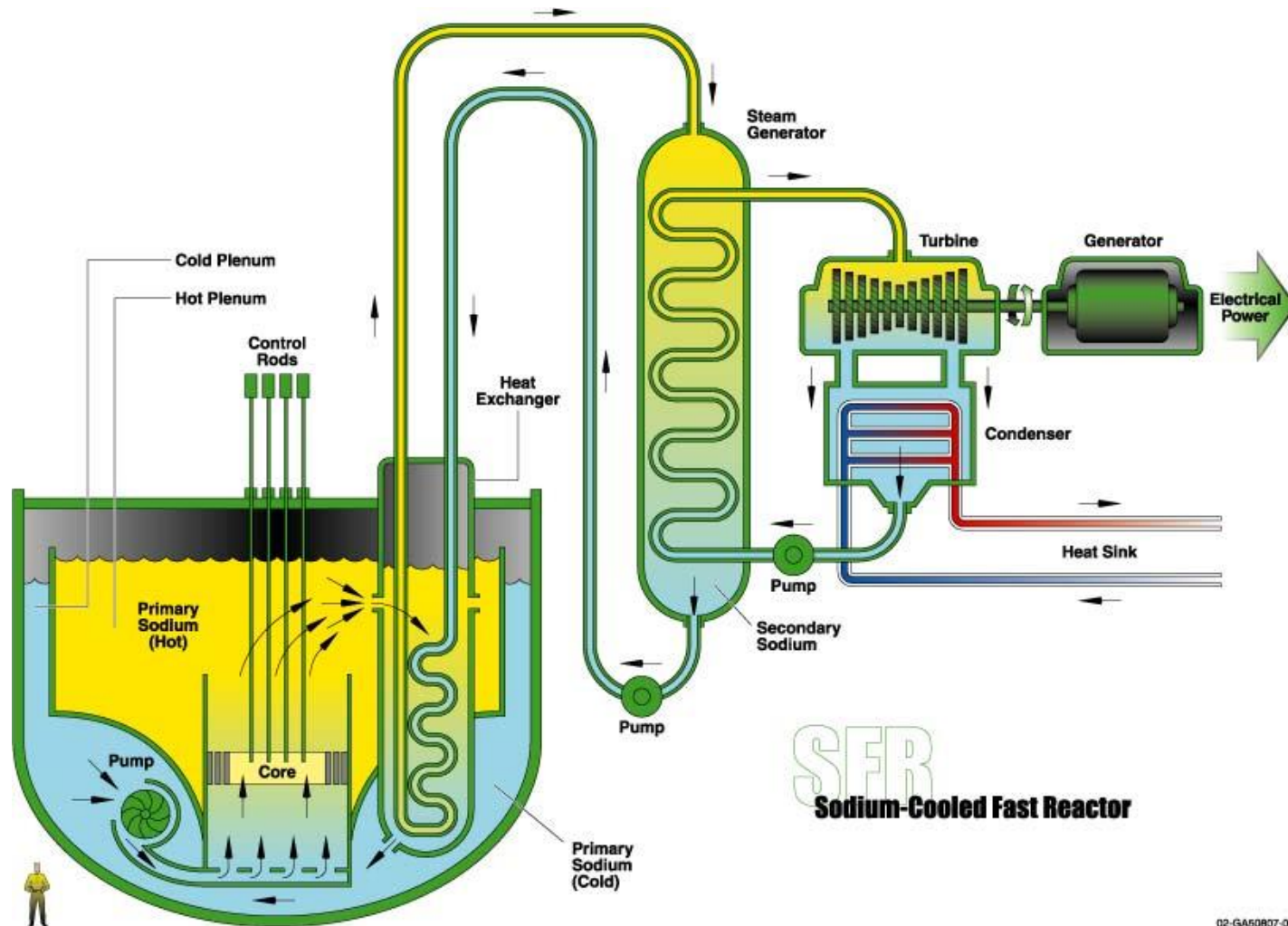
# CANDU Fuel Bundle



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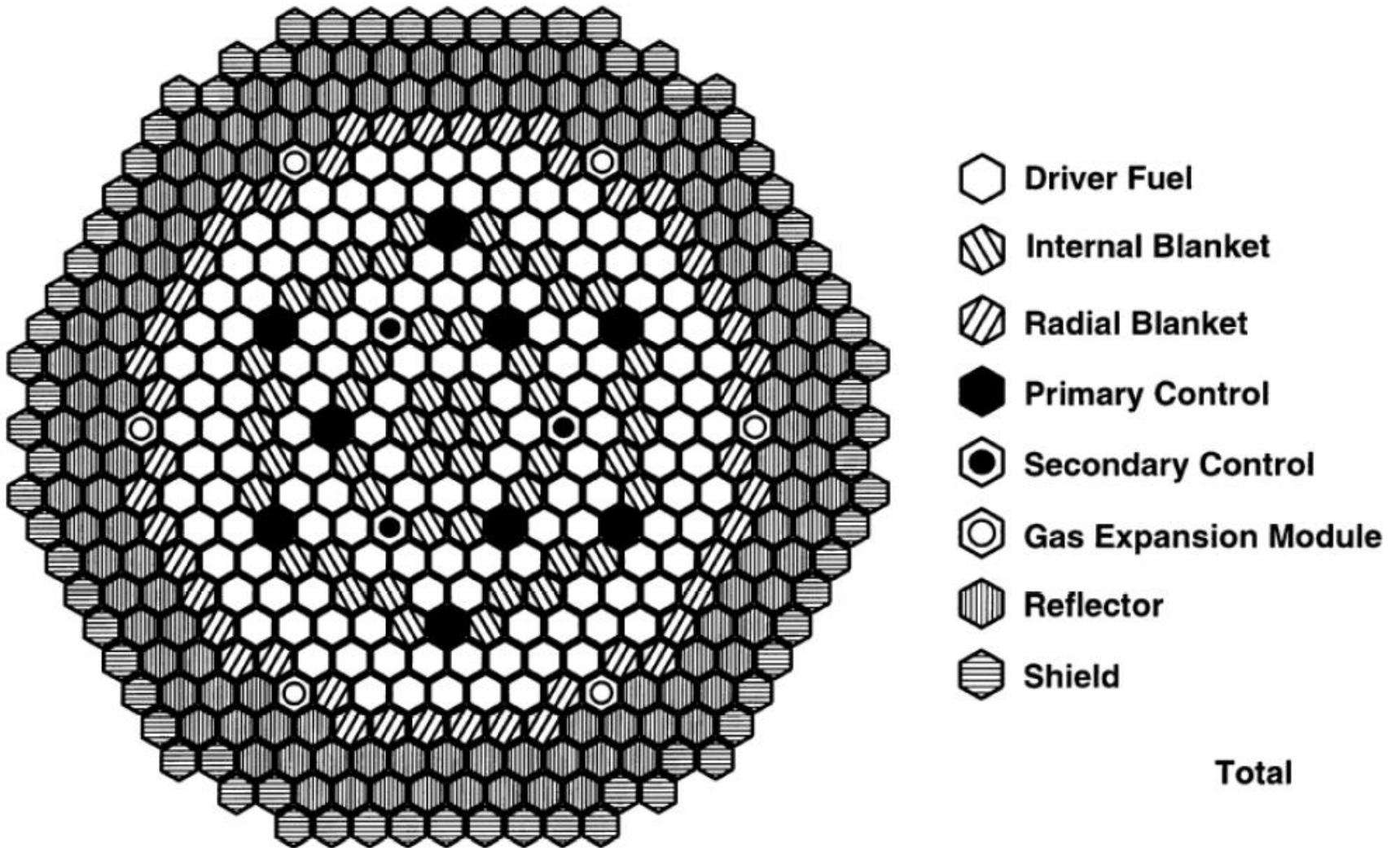


# LMFBR



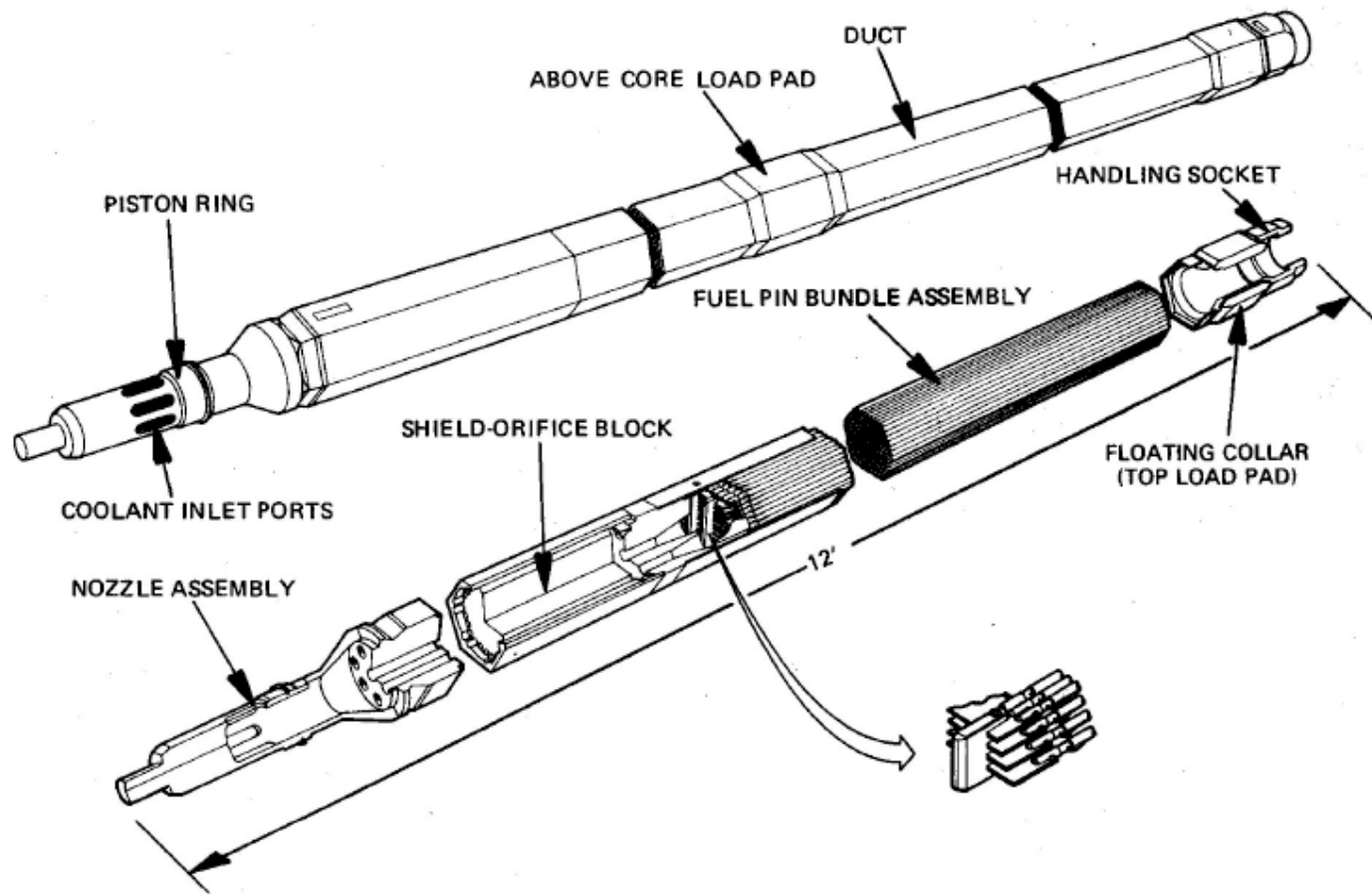
Courtesy of Idaho National Laboratory. Used with permission.

# LMFBR Core



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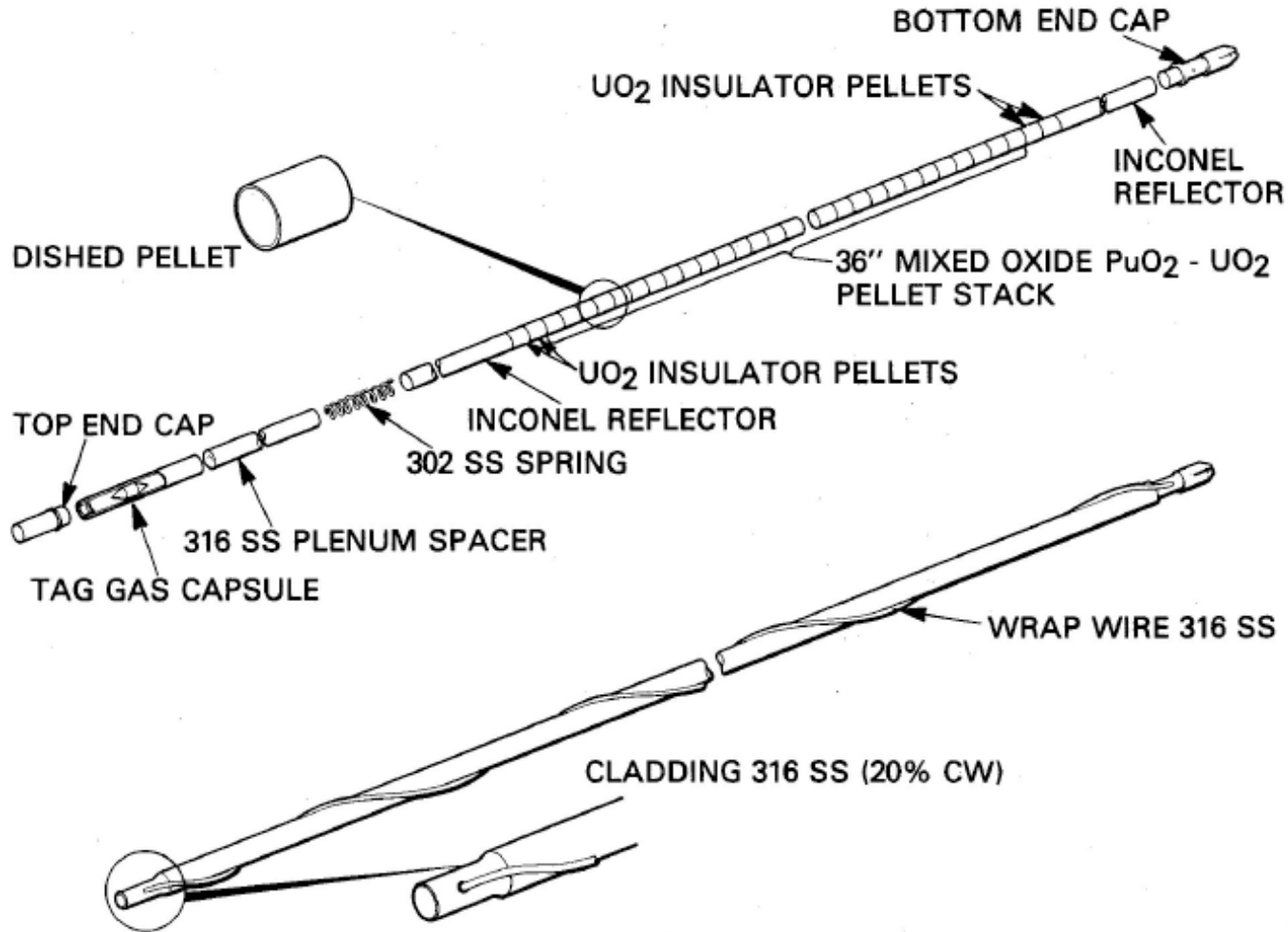
# LMFBR Assembly



Public domain image, from U.S. DOE.

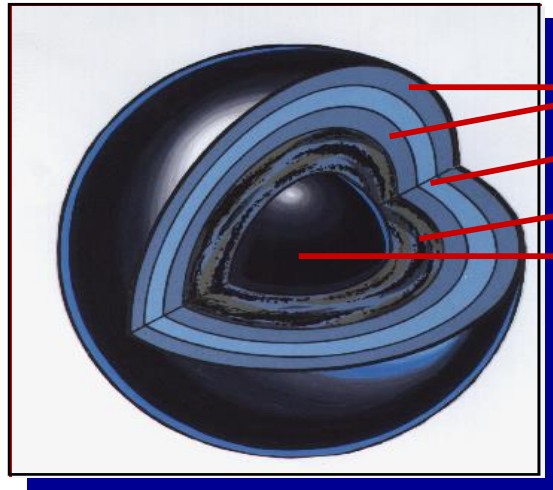


# LMFBR Pin



# Fuel for Block Core HTGR

TRISO fuel particle



- Pyrolytic Carbon
- Silicon Carbide
- Porous Carbon Buffer
- UO<sub>2</sub> (or UCO) Kernel

TRISO Coated fuel particles (left) are formed into cylindrical fuel compacts (center) and inserted into hexagonal graphite fuel elements (right).



TRISO PARTICLES

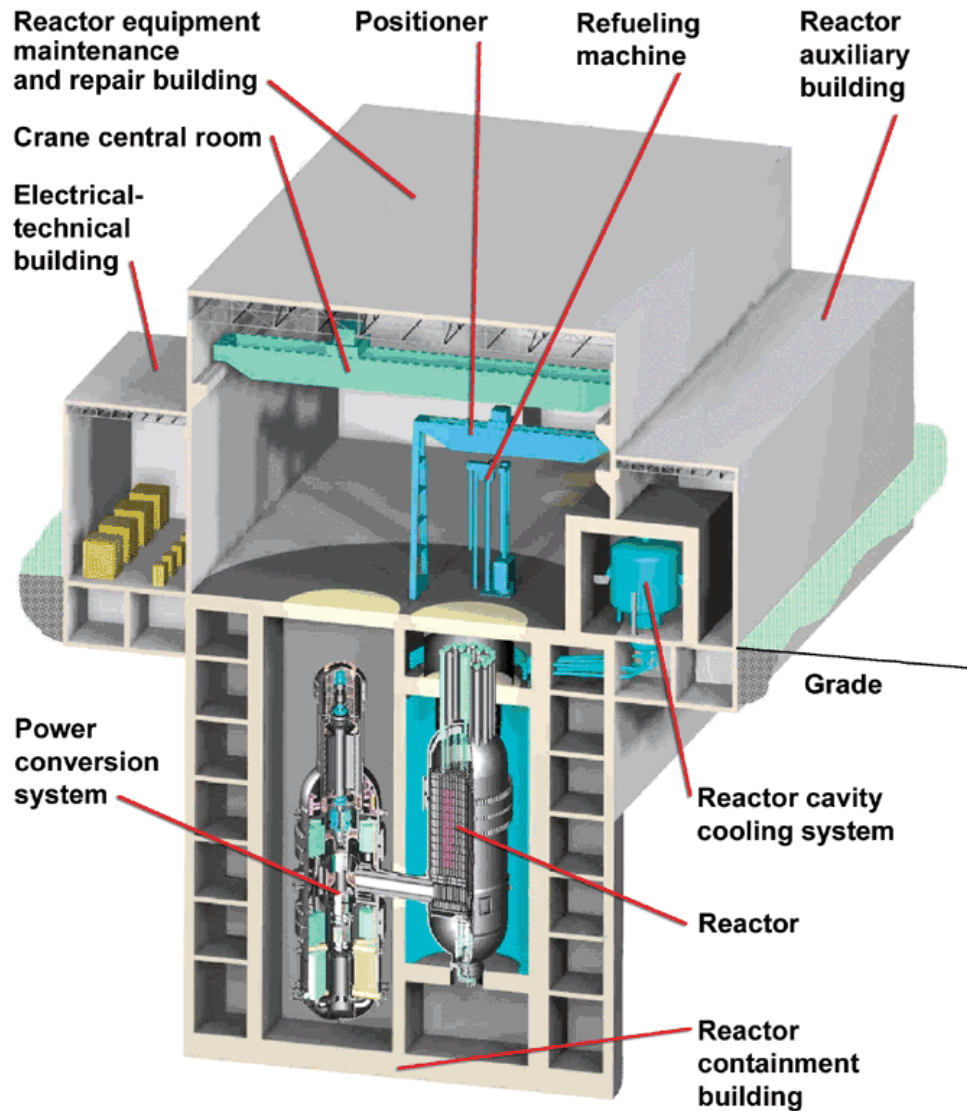


CYLINDRICAL  
COMPACTS



HEXAGONAL  
FUEL ELEMENTS

# HTGR



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# Fuel for Pebble Bed HTGR

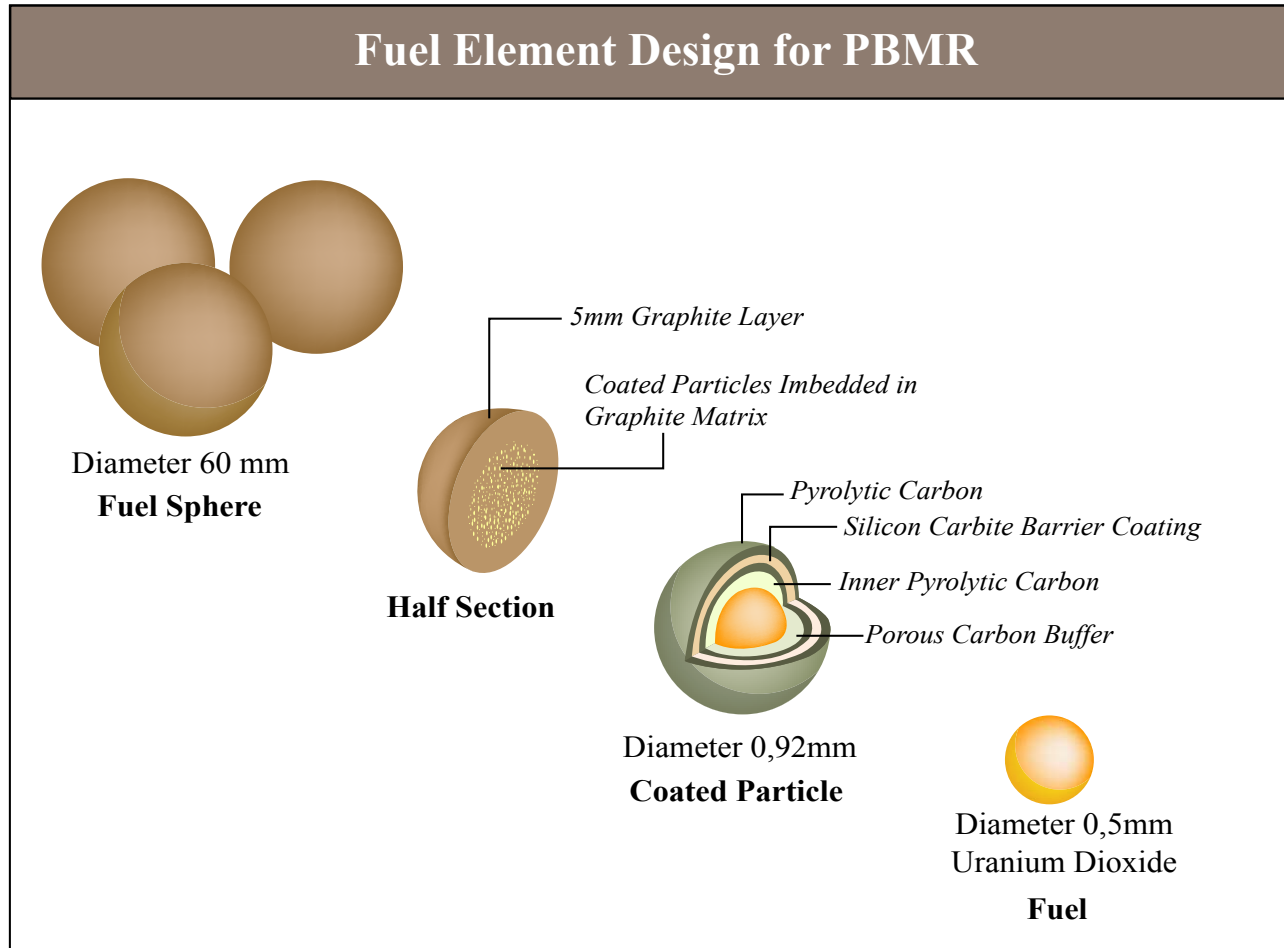
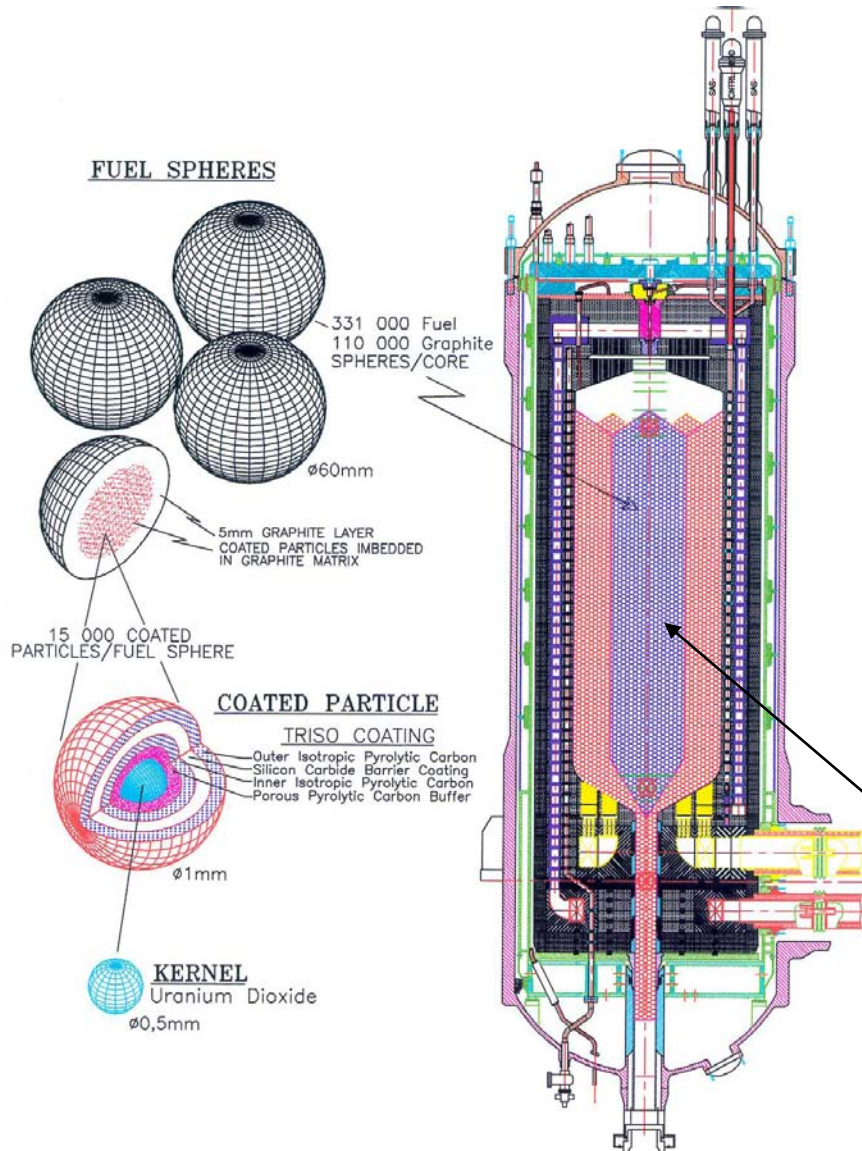


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# Pebble Bed HTGR



<b>Thermal Power</b>	<b>250 MW</b>
<b>Core Height</b>	<b>10.0 m</b>
<b>Core Diameter</b>	<b>3.5 m</b>
<b>Fuel</b>	<b>UO<sub>2</sub></b>
<b>Number of Fuel Pebbles</b>	<b>360,000</b>
<b>Microspheres/Fuel Pebble</b>	<b>11,000</b>
<b>Fuel Pebble Diameter</b>	<b>60 mm</b>
<b>Microsphere Diameter</b>	<b>~ 1mm</b>
<b>Coolant</b>	<b>Helium</b>

Pebble bed

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22.312 Engineering of Nuclear Reactors  
Fall 2015

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