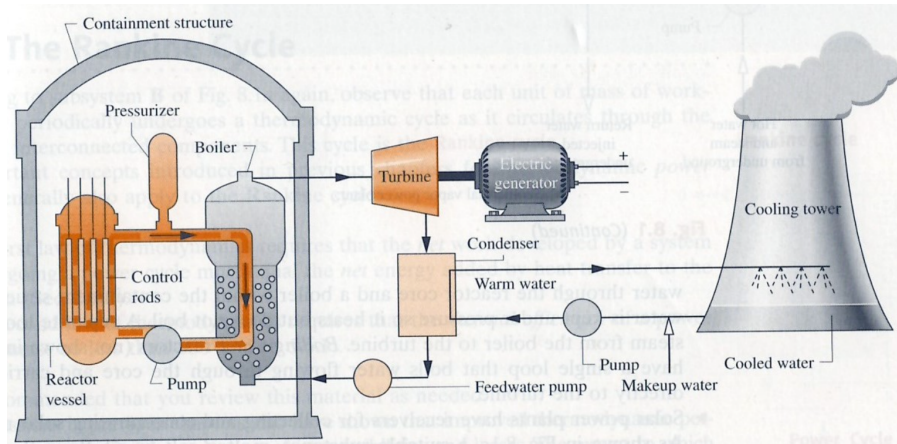
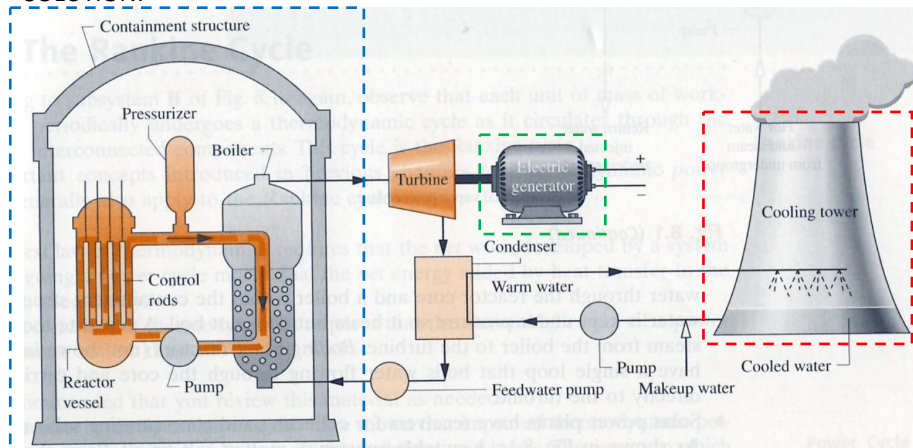


For the pressurized-water nuclear reactor power plant shown in the following figure, water vapor is generated in the boiler for use in the turbine/condenser/pump power cycle. The power plant generates electrical power using the generator. The water leaving the turbine is condensed using cooling water supplied by a cooling tower in a separate water loop. This is not the water loop that circulates in the reactor core and boiler within the containment structure.

- Consider a control volume surrounding the cooling tower. Identify the locations on the control volume boundary where the control volume interacts with the surroundings and the directions of flow (i.e., show the EFD).
- Repeat for the containment structure and the electric generator as the control volumes.



SOLUTION:



For part (a), the control volume surrounding the cooling tower is shown as a red, dashed line. The interactions with the surroundings include:

- The cooling water entering and leaving the control volume (a form of mass transfer).
- The water vapor leaving the cooling tower (a form of mass transfer).

For part (b), the control volume for the containment structure is shown as a blue, dashed line. Here the interactions with the surroundings are via the steam flow into the turbine and the water flow out of the feedwater pump. These are both forms of mass transfer.

The control volume for the electric generator is shown as a green, dashed line. Here the interactions with the surroundings includes the shaft work that the turbine exerts on the generator and the electric work leaving through the electrical lines.

(1)