and/or control rods into a single replaceable unit having a higher and more economic power density while retaining the advantages of a sealed unit. Once the design life of such an Integral Molten Salt Reactor (IMSR) is reached, for example, in the range of 3 to 10 years it is disconnected, removed and replaced as a unit and this unit itself may also potentially function as the medium or long term storage of the radioactive graphite and/or heat exchangers and/or control rods and/or fuel salt itself. The functions of decay heat removal and volatile off gas storage may also be integrated in situ.

[00016] ~~In a first aspect of the disclosure, there is provided~~ The present disclosure provides a method of operating a nuclear power plant. The nuclear power plant comprises a molten salt reactor (MSR) to produce heat, a heat exchanger system, and an end use system, the heat exchanger system to receive heat produced by the MSR and to provide the received heat to the end use system. The method comprises steps of: operating the MSR, the MSR comprising a vessel, a graphite moderator core positioned in the vessel, and a molten salt circulating at least in the vessel, the heat exchanger system to receive heat from the molten salt; shutting down the MSR after a pre-determined duration of operation, to obtain a shut-down MSR; severing any operational connection between the shut-down MSR and any portion of the heat exchanger system located outside the vessel, to obtain a severed, shut-down MSR; sequestering the severed, shut-down MSR; and operationally connecting a replacement MSR to any portion of the heat exchanger system located outside the vessel of the replacement MSR.

[00016a] In a first aspect of the disclosure, there is provided a method of operating a nuclear power plant, the nuclear power plant comprising a molten salt reactor (MSR) to produce heat, a heat exchanger system, and an end use system, the heat exchanger system to receive heat produced by the MSR and to provide the received heat to the end use system, the method comprising steps of: operating the MSR, the MSR comprising a vessel, a graphite moderator core positioned in the vessel, and a molten salt circulating at least in the vessel, the heat exchanger system to receive heat from the molten salt; shutting down the MSR after a pre-determined duration of operation, to obtain a shut-down MSR; severing any operational connection between the shut-down MSR and any portion of the heat exchanger system located outside the vessel, to obtain a severed, shut-down MSR; sequestering the severed, shut-down MSR; and operationally connecting a replacement MSR to any portion of the heat exchanger system located outside the vessel of the replacement MSR.

[00017] ~~In a second aspect of the disclosure, there is provided~~ The present disclosure also provides a nuclear power plant that comprises: a molten salt reactor (MSR) to produce heat; a heat exchanger system; radioactivity detectors positioned outside the vessel; shutoff mechanisms positioned outside the vessel; and an end-use system. The MSR comprises a vessel, a graphite moderator core positioned in the vessel, and a molten salt circulating at least in the vessel, the molten salt to transfer the heat produced by the MSR to the heat exchanger system, the graphite moderator core defining one or more than one through hole. The heat exchanger system is to receive the heat produced by the MSR and to provide the received heat to the end use system. The heat exchanger system comprises a plurality of heat exchangers in fluid communication with the one or more than one through hole of the graphite moderator core. Each heat exchanger has associated thereto a respective radioactivity detector. Each radioactivity detector is arranged to detect radioactivity present in the coolant salt circulating in the respective heat exchanger. Each shutoff mechanism is arranged to shut off circulation of the coolant salt circulating in the

respective heat exchanger when radioactivity beyond a threshold amount is detected, by the respective radioactivity detector, in the respective heat exchanger.

[00017a] In a second aspect of the disclosure, there is provided a nuclear power plant comprising: a molten salt reactor (MSR) to produce heat; a heat exchanger system; radioactivity detectors positioned outside the vessel; shutoff mechanisms positioned outside the vessel; and an end-use system, the MSR comprising a vessel, a graphite moderator core positioned in the vessel, and a molten salt circulating at least in the vessel, the molten salt to transfer the heat produced by the MSR to the heat exchanger system, the graphite moderator core defining one or more than one through hole, the heat exchanger system to receive the heat produced by the MSR and to provide the received heat to the end use system, the heat exchanger system comprising a plurality of heat exchangers in fluid communication with the one or more than one through hole of the graphite moderator core, each heat exchanger having associated thereto a respective radioactivity detector, each radioactivity detector arranged to detect radioactivity present in the coolant salt circulating in the respective heat exchanger, each shutoff mechanism arranged to shut off circulation of the coolant salt circulating in the respective heat exchanger when radioactivity beyond a threshold amount is detected, by the respective radioactivity detector, in the respective heat exchanger.

[00018] Other aspects and features of the present disclosure will become apparent to those ordinarily skilled in the art upon review of the following description of specific embodiments in conjunction with the accompanying figures.

BRIEF DESCRIPTION OF THE DRAWINGS

[00019] Embodiments of the present disclosure will now be described, by way of example only, with reference to the attached figures

[00020] Figure 1 shows an embodiment of a molten salt nuclear reactor in accordance with the present disclosure.

[00021] Figure 2 shows a top view of the embodiment of Figure 1.

[00022] Figure 3 shows, in accordance with the present disclosure, inlet and outlet molten salt conduits arranged to be shutoff when radioactivity is detected in the molten salt conduits or when a pressure change is detected in the molten salt conduits.

[00023] Figure 4 shows another embodiment of a molten salt nuclear reactor in accordance with the present disclosure.

[00024] Figure 5 shows a top view of the embodiment of Figure 4.

[00025] Figure 6 shows yet another embodiment of a molten salt nuclear reactor in accordance with the present disclosure.

[00026] Figure 7 shows a further embodiment of a molten salt nuclear reactor in accordance with the present disclosure.

[00027] Figure 8 shows an additional embodiment of a molten salt nuclear reactor in accordance with the present disclosure.

[00028] Figure 9 shows a flowchart of a method according to certain examples of the present disclosure.

[00029] Figure 10 shows a nuclear power plant according to certain examples of the present disclosure