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(56) Documents Cited:
GB 2508537 A **JP 2014010022 A**

(58) Field of Search:
INT CL **G21C**
Other: **WPI; EPODOC**

(54) Title of the Invention: **Method to remove and process gaseous waste from a molten salt nuclear reactor**
Abstract Title: **Managing gaseous fission product waste in molten salt nuclear reactors**

(57) The disposal of gaseous fission products from the fuel tubes of a molten salt reactor may be deferred until the fuel tubes are removed from the reactor for replacement and reprocessing provided the rate of evolution of said gases, the available gas space above the fuel salt and the strength of the fuel tube wall allow the safe accumulation of said gases for the planned life of the fuel tube. For reactors not meeting the above criteria, however, each fuel tube may be pierced or perforated at one or more points above the level of the fuel salt therein, and above the level of a surrounding coolant within the reactor, so that fission product gases can escape into the gas space within the reactor tank. The gaseous fission products may then be collected from the reactor by continually purging said gas space with a circulating stream of helium gas.

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METHOD TO REMOVE AND PROCESS GASEOUS WASTE FROM A MOLTEN SALT NUCLEAR REACTOR

BACKGROUND

A novel design for a molten salt based nuclear reactor was disclosed in UK application number 1402908.6 entitled "A practical molten salt fission reactor". The basis for the design was to place the molten salt fissile material in static tubes from which heat was transferred to a coolant liquid by a combination of conduction and convection.

In that reactor, volatile fission products, primarily noble gasses, were allowed to bubble out of the molten fuel salt and were collected from the top of the tubes containing the fuel salt and piped away for collection and disposal.

That system, while perfectly practical, does result in a complex network of collection tubes above the reactor. It has now been discovered that there are less complex alternatives to that complex system.

DESCRIPTION

Disposal of gaseous waste from the fuel tubes in the molten salt reactor can be deferred until the fuel tubes are removed from the reactor for replacement and reprocessing providing the combination of the rate of evolution of the gasses, the available gas space above the fuel salt and the strength of the fuel tube wall allow safe accumulation of the gasses for the planned life of the fuel tube. In this instance the fuel tube is sealed at the top. This option will be particularly suitable for reactors operating at relatively low power levels and hence producing noble gasses at relatively low rates.

For reactors not meeting the criteria above, where the gasses cannot be allowed safely to accumulate without producing unsafe pressures within the fuel tube, each fuel tube can be pierced at one or more points above that reached by the coolant liquid and above the level of the fuel salt but below the lid of the reactor. The fission waste gasses then accumulate within the empty space of the fuel tube within which most short lived radioactive gasses decay to non volatile elements. As pressure builds up, the gasses pass out through the piercings of the fuel tube into the gas space within the reactor tank, above the coolant liquid but below the reactor lid.

That gas space can optionally be continually purged by a stream of gas, preferably helium, which carries the fission gasses out of the reactor tank to a collection system from which the circulating helium is returned to the reactor tank. Very small amounts of the fission product gasses decay to other elements while they are in the gas space at the top of the tank and those may be captured in the coolant liquid.

CLAIMS

1) A method to manage fission product gaseous waste from a molten salt nuclear reactor where the fissile fuel salt is held in static fuel tubes comprising sealing said fuel tubes at the top and accumulating fission product gasses throughout the life of the fuel tube.
2) A method to manage fission product gaseous waste from a molten salt nuclear reactor where the fissile fuel salt is held in static fuel tubes comprising sealing the top of the fuel tube and perforating the fuel tube one or more times at a point above the level of the fuel salt.
3) The method of claim 2 where the perforations in the fuel tube allow fission product gasses to pass into a gas filled space within the reactor tank
4) The method of claim 3 where the gas space within the reactor tank is filled with a noble gas which is continually processed to remove fission product gasses.

Application No:	GB1404976.1	**Examiner:**	Geoff Holmes
Claims searched:	1	**Date of search:**	24 September 2015

Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
X	1	JP 2014010022 A [HITACHI-GE NUCLEAR ENERGY] see abstract, paragraph 18, & Figures 1, 4 & 8 in particular
A,E	-	GB 2508537 A [SCOTT] whole document relevant

Categories:

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC^{X} :

Worldwide search of patent documents classified in the following areas of the IPC

G21C

The following online and other databases have been used in the preparation of this search report

WPI; EPODOC

International Classification:

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G21C	0003/24	01/01/2006
G21C	0003/04	01/01/2006
G21C	0001/22	01/01/2006
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