Editor's Comments:

In my opinion it suffers from three severely crippling short-comings:

The notion that radiological waste can be considered non-contaminating simply because it be employed for useful commercial purposes is specious on its face; and

- The assertion that the FBNR module can be considered safe because it represents a variation on current encapsulation means for transport ignores the fact that the operating temperatures inside the module exceed 1600C – there is no likelihood that this means of encapsulation will be approved for transshipment under prevailing nuclear regulatory treaties because in point of fact the capsule itself constitutes a fundamental danger to life and limb; and
- The paper ignores the primary threat to public welfare and safety. Nowhere do the authors engage the issue of neutron embrittlement in their cavalier discussion of the dangers imposed by encapsulating high temperature floating bed nuclear fission reactor elements. The simple fact of the matter is that it is now abundantly clear that no material known to science can withstand the ravages of neutron embrittlement for more than 10 years. The extraordinary rate of containment failure at nuclear waste storage sites such as Savannah River in the United States demonstrates that radioactive daughter products created during the nuclear fission cycle cannot be safely encapsulated using any known material or strategy. This is precisely why the Yucca Mountain initiative failed. It is also why the radioactive waste storage facility located in New Mexico exploded – encapsulation is a non-starter by any reasonable consideration.

Further, it is precisely because there is no accepted method for remediating radioactive emissions generated by spent nuclear fuels. Fuel rods and the structural elements which hold them in place, whether devised of carbon or other materials, remain contaminated for long periods of time. The proliferation of unremediated nuclear waste materials constitutes and existential threat to every living thing on the planet. The fact that the waste material can be exploited for ancillary commercial applications notwithstanding, the authors notion that high level nuclear waste materials can be safely used without due and prudent attention to the dangers they represent is preposterous and unscientific.

While it remains true that decay products are still produced during the fission cycle reactions, it is also accurate to suggest that a properly designed apparatus could be built to operate in isolation for up to 300 years without requiring maintenance or repair. A liquid sodium-thorium reactor cannot achieve self-sustained criticality and therefore does not represent a clear and present danger even in the face of catastrophic natural events such as occurred in Northern Japan in 2011.

Authors Feedback:

Please see my reply to the reviewer as embedded in his/her text. It seems that unfortunately he/she did not understand the reactor concept and has embarked on matters unrelated to the content and objective of this paper. The FBNR nuclear reactor concept has been discussed by greatest world scientists for decades, as you see from the list of the references, and its research and development has been supported , both financially and morally (positive evaluations), by the highest world authority in nuclear energy namely the International Atomic Energy Agency (IAEA). Since the subject before us is not to defend or condemn nuclear energy, I will let it for future should you feel necessary and appropriate to open such discussions. The subject of the present paper is a proposal how to REDUCE the environmental impact of future nuclear reactors. It is not a debate between pro-nuclear and anti-nuclear

groups. The FACT of life is that today exist thousands of radiations sources in the world serving various purposes in medicine, agriculture and industry for decades. The enormous IAEA and other publications can be consulted on the subject about their uses..

Here, essentially we are discussing the spent fuel from FBNR nuclear which is a tiny 15mm in diameter spherical stainless steel vessel containing radioisotopes. They are only emitters of gamma radiations. They are proposed to be used as the source of radiation along with many other types of sources of radiations that are presently used worldwide under the regulations imposed by the national and international governing bodies such as the IAEA. Our business in reviewing papers is to be purely scientific and do not allow our opinion as pro or anti nuclear, or lover of other types of reactor affect it.

For the time being, I make brief comments as replies, and hope that they will not be interpreted as humiliating as I believe the reviewer did not comprehend the paper.

- The notion that radiological waste can be considered non-contaminating

  This is a misunderstanding. No one said thatin general. We claim that the spent fuel from FBNR has special characteristics that can be used as the source of radiation for irradiation purposes. This is an important advantage of FBNR..

  simply because it be employed for useful commercial purposes is specious on its face; and

- The assertion that the FBNR module

  We never discussed the reactor module….we talked.only about the tiny fuel elements.

  If the transportation of tiny radioactive source is of your concern, please make a literature review to see how the big sources are transported with safety? See the regulations, attentions, and concerns about them..

  The temperature of spent fuel outside the reactor is room temperature. Inside the FBNR reactor the maximum temperature is about 350C. The 1600C is what TRISO fuel can stand. This has nothing to do with what we are discussing..

  can be considered safe because it represents a variation on current encapsulation means for transport ignores the fact that the operating temperatures inside the module exceed 1600C – there is no likelihood that this means of encapsulation will be approved for transshipment under prevailing nuclear regulatory treaties because in point of fact the capsule itself constitutes a fundamental danger to life and limb;

  Unfortunately totally misunderstood….they are unrelated to the problem under discussion.

- and

  The paper ignores the primary threat to public welfare and safety. Nowhere do the authors engage the issue of neutron embrittlement

Neutron embrittlement has nothing to do with our subject. It is the question that you can put when you review the reactor design. Here we talk about the fuel that came out of the reactor and is physically in good condition no matter under which conditions it survived. .

I donot want to challenge the knowledge of reviewer about this subject since he/she seems to consider himself/herself an expert in this area. However, I would like to remind that there exist more than 1000 nuclear reactors working in the world that their materials are exposed to neutrons for decades.

- in their cavalier discussion of the dangers imposed by encapsulating high temperature floating bed nuclear fission reactor elements. The simple fact of the matter is that it is now abundantly clear that no material known to science can withstand the ravages of neutron embrittlement for more than 10 years. The extraordinary rate of containment failure at nuclear waste storage sites such as Savannah River in the United States demonstrates that radioactive daughter products created during the nuclear fission cycle cannot be safely encapsulated using any known material or strategy. This is precisely why the Yucca Mountain initiative failed. It is also why the radioactive waste storage facility located in New Mexico exploded – encapsulation is a non-starter by any reasonable consideration.

The problem of waste storage site in USA has no relation to the subject we are talking about.

Further, it is precisely because there is no accepted method for remediating radioactive emissions generated by spent nuclear fuels. Fuel rods and the structural elements which hold them in place, whether devised of carbon or other materials, remain contaminated for long periods of time. The proliferation of unremediated nuclear waste materials constitutes and existential threat to every living thing on the planet. The fact that the waste material can be exploited for ancillary commercial applications notwithstanding, the authors notion that high level nuclear waste materials can be safely used without due and prudent attention to the dangers they represent is preposterous and unscientific.

We never said that all high level radioactive materials can have commercial value. Here we note one of the advantages of FBNR , and we say that the spent fuel from FBNR due to its adequate shape and size can be used as the source of radiation for irradiation purposes. This is an advantage of FBNR over other reactor.

While it remains true that decay products are still produced during the fission cycle reactions, it is also accurate to suggest that a properly designed apparatus could be built to operate in isolation for up to 300 years without requiring maintenance or repair. A liquid sodium-thorium reactor cannot achieve self-sustained criticality and therefore does not represent a clear and present danger even in the face of catastrophic natural events such as occurred in Northern Japan in 2011.