Reviewer’s report

**Title:** Incidence of cancer among residents of high temperature geothermal areas in Iceland: A census based study 1981 to 2010

**Version:** 1  **Date:** 20 July 2012

**Reviewer:** Suminori Akiba

**Reviewer’s report:**

Authors observed an increased cancer incidence among residents in the high temperature geothermal areas. An increased cancer incidence was observed for cancers of the pancreas, breast, lymphoid and hematopoietic system. Hodgkin lymphomas and basal cell carcinoma were also increased. Since the increase was observed even when they used the warm reference area for comparison, it is not due to the difference of temperature in the exposed and control areas. The observed increase cannot be explained by smoking, either, since the lung cancer risk was not much increased among residents in the geothermal areas. Smoking cannot explain the excess cancer of breast cancer, which is known to be only weakly related to active smoking, if at all. The absence of lung cancer risk among men also makes it unlikely that radon gas exposure caused observed increase of cancers.

Authors suspects that pancreas cancer is increased by radon gas exposure. However, as already pointed out, the fact that lung cancer risk did not increase indicates a lack of significant exposure to radon gas and it decay products. It is also of note that a pooled analysis of 10 studies of underground miners exposed to radon showed an O/E of 1.05 for pancreatic cancer (IARC monograph 78). Authors may suspect that the observed increase of pancreatic cancer was caused by exposure to water radon. However, as pointed out by Kedall and Smith (J Radiol Prot 2002;22:389–406.), the highest organ dose from ingested radon is to the stomach, which receives 90% of the total effective dose. The absence of an excess stomach cancer risk in the present study does not support the involvement of radon in water.

Authors may suspect a radon exposure to the skin and the breast from radon daughters attached to the body surface when taking bath. In the case of the breast, however, it is unlikely that radon on the body surface give a significant dose to breast cancer stem cells since alpha particles are stopped by the skin (since it has a low permeability).

Anyway, if authors suspect the involvement of radon exposure, they should present estimated radiation doses from such an exposure and discuss whether that dose is large enough to explain a 59% increase of breast cancer risk.

Authors should pay more careful attention to factors other than radiation. Is there any possibility that women in the geothermal areas tend to stay indoors and
therefore they are more likely to be exposed to passive smoking, which is strongly suspected to increase a breast cancer risk? The increase of lung cancer risk by 24% (when compared to warm reference area) among women is compatible with that idea. – Note that I have no intention to argue that the observed increase is due to passive smoking. I am trying to indicate that authors should make discussions regarding such possibilities. It cannot be denied that each cancer is caused by different factors, rather than radiation.

Authors wrote that the best known etiological factors for bone cancer are ionizing radiation, radionuclides and x-ray therapy. However, I do not think that bone cancer is strongly related to external exposure to ionizing radiation, including x-ray.

**Level of interest:** An article of limited interest

**Quality of written English:** Acceptable

**Statistical review:** Yes, and I have assessed the statistics in my report.

**Declaration of competing interests:**

I declare that I have no competing interest.