Date: 12/17/2011
Time: 8 hour test
Tester: Tom
Specimen Number: **J-F_28800_121711**

Owner or Handler of Specimen: Tom

Equipment used: UCS30 MCA, 6S6P1.5VDC2 38mm NaI(Tl) Scintillator, "Neko Nomi"

Settings: Voltage: 700+, Coarse Gain: 1, Fine Gain: 1

Reason for Test: Test of sample air filter for suspected radioactive contamination from Fukushima.

Description of Specimen:

Specimen is of thin cotton-like "paper" material. The specimen is a roughly 45 cm x 15 cm rectangle, being slightly misshapen in a wavy pattern to one long side. The thickness is less than 1 mm. The object was used as an air filter medium for a combination air conditioner / heater. The filter was installed on or around March 11, 2011, and finally removed on or around June, 2011. The filter was exposed to untreated "natural" atmosphere for the entire 3-4 month period, during the height of the Fukushima indecent, in a residential apartment window in Saga City, Saga Prefecture, Japan, roughly 1100 km west by south west, from the Fukushima Daiichi Power Plant. The original owner of the specimen stated that the specimen had been tested with a small hand-held Geiger counter, displaying *elevated readings*, which slowly returned to approximately the *normal background* readings of the environment where the sample came from.

Description of Testing Procedures:

The sample was folded twice and rolled into a tight cylindrical form. The rolled sample was placed into a borosilicate glass beaker of a volume of 100 ml. The beaker was placed into the testing chamber and made to rest parallel to the scintillation detector at a distance of about 1 cm. Between the scintillation detector and the beaker, a series of pressed aluminum foil sheets, measuring approximately 1mm, were placed. The purpose of the aluminum was to reduce possible beta emissions from the sample, thus reducing bremsstrahlung photons.

The test was run using the dead time accounting algorithm built into the multi-channel spectrometer. Accounted time was 28800 seconds, while actual time was 28801 seconds. The test was run during the night, from December 17, 2011, 03:35:48 GMT-5 until December 17, 2011, 11:35:50 GMT-5, to avoid possible higher solar radiation interference. The rational for this decision was based in part on the limits of the scintillation detector "lead castle", being an average of 38.1 mm in thickness, and being able to stop over 95 % of gamma energies below 1 MeV, but having much less stopping power for higher energy gammas.

Energies Found:

76.28 KeV – This energy range is primarily x-rays caused by gamma rays interacting with the scintillation detector and the detector sheilding. Peaks in this energy range are quite common and exist throughout all spectra taken the Neko Nomi detector.

513.08 KeV – The photo-peak is well defined, but the peak resolution is quite low, given a centroid height to ROI width of 1:2, and a FWHM of 38.325 KeV. During the period of the experiment, a total of 5,769 detections occurred within this ROI, for an average of 0.2003125 detections per second, 12.01875 CPM. An isotopic analysis is difficult with a low resolution and low activity peak, given the larger range of possible energy matches, as well as the general inaccuracy of the detector, being measured as between 1-5 KeV at the ROI range. One possible isotope match would be 85 Kr, which produces a clear gamma photon of the energy 514 KeV as its primary gamma energy. The energy spectrum for 85 Kr is quite low in energy, with low branching ratios less than 1 x 10^-4 for all gammas other than a single 514.0067 KeV gamma.

The spectrum for 85 Kr[1]:

Energy	Branching Ratio
514.0067 KeV	4.34 x 10^-3
129.820	< 1x10^-4
151.159 6	< 1x10^-4
362.81 4	< 1x10^-4

1417.95 KeV – The photo-peak is well defined, but the peak resolution is very low, given a centroid height to ROI width of nearly 1:2, and a FWHM of 64.369 KeV. During the period of the experiment, a total of 3808 detections occurred within this ROI, for an average of $0.13\overline{22}$ detections per second, 7.932 CPM. An isotopic analysis is difficult with a low resolution and low activity peak, given the larger range of possible energy matches, as well as the general inaccuracy of the detector, being measured as between 1-5 KeV at the ROI range. An analysis of both common nuclear fission products and standard natural isotopes has not concluded any likely suspect for this photo-peak.

Conclusion:

Sample J-F_28800_121711 does not reveal any specific photo-peaks with any degree of deviation from the norm which provide nearly 100% detection certainty. The presence of at least two distinct and well formed photo-peaks suggests the presence of radioactive contamination in the filter. A strong indication of a peak energy, 513.08 KeV, was found which was a mere -0.9267 KeV from a largely observed and well-known fission product, Krypton 85. The half life of 85 Kr, roughly 10.8 years, would enable particulate concentrations to remain active for many years.

Through correspondence with the original specimen owner, a United States citizen living in Japan, some information about the state of the specimen was obtainable, though only via recollection and anecdote. The correspondence cannot be directly considered as scientific evidence, but can be considered in the conclusion, given the strict general adherence to basic scientific method of the specimen originator and the extraordinary events surrounding the specimen, i.e. the meltdown of three reactors within 1100 km of the specimen.

The original owner of the specimen stated that, "In June it (specimen J-F) was *easily* 40% over background..."[2], indicating an increase in radioactivity detectable from the specimen. It should be noted that the original owner stated that his background reading was approximately 0.12 uSv/hr, as measured by a small hand-held Geiger counter with a Cs137 gamma calibration. Given time, the readings reduced to the normal background of the specimens environment, "...but now it (specimen J-F) doesn't seem to be detectably above bg (Background)"[2]. While the original cause of the allegedly higher activity of the specimen cannot be directly observed, the likelihood of the afore mentioned 85 Kr being the cause is very slight, given the half-life and the rapid period of diminishment. A more likely, though fully speculative assessment would indicate the presence of radio-iodine, a very short lived set of isotopes, 131 I and 133 I, both being commonly detected throughout Japan at the time of the specimens use, and being given to a rapid diminishment of activity. This is speculation.

The energy spike at 1417.95 KeV could not be identified with any degree of certainty, given a list of tens of possible isotopic matches. The width of the photo-peak was quite large, approximately 150 KeV, having an in accuracy of at least 1-5 KeV. The result is an inability to determine a cause. The only clear conclusion which may be drawn is that there is a second radioisotope involved. 85 Kr, should that be the cause of the 513.08 KeV peak, does not produce any peak anywhere within the range of 1417.95 KeV ± 150 KeV, and that range does not appear on standard background tests using Neko Nomi.

Sample J-F_28800_121711 was likely exposed to doses of radioisotopes in excess of what might be considered "normal". The sample contains probable fission products, namely 85 Kr. Given the geographic location and timing of the specimens usage, these results are consistent with likely outcomes of an air filter used in the general location of a triple nuclear reactor meltdown, i.e. containing detectable gamma-emitting radioisotopes.

1. Chu, S. Y. F., Ekström, L. P., and Firestone, R. B., The Lund/LBNL Nuclear Data Search, Version 2.0, February 1999. (Lund University, Lund Sweden 1999)
2. Source on file and unlisted due to possibility of reprisal. Personal Correspondence, (Japan, December 3, 2011)