

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

September 28, 2016

TestAmerica Laboratories, Inc.

U.S. Nuclear Regulatory Commission
Region III
ATTN: Materials Licensing Branch
2443 Warrenville Road, Ste 210
Lisle, Illinois 60532-4352

Reference: Radioactive Materials License Number 24-24817-01
TestAmerica Laboratories
13715 Rider Trail North, Earth City, MO 63045
License Amendment Request
Request to Add Individual Thorium Isotopes

Dear Commission:

We would like to request an addition to the latest amendment to our NRC Radioactive Materials License to add the following individual Thorium Isotopes with the listed maximum limits:

- Thorium-227, 2.1 milliCuries, any form
- Thorium-228, 200 milliCuries, any form
- Thorium-229, 100 microCuries, any form
- Thorium-230, 45.4 milliCuries, any form
- Thorium 231, 2.1 milliCuries, any form
- Thorium 232, 200 milliCuries, any form
- Thorium 234, 45.4 milliCuries, any form

Justification for amendment to the license:

The laboratory accepts a wide range of sample matrices, including (but not limited to) clean drinking water, groundwater, process materials, soil, waste materials, vegetation, flora/fauna, and oil from a variety of customers including commercial and federal clients for analysis of a wide range of potential environmental contaminants. Generally, the laboratory does not have complete knowledge of the samples (the client often doesn't either, that is why they are sending them out for analysis), and therefore does not know the potential equilibrium state of parent/daughter nuclides. Because of this, and in order to be conservative on possession limits, the laboratory is proposing individual thorium isotope limits (with the exception of Th-229) based upon assuming equilibrium with currently approved natural uranium or natural thorium possession limits.

Th-227 has a 18.7 day half-life alpha/gamma emitter in the U-235 decay chain. If analyzing for this analyte, the laboratory would not know whether it were due to a natural uranium source (e.g. ore or soil) or due to byproduct material (e.g. Pa-231/Ac-227

waste). However, if the Th-227 were in natural form, the laboratory would not expect to have more Th-227 in inventory than U-235 present based upon currently approved limits in license item 6J (Natural Uranium, any form, 136 kilograms). Converting this 136 kg of natural uranium to the U-235 content we arrive at 2.1 milliCuries. Therefore, the laboratory requests a Th-227 license limit of 2.1 mCi, any form.

Th-228 has a 669 day half-life alpha emitter in the Th-232 decay chain. If analyzing for this analyte, the laboratory would not know whether it were in equilibrium with Th-232, or if it were potentially separated by some natural or anthropological process. However, the largest quantity the laboratory would expect to possess at any one time would be based upon currently approved limits in license item 6F (Natural Thorium, any form, 200 mCi). Therefore, the laboratory requests a Th-228 license limit of 200 mCi, any form.

Th-229 has a 7880 year half-life alpha emitter. It is not naturally occurring, and would only be present due to anthropological processes. The main use of this nuclide in the laboratory is for tracing of chemical recovery in alpha spectrometry analyses, although there is potential for client samples (especially from DOE sites) to contain Th-229. The laboratory requests a Th-229 license limit of 100 microcuries (uCi), any form, based upon similar energy plutonium alpha-emitting nuclides on the license.

Th-230 has a 75,380 year half-life alpha emitter in the uranium (U-238) decay chain. While using this analyte in method quality control (spiked at very low levels in laboratory control samples), the laboratory expects the bulk of the isotope possessed to be contained in client samples received for analysis. When analyzing for this nuclide, the laboratory would not know whether it were in equilibrium with U-238/U-234, or if it were potentially separated by some natural or anthropological process. However, the largest quantity the laboratory would expect to possess at any one time would be based upon currently approved limits in license item 6I (Natural Uranium, any form, 136 kilograms). Converting this 136 kg of natural uranium to the U-238 content we arrive at 45.4 mCi. Therefore, the laboratory requests a Th-230 license limit of 45.4 mCi any form.

Th-231 has a 25.5 hour half-life beta/gamma emitter. It is only expected to be present as the daughter in equilibrium with U-235. As seen above, if this were present due to the already approved limits in license item 6J (Natural Uranium, any form, 136 kilograms), the laboratory would expect to possess up to 2.1 mCi. Therefore, the laboratory requests a Th-231 license limit of 2.1 mCi, any form.

Th-232 has a $1.4E10$ year (essentially stable) half-life alpha emitter. It is the main component of naturally-occurring thorium, although it could be present due to natural or anthropological processes, not in equilibrium with the decay-chain daughters. As the laboratory does not typically know whether this isotope is in equilibrium with the decay chain, and due to the fact the laboratory already tracks Th-232 under currently approved license item 6F (Natural Thorium, any form, 200 mCi), the laboratory recommends we continue to utilize license item 6F. If the Agency believes the laboratory needs a line item specifically for this nuclide, the laboratory proposes the currently approved limit from item 6F of 200 mCi, any form.

Th-234 is a 24.1 day half-life beta/gamma emitting daughter of U-238. The laboratory does not expect to observe Th-234 outside of this equilibrium, and the largest quantity the laboratory would expect to possess at any one time would be based upon currently approved limits in license item 6I (Natural Uranium, any form, 136 kilograms). Converting this 136 kg of natural uranium to the U-238 content we arrive at 45.4 mCi. Therefore, the laboratory requests a Th-234 license limit of 45.4 mCi any form.

If you have any questions, please feel free to contact me at (314) 298-8566.

Sincerely,



Michael J. Ridenhower
Radiation Safety Officer
TestAmerica Laboratories – St. Louis