ATTACHMENT A

FACILITY-SPECIFIC CRITERIA FOR APS

If you have any question over whether or not a sample should be declared as "radioactive," please contact the User ESH Group Leader or APS Material Balance Area Custodian as soon as possible and at least two weeks before the experiment is scheduled to run. This individual will contact health physics.

The following guidance can be used in determining if an experiment sample must be designated as "radioactive" on the Experiment Safety Assessment Form (ESAF).

Is the sample source from any of the following?

i. Ores of uranium or thorium
ii. Mine tailings from mining of any of the above ores
iii. Sands, soils, rocks, or other natural materials from any global locations known to have concentrations of thorium or uranium or thorium/uranium daughters above the background values given in Table A
iv. Soils from the Chernobyl or Fukushima exclusion zones
v. Soils from any site related to nuclear weapons testing or production areas which have not been environmentally remediated
vi. Soils from nuclear waste storage areas which have not been environmentally remediated
vii. Sediments in water outflows from the areas listed in iv, v, and vi above
viii. Materials controlled as radioactive by user's originating USA state laws, USA federal regulations, or user's originating nation's regulations (user's home institute's radiological safety officer should be able to advise on this)
ix. Materials in which a radioactive isotope concentration has been increased by isotopic separation

If a sample is from one of these sources, contact the User ESH Group Leader or APS Material Balance Area Custodian as soon as possible and at least two weeks before the experiment is scheduled to run to discuss the sample. This individual will contact health physics.

Will you be examining any of these elements or is there a known quantity of these elements in the sample material: technetium, uranium, thorium, any transuranic?

If "Yes" – Contact the User ESH Group Leader (Bruce Glagola) or APS Material Balance Area Custodian (Wendy VanWingeren) as soon as possible and at least two weeks before the experiment is scheduled to run and provide him/her with information regarding the quantity of radionuclides involved and the sample(s) constituents, overall mass, size, etc. This applies to even a single sample out of a group of samples and the information provided must be for that sample. The User EHS Group Leader or APS Material Balance Area Custodian will coordinate with health physics.

Table A provides radioactivity threshold values for uranium, thorium, plutonium and americium in Curies per gram and mass concentration threshold value in grams per gram that will be used by APS staff to evaluate whether or not the samples should be marked as radioactive on the ESAF. Please note the ESAF must be marked as "radioactive" even if one sample is an extracted quantity of any of these elements. See *Using Radioactive Samples / Materials at the APS* for additional information on radioactive samples.

If the radioactive isotope is from an element not listed on the table or you don't know the quantity in the sample, contact the User ESH Group Leader (Bruce Glagola) or APS Material Balance Area Custodian (Wendy VanWingeren) as soon as possible and at least two weeks before the experiment is scheduled to run to discuss the sample(s). This individual will contact health physics.

Table A
Argonne Radiological Background Concentrations in Soil

Radionuclide	Concentration (pCi/g)	Mass Concentration[1]	Equivalent dpm/g
Strontium-90 (Sr90) from Fallout	0.2	1.5fg/g (1.5 ppq)	0.44
Cesium-137 (Cs137) from Fallout	1.0	11 fg/g (11 ppq)	2.2
Other gamma-ray emitting fission and activation products such as europium-152 from Fallout	0.2	-	0.44
Natural uranium (99.28% U238, 0.72% U235)	1.73 U238[2] 0.08 U235	5 µg/g (5 ppm)[2]	3.8 U238[2] 0.18 U235
Individual U238 daughters[3] such as Ra-226	1.73	-	3.8
Individual U235 daughters[4] such as Th231	0.08	-	0.18
Natural thorium (100% Th232)	1.76	16 µg/g (16 ppm)	3.9
Individual Th232 daughters[5] such as Th228	1.76	-	3.9
Plutonium-239 (Pu239) from Fallout	0.03	0.5 pg/g (0.5 ppt)	0.07
Americium-241 (Am241) from Fallout	0.01	3 fg/g (3 ppq)	0.02

1 µg/g = micrograms per gram of sample (parts per million, ppm)
pg/g = pictograms per gram of sample (parts per trillion, ppt)
fg/g = femtograms per gram of sample (parts per quadrillion, ppq)

2 Use for depleted uranium and separated U238

3 U238 principal daughters in sequence of decay are: Th234, Pa-234m, Pa234, U234, Th230, Ra226, Rn222, Po218, Pb214, Bi214, Po214, Pb210, Bi-210, Po-210, Pb206 (stable)

4 U235 principal daughters in sequence of decay are: Th231, Pa231, Ac227, Th227, Ra223, Rn219, Po215, Pb211, Bi211, Tl207, Pb207 (stable)

5 Th232 principal daughters in sequence of decay are: Ra228, Ac228, Th228, Ra224, Rn220, Po216, Pb212, Bi212, Po212 (64% of Bi212 decays), Tl208 (34% of Bi212 decays), Pb208 (stable)

Additional Guidance for Samples Containing Concentrated Naturally Occurring Radioactive Material (NORM)

A sample containing elements (other than shown in Table A) with naturally occurring radioactive isotopes (such as C14, K40, Rb87, La138, Sm147, & Sm148) where the element concentration in the sample has been increased above the element's source concentration (typically the average crustal abundance as given in the CRC Handbook of Chemistry and Physics, 95th Edition) must be considered as a radioactive sample if:

- The isotopic concentration of one or more of the unstable isotopes in an element with stable isotopes has been increased OR
- The concentration has been performed in order to utilize the radiological properties of the naturally occurring radioactive isotopes (e.g., the use of rubidium in RbCl as a biomarker or x-ray diffraction standard does not involve concentrating rubidium for use of the radioactive emissions of Rb87).