**Section 406.220 Laboratory Equipment and Instrumentation**

Instruments that are needed to analyze for the parameters for which the laboratory is being certified shall meet the following minimum specifications.

a) An analytical balance shall have a precision of plus or minus 0.1 mg or better and a scale readability of 0.1 mg or better.

b) A pH meter shall have an accuracy of plus or minus 0.1 units or better, and a scale readability of plus or minus 0.1 units or better. The pH meter may be either line/bench or battery/portable operated.

c) A specific ion meter shall have an accuracy and scale readability of plus or minus 0.1 mV or better and shall have expanded millivolt scale capability. The specific ion meter may be either line/bench or battery/portable operated.

d) A conductivity meter and cell combination, suitable for checking distilled water quality, shall be readable in ohms or mhos, and have a range of up to 4 megohm/cm or greater (conductivity down to 0.1 micromhos/cm) plus or minus 1 percent. The conductivity meter may be either line/bench or battery/portable operated.

e) A drying oven shall be of the gravity convection type.

f) A desiccator may be a glass, glass and metal, or plastic model, depending upon the particular application.

g) A hot plate shall have a selectable temperature control for safe heating of samples and laboratory reagents.

h) Glassware which is used for purposes that may subject it to damage from heat or chemicals shall be of borosilicate glass. All volumetric glassware shall be Class A, denoting that it meets federal specifications and is certified by the manufacturer as meeting the standards established by the American Society for Testing and Materials (ASTM).

i) A muffle furnace shall be automatically controlled with a chamber capacity of at least 2200 cubic centimeters. The maximum operating temperature of the muffle furnace shall be at least 1100º C intermittent and 1000º C continuous.

j) A centrifuge shall be capable of attaining a speed of at least 3000 rpm and shall have a loading option of 4 x 50 mL capacity.

k) A fluorometer shall be capable of detecting 0.0005 micrograms of uranium.

l) A liquid-scintillation system shall be such that the sensitivity of the radioanalysis meets or exceeds the standards specified in this Part.

m) A gas-flow proportional counting system or other low background alpha-particle and beta-particle counting system shall have a cosmic guard detector operated in anticoincidence with the signal from the sample detector and shielding, such that the alpha-particle background will not exceed 0.2 cpm and the beta-particle background will not exceed 2.0 cpm for a 2 inch diameter counting planchet geometry. The system shall be such that the sensitivity of the radioanalysis will meet or exceed the standards specified in this Part.

n) A scintillation system designed for alpha-particle counting and used for the measurement of gross alpha activities or radium-226 shall include a Mylar disc coated with a phosphor (silver-activated zinc sulfide) which is placed either directly on the sample or on the face of a photomultiplier tube and is enclosed in a light-tight container. The system shall also include appropriate electronics (high voltage supply, amplifier, timer and scaler).

o) A scintillation cell system for the specific measurement of radium-226 by the radon emanation method shall include a light-tight enclosure capable of accepting the scintillation cells, a detector (phototube) and the appropriate electronics (high voltage supply, amplifier, timer and scaler).

p) A gamma-ray spectrometer system shall include a thallium-activated sodium iodide (NaI(TI)) crystal, a solid state lithium drifted germanium (Ge(Li)) detector, a high purity germanium detector or a gamma-X photon detector connected to a multichannel pulse-height analyzer.

1) If a sodium iodide detector is used, the crystal shall be, at minimum, a 7.5 cm x 7.5 cm cylindrical crystal, or preferably, a 10 cm x 10 cm crystal. A minimum shielding equivalent to 10 cm of iron shall surround the detector. The multichannel pulse-height analyzer, in addition to appropriate electronics, shall contain a memory of not less than 250 channels and at least one readout device.

2) If a lithium-drifted germanium detector, a high purity germanium detector or a gamma-X photon detector is used, a minimum shielding equivalent to 10 cm of iron shall surround the detector. The multichannel analyzer, in addition to appropriate electronics, shall contain a memory of not less than 2000 channels and at least one readout device.