



Radioactive Air Emissions Guide: Calculating Radioactive Air Emissions from Annual Possession Quantity

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This guide may be used as part of the licensing process to calculate potential-to-emit (PTE) and abated emissions. It can also be used to calculate radioactive air emissions in lieu of in-stack sampling and monitoring for annual reports.

1. Determine how many curies of each radioisotope you had on hand at the beginning of the calendar year and how many curies you received or produced during the calendar year.

The sum of these values is your annual possession quantity (APQ) for the calendar year. Radioactive materials sealed in containers, that remained unopened during the year, should not be included in your APQ.

If you are applying for a new license or license revision, consider a high estimate of how many curies of each radioisotope you may have on hand, receive, and produce in a calendar year. This will be your APQ limit in your license. Sealed sources should not be included as part of your air emission APQ limit.

2. Multiply the APQ of each radioisotope by the appropriate release fraction.

- a. Multiply by a release fraction of 1 for gases and radionuclides subjected to temperatures at or above its boiling point. You must also use this release fraction if the chemical form is unknown and is heated to temperatures of 100°C or more, boils at 100°C or less, or is intentionally dispersed into the environment.
- b. Multiply by a release fraction of 0.001 for particulate solids, liquids, or radionuclides subjected to temperatures at or above its melting point but below its boiling point.
- c. Multiply by a release fraction of 0.000001 for solids.

This will give you the unabated release rate, or PTE, in curies per year.

3. Multiply your PTE by the appropriate adjustment factor for your abatement technology. This will give you the abated release rate in curies per year. If you do not have any abatement technology, proceed to step 4.

The following table has the accepted adjustment factors given in 40 CFR Part 61 Appendix D. Other factors may be approved by the department on a case-by-case basis and should be given as an alternate approval in your license.

Controls	Radionuclide type	Adjustment factor	Comments and conditions
HEPA filters	Particulates	0.01	Not used for gaseous radionuclides. Filters should be regularly tested for high removal efficiency.
Fabric filter	Particulates	0.1	Monitor for tears in filter.
Sintered metal	Particulates	1	Not enough data to make a recommendation.
Activated carbon filters	Iodine gas	0.1	Monitor to ensure effectiveness.
Douglas bags: Held 7+ days for decay.	Xenon	0.5 per week	Based on xenon half-life of 5.3 days.
Douglas bags: Released within 7 days.	Xenon	1	Provides no reduction of exposure to general public.
Venturi scrubbers	Particulates	0.05	Although venturi scrubbers may remove gases, adjustment is only for particulates because efficiency varies for gas removal.
	Gases	1	
Packed bed scrubbers	Gases	0.1	Applies to gases and not particulates.
Electrostatic precipitators	Particulates	0.05	Does not apply to gaseous radionuclides.
Xenon traps	Xenon	0.1	Time is critical; monitor to ensure effectiveness.
Fume hoods	All	1	These do not reduce exposure to the public.
Vent stacks	All	1	Generally, these do not reduce exposure to the public.

4. Input your release rate into an approved dose calculation model (e.g. COMPLY, CAP88) to calculate a dose to the maximally exposed individual. You may be required to submit two dose calculations, one to compare to your PTE limit and another to compare to your abated emission limit.

References

- American National Standards Institute, Inc. (ANSI), “Sampling and Monitoring Releases of Airborne Radioactive Substances from the Stacks and Ducts of Nuclear Facilities,” Health Physics Society, McLean, VA, March 30, 2011, ANSI N13.1-2011 Section 4.2.1
- Electronic Code of Federal Regulations, “[40 CFR Part 61.96 Applications to construct or modify](#)”
- Electronic Code of Federal Regulations, “[40 CFR Part 61.107 Emission determination](#)”
- Electronic Code of Federal Regulations, “[Appendix D to Part 61-Methods for Estimating Radionuclide Emissions](#)”
- Office of Radiation Programs, “Background Information Document: Procedures Approved for Demonstrating Compliance with 40 CFR Part 61, Subpart I,” U.S. Environmental Protection Agency, Washington, DC, October 1989, EPA 520/1-89-001.
- Washington Administrative Code, “[WAC 246-247-030 Definitions](#)”