

American National Standard Radiation Protection in Uranium Mines ANSI/HPS n13.8 revision

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The findings and conclusions in this presentation are those of the authors and do not necessarily represent the views of their respective organizations.

Key reasons we should care about the ANSI/HPS n13.8 Revision

- Specific MSHA Regulations Incorporate ANSI N13.8-1973 by Reference
 - 30CFR57.5037 – Sampling equipment and procedures for radon
 - 30CFR57.5047(b) – Gamma surveys
- There is no current version of ANSI N13.8
 - ANSI has withdrawn the standard
- Current and emerging mining activities involving exposure to radiation and radioactive materials can benefit from an updated and approved standard

ANSI Standard Development Process

- American Standards Committee, N13, Radiation Protection, is responsible for the development of certain radiation safety standards for the American National Standards Institute (ANSI)
- The Secretariat for N13 is the Health Physics Society (HPS), and coordinates closely with the HPS Standards Committee. (<https://hps.org/hpssc/>)
- As a professional society member, HPSSC holds only one vote toward the approval or disapproval of N13 standards. There are presently 32 N13 voting members.
- Once a work group (WG) is established under N13, they produce a draft standard by consensus. The WG should consist of individuals across a spectrum of interest groups (e.g., academia, government, and industry).

ANSI N13.8 History

- ANSI N13.8
 - Originally developed by the Atomic Industrial Forum Secretariat as ANSI N7.1-1960, and as ANSI N7.1a-1969, and as ANSI N13.8-1973
 - Old terminology in document
 - Radon “daughters”
 - Radium A, B, C, C’ (Po-218, Pb-214, Bi-214, Po-214)
 - Withdrawn by ANSI in 1989 due to lack of an update, but still incorporated by reference in MSHA regulations
 - N13 filed a Project Initiation Notification System (PINS) information form in 2010 to move forward with a revision to the standard
 - The WG plans to have a draft revision complete for review by July 2023

ANSI/HPS n13.8 Working Group

- Chair - Mark Hoover - Mark D Hoover LLC
- Secretary – Phil Egidi - EPA
- Members and Consultants
 - Jan Johnson – Sopris Environmental
 - Phil Jenkins - Bowser-Morner
 - Chris Findlay - MSHA
 - David Galizia – MSHA
 - David Baltz - Bladewerx
 - Steven Brown – SHB, Inc.
 - Doug Chambers - Arcadis

MSHA Radiation Protection Standards – 30CFR57 Summary Underground Metal and Non-metal Mines

- Radon decay product exposure – 4 WLM/year
 - If EPA recommends a different standard it must be adopted
- Direct gamma radiation – 5 rem/year
- Airborne particulates – 15 rem/year to any organ based on assumed ACGIH 1973 Threshold Limit Values TLV.
- Summation of doses not required
- Radon and in some cases direct gamma are generally the major contributors to dose
- Potential total dose limit from direct gamma, radon and airborne particulates– 10 to 15 rem/year
- Miners are not protected to the same degree as other uranium workers

30CFR56: Safety and Health Standards Surface Metal and Non-metal Mines

- No Specific Radiation Regulations
- Exposure Limits for Airborne Contaminants (56.5001) – incorporated by reference 1973 ACGIH TLVs
- 1973 TLVs are based on 1959 NBS Handbook 69

- From ACGIH 1973 TLV book

Radioactivity: For permissible concentrations of radioisotopes in air, see U.S. Department of Commerce, National Bureau of Standards Handbook 69, "Maximum Permissible Body Burdens and Maximum Permissible Concentrations of Radionuclides in Air and in Water for Occupational Exposure," June 5, 1969. Also, see U.S. Department of Commerce National Bureau of Standards, Handbook 59, "Permissible Dose from External Sources of Ionizing Radiation," September 24, 1954, and addendum of April 15, 1958. A report, Basic Radiation Protection Criteria, published by the National Committee on Radiation Protection, revises and modernizes the concept of the NCRP standards of 1954, 1957 and 1958; obtainable as NCRP Rept. No. 39, P.O. Box 4867, Washington, D.C. 20008.

Airborne Radionuclides

NBS Handbook 69 (ACGIH TLVs) vs NRC DACs

Note: TLVs are applied on a 40 hour work week basis while DACs are applied on an annual basis.

Nuclide	NBS Handbook 69 MPC (uCi/cc) (Based on 15 rem/y to any organ)	10CFR20 Appendix B DAC (uCi/ml) (Based on 5 rem/y effective dose)
U-238 (insol.)	1E-10 (lung)	2E-11
Th-230 (insol.)	1E-11 (lung)	6E-12 (bone)
Ra-226 (sol)	3E-11 (bone)	3E-10 (bone)
Rn-222	3E-8 (lung) Daughter isotopes (sic) assumed to be present to the extent they are in unfiltered air	4E-6 (no decay products) 3E-8 (with decay products) 0.33 WL
Pb-210 (insol.)	2E-10 (lung)	1E-10 (bone, soluble)
Ore dust		6E-11 gross alpha

OSHA Radon Standards

- 29CFR1910.1096(c) 1: Reference to 10CFR20 Appendix B
 - 30 pCi/L with decay products present
 - 4,000 pCi/L with no decay products present
- OSHA PEL – 100 pCi/L
 - No specification of decay products
 - PEL dates back to 1970 AEC 10CFR20 Appendix B
- Standards internally contradictory?
 - Interpretive letter issued in 2002 verifies that the OSHA PEL is the controlling standard but that use of the more restrictive current 10CFR20 Appendix B derived air concentration would be considered a “de minimus violation”.

30CFR57.5037 Requirement

- Radon daughter “sampling shall be done using suggested equipment and procedures described in Section 14.3 of ANSI N13.8-1973...or equivalent procedures and equipment acceptable to...” MSHA.
- ANSI N13.8-1973 describes only the modified “Kusnetz” Method with lots of shoulds and shalls.
 - Equipment
 - Filter type
 - Sampling procedure
 - Calibration
 - Specific method for calculating self-absorption on filters
- Radon Gas Measurement – ANSI N13.8-1973
 - Lucas chamber
 - Two filter method

30CFR57.5047 Requirement

- Gamma surveys shall be in accordance with ANSI N13.8-1973 section 14.1
- Section 14.1 – Gamma radiation may be measured by calibrated Geiger counter survey meters, ion chambers or scintillometers
- Shields thick enough to stop beta particles
- Specifies locations of the measurements
- Allows individual miner measurements with film badges or TLDs.

Where the ANSI/HPS n13.8 working group is going with the revision

- Updating the scope and text to reflect current science and current mining realities
- Recognition that radiation protection in mining is not limited to uranium mines (e.g., emerging radiation issues in rare earth and other mineral extraction operations involving both underground and surface operations)
- Potential title change from *Radiation Protection in Uranium Mines* to *Radiation Protection in Mining*
- Inclusion of measurement of thoron decay products, as appropriate, in addition to radon decay products
- Inclusion of limits based on total exposure (not just inhalation)
- Clarification of issues related to currently divergent regulations, with recommendations to defer to applicable regulatory authorities

Where the ANSI/HPS n13.8 working group is going with the revision (continued)

- Developing a simplified, technically defensible, graded approach table for exposure-dependent and dose-dependent schedules for measurement and reporting of radon/thoron and whole body exposure in mining operations
- Including recommendations to follow the new IEEE/ANSI PN42.50 standard on *Performance Specifications for Measuring Radon Progeny*
- Reviewing and updating record-keeping requirements, as needed
- Adding at least one informative Annex to the standard
 - Comparison and clarification of currently conflicting radiation dose-conversion values and standards
- Moving some example materials from the body of the standard to Annexes
 - Example radon (Rn-222) decay product measurement methods
 - Example thoron (Rn-220) decay product measurement methods
 - Example reporting forms
 - Others?

Thoron Decay Product Sampling

From MSHA Radiation Protection Training Manual – 1980
(No other reference found)

- Fifty liter air sample within 30 minutes
- Set sample aside for 5 to 17 hours
- Count sample for “several minutes” (my suggestion – 30 minutes)
- $WL = (cpm \times ef) / (Vol \times TF)$
 - cpm- counts per minute
 - ef – efficiency factor
 - Vol – volume of air collected
 - TF – thoron time factor

Hours	TF	Hours	TF
5	13.0	12	8.25
6	12.2	14	7.25
8	10.65	16	6.35
10	9.35	17	5.85

Other Thoron Decay Product Methods

- Most measurement methods in the literature related to indoor radon
- Equilibrium fraction in homes – estimated to be about 0.02 in one study
- Would be different for mines.
- Will be looking for other methods applicable to mines.

The way forward

- The Working Group welcomes input
- We plan to have a reviewable draft ready for the 2023 HPS Annual Meeting in July if not before.
- Project will be withdrawn if no draft is submitted by October 2023.
- *What happens to MSHA regulations if there is no valid ANSI N13.8?*

Questions?

For more information or comments please contact Jan Johnson at janetj@sopris.net



"Lessons Learned Over 20 Years of the Health Physics Society's Ask the Experts Feature"

Jan Johnson
ATE Environmental Editor

Craig A. Little, PhD - Federal Agency Liaison and Society
Operations Editor
Health Physics Society

Q&A Categories

- Accelerators
- Cell phones, radiofrequency radiation, powerline fields
- Consumer products
- Decommissioning and rad waste disposal
- Environmental and background radiation
- Homeland security
- Industrial radiation
- Instrumentation and measurements
- Lasers, infrared & UV
- Medical and dental equipment/shielding

Q&A Categories (2)

- Medical and dental patient issues
- Nuclear medicine patient issues
- Nuclear power
- Other
- Policy, guidelines and regulations
- Popular culture and radiation
- Pregnancy and radiation
- Radiation accidents
- Radiation fundamentals
- Radiation materials science
- Regulations, policies and standards
- Security screening

How It Works

- Question submitted
- Editor in Chief (EIC) assigns a topic editor
- Topic editor either answers directly or assigns to an expert
- Questioner is answered directly via email
- EIC decides to post question on hps.org
- Tech editor adapts Q&A into appropriate form

Wide Spectrum of Questioners

- General public – Least knowledgeable, most anxious
- News media – Need quick response, short bites
- Entry-level HPs and other technical persons – Need answers and tutoring on basics
- Professionals who are not HPs (MDs, lawyers, other scientists) – need detail and backup for their situations
- Professional-level HPs – Need information in an area beyond their expertise



Most Common Environmental Questions

- Radon – probably about 50%
 - High radon - >50 pCi/L – what is the risk
- Uranium in water
 - Domestic water at 1.0 mg/l
 - Dose rate at the external surface of a tank containing water treatment residues – 100 mg/l

A Successful Venture

HPS considers its ATE feature the most valuable service the Society offers for the public.

- Over 14,000 personally answered questions
- Materials posted in 26 categories
 - Answers to selected questions
 - Searchable frequently asked questions
 - Fact sheets and position statements
 - Links to more information, e. g., public information sheets
- ATE feature draws > one million visitors per year



Lessons Learned

- Give the bottom line first, then background info.
- Be factual but brief.
- Show compassion. “Nobody cares how much you know until they know how much you care.”
- Explain units.
- Use plain language at the level of the questioner.
- Rely on NCRP publications, HPS position statements, fact sheets and other peer-reviewed documents for credibility.

* Theodore Roosevelt



Conclusions

- We help people! Especially the many, very anxious members of the public.
- That's why 20 editors and >400 experts are such willing volunteers. And we always need more experts.

