Sampling and Monitoring Releases of Airborne Radioactivity in the Workplace of Nuclear Facilities: Status of ANSI N 13.56

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Status

- Draft sent in for ballot
- Results
  - 8 positive with some minor changes
  - 2 negative votes
- Asked to address comments and resubmit
- In the meantime, I have gotten several other good comments for us to include
- My goal is to have the comments addressed and resubmitted by the summer HPS meeting

Need for Standard

- Air sampling is a critical component in radiation protection program
  - Need to get it right
- No high-level standard since ANSI N13.1 (1969) whose focus was on extractive sampling
- DOE IG, NUREG-1400, and NRC Reg. Guide 8.25 provide guidance on air sampling, but not always applied consistently across regulatory boundaries (DOE vs NRC)
- New advances in instrumentation and utilization since 1969

Main elements of the standard

- Evaluating need for air sampling/monitoring
- Collection of air samples
- Evaluation of air sample results
- Location of air sampling instrumentation
- Quality assurance and control
- Evaluating the effectiveness of the air sampling program at each site

Evaluating the need for air sampling/monitoring: Dose-based limits for air sampling/monitoring

Annual dose-based limit (yr^{-1})	Air sampling requirement
< 0.02 ALI (<100 mrem)	Air sampling not always needed if potential concentration is < 0.02 DAC averaged over 2000 hrs/yr (<40 DAC-hrs)
> 0.02 ALI (>100 mrem)	Continuous air sampling required if potential concentration is > 0.02 DAC averaged over 2000 hrs/yr (>40 DAC-hrs). Grab sampling ok for periodic operations
> 1 ALI	Continuous air monitoring required if potential time-integrated concentration is >40 DAC-hrs in a time period ≤ 1 week.

Evaluating the need for air sampling/monitoring

- Based on assessment of inhalation risk to worker
  - **Preferred method**: If adequate historical data is available, risk can be assessed using
    - previous intake data
    - air sample results
  - If historical data is not adequate, risk can be assessed using
    - Task (mechanical action, heating, etc.)
    - Material (amount, dispersibility, ALI, etc.)
    - Confinement (open bench, hood, glovebox)
    - **Need to verify risk through time with data once operational**

How to collect air samples

- Aerosol Sampling
  - Considerations for collection of samples
    - Filter selection
    - Particle collection efficiency (transport tubes, sampling inlets)
- Gas Sampling (we do not address radon/thoron)
  - Active
  - Passive
- Tritium

How to collect air samples: Sampling strategy based on purpose of sample

- Verify confinement
- Characterize concentrations in general workplace (posting, evaluate operations for radiation protection)
- Estimate worker intakes
- Verify PPE or hot job sampling
- Early warning of a release

How to collect air samples: frequency of collection

- Grab verses continuous air sampling
  - Periodic (grab) sampling for periodic operations
  - Weekly exchange for continuous air sampling if average concentration over a week is > few % of a DAC.
- Prompt analysis for air samples
  - Unanticipated releases with potential for being above 40 DAC-hrs should be evaluated quickly.
  - Credit can be taken for respirators
- Continuous air monitoring
  - > 40 DAC-hrs in a time period $\leq$ 1 week
  - Continuous check sources can be used $\pm$ 20% of normal response

Analysis of air sample results

- Calculation of concentrations
  - Activity concentrations (Bq/m3)
  - Time-integrated relative concentrations (DAC-hrs)
- Minimum detection capabilities
  - MDA
  - MDC
- Error analysis and propagation
  - Systematic
  - Random

Placement of air samplers

- Concentrations in workplace vary in time and space
  - Impacts for both sampling and monitoring capability and interpretation
- Types of airflow studies
  - Quantitative- tracer studies (likelihood of > 40 DAC-hrs/year)
    - Where CAMs are used
  - Qualitive – smoke studies (likelihood of < 40 DAC-hrs/year)
    - Where retrospective sampling is done

Placement strategy dependent on purpose of air sample

- Dose Estimates
- Evaluating containment
- Posting of Airborne Radioactivity Area
- Evaluation of respiratory protection during hot jobs
- Determining optimal number and placement of CAMs

Quality assurance for counting and instruments

- Physical samples
  - Identification
  - Handling
  - Storage
- Calibration of counting systems annually and to ± 10%
- Operability checks for counting systems before use
- Air monitors calibrated annually, or following repair or instrument modifications
  - Airflow rate criteria ± 15%
  - Detectors ± 10%
  - Daily operability checks
- Inleakage tests following filter exchanges, operability checks on flow rate meters

Documentation

- 15 items related to the measurements are listed and should be easily retrievable:
  - Purpose, results, uncertainty, all calculations and factors, location of sample, ID, records of operability and performance, calibration records, performance checks, all applicable procedures used, QA results, MDAs, MDAs relative to goals of program, and historical performance, etc.

Evaluating the effectiveness of the air sampling/monitoring program

- Confirm that the equipment is working, results are accurate, reliable, and have sufficient sensitivity
- Technical basis documents are needed for various parts of the program and demonstrate that the program is technically advanced and justified

Conclusions

- ANSI N13.56 has been drafted and is close to pass on for additional review
- Would like to put out for review this summer
- This standard, once published, will hopefully help those establishing air sampling programs or for evaluating and improved already established programs.