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

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Some opinions are more important than others

Macaroni Grill

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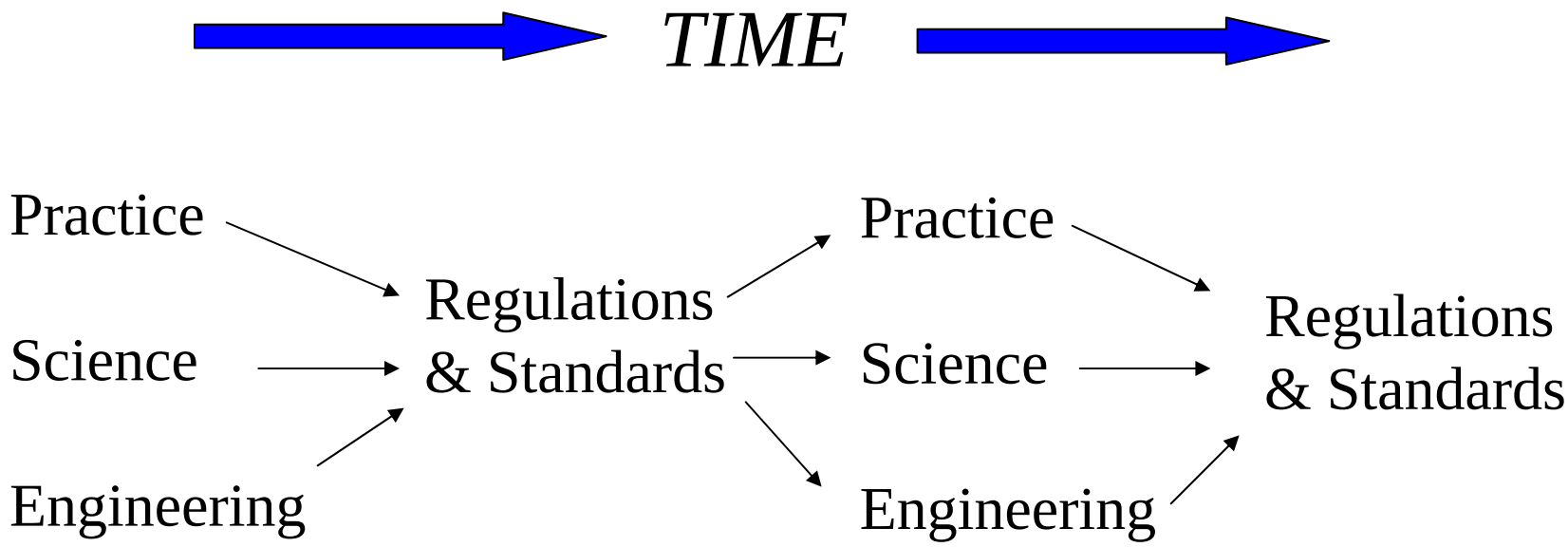
Evolution of a profession:



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 workplace 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
- Guidance for evaluating the effectiveness of the air sampling program at each site

Evaluating the need for air sampling/monitoring

- **Based on assessment of inhalation risk to worker**
  - 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

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.

Collection of air samples

- Aerosol Sampling
  - Considerations for collection of samples
    - Filter selection
    - Particle collection efficiency
      - Instrument inlet efficiency should be known
      - transport tubes discouraged (> 50% collection efficiency for 5 μm diameter particles)
      - Code DEPOSITION can be used to estimate loss
      - Corrections are required for collection efficiencies <95%
- Gas Sampling (we do not address radon/thoron)
  - Active
  - Passive

Sampling strategy based on purpose of sample

- Verify confinement- sample representative air near object
- Characterize concentrations in general workplace (posting, evaluate operations for radiation protection)
- Estimate worker intakes – Bioassay preferred but BZ otherwise
- Verify PPE or hot job sampling –BZ sampling
- Early warning of a release- Timely and sensitive

Sampling Strategy- frequency of collection

- Grab verses continuous air sampling
  - Periodic (grab) sampling for periodic operations
  - At least a 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)
  - Relative concentrations (DAC)
  - Time-integrated relative concentrations (DAC-hrs)
- Minimum detection capabilities
  - MDA
  - MDC
- Error analysis and propagation
  - Systematic- Correction for actual volume of air sampled/breathed
  - Random

Location 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 (higher likelihood of high concentrations- e.g., when CAMs are required)
  - Qualitive – smoke studies (higher likelihood of high concentrations- e.g., when only air sampling is required)

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 ± 10% for counting systems
- Operability checks for counting systems before use
- Air samplers and monitoring equipment calibrated annually, or following repair or instrument modifications (criteria ± 15%)
- Inleakage tests following filter exchanges

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 that the program is technically advanced and justified

Conclusions

- ANSI N13.56 has been drafted and is close to point 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 improving already established programs.