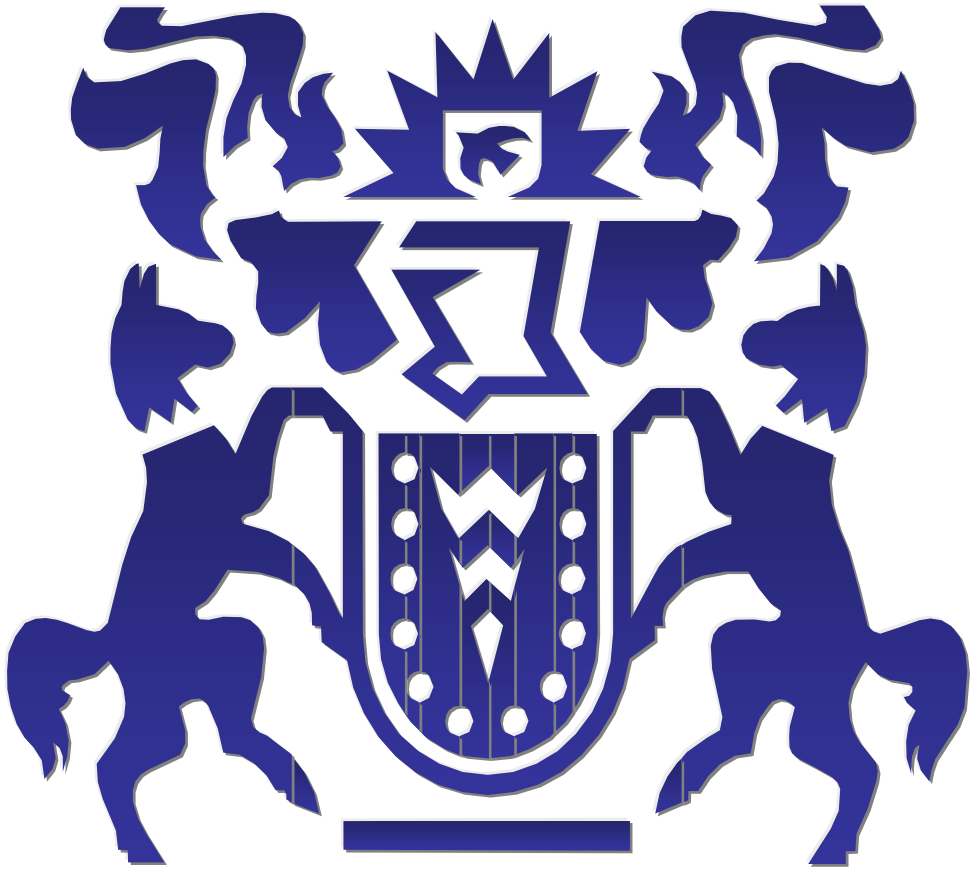

WORKPLACE AIR SAMPLING

Stuart Fannin, UKAEA

TYPES OF AIR SAMPLING REGIMES

- Real Time Air Monitoring
  - To provide a prompt alert to breakdowns in control / containment
  - Where immediate action is required to mitigate harm to worker / work
- General Workplace Static Air Sampling
  - To detect low level chronic releases from engineered containments
  - Detect re-suspension of historic contamination
  - Control of low risk well known operations (incl protected ops)
  - Used to establish trends, allows early action to be taken to avoid internal doses

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APPLICATION OF SAMPLING REGIMES

REAL TIME AIR SAMPLING

- Routine operations
  - When working in containments, glove boxes, cells etc
  - At all times at entrances to ventilated enclosures, tents and modular containments
  - Lab plenum inputs where the building ventilation re-circulates air

- Protected operations
  - When bagging out or posting operations carried out
  - When breaking into or disconnecting glove box / containment service lines
  - When opening systems not routinely surveyed such as safes and transport packages
  - At boundaries between temporary restricted / exclusion areas

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APPLICATION OF SAMPLING REGIMES

REAL TIME AIR SAMPLING (cont.)

- Emergency response
  - One monitor in each area with potential to release gross level of contamination (connected to essential supply with a remote readout).
  - In rooms and corridors adjacent to pressurised suit areas or labs with glove boxes or containments (on essential power supply with remote read out capability).
  - At pre-designated places of safety, e.g. evacuation points identified in SSOW
  - During emergencies at Forward Control Points.

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APPLICATION OF SAMPLING REGIMES

STATIC AIR SAMPLING

- Continuously in areas where
  - Real time air sampling is carried out.
  - RPE is routinely worn in temporary restricted / exclusion areas.
  - Loose contamination can be generated.

- As required
  - Inside exclusion / restricted areas to demonstrate suitability of selected RPE.
  - Prior to down designation / de-restriction of areas to demonstrate compliance with RA endpoints.

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FACTORS AFFECTING PERFORMANCE OF MONITORING REGIME

- **Room air flow patterns**
  - Air does not flow directly from plenum to lab extract point.
  - Plume migration time (minimised if sampler directly downwind).
  - Probability of plume hitting sampler.
- **Distance of sampler from release point**
  - Greater the distance the more dilute the plume the less activity a remote sampler collects.

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Alarms

- If alarm level is set too high may not collect sufficient activity to generate an alarm in time to avert uptake
- If the level is too low get excessive radon induced false alarms.
  - Radon false alarm rate should not exceed 1 per instrument per 6 months.

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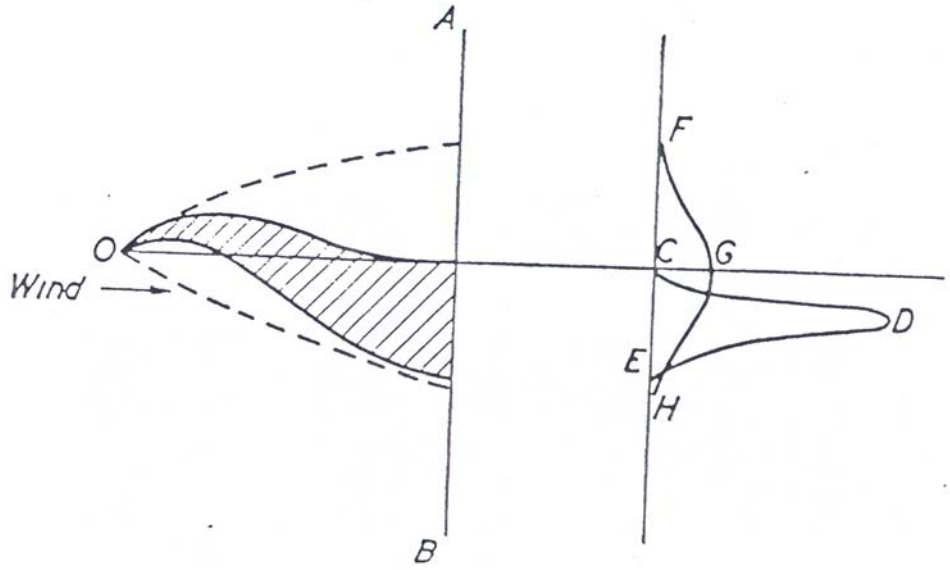
PROBABILITY OF PLUME HITTING SAMPLER



INTERMITTENCY EFFECT

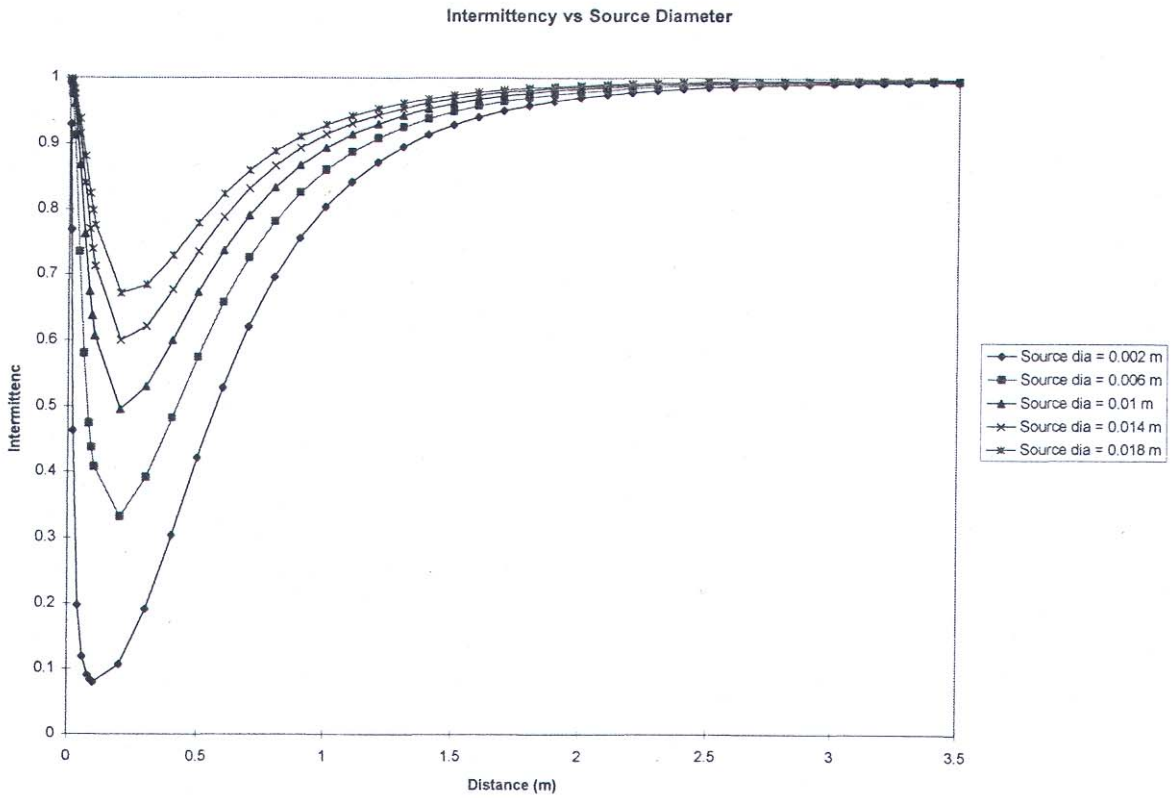
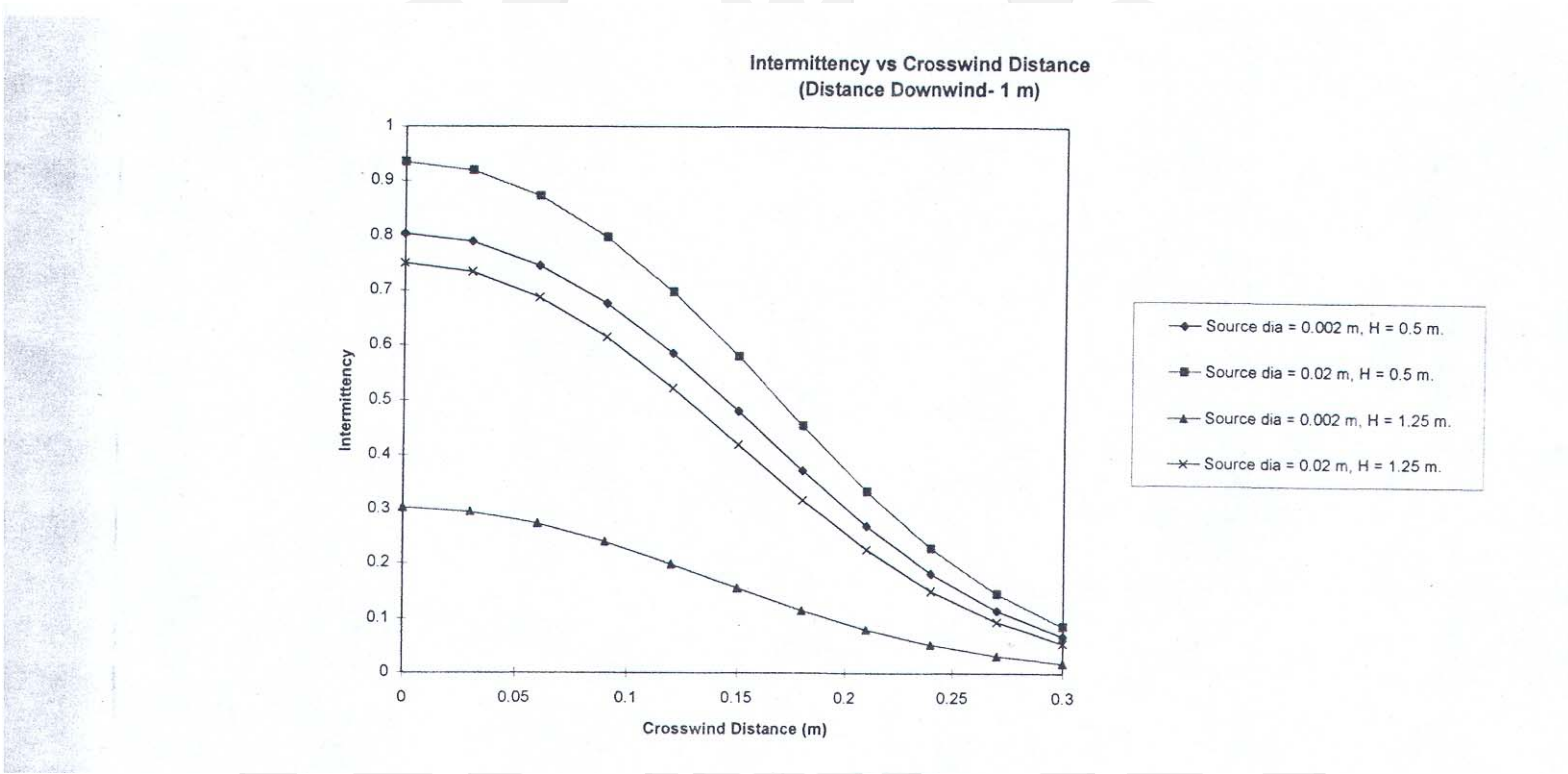
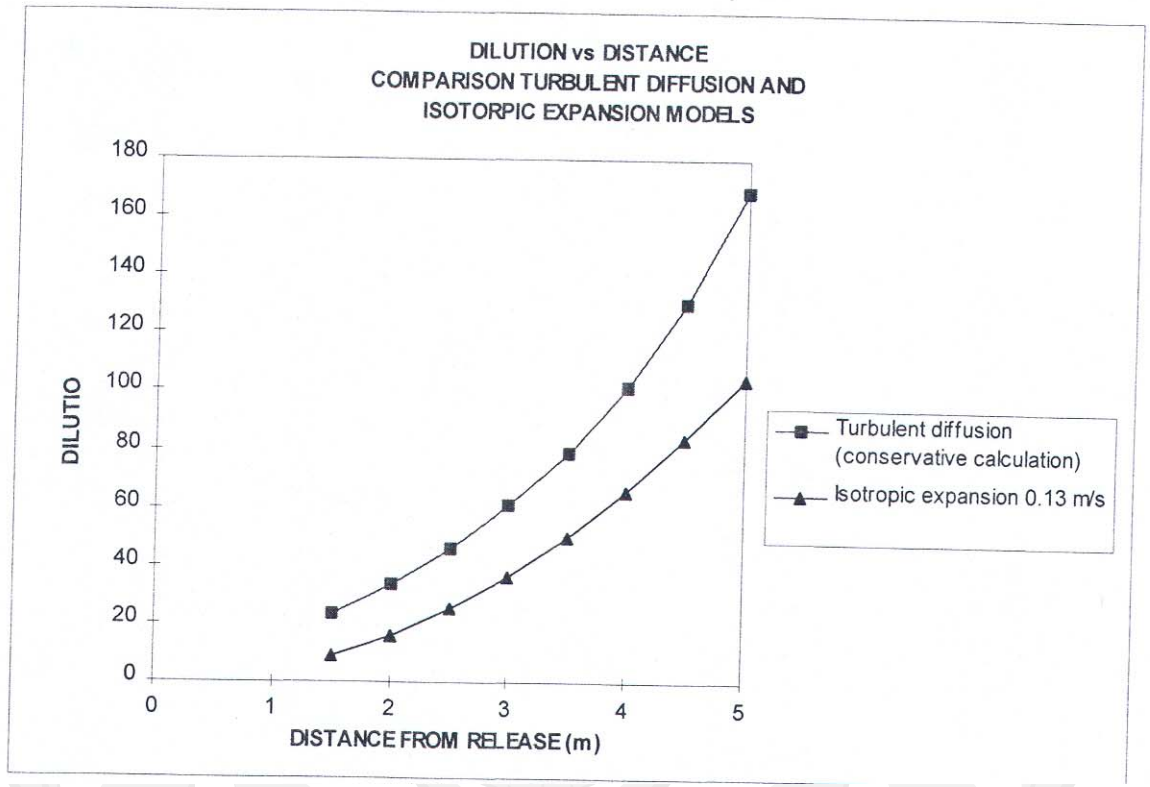


FIGURE 2

INTERMITTENCY EFFECT



DILUTION VERSUS DISTANCE



MERITS OF AIR MONITOR LOCATIONS

	Close to release point (Directly downwind)	Remote from release point
Dilution	Low	High
Air monitor alarm setting	Can be higher	Must be set low
Probability plume hitting monitor	Lower	Higher
Regime alarm response time	Short	Long (several minutes)
Regime detection level	Low (good)	High (poor)

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OPTIMISED AIR MONITORING REGIME

- **Real time air monitoring criteria**

  Achieve a high probability of generating a prompt alarm at an acceptably low dose to an individual.

- **No single air monitor position that satisfies criteria**

- **Need to deploy air monitors close to and remote from the release point**

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REAL TIME AIR MONITOR DETECTION LEVELS

	Primary monitoring (task specific)	Secondary air monitoing (fixed position)
Location	Above workers head > 1 to 1.5 m downwind < 0.2 to 0.4 m off axis	Adjacent to extract points In cellular flow regions
Dilution	10 (worst case)	100 (10 to 300 been observed)
Monitor detection level	8 DACh	8 DACh
Overall alarm response time	Lab mixing few seconds + Instr response 3 mins **Total = 3 minutes**	Lab mixing 10 minutes + Instr response 3 mins **Total = 13 minutes**
Regime detection level	8 * 10 = 80 DACh = **0.8 mSv**	8 * 100 = 800 DACh = **8 mSv**

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STATIC AIR SAMPLER LOCATIONS

- Low risk reactive monitoring - no need for prompt result
- Need to cover entire work area
- Locate at position most likely to detect activity

- Adjacent to lab / containment extract points
- All lab extract points sampled - cellular flow effects

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APPLICATION

- **Primary real time air monitoring**

  Not practical to:

  – Retrospectively install unless construction of a new facility, modification or decommissioning of existing facility.

  Practical to:

  – Apply to higher risk operations e.g. glove changing, posting & bagging operations, sleeving ops, containment service line disconnections, entrances to tents, opening containers.
    - Use either air monitor connected to a sampling line
    - Encourage air monitor designers to separate sampling head from pump e.g. Lab Impex trials
    - Static samplers on extendible arms “Giraffes”

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APPLICATION (cont.)

- **Secondary real time air monitoring**
  - Likely to be compliant in most areas.
  - Review to ensure applied to routine, protected and emergency response activities.
  - ADS count of air monitor filter papers.
  - Ensure false alarm rate < 1 per instrument per 6 months.
- **Static air sampling**
  - Likely to be compliant in most areas.
  - Review data at lower levels to identify trends etc.

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Summary (PHB)

- Positioning is key and difficult
- The high dose per unit intake leads to a need to alarm with very low levels of activity deposited on the filter.
- Slow response times.
- Only generally practicable for time integrated concentration.

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Summary (PHB)

- Old buildings with poor ventilation and high radon levels offer major challenges.
- Instrument radon rejection ability is very important

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