

Airborne Activity Sampling and Monitoring at Hinkley Point 'A' Site

David Williams, Hinkley Point 'A' Site

Presentation objectives

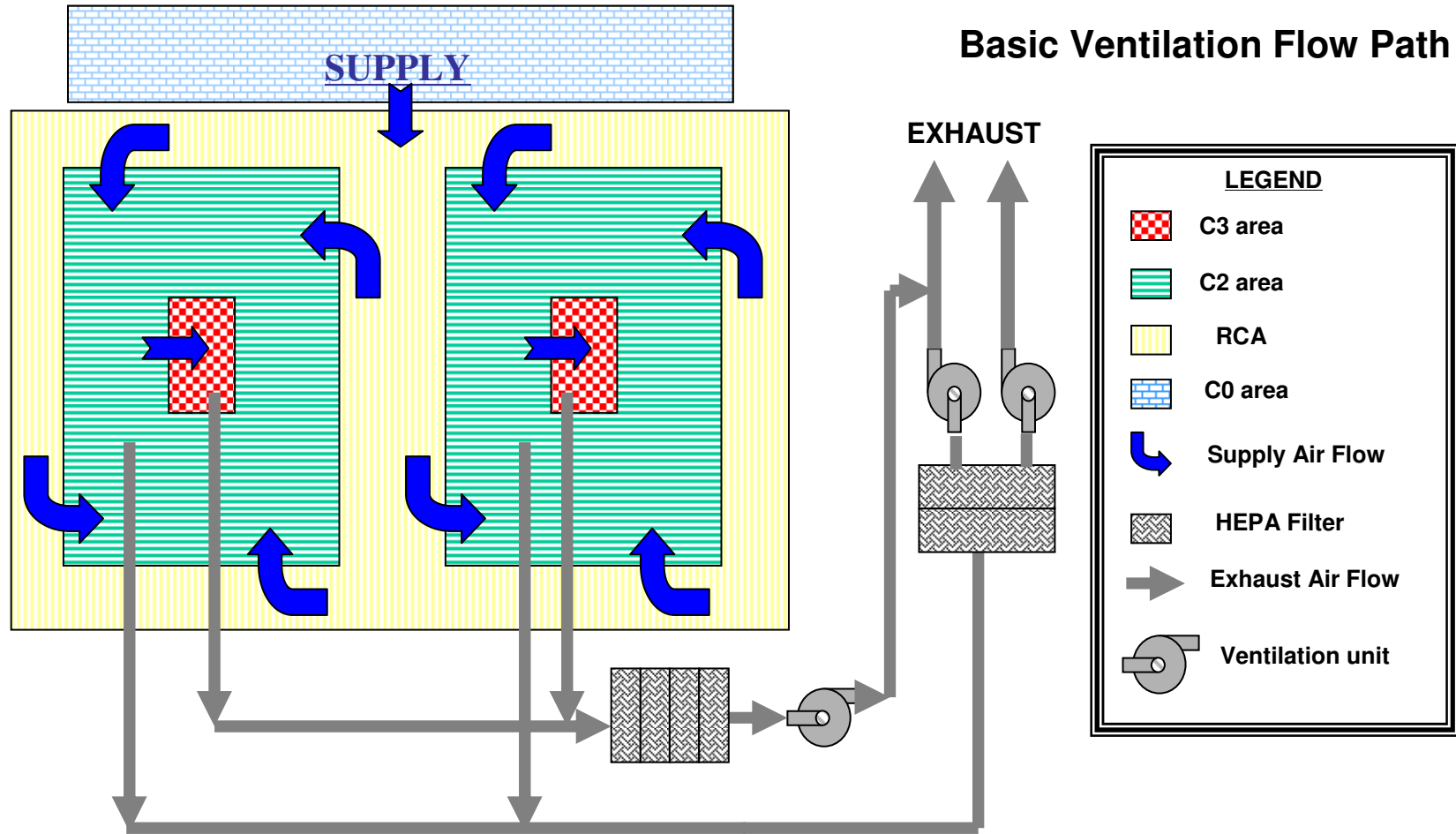
- Ventilation controls in use at Hinkley Point 'A' Site
- The air sampling and monitoring programme

Ventilation controls

Health and Safety Executive (HSE) Hierarchy of Controls:

- i. Eliminate the use of the hazardous substance wherever possible
- ii. Enclose the process to reduce the potential for exposure to the hazardous substance wherever possible
- iii. Control the exposure of the substance at the source, using engineering means such as local exhaust ventilation
- iv. Provide adequate protective equipment such as respiratory protective equipment - RPE

Ventilation flow paths



Three primary principles of ventilation control

Depression

- Keeping the inside work area air pressure lower than the outside air pressure

Volume

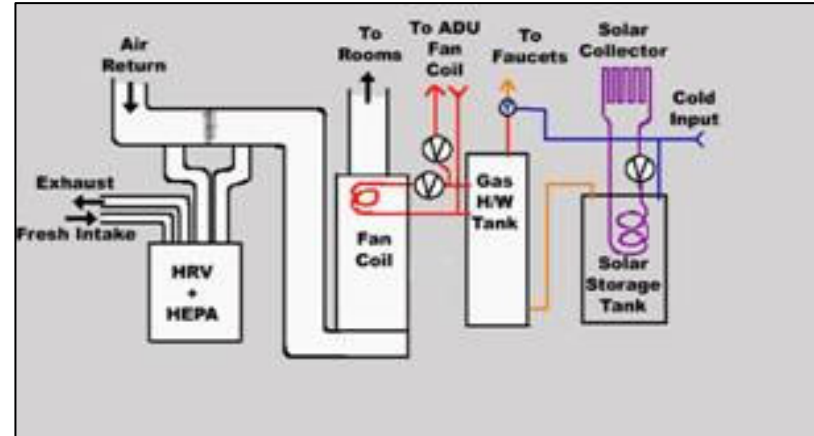
- Ensuring the work area air volume turn over rate is sufficient to minimise airborne contamination buildup

Velocity

- Ensure that airborne material which is capable of penetrating to the gas-exchange region of the lungs are directed away from the workers breathing zone

Ventilation systems types

Installed building ventilation



Point source ventilation (HEPA vacuum cleaner)



Portable filtration units

Building HVAC ventilation

Building HVAC system

- The HVAC is an engineering system specifically credited with reducing the risk of analysed accidents



Portable ventilation systems

- Mobile Extraction Unit (MEU)
- Mobile Air Mover
- Local exhaust ventilation unit



Ventilation controls

- Ventilation systems protect the health and safety of:
 - The public
 - The co-workers
 - The immediate worker

...from an uncontrolled release of radioactive material
or other hazardous chemicals

Contaminant characteristics

Inertial effects

- Respirable particles will not exhibit inertial effects particles >20 μm

Specific gravity

- Hazardous Fine dust particles are truly airborne (small enough to breathe small enough to fly)

Wake effects (boundary layer separation)

- Similar to the wake of a ship. Can cause recirculation of the contaminant into the breathing zone

Types of ventilation controls

- Room Exhaust
- Point Source
- Local Exhaust
- Other

Room exhaust

- High overall flow rate
- Low velocity
- Issues
 - Recirculation or single pass
 - Cost electricity heating
 - Radon Build-up
 - Re-suspension vs. dilution
 - Air monitor placement
 - Should have HP involvement in design
 - Room exhaust is not local exhaust
- Contamination control or defence in depth

Local extract

- High volumetric flow 6k to 10k m³ hr⁻¹ with respect to area concerned
- Medium velocity 0.5 to 1 ms⁻¹
- Can augment / act as room exhaust (Depression)
 - Caution needed to ensure activities do not reduce /block room exhaust
 - Not a good idea to serve as only source of ventilation for area
- Downdraft tables
- Industrial safety hoods

Local extract



Local extract



Point source

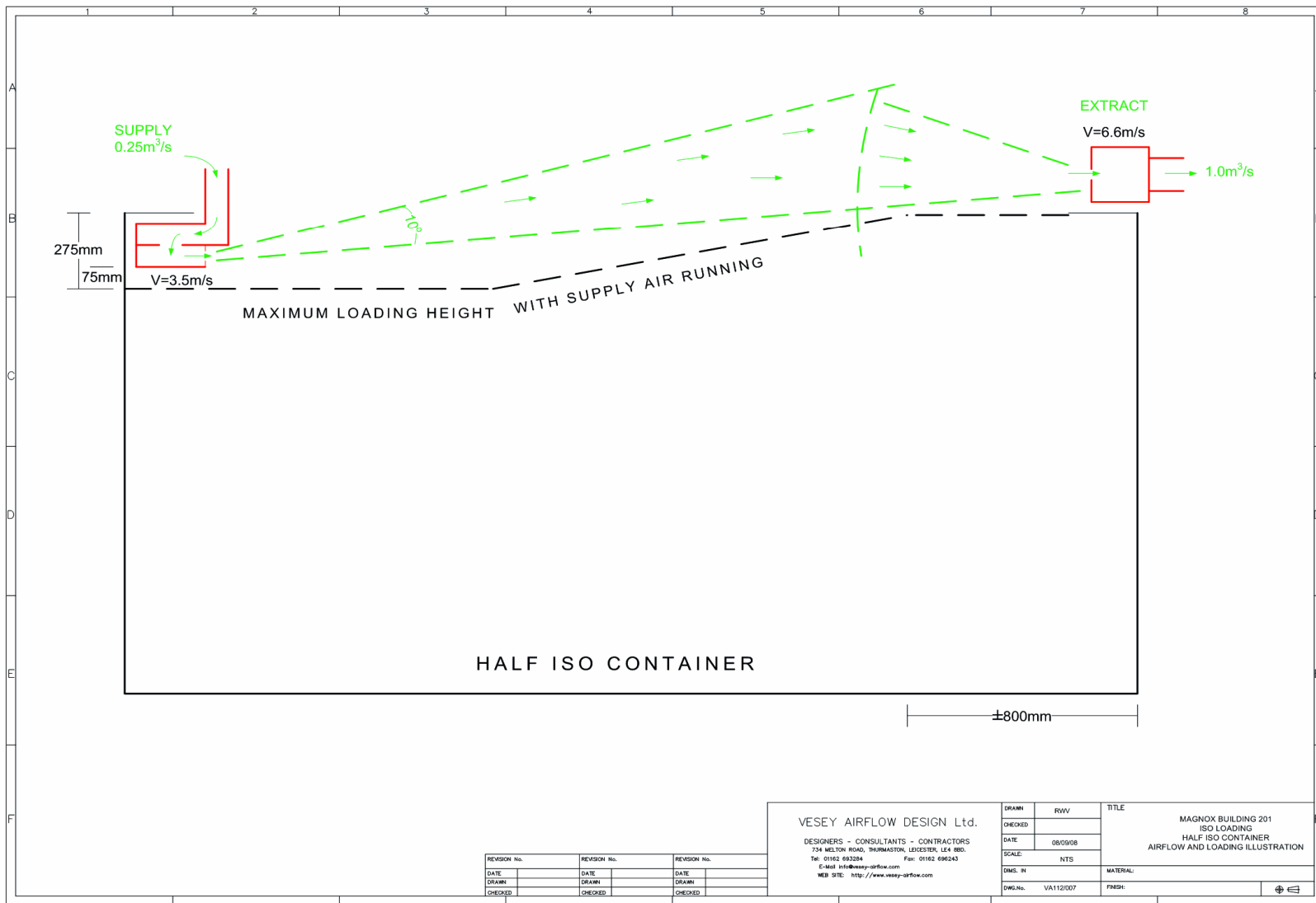
- High velocity
- Low overall flow rate
- Held close to the source
- Rule of thumb
 - Distance to source < 1.5 times diameter of hose
 - Bell mouth design can increase capture area

Point source



Push pull vent system

- Capture velocity of hood decreases inversely with square of distance to hood
- Push jet can be blown up to 30 feet
- Jet captures contaminant and carries it to the exhaust



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DATE	DATE	DATE
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CHECKED	CHECKED	CHECKED

VESEY AIRFLOW DESIGN Ltd.
 DESIGNERS - CONSULTANTS - CONTRACTORS
 734 MELTON ROAD, THURMASTON, LEICESTER, LE4 8BD.
 Tel: 01522 693204 Fax: 01522 696243
 E-Mail: info@vesey-airflow.com
 WEB SITE: <http://www.vesey-airflow.com>

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CHECKED		MAGNOX BUILDING 201
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DWG.No.	VA112/007	MATERIAL
		FINISH



Objectives of the monitoring programme

- Provide early warning of the release or elevation of airborne radioactivity
- Monitor engineering controls designed to protect personnel and the environment
- Confirm areas have the correct area designation according to the existing or potential hazard
- Permit airborne radioactivity concentrations to be assessed on a project basis and reviewed to ensure exposures are as low as reasonably practicable (ALARP)
- Create a permanent record of radiological conditions

Workplace airflow patterns

Airborne activity concentrations may vary significantly within a work area due to airflow patterns which exist and which cannot be predicted in many work areas from supply and exhaust locations

Airflow patterns need to be understood to enable effectively monitor and provide protection from airborne activity

Workplace airflow patterns

Key considerations:

- Stratification
- Bi-level airflows
- Circulating airflows
- Fuel cooling ponds
- Installed or portable equipment
- Doors / windows
- Wall and floor penetrations

Understanding workplace airflow patterns

For permanent work areas airflows should be reassessed at appropriate intervals or significant project timescales such as:

- Change in aerosol release location
- Change in area configuration
- Addition, removal or relocation of plant or equipment
- Changes to the ventilation systems

Temporary work areas should be reassessed on a more frequent basis

Understanding workplace airflow patterns

Airflow pattern studies

- Smoke generating machine
- Smoke tubes
- Anemometers

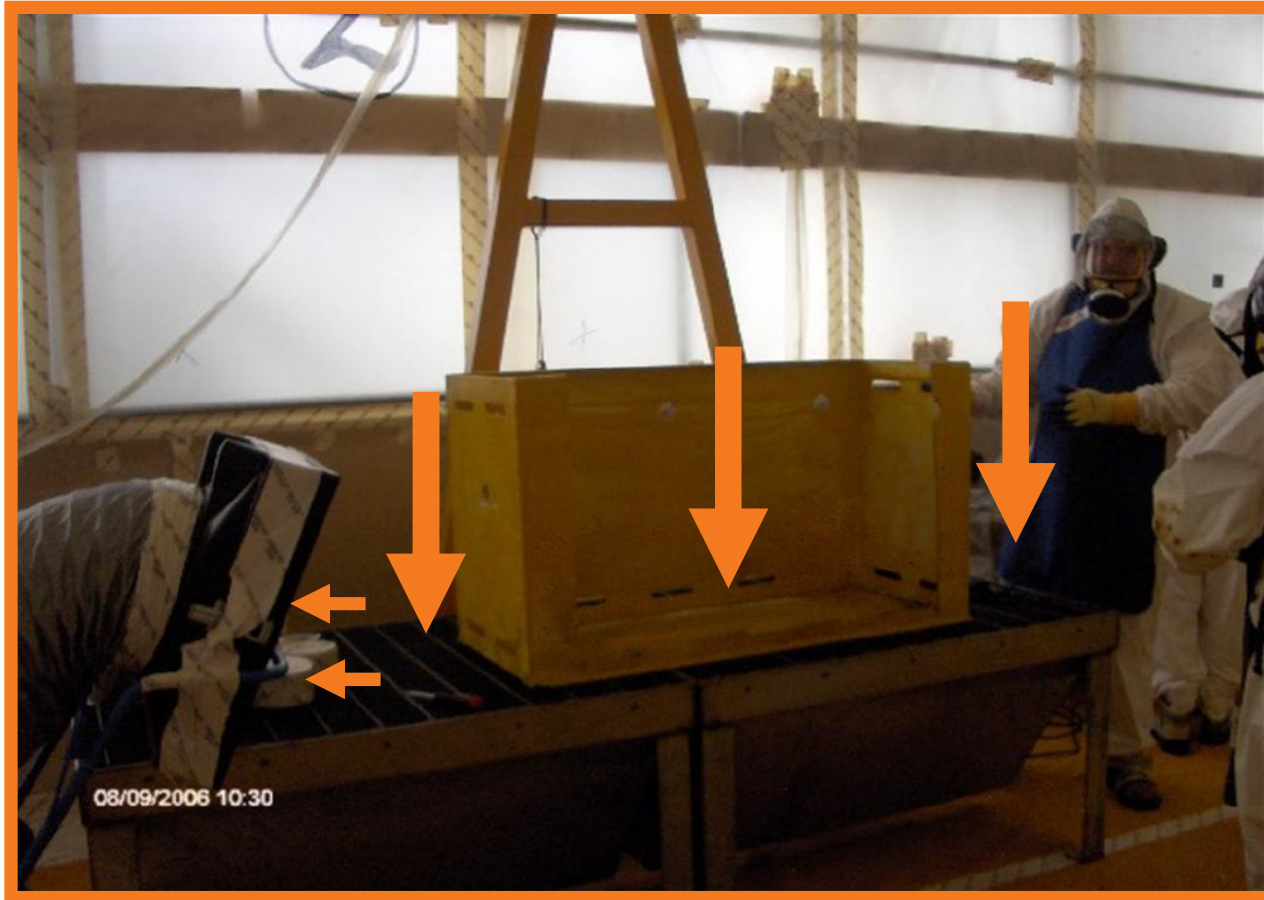
Airflow pattern studies should evaluate airflows with intending supply and extract configuration and with 'natural' airflow in the event of loss of engineering controls



Using engineered airflows



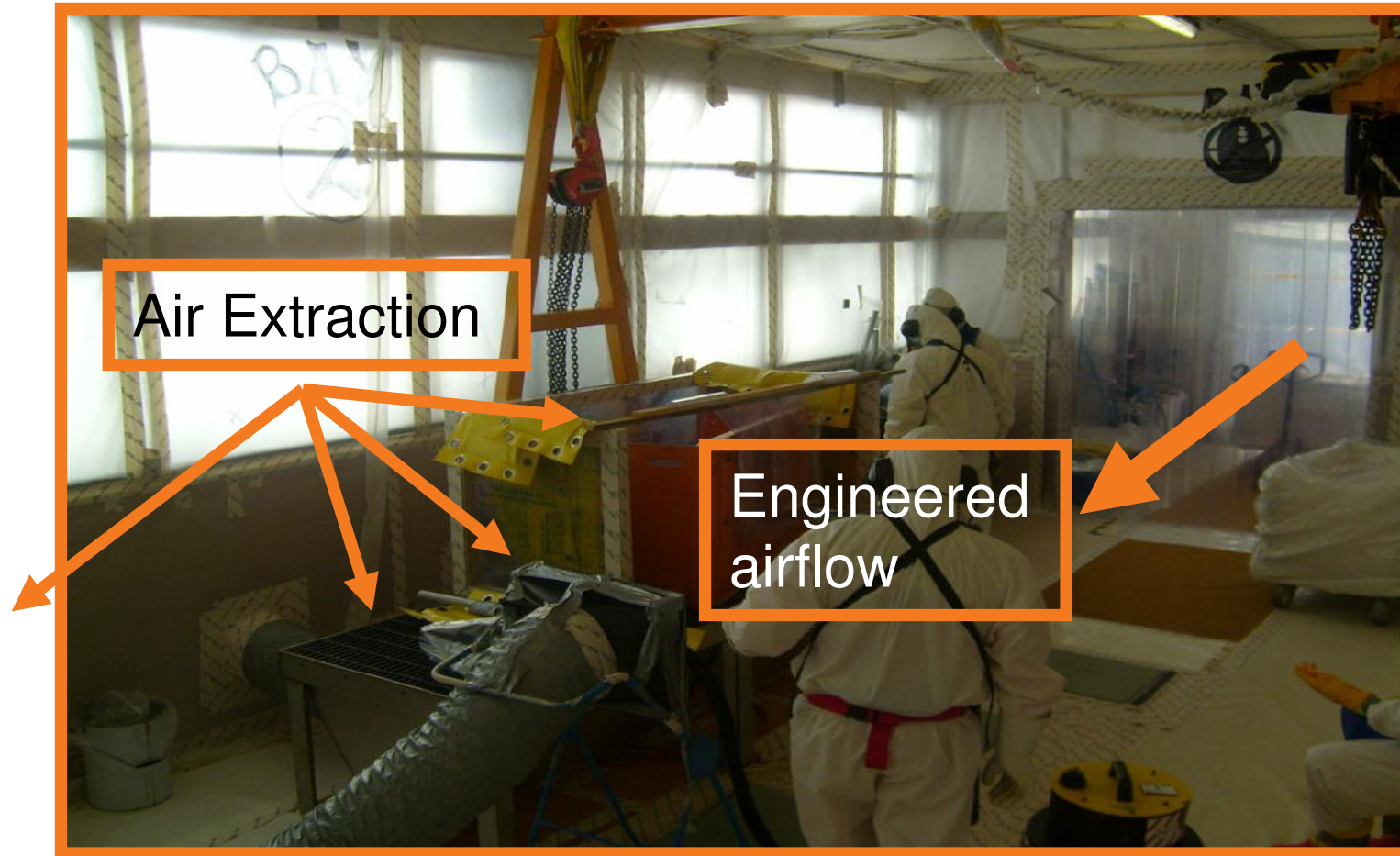
Using engineered airflows



Using engineered airflows



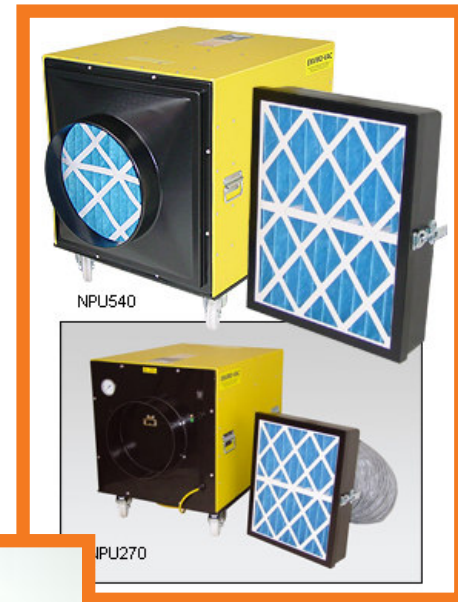
Using engineered airflows



Equipment

- Fixed Location Air Samplers
- Fixed Location Air Monitors
- Personal Air Samplers
- Portable Engineering Controls

Equipment



Positioning air samplers and monitors

Equipment should be placed using understanding of workplace airflow patterns

Workplace airflows should draw contaminated air from the point of release away from the workforce breathing zone

- This is an ideal
- Old facilities often not designed with this in mind
- Small work areas mean a balance often has to be struck

Principles of positioning of air samplers and monitors

Point of work air samplers are used to confirm the area designation remains correct

- Positioned in the general work area

Air monitors are used to provide an early indication of release or elevation in airborne activity concentration

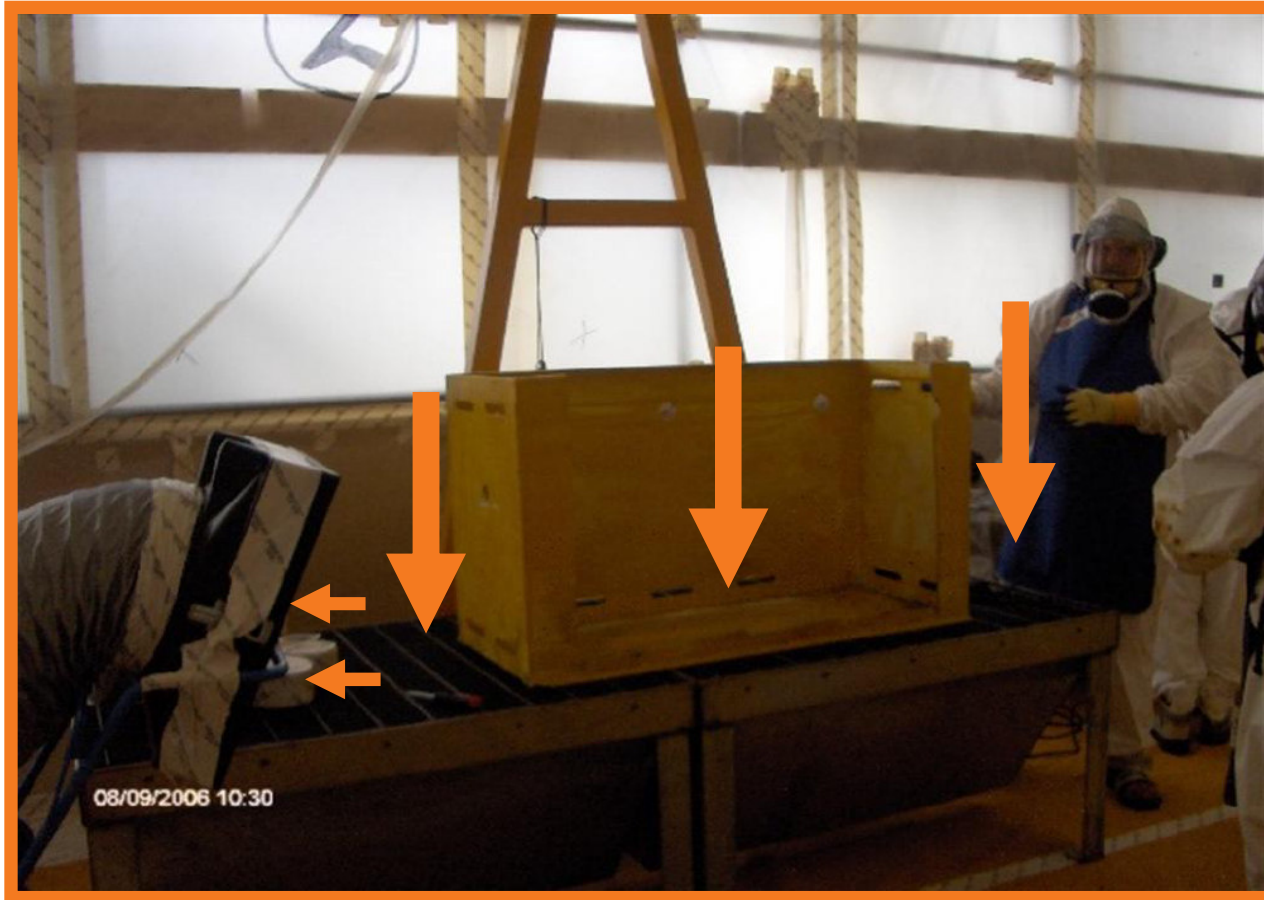
- Positioned between the point of release or generation and the worker

Both may be used to estimate potential internal doses and monitor engineering controls designed to protect personnel and the environment as well as confirm the anticipated work conditions

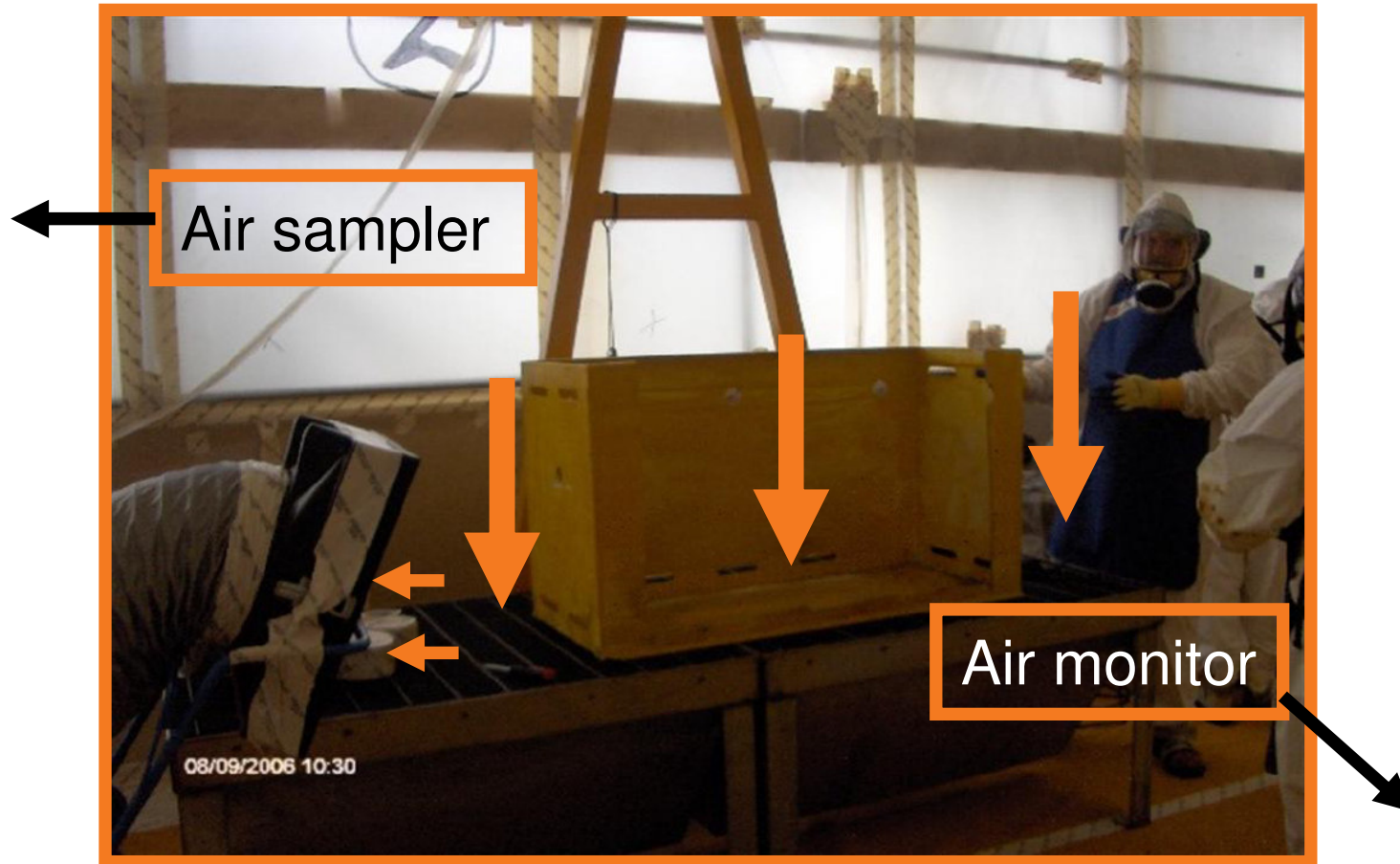
Positioning air sampling and monitoring equipment



Positioning air sampling and monitoring equipment



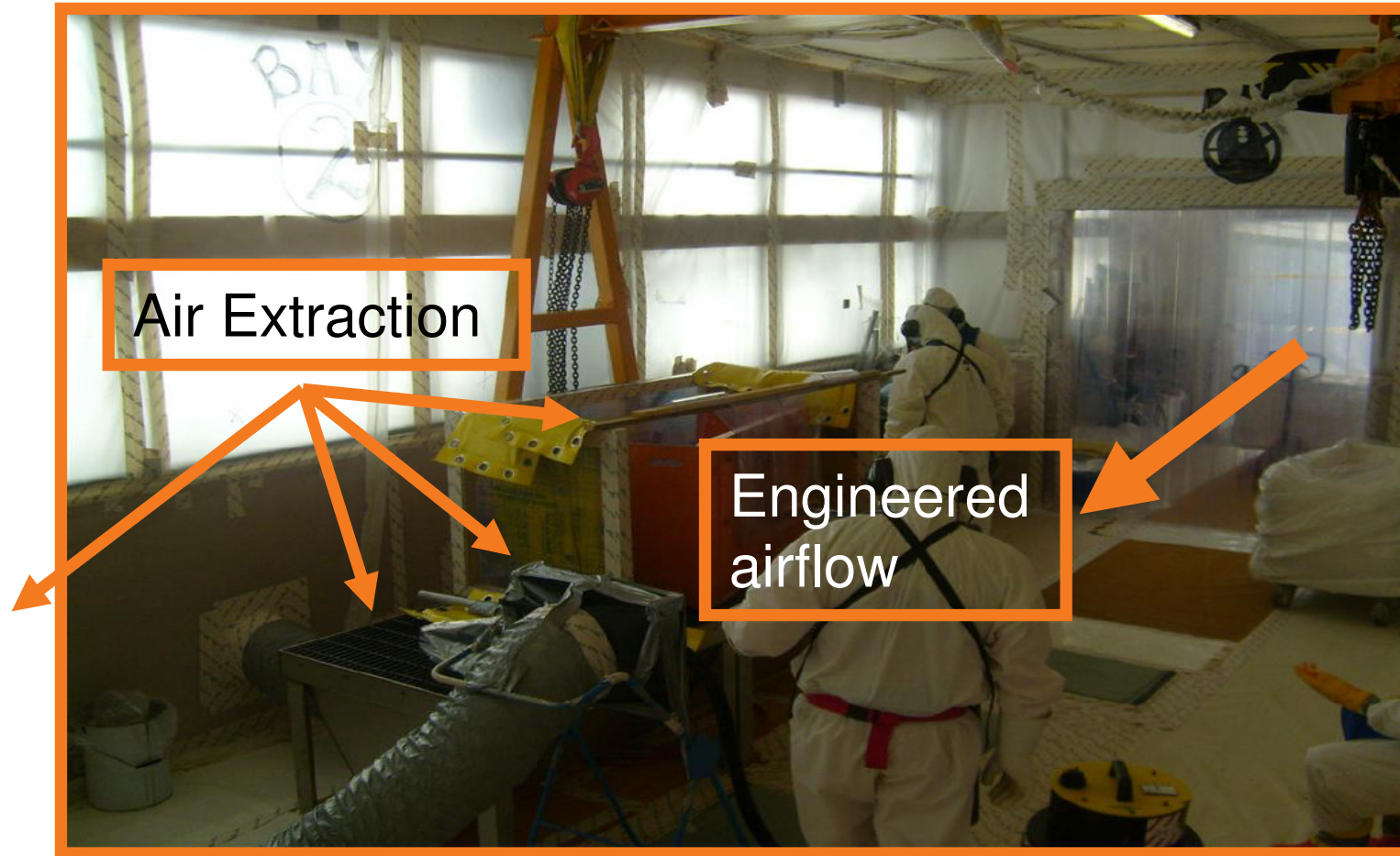
Positioning air sampling and monitoring equipment



Positioning air sampling and monitoring equipment



Positioning air sampling and monitoring equipment



Positioning air sampling and monitoring equipment



Sample is representative of worker inhaled air

Many factors contribute whether samples are representative of worker breathing zone including movement of plant, work item and personnel

Samples may be proved representative through:

- Sample obtained within 30 cm of worker location
- Comparison with personal air samplers
- Comparison with bioassay sampling results
- Comparison with multiple samplers
- Combination of the above