Local Exhaust Ventilation Improvement Efforts at a Global Specialty Chemical Manufacturer

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Good Chemistry at Work

Global Expectations and Requirements

- Global EHS Standard for Workplace Exposure Assessment and Control
- Global EHS Standard for Laboratory Hoods

Workplace Exposure Assessment and Control Standard

- Health hazard controls are implemented when exposures are judged unacceptable.
- Use hierarchy of controls strategy: engineering, administrative, and PPE as a last resort.
- Hazard control measures instituted:
  - When exposures exceed standards.
  - When there is evidence of adverse health effects or significant employee discomfort below established limits.

Workplace Exposure Assessment and Control Standard

- LEV selected as the ventilation system of choice where control of air contaminants is necessary.
- LEV systems must be inspected at least semi-annually.
- Exhaust air may not be recirculated.
- LEV inspections must be documented.
- All systems must be included in a preventive maintenance program.

Lab Hood Ventilation Specifications

- Lab hood must attain 0.5 m/s face velocity, with the sash open to its maximum position.
- If sash must be lowered to achieve target face velocity, permanent alterations must be made.
- Temporarily lowering the hood sash to attain target face velocity is not permitted.

ASHRAE Specification Alternative

- Allow use of ASHRAE tracer gas laboratory hood performance test.
- Once ASHRAE performance is demonstrated, an inspection program conforming to the standard, but using the lower face velocity specification, can be followed.

Laboratory Hood Standard – Other elements

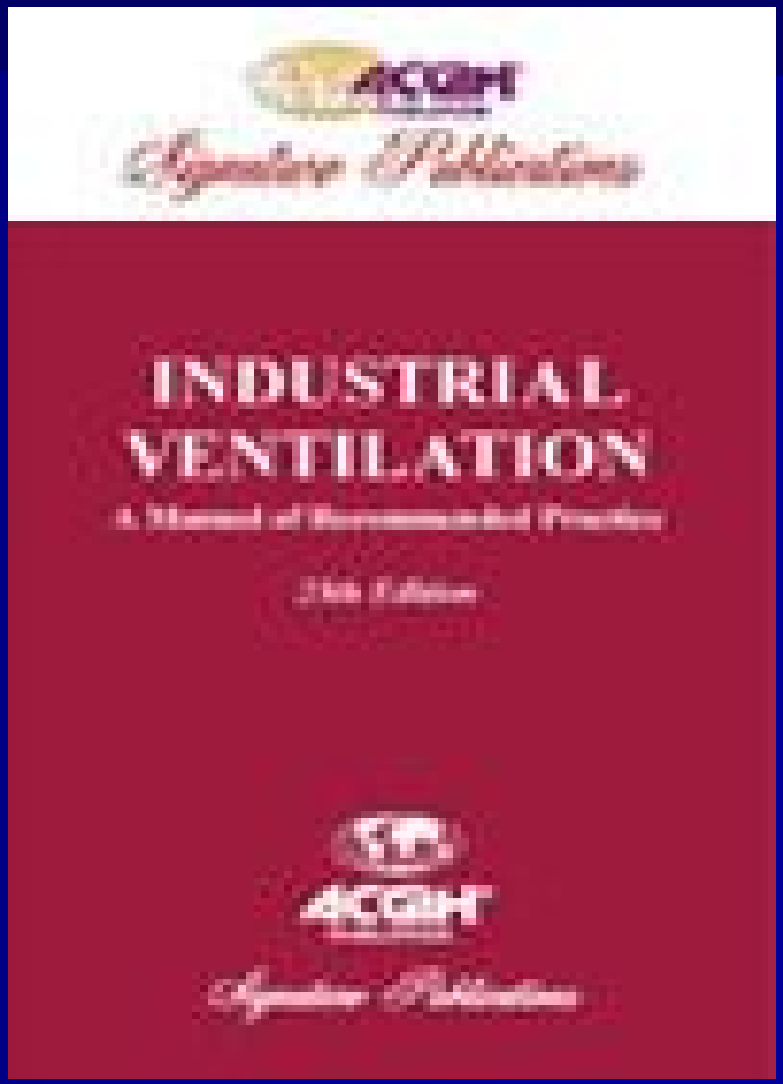
- VAV hood requirements
- Room air balance
- No recirculation of exhaust air
- Stack location
- Initial and semi-annual inspections
- Annual inspection if hoods are equipped with flow or static pressure devices and audible low flow or low static pressure alarms.

Laboratory Hood Standard – Other elements

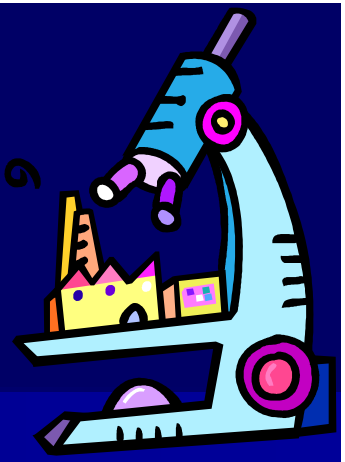
- Evaluate hoods after significant changes are made.
- Post hood inspection and test results, communicate to affected employees.
- PM program for hood fans, motors, and air cleaning devices.
- Maintain inspection records permanently.
- Train employees on good work practices.

ACGIH Vent Manual –

- One of the required Industrial Hygiene texts each site is expected to have on site.



Worldwide EHS Audits



- 3-year Audit Cycle
- Workplace Exposure Assessment and Control and Laboratory Hood standards audited each cycle
- Government Regulation Protocols

Manufacturing Excellence Efforts

- Assist sites and businesses to maximize asset utilization, optimize their processes, including EHS assessments.
- Develops tools and methods to help sites track equipment utilization, improve equipment reliability, reduce maintenance costs, inspect equipment, propose repairs, and recommend new designs.

Engineering Technical Center

- Industrial Ventilation Consulting
- Vent Collection System Design and Safety
- Engineering Standard 105-100 - Ventilation system design guide

Engineering Technical Center efforts

- Specifying new installation requirements
- Reviewing contractors proposals and designs
- Provide evaluations of existing systems
- Recommend balancing or measurement to determine existing conditions

Engineering Technical Center Recent Projects

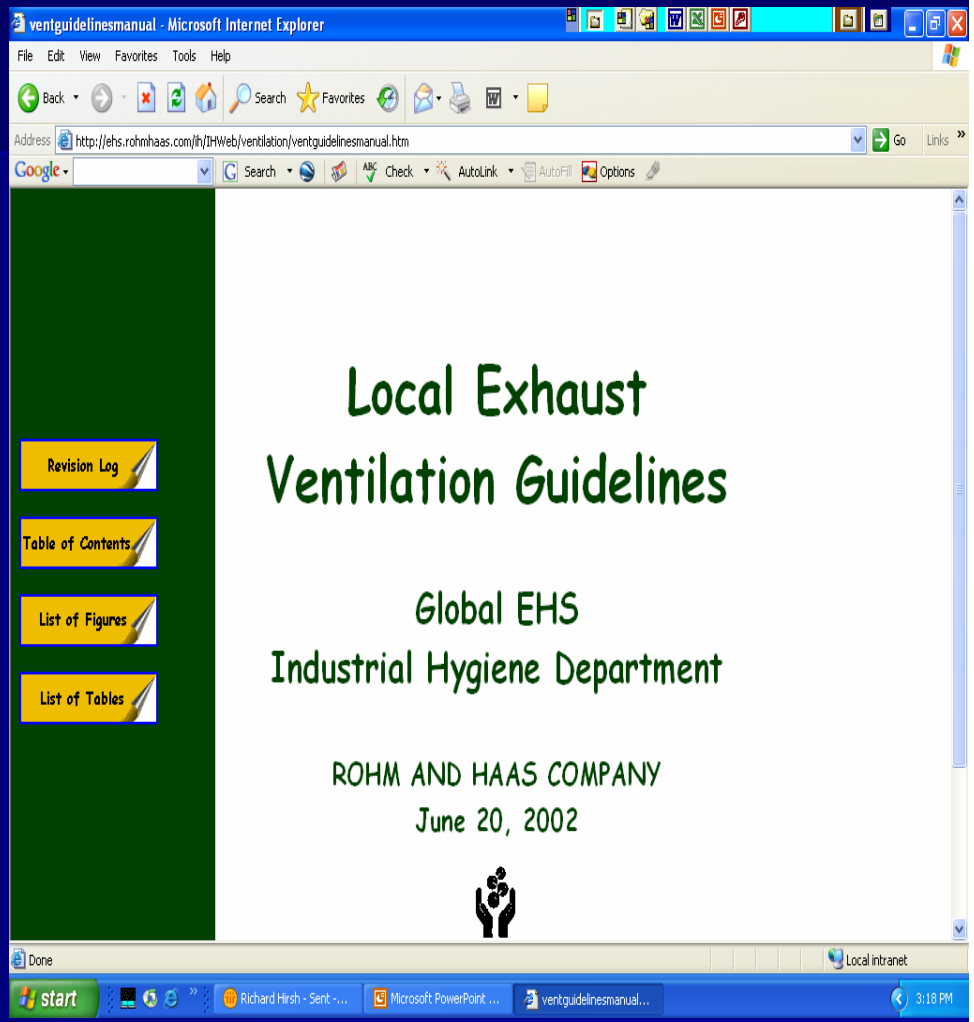
- Site 1 - in Mexico - upgrading a deficient system
  - collection system - location and air flows
  - exhaust system - exhaust through carbon filter was discharged at grade.
- Site 2 - in the US - guiding the design of new LEV for ~30 process operations.

Training

- Training programs
  - Fundamentals of IH Course – offered annually include ventilation design and measurement
    - Classroom
    - IH Survey practical hands-on training
  - Jeff Burton Industrial Ventilation course – for EHS personnel and Engineers
  - IH Surveys/Training at individual sites

Ventilation Web page

- LEV guidelines
- Ventilation equipment vendors
- Example installations
- Ventilation Survey Forms
- Example Survey Reports
- Other support references
- Ventilation equipment recommendations



EHS Review Process

- Design Stage
- Pre-Start-up
- Challenges: Plans vs Installation
  - Specs to Reality
  - Expertise of installation firms

2005 LEV Position Paper

- To address LEV deficiencies globally due to improper selection, design, installation, and performance.
  - Inadequate capture velocities to control contaminants
  - Poorly designed hoods
  - No transitions between different sized ducts
  - Ninety degree branch duct entries
  - Rain caps on stack
  - Lab stacks redirected downward
  - Use of plastic flex duct with internal articulating joints subject to chemical attack

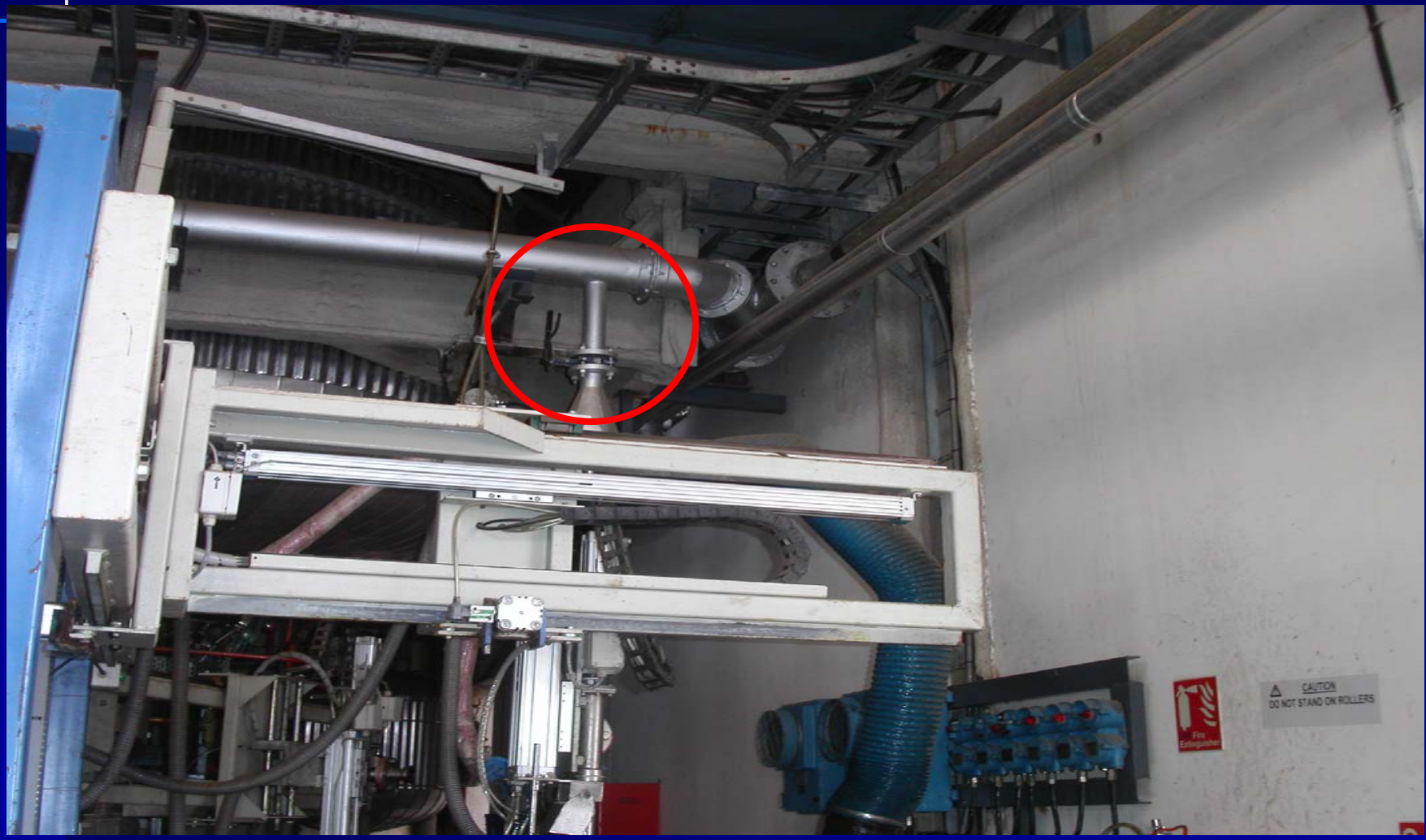
Impact of LEV Deficiencies

- Ineffective engineering controls at drum charging stations and pack-out stations
- Requires employees and contractors to use respiratory protection for extended periods of time
- Reintrainment of contaminants in office areas, control rooms and laboratories.

LEV Problems Identified

- Inadequate designs proscribed for new facilities
- Inadequate EHS Reviews at the design stage and pre-start-up allowed deficient systems to be approved
- Inadequate supervision of system installation by contractors
- Additional capital spent by site to upgrade their systems in order to meet target velocities.

Improper Design or Installation?



Hood Design Problems

- History of repair problems
- Plastic Hoods not durable, break easily
- Internal articulation focus of chemical attack
- Cannot be easily inspected for corrosion, and repair work requires dismantling the entire apparatus
- Internal hardware and extensive flex duct increases turbulence thus reducing efficiency and velocity pressure
- Not appropriate for dry chemical weigh-up activities

Recommendations

- All LEV equipment specifications, designs, and installations must be included in formal gate check process before AR approvals.
- LEV systems should conform to company LEV guidelines
  - All exhaust stacks should be designed and installed as a stack within a stack design
  - Exhaust stacks should be positioned and directed away from air intakes
  - Articulating arms should involve external articulations and smooth metal ductwork

Ventilated Drum Lance Design

- Several key beneficial features:
  - better control of chemical vapors at the drum bung during charging
  - better control of vapors from the contaminated lance
  - better ergonomics associated with lance handling
  - more efficient use of available local exhaust ventilation (less air volume needed)

Ventilated Drum Lance Installations

- Installed in China, U.S., India and France.
- Some positive results:
  - Monitoring results N.D. or very low when properly installed.
  - Less $ than installing a walk-in drum hood
  - Much smaller floor footprint than walk-in hood
  - Lowered the total airflow allowed for smaller, less expensive scrubber
  - Less nuisance odors while charging drums
- Installations have been successful and we have plans to install as standard design in 5 new facilities: France, India, Vietnam, Russia, Mexico, Thailand and China

Ventilated Drum Lance