

Hazard Prevention – Engineering Controls

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Outline

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- Benchtop Weighing and Handling
- Bag Dumping
- Bag Filling
- Charging Tanks and Mixers
- Drum filling and emptying
- Work Practice Controls

Introduction

Traditionally, a hierarchy of controls has been used as means of determining how to implement feasible and effective controls:

- Elimination/Substitution
- Engineering Controls
- Work Practice Controls
- Personal Protective Equipment (PPE)

General Considerations

Standard precautions that minimize exposure and reduce risk of flavoring-related lung disease:

- Isolate rooms where flavorings or flavoring chemicals are handled
- Maintain flavoring mixing rooms and other areas where flavorings are handled under negative air pressure
- Install static pressure gauges near hoods
- Install a control “on/off” light to indicate the status of the exhaust fan

General Considerations

- When possible, place hoods away from doors, windows, air supply registers, and aisles to reduce the impact of cross drafts
- Provide supply air to production rooms to replace most of the exhausted air
- Direct exhaust air discharge stacks away from air intakes, doors, and windows

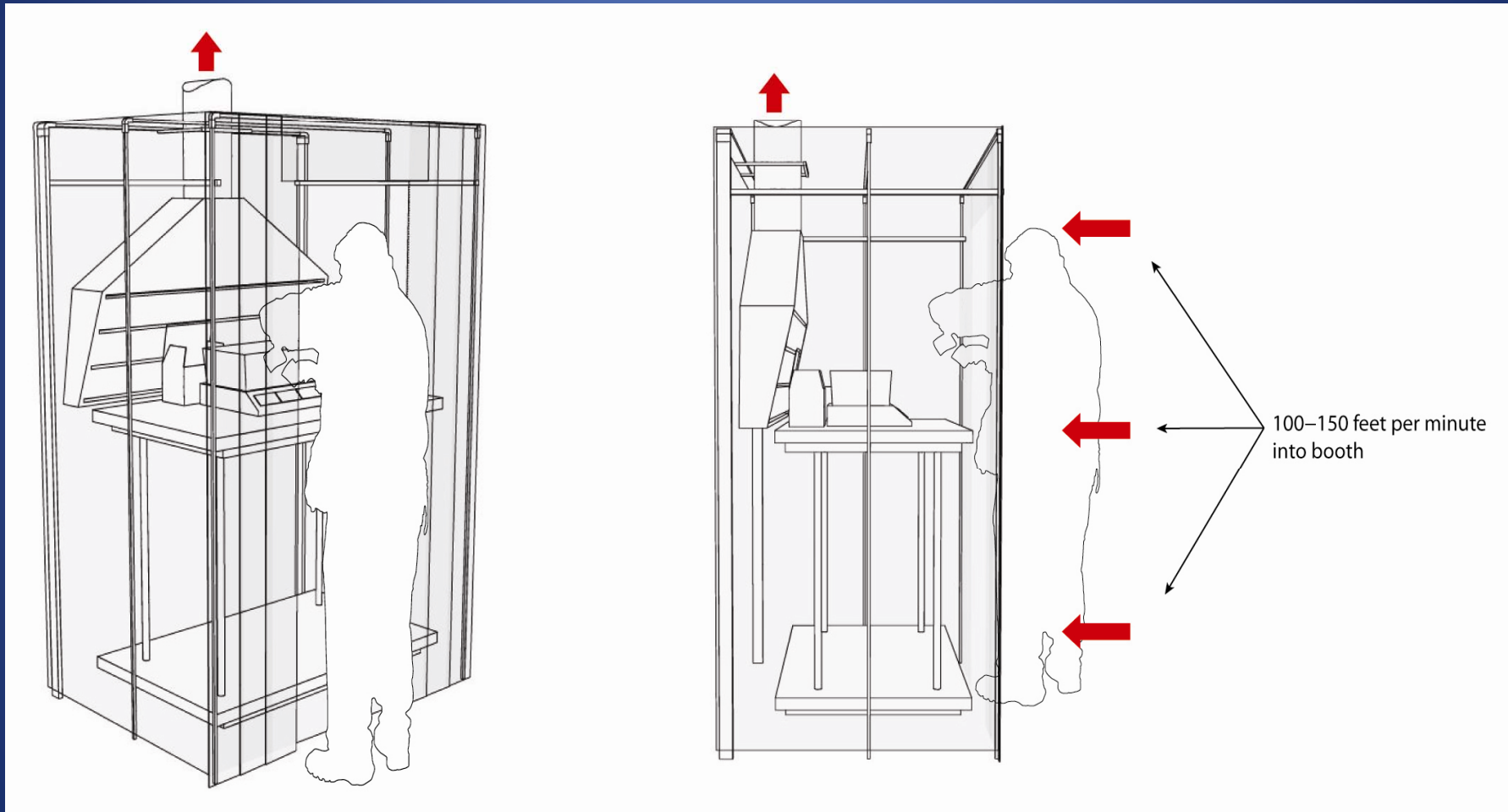
Primary Production Processes

- The food and flavoring production industries have several processes that may result in increased potential for worker exposure to diacetyl, 2,3-pentanedione, and other flavoring chemicals.
 - Benchtop weighing and handling
 - Bag dumping
 - Bag filling
 - Charging tanks
 - Drum filling and emptying

Benchtop Weighing and Handling

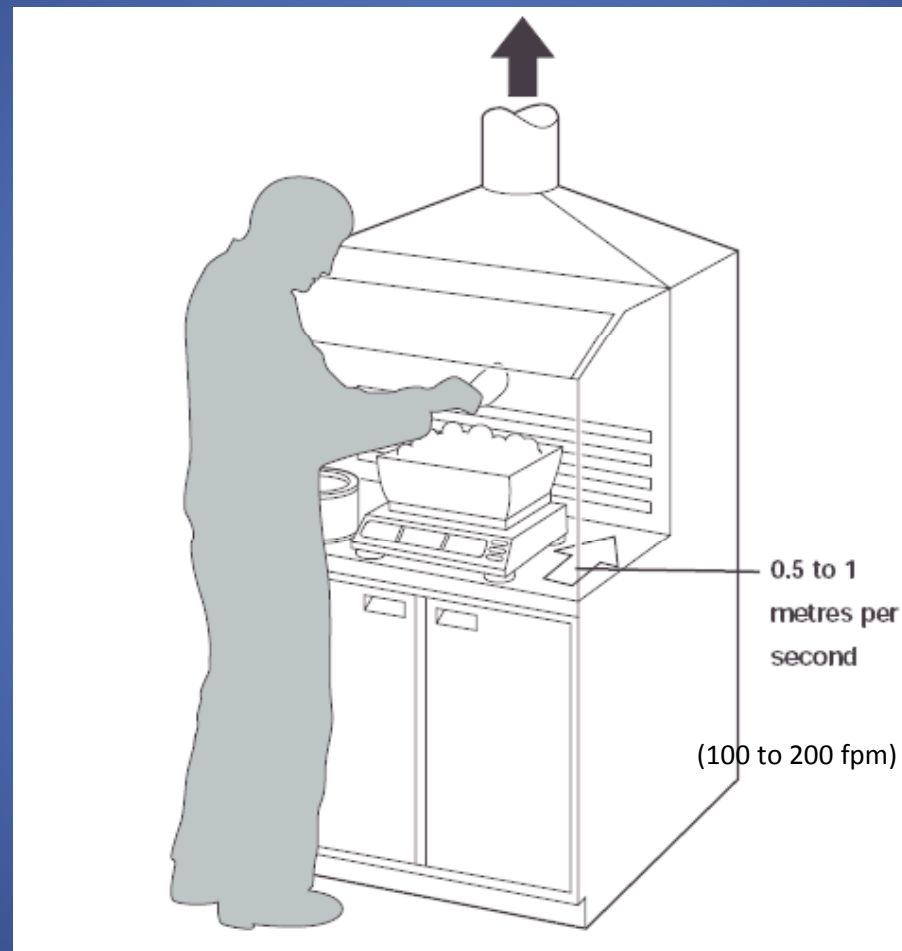
- Small-scale weighing and handling of ingredients are common tasks used in flavoring production, bakeries, dairy production, and snack food manufacturing.
- Ventilated back-draft workstations have been used for small batch mixing. Designed to maintain 100–150 feet per minute (fpm) at the face of the enclosure, studies showed 90%-97% reductions in exposure when mixing using these stations.

Benchtop Weighing and Handling



Ventilated small batch mixing workstation

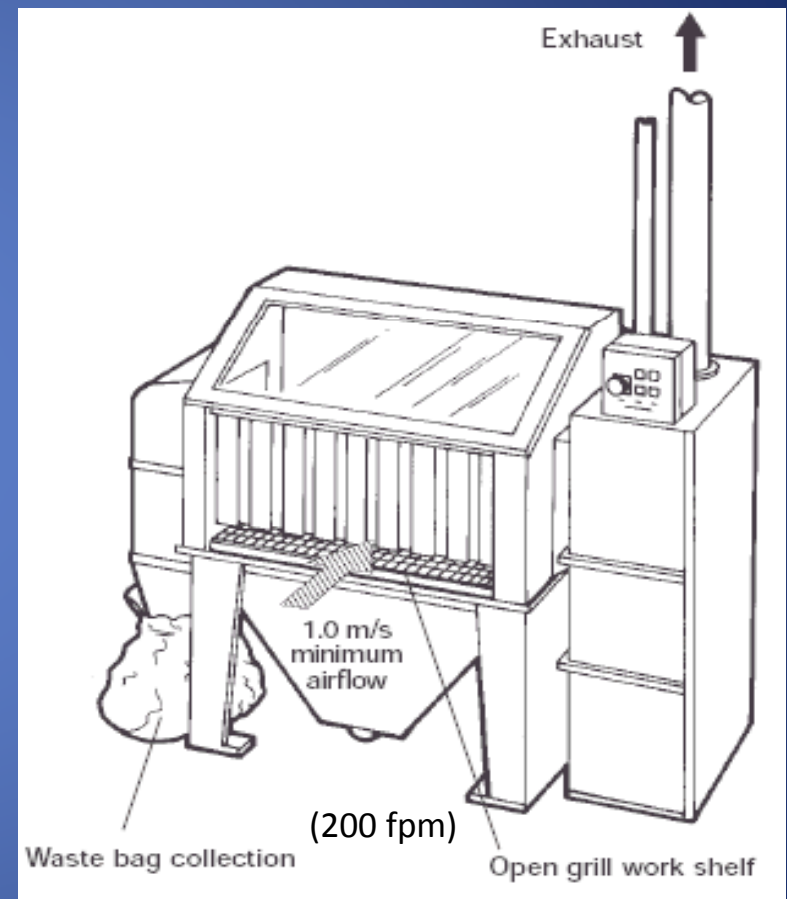
Benchttop Weighing and Handling



Benchttop ventilation for weighing/handling powders

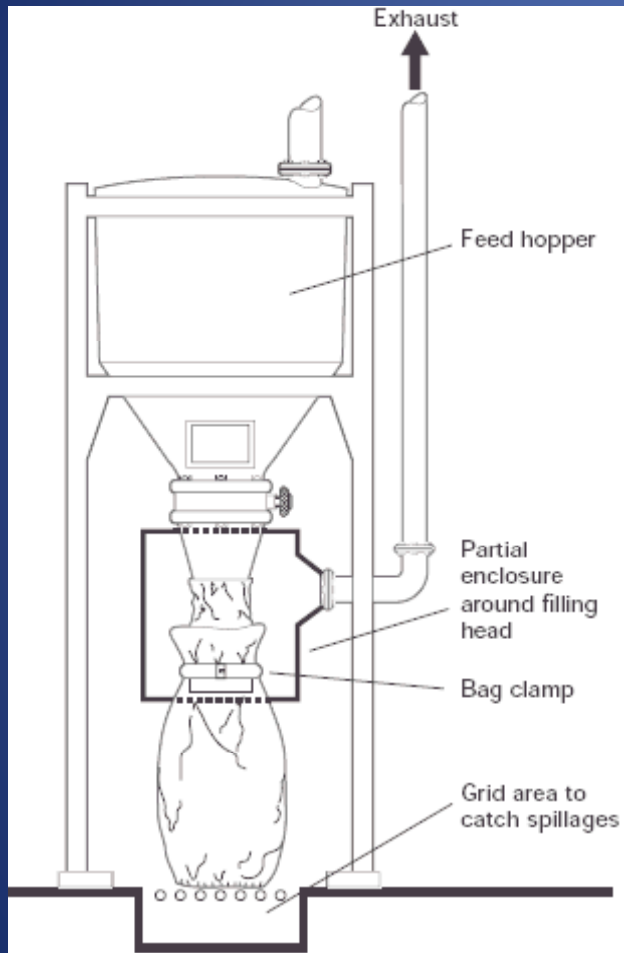
Bag Dumping

- Manual handling of powders is used in many industries, including food and flavoring production.
- A ventilated bag dump station consists of a hopper with an exhaust ventilation system to pull dusts away from workers as they open and dump bags of powdery materials.



Ventilated bag dumping/emptying station (HSE)

Bag Filling

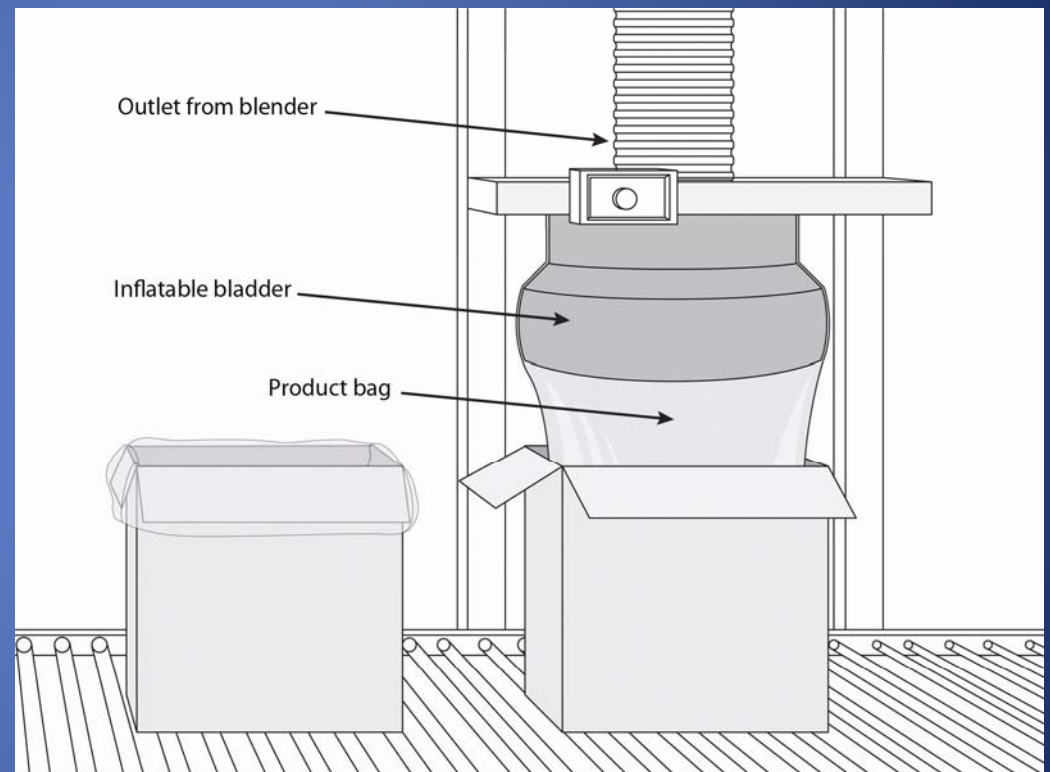


Ventilation for bag filling (HSE)

- Bag filling is typically done by flavor manufacturers and other producers of powder materials.
- After blending, the powder product may be discharged into a bulk tote or packaged into smaller containers.

Bag Filling

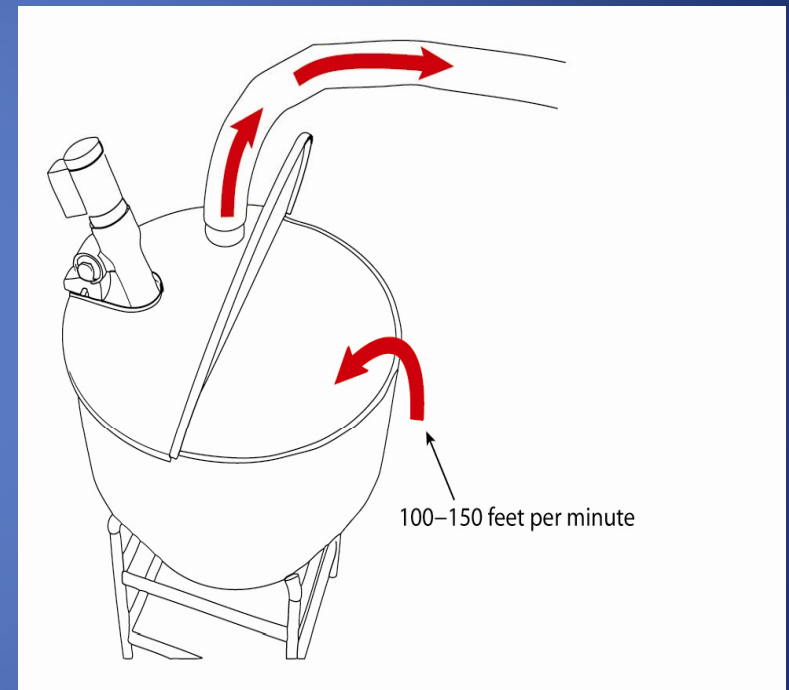
Dust control approaches used by other industries should be applicable for food and flavoring production. For example, an inflatable seal can be used to create a dust tight seal on the discharge of an industrial blender.



Dust control during bag filling operation

Charging Tanks and Mixers

- Adding solid and liquid ingredients to mixing vessels can cause exposure to dusts and vapors.
- NIOSH evaluated a ventilated tank lid during the mixing of a food flavoring. The result was a reduction of approximately 76% compared to the same operation without the ventilated tank lid.

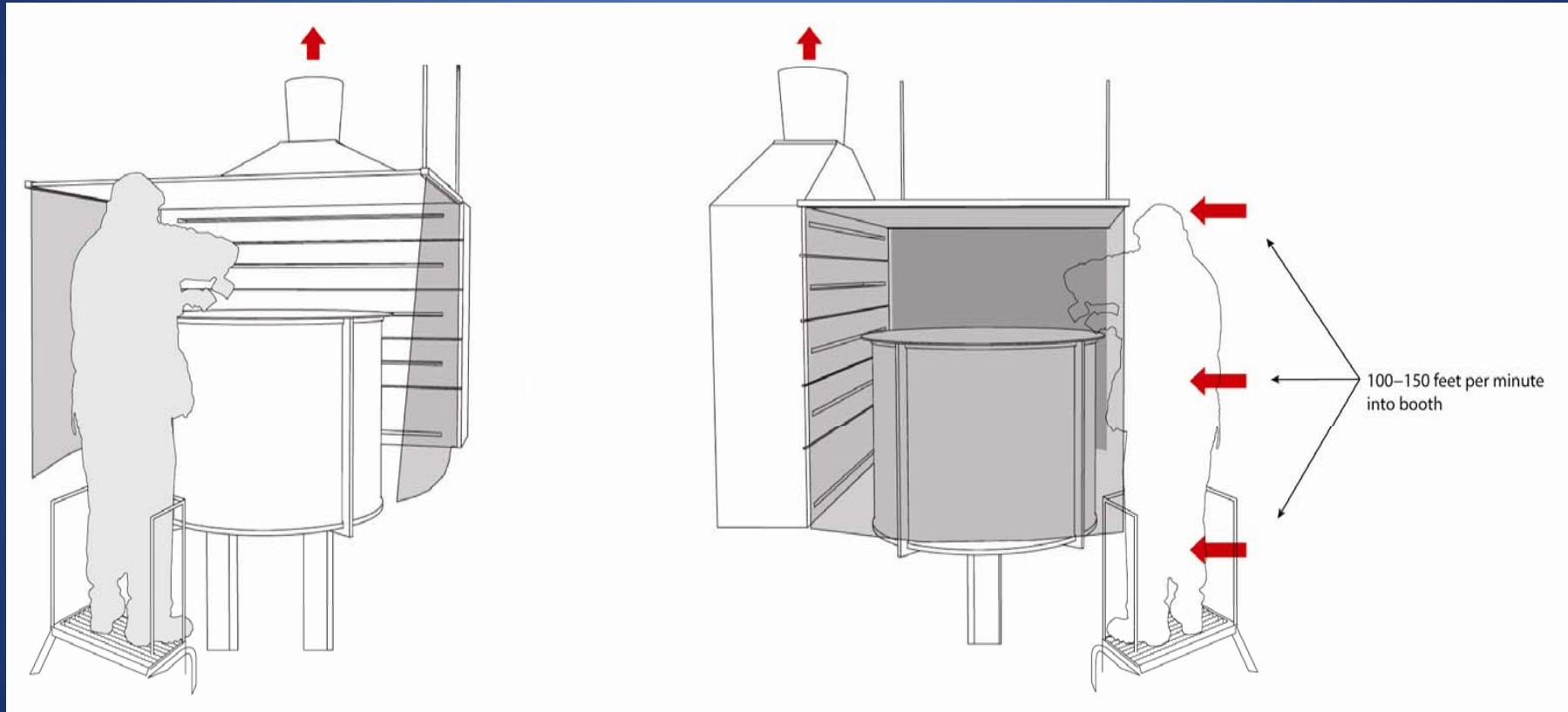


Mixing vessel with a ventilated hinged tank lid (HSE)

Charging Tanks and Mixers

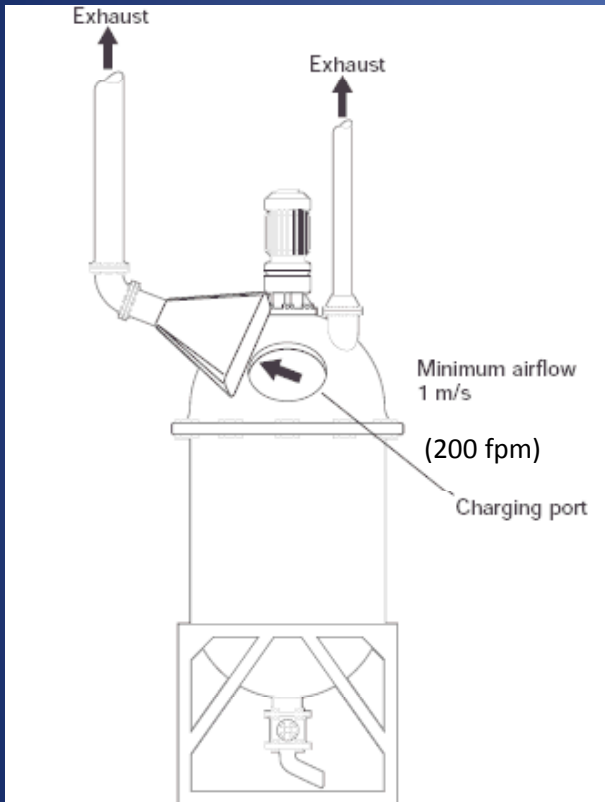
- A ventilated mixing booth allows a large portable mixing tank to be rolled inside. The chemical vapors emitted during pouring and mixing are captured and exhausted outdoors.
- The booth provides flexibility as it can be used for other production tasks such as large pouring and packaging activities.

Charging Tanks and Mixers

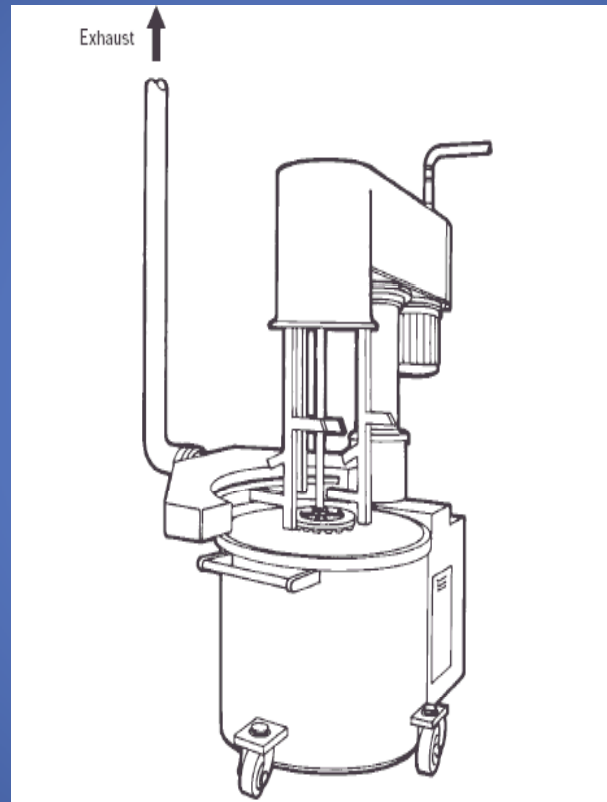


Ventilated booth for large batch mixing

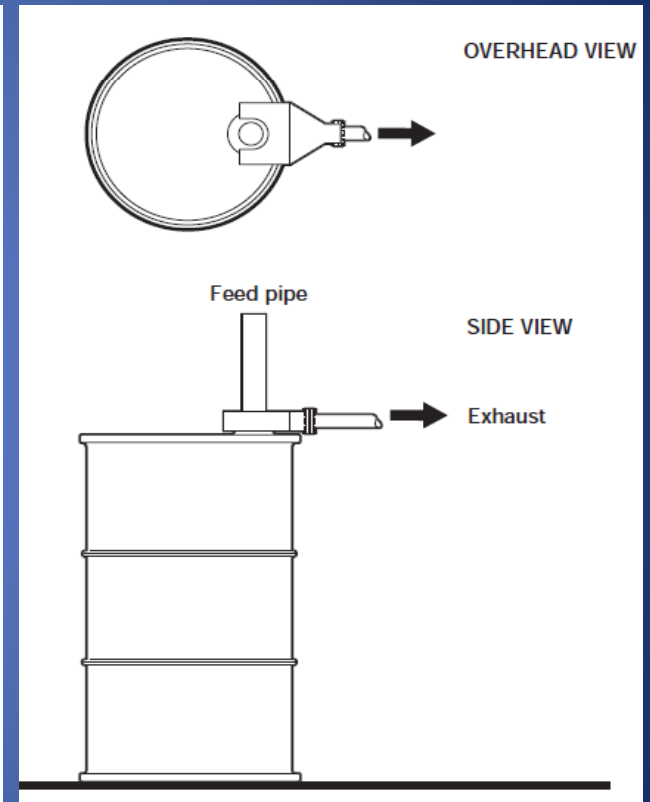
Charging Tanks and Mixers



Charging reactors and mixers from a sack or keg (HSE)



Annular exhaust for capturing dust/vapors from mixers (HSE)



Annular exhaust for capturing vapors during drum filling (HSE)

Drum filling and emptying

- Manually operated and powered pumps have been used to transfer liquids from barrels to mixing and feed tanks.
- The use of ventilation at the barrel opening has been recommended for capture of vapors during chemical transfer.
- The recommended airflow is a minimum of 100 fpm across the drum cap/bung hole.

Drum filling and emptying

Close clearance
 $D + 12''$
 D
 45°

1" slot
 $4'' \text{ min.}$

Feed spout 4" min. dia.
Flex duct
Exhaust duct
 45°

Close clearance
 45°

Q = 100 cfm/ft² barrel top (minimum)
Minimum duct velocity = 3500 fpm
 $h_e = 1.78 VP_s + 0.25 VP_d$

Q = 150 cfm/ft² of open face area
Minimum duct velocity = 3500 fpm
 $h_e = 0.25 VP_d (45^\circ \text{ taper})$

Q = 50 cfm x drum diam. (ft)
Minimum duct velocity = 3500 fpm
 $h_e = 0.25 VP_d$

Q = 300-400 cfm
Minimum duct velocity = 3500 fpm
 $h_e = 0.25 VP_d$

Note 1: Air displaced by material feed rate may require higher exhaust flow rates.
Note 2: Excessive air flow can cause loss of product.
Note 3: When transferring flammable or combustible liquids, bonding and grounding requirements of NFPA Code 77 should be followed.

Work Practice Controls

Work practices, sometimes called administrative controls, are procedures followed by employers and workers to control hazards in the workplace:

- Good Housekeeping Practices
- Closed Transfers, Containers, and Processes
- Hygiene Procedures
- Reduced Process Temperatures for Priority Flavoring Chemicals
- Cleaning Practices for Equipment and Tools (cold vs. hot wash)
- Limit Access to Priority Flavoring Chemicals
- Hazard Training and Communication

Conclusions

- Traditional industrial hygiene practice suggests following a hierarchy of controls.
- Engineering controls used in other industries are typically applicable to flavorings processes.
- Local exhaust ventilation, process enclosures, and work practice controls are recommended to reduce the potential for employee exposure.