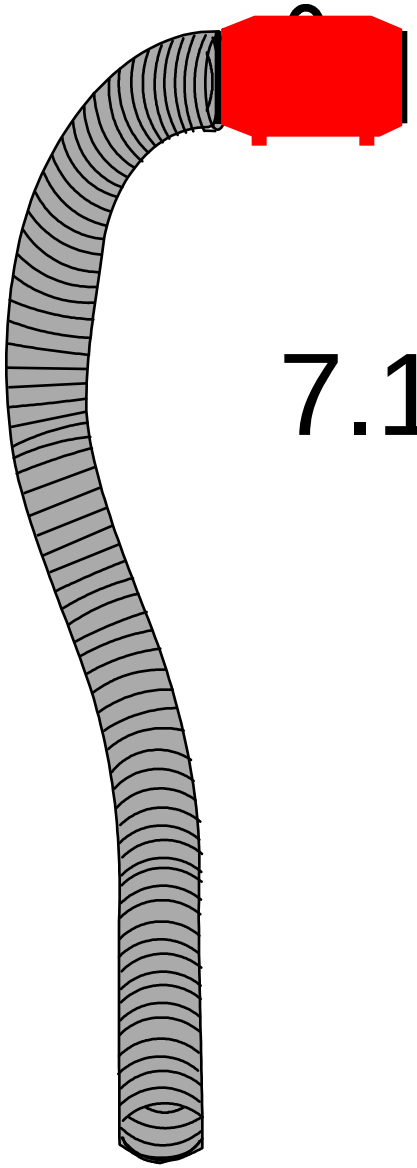
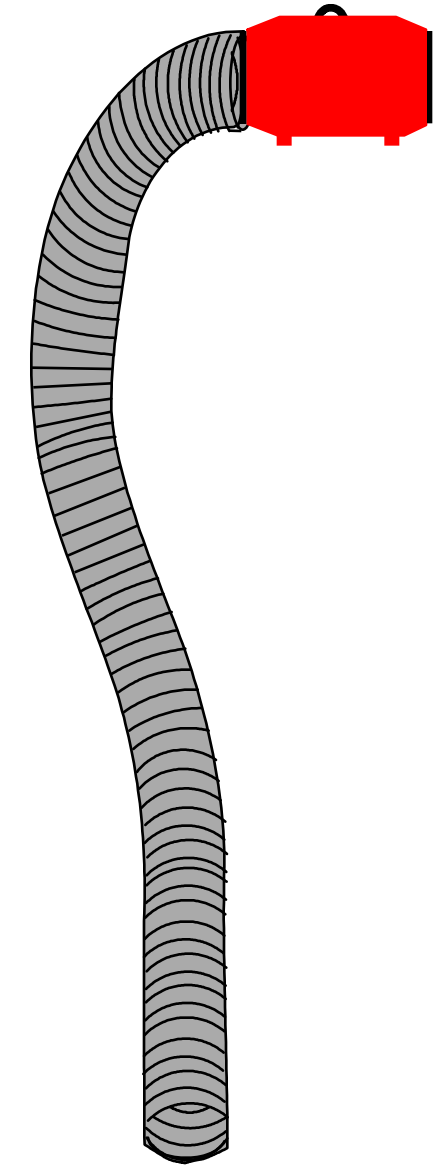
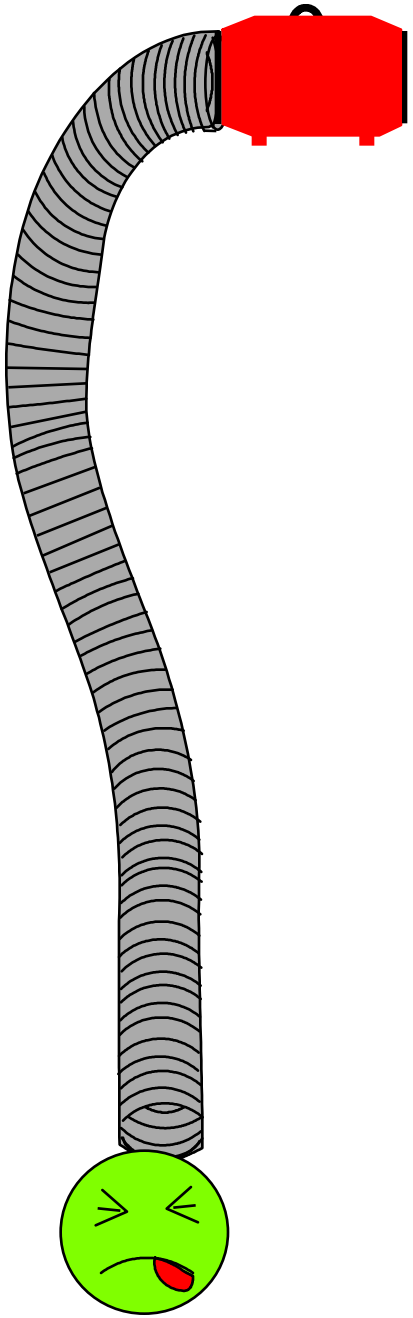
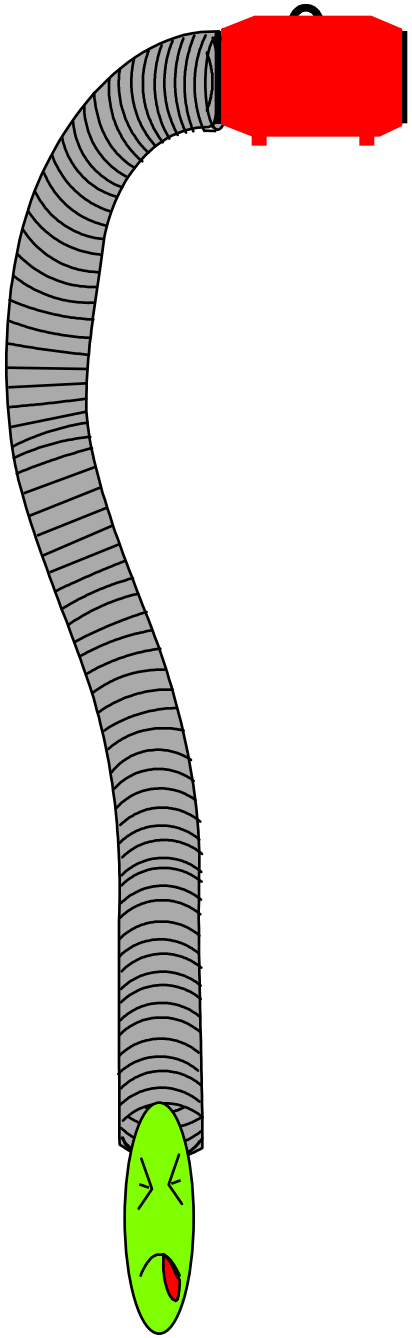
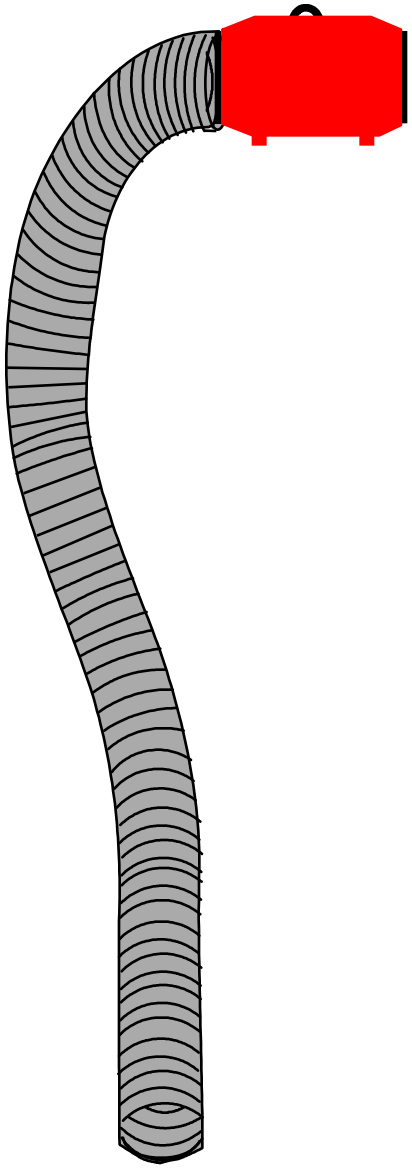


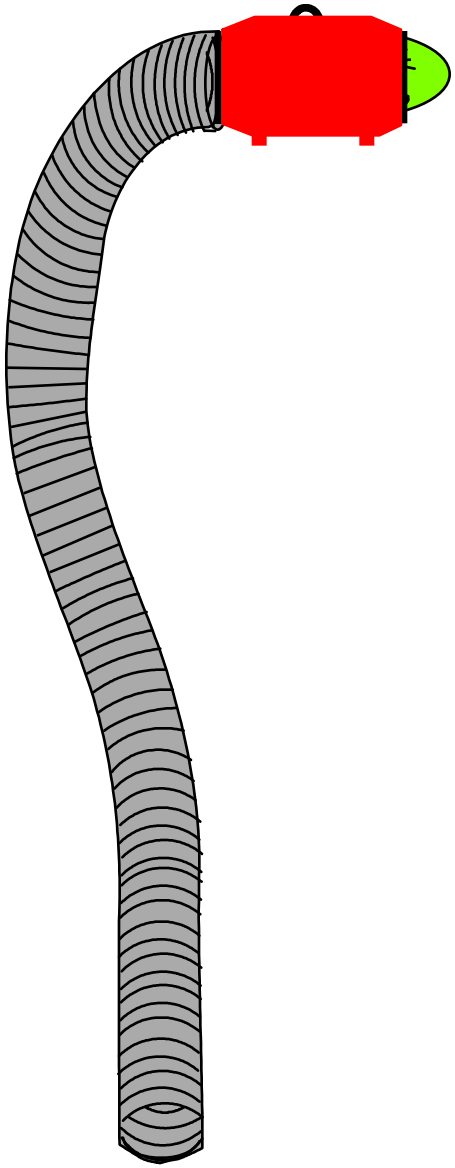
7.12 VENTILATION PROCEDURES

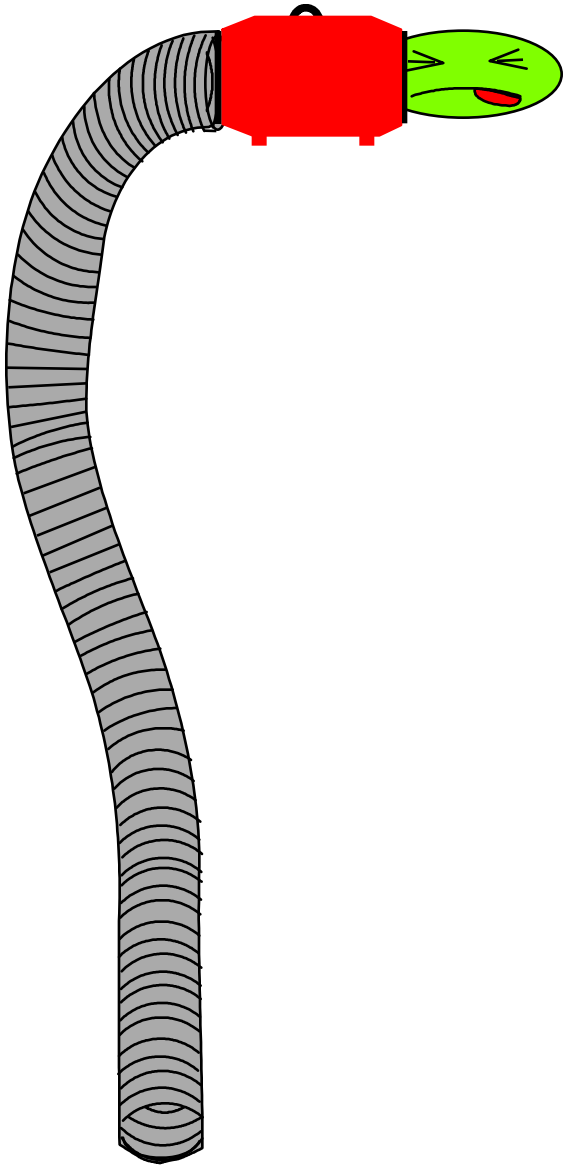


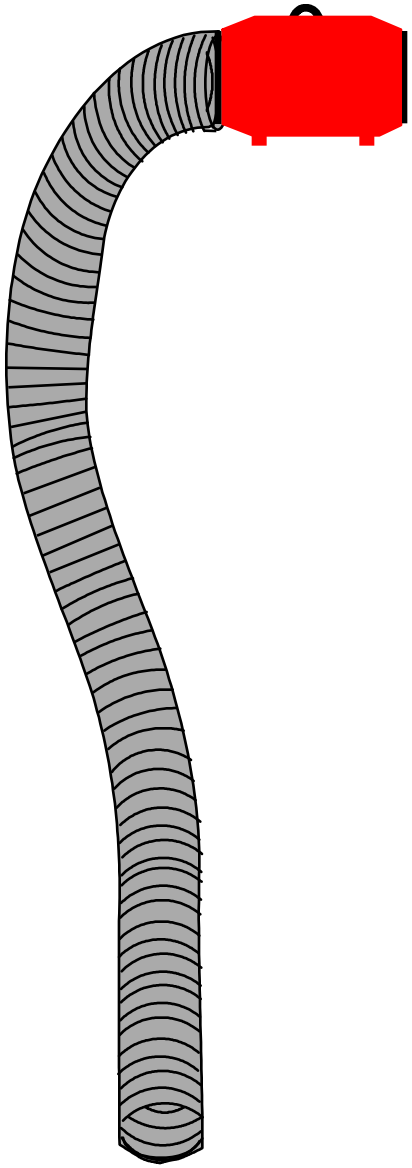












ENABLING OBJECTIVES

- DESCRIBE the objectives for ventilating a compartment for a GFE evolution
- DEFINE the terms used to describe ventilation during a GFE evolution
- DESCRIBE the procedures for ventilating a compartment for a GFE evolution
- DESCRIBE the common difficulties encountered in preparing a compartment for ventilation and the recommended solution to overcome them
- CALCULATE the rate of ventilation required to provide general ventilation

ENABLING OBJECTIVES

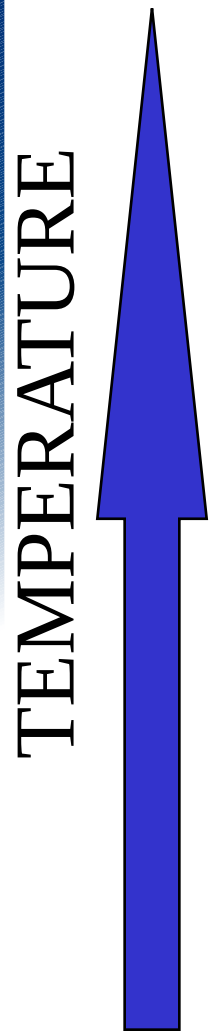
- Given the rated capacity of portable ventilation equipment, CALCULATE its effective capacity
- Given solvent concentration in a paint mixture, CALCULATE the rate of dilution ventilation required for a spray painting operation
- STATE the flow rate required for local exhaust ventilation during welding operations

REFERENCES:

(a) NSTM Chapter 074, Vol 3, Rev 4

(b) OPNAVINST 5100.19D, Section C-15

COMBUSTION THRESHOLDS



Ignition Temperature Is?

Minimum temperature at which self sustained combustion occurs without an external ignition source.

Fire Point Is?

Temperature at which sufficient vapors are released to support continuous combustion once ignited.

Flash Point Is?

Minimum temperature at which sufficient vapors are released to form an ignitable mixture.

VENTILATION - Definition

- Introduction and movement of fresh air into a space
- Removes contaminated air
- Controls the temperature of the space or tank

When is Ventilation Required?

- Entry into a closed compartment or confined space
- Maintain Gas Free Conditions
- Cleaning a tank or void
- Welding, cutting, brazing
- Painting, coating or use of solvents to remove paint
- Abrasive blasting
- Fire extinguishment

VENTILATION - LIMITATIONS

- Flammable, O2 deficient or enriched atmospheres are the result of inadequate natural or mechanical ventilation
- Ship configuration, portable blowers availability, duct limits restrict ventilation

- Providing temporary ventilation using portable fans or blowers can limit hazards to an acceptable level

VENTILATION OBJECTIVES

- Remove contaminated air from space
- Limit flammable atmospheres to 10% or less of LEL
- Limit toxic concentrations to PEL
- Capture & remove contaminants or dilute to safe levels
- Provide fresh, breathable air for health and comfort

VENTILATION PRIOR TO ENTRY

"There will be a minimum of *two air* changes prior to entry into a confined space unless installed ventilation is in operation"

NSTM 074-21.3

EXAMPLE

- SPACE 20ft X 10ft X 10ft = 2000 ft^3
- RAMFAN VOLUMETRIC FLOW RATE = 2000 FT^3 / MIN
- How many minutes needed for **two** complete air changes?
- 2 MINUTES NEEDED FOR 2 COMPLETE AIR CHANGES

TYPES OF VENTILATION

- **GENERAL**
- **LOCAL EXHAUST**
- **DILUTION**

GENERAL VENTILATION

- Provides uncontaminated air for breathing or general comfort
- Supply *or* Exhaust

- ***ONE COMPLETE AIR CHANGE EVERY 3 MINUTES***

Calculating General Ventilation

- The space is 20ft x 35ft x 10ft = 7000 ft^3
- Blower to be used = 2000 ft^3 /min (or cfm)
- 7000 ft^3 divided by 2000 cfm = 3.5 min
- How many fans are needed?
- 3.5 min. divided by 3 (Gen. Vent.) = 1.166
- Round up = 2 blowers

LOCAL EXHAUST VENTILATION

- Captures contaminants as they are generated
- Draws them through exhaust ductwork intake positioned 6-10 inches from work generating contaminants
- Effective for welding and solvent cleaning
- *Exhaust* only
- 100 FPM

*** DO NOT REMOVE - REQUIRED FOR I.M.S. DEPARTMENT PROCESSING ***

SECTION L

REPAIR DEPARTMENT
06/06/2001

THE FOLLOWING STATUS CODES MAY BE CIRCLED ON THE FAR RIGHT

C- COMPLETE ON IN EFFECT R- REQUIRES FUTHER ACTION NA- NOT APPLICABLE

****

(B1M0) ARE ALL WELDING AND BRAZING AREAS PROVIDED WITH LOCAL EXHAUST VENTILATION?

REF: **OPNAVINST 5100.19D ART C1102**
NSTM 074-10.72

(C) R NA

****

DILUTION VENTILATION

- Portable, locally rigged *exhaust* ventilation
- Replaces contaminated air with fresh air, diluting concentration
- Used to control flammable, O2 deficient/enriched areas
- SAR may be required when toxics are being generated

VENTILATION CONSIDERATIONS

- Needed capacity (how many fans) based on space size
- Needed ducting based on space layout and obstructions
- Initial atmospheric test results
- Potential hazards

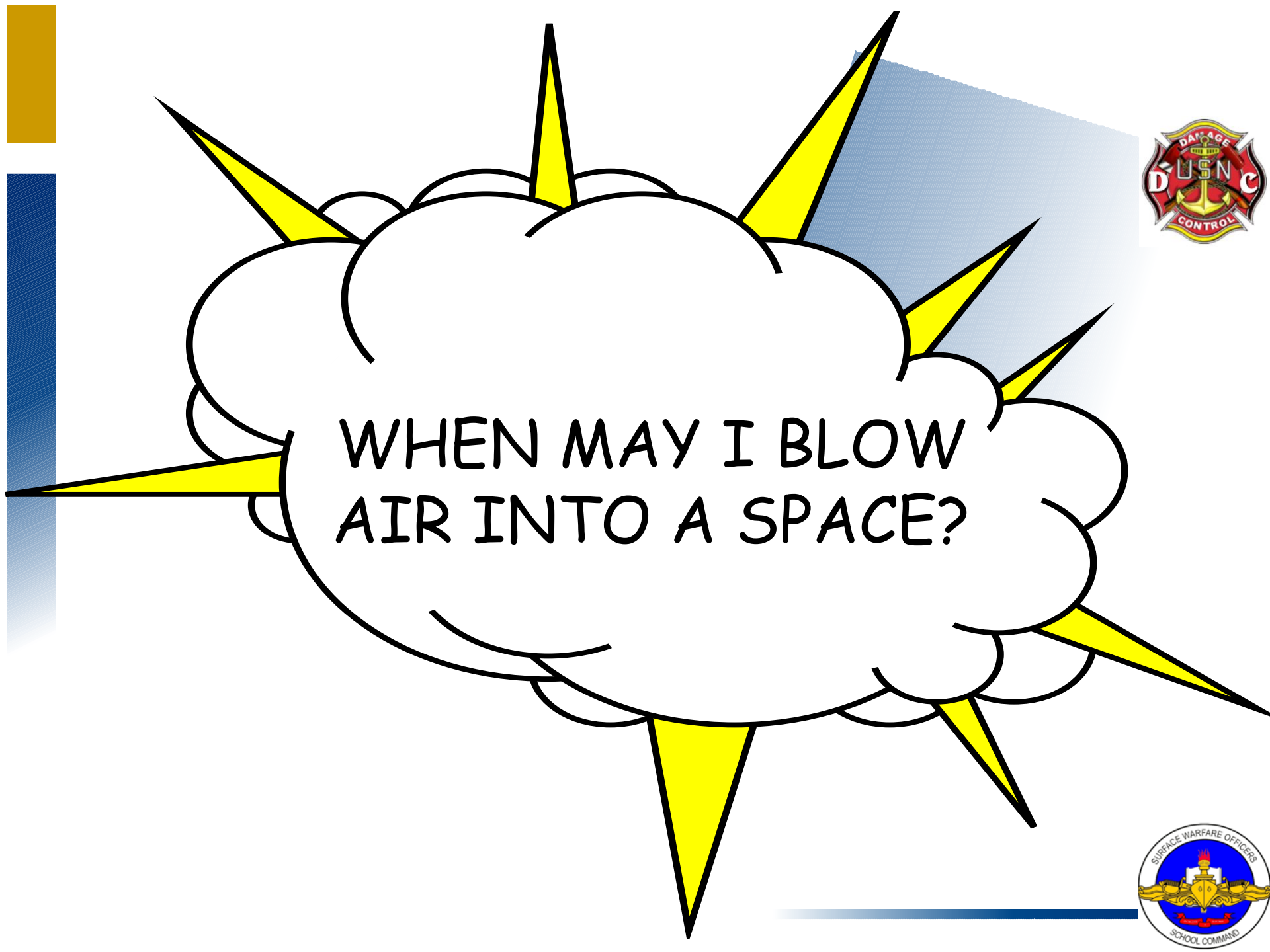
VENTILATING FLAMMABLE ATMOSPHERES

- Equipment explosion proof or intrinsically safe
- Equipment grounded to control static electricity

BLOWING VS DRAWING

"NEVER BLOW AIR INTO A SPACE WHICH CONTAINS FLAMMABLE OR TOXIC PARTICLES"

NSTM 074-21.6.4

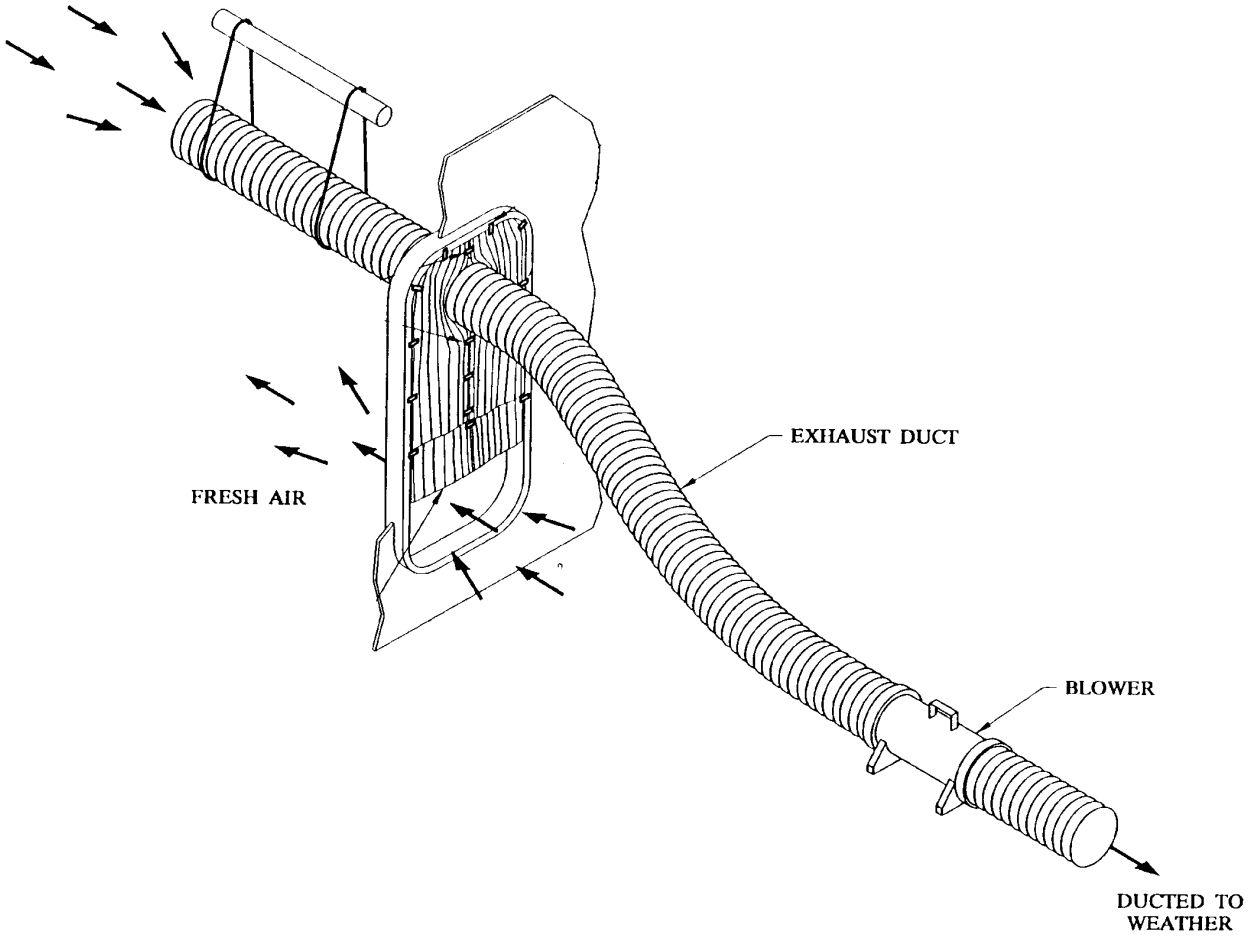

WHEN MAY I BLOW AIR INTO A SPACE?

BLOWING AIR

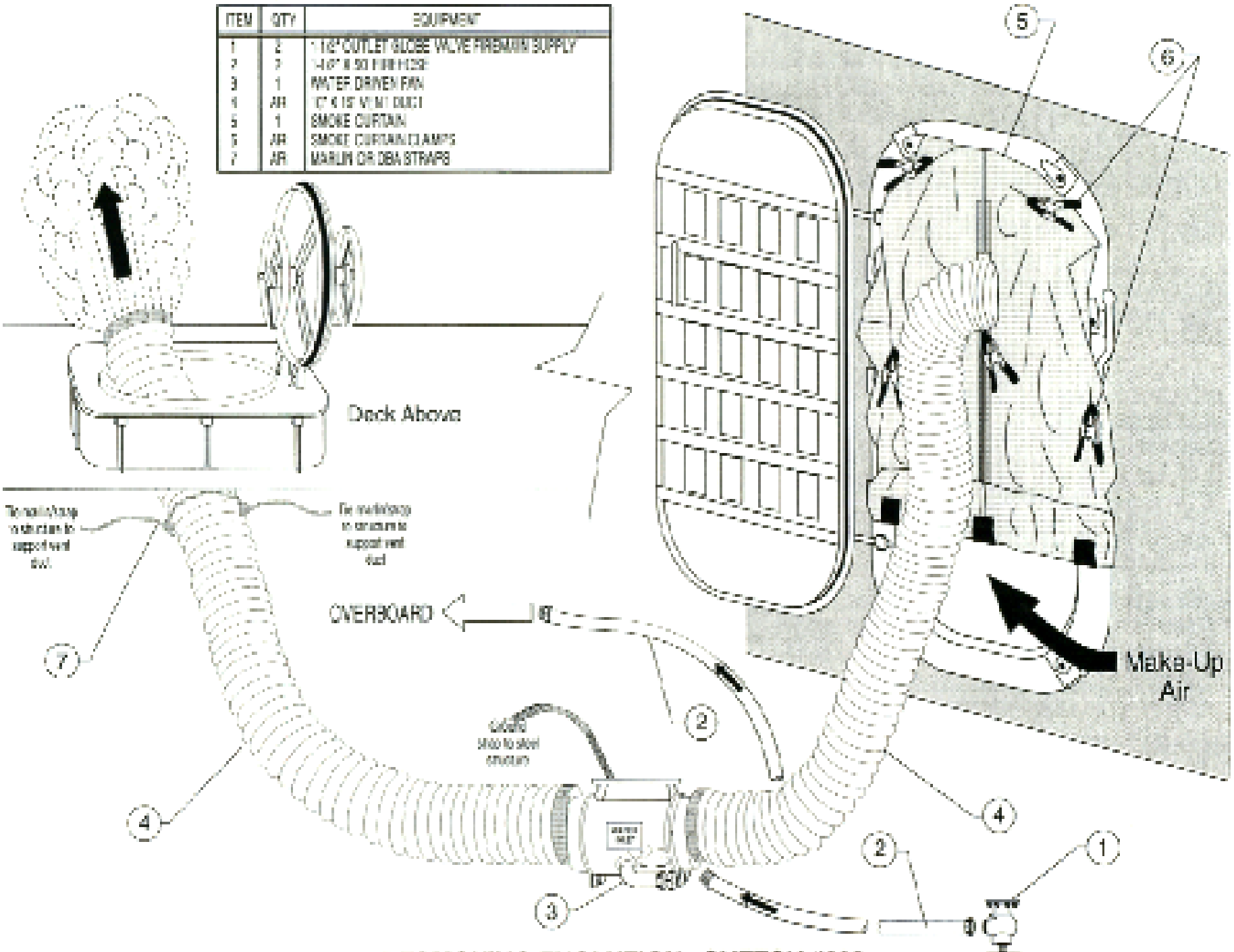
- No flammables present or being generated
- No toxics present or being generated
- Only to provide clean air for breathing and comfort

EXHAUST CONFIGURATION REFERRED OVER SUPPLY

- Supply can produce a static charge build-up
- Supply could introduce foreign objects into space
- Supply can result in contamination of adjacent spaces


FRESH AIR
EXHAUST DUCT
BLOWER
DUCTED TO
WEATHER

ITEM	QTY	EQUIPMENT
1	2	[illegible]
2	2	[illegible]
3	1	WATER DRIVEN FAN
4	AR	[illegible]
5	1	SMOKE CURTAIN
6	AR	SMOKE CURTAIN CLAMPS
7	AR	MARLIN OR DBA STRAPS



DUCTING

- Greater length and bends results in greater friction
- Maximum of three 15 ft ducts per fan

DILUTION VENTILATION VOLUME FORMULA

- One complete air change every 3 minutes

EXAMPLE

- The space is 15 Ft x 20 ft x 10 ft
- *What volumetric flow rate is needed?*

EXAMPLE

$$Q = \frac{\text{VOLUME OF SPACE}}{3 \text{ MINUTES}}$$

WHERE Q IS VOLUMETRIC FLOW RATE

$$Q = \frac{15\text{FT X } 20 \text{ FT X } 10 \text{ FT}}{3 \text{ MINUTES}} = \frac{3000 \text{ FT}^3}{3 \text{ MINS}}$$

$$Q = 1000 \text{ FT}^3/\text{MIN}$$

EXAMPLE

- Need 1 RAMFAN

  (1 Ramfan = 2000 cfm)

DILUTION FOR SPRAY PAINTING

- Ventilation shall dilute contaminants to 10% or < of the LEL
- Ventilate *continuously* during and then afterward
- Test as necessary during operations
- If concentrations of flammable vapors exceeds 10% of the LEL, STOP operations, continue ventilation

FLOW RATES FOR DILUTION VENTILATION FOR SPRAY PAINTING

$$Q = \frac{C\,(100 - LEL)}{LEL} \times Vv \times \frac{GAL}{MIN} \times \%SOLVENT$$

Q = VOLUMETRIC FLOW NEEDED TO MAINTAIN 10% OF LEL

Vv = VAPOR VOLUME PER 1 GALLON OF LIQUID

EXAMPLE

- Paint containing 12% toluene and 25% acetone used at rate of 1 gallon every 4 minutes.
- What dilution volumetric flow rate is needed to maintain 10% of LEL?

EXAMPLE

$$Q = \frac{C\,(100 - LEL)}{LEL} \times Vv \times \frac{GAL}{MIN} \times \%SOLVENT$$

12% TOLUENE AT 1 GAL EVERY 4 MINS

$$Q_{toluene} = \frac{10\,(100-1.4)}{1.4} \times \frac{30.4FT^3}{GAL} \times \frac{1GAL}{4\ MINS} \times .12$$

$Q_{toluene} = 642.3\ FT^3/MIN$

EXAMPLE

$$Q = \frac{C\,(100 - LEL)}{LEL} \times Vv \times \frac{GAL}{MIN} \times \%SOLVENT$$

25% ACETONE AT 1 GAL EVERY 4 MINS

$$Q_{acetone} = \frac{10\,(100-2.6)}{2.6} \times \frac{44.0 FT^3}{GAL} \times \frac{1GAL}{4\ MINS} \times .25$$

$$Q_{acetone} = 1030.2\ FT^3/MIN$$

EXAMPLE

Q toluene = 642.3 FT^3/MIN

Q acetone = 1030.2 FT^3/MIN

EXAMPLE

Q toluene = 642.3 FT^3/MIN

+

Q acetone = 1030.2 FT^3/MIN

Q total = 1672.5 FT^3/MIN

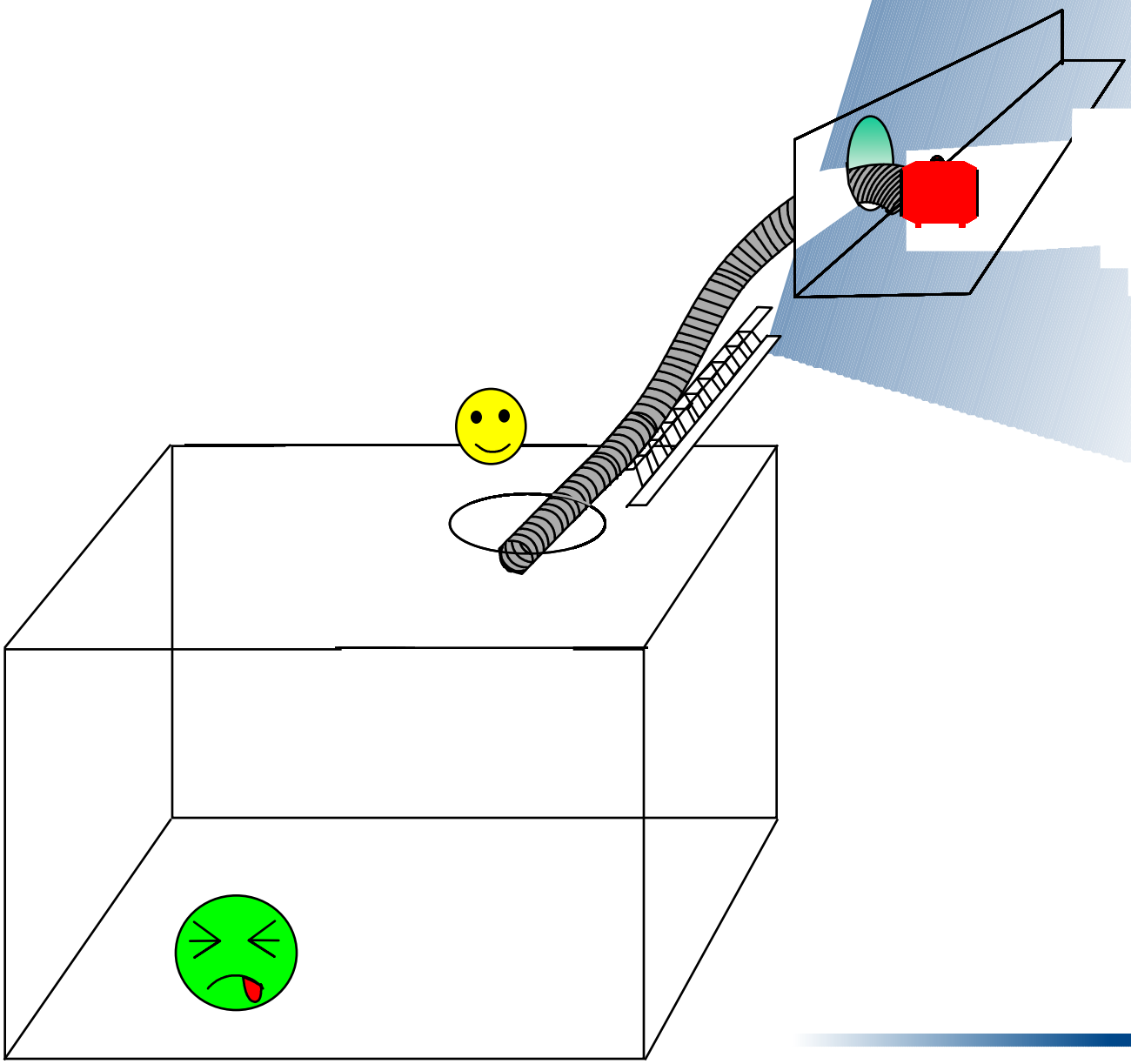
COMMON DIFFICULTIES WITH VENTILATION

SHORT CIRCUITING

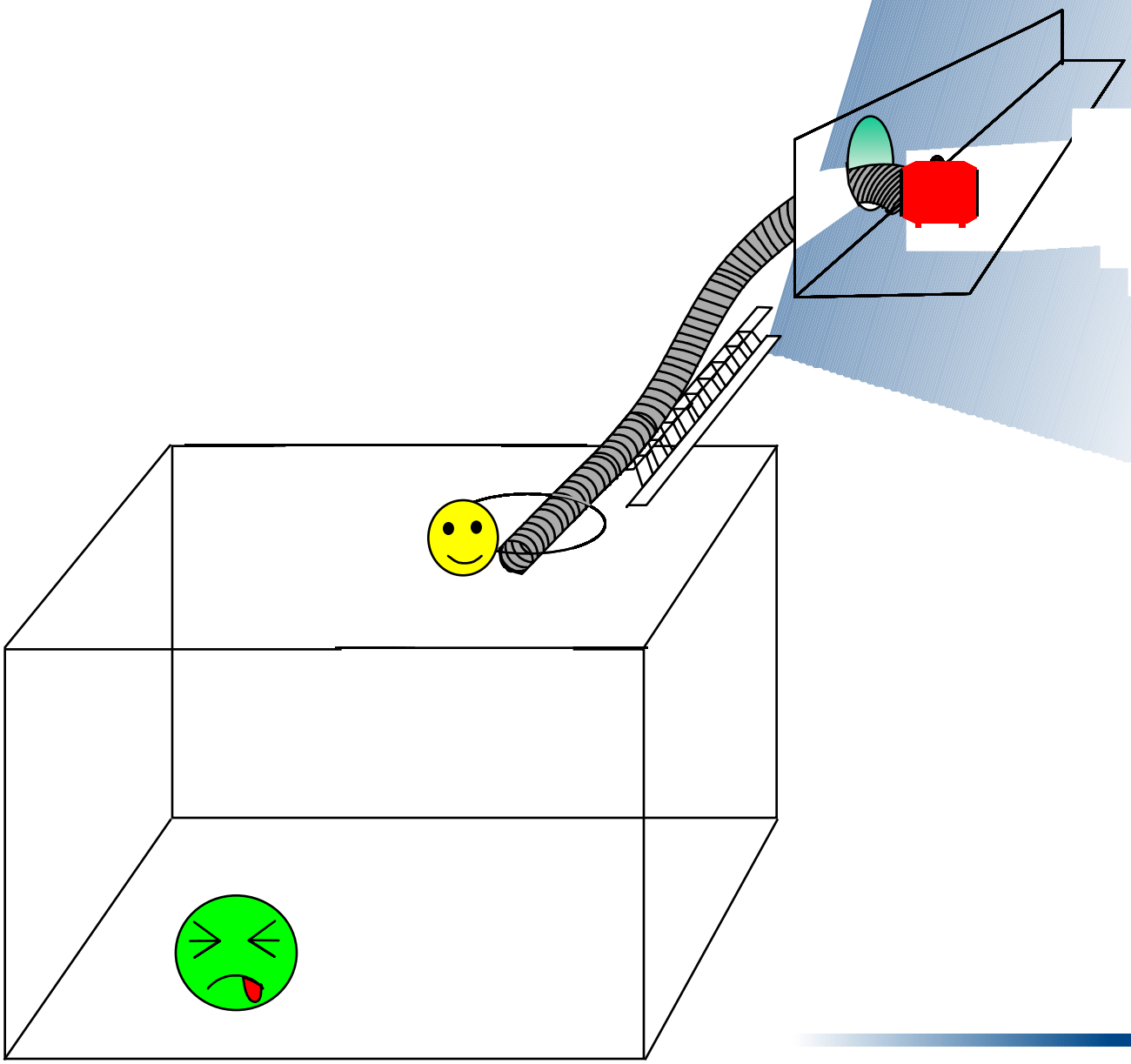
- Source of make up air is too close to the exhaust trunk
- Effective volume ventilated is insufficient
- Remedy?

Place trunk further into space

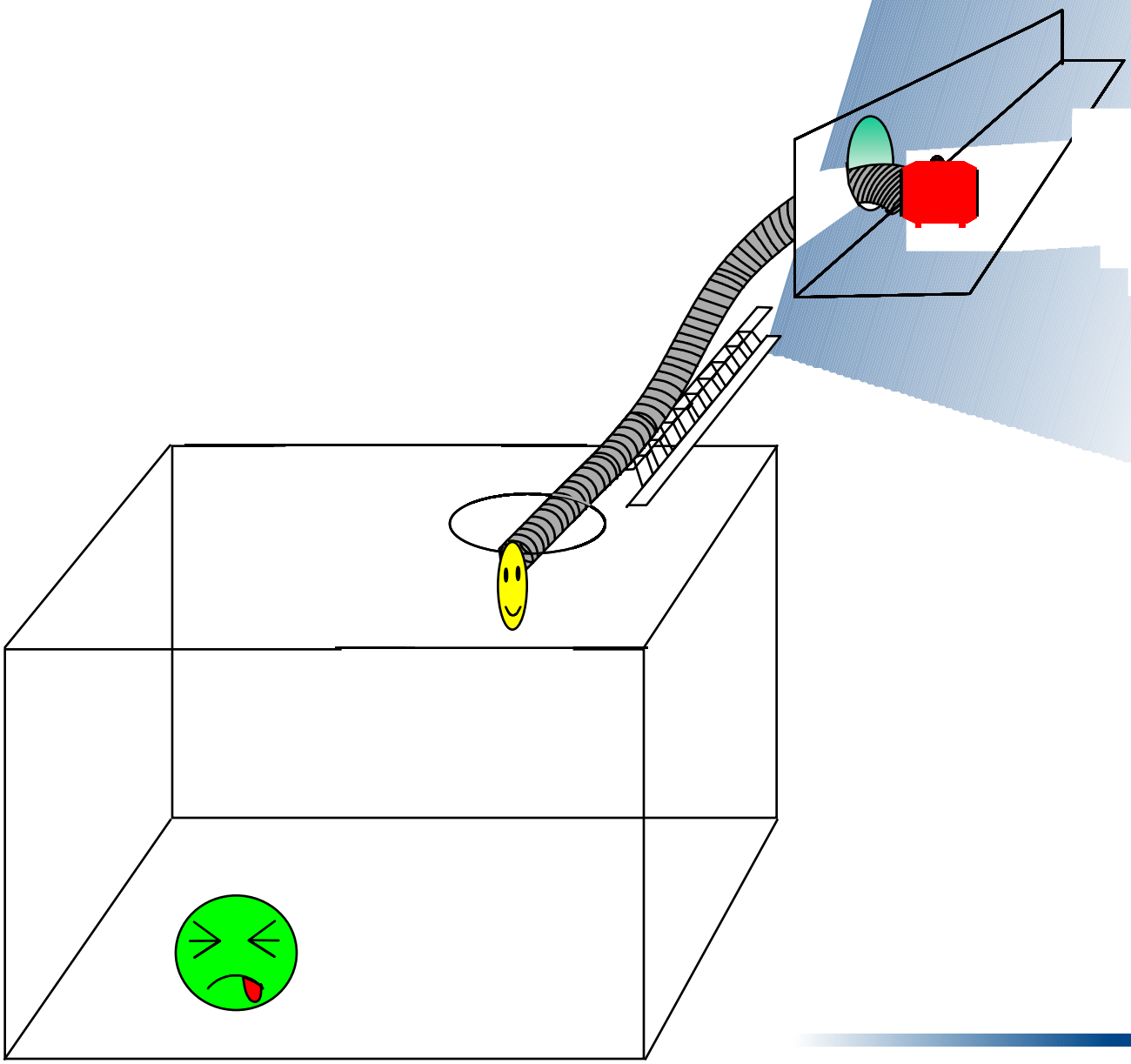
SHORT CIRCUITING



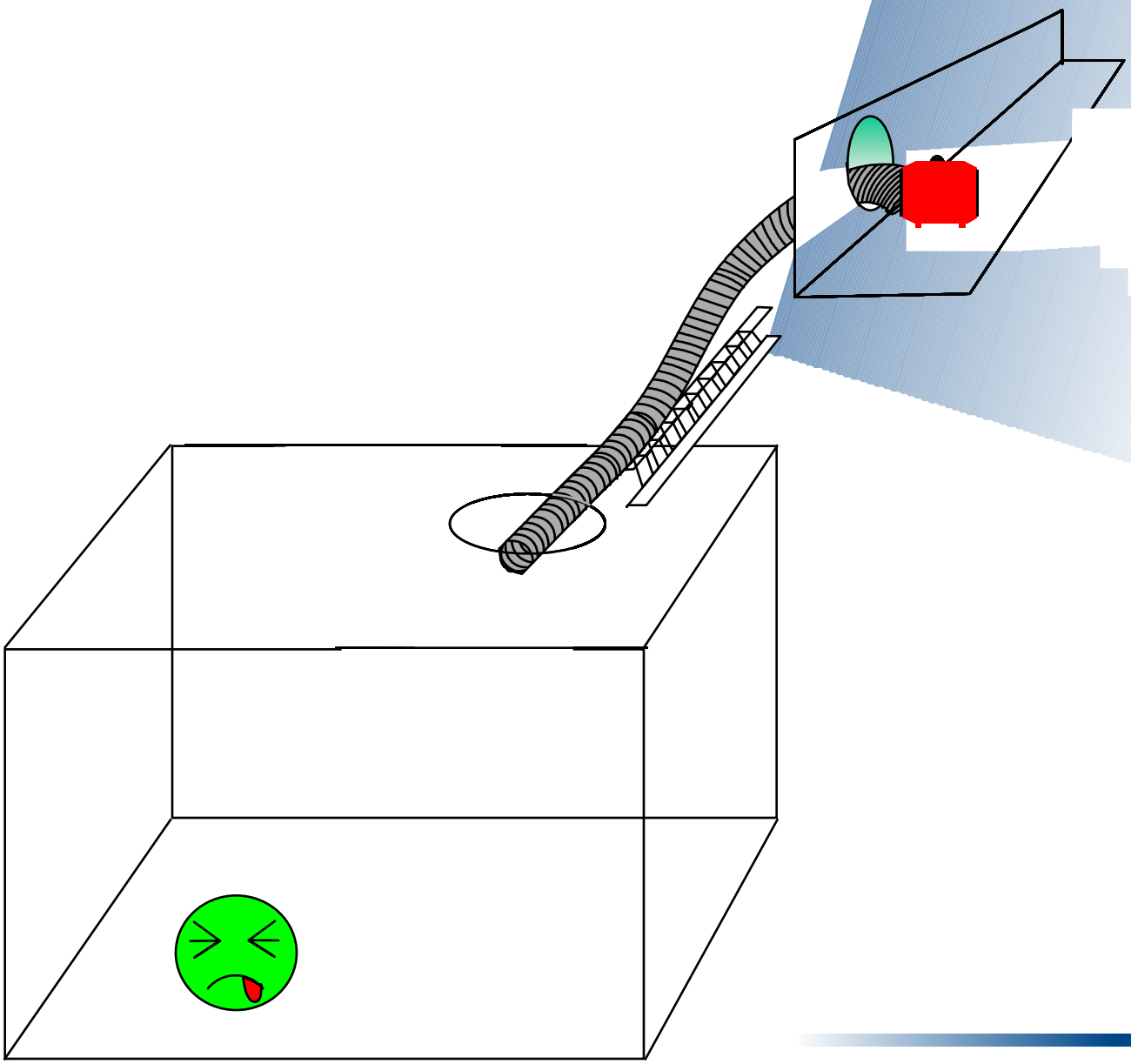
SHORT CIRCUITING



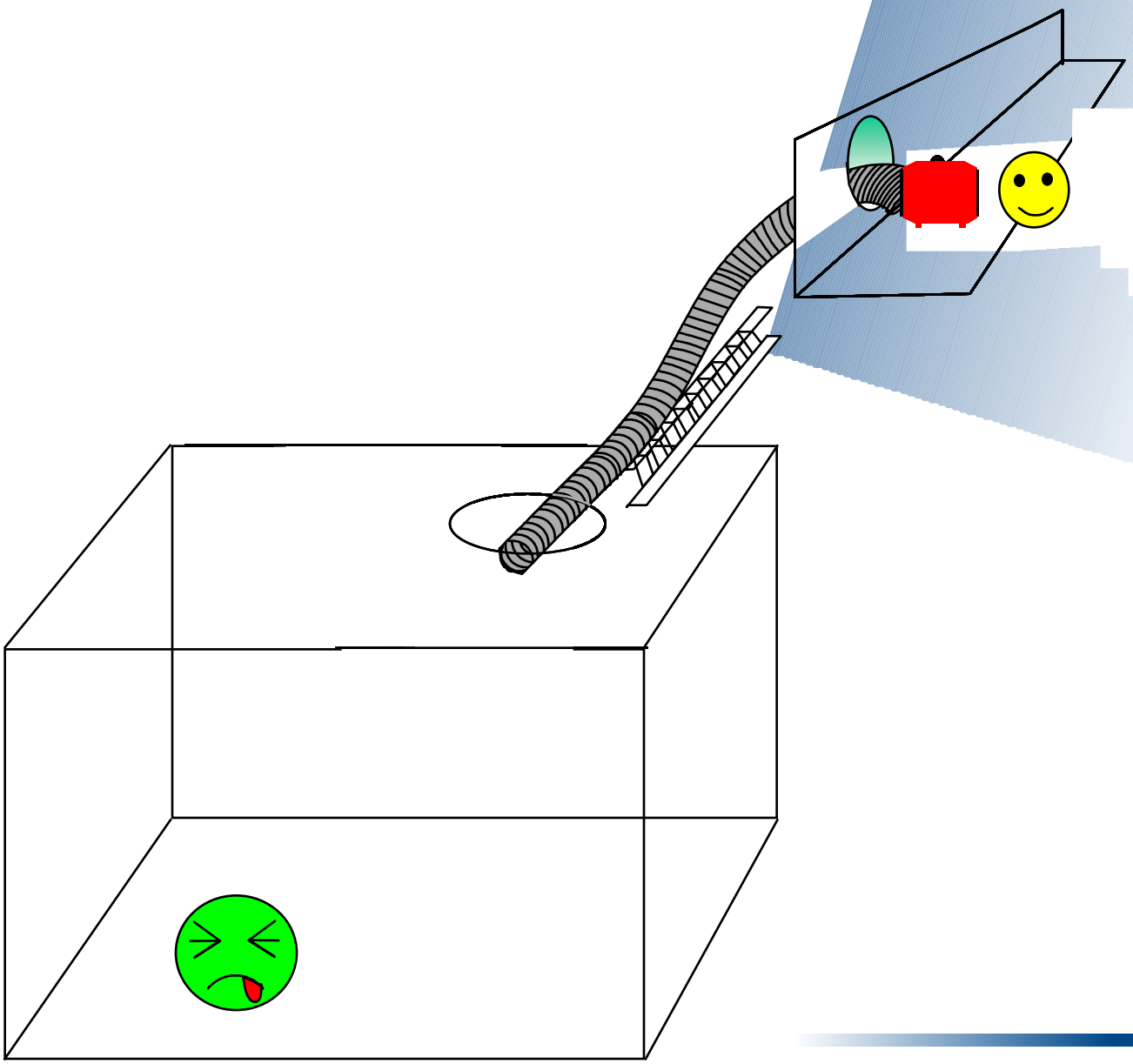
SHORT CIRCUITING



SHORT CIRCUITING



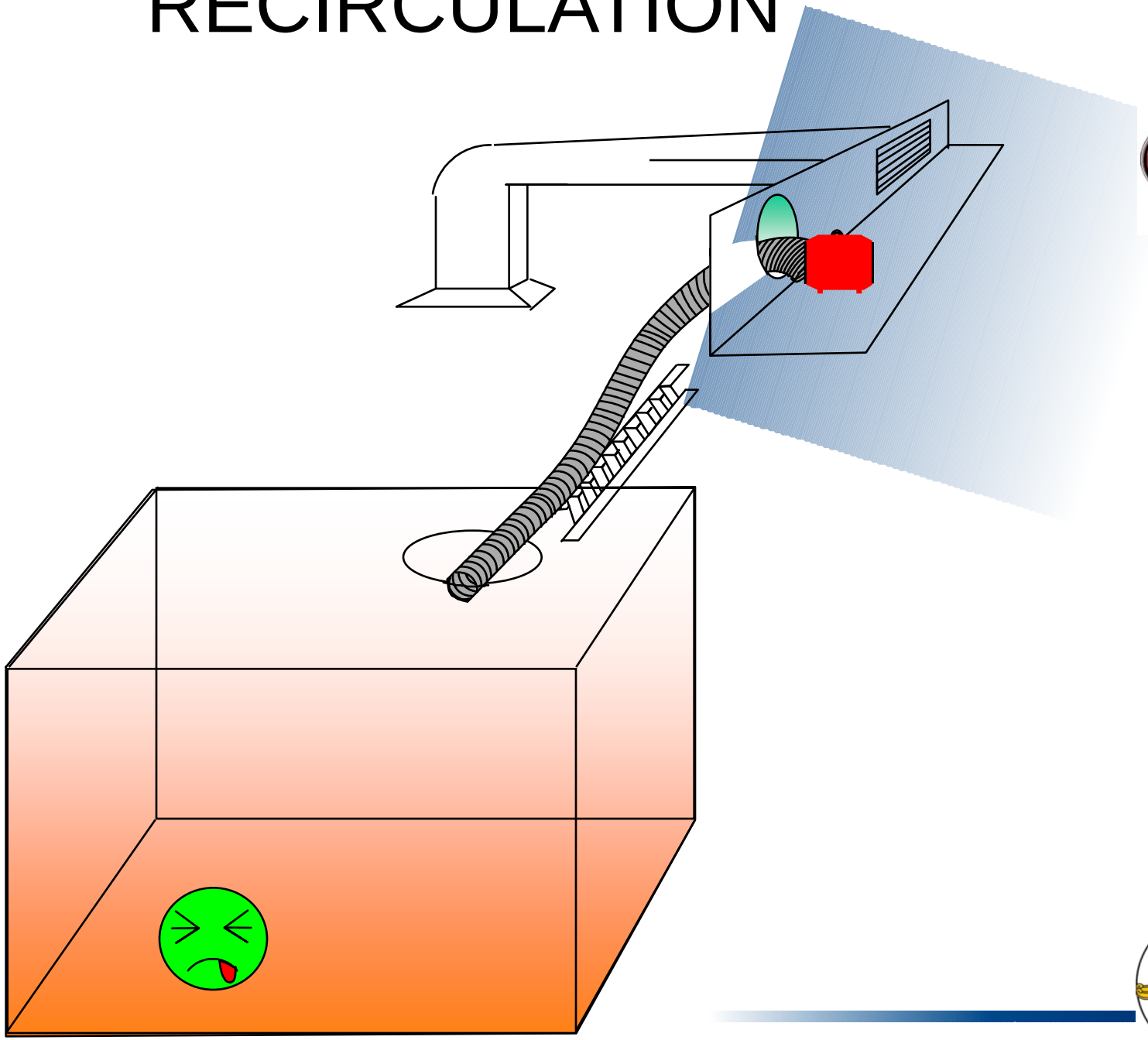
SHORT CIRCUITING



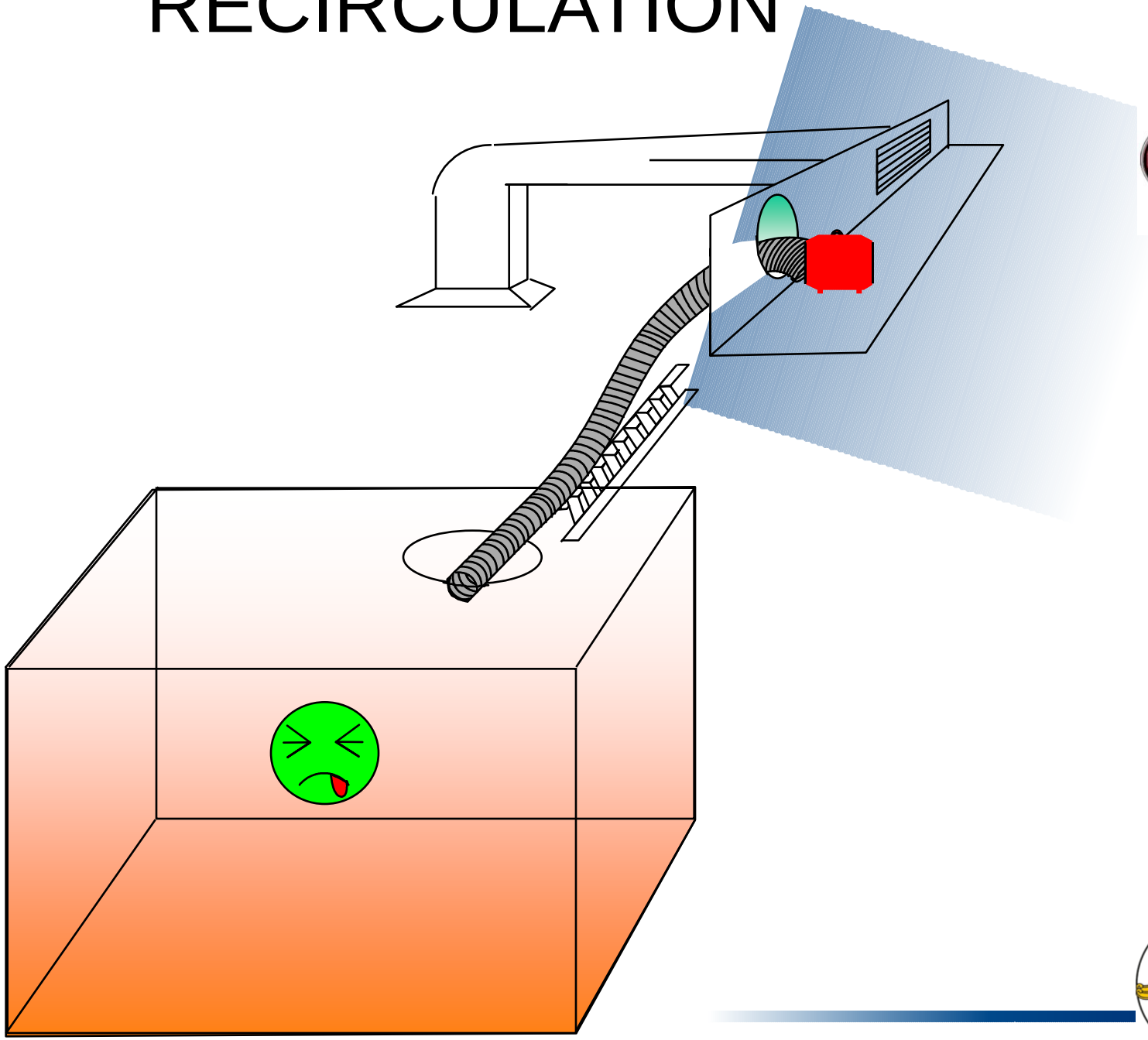
RECIRCULATION OF CONTAMINATED AIR

- Exhaust discharge is drawn back into the make-up air
- Drawn back into space

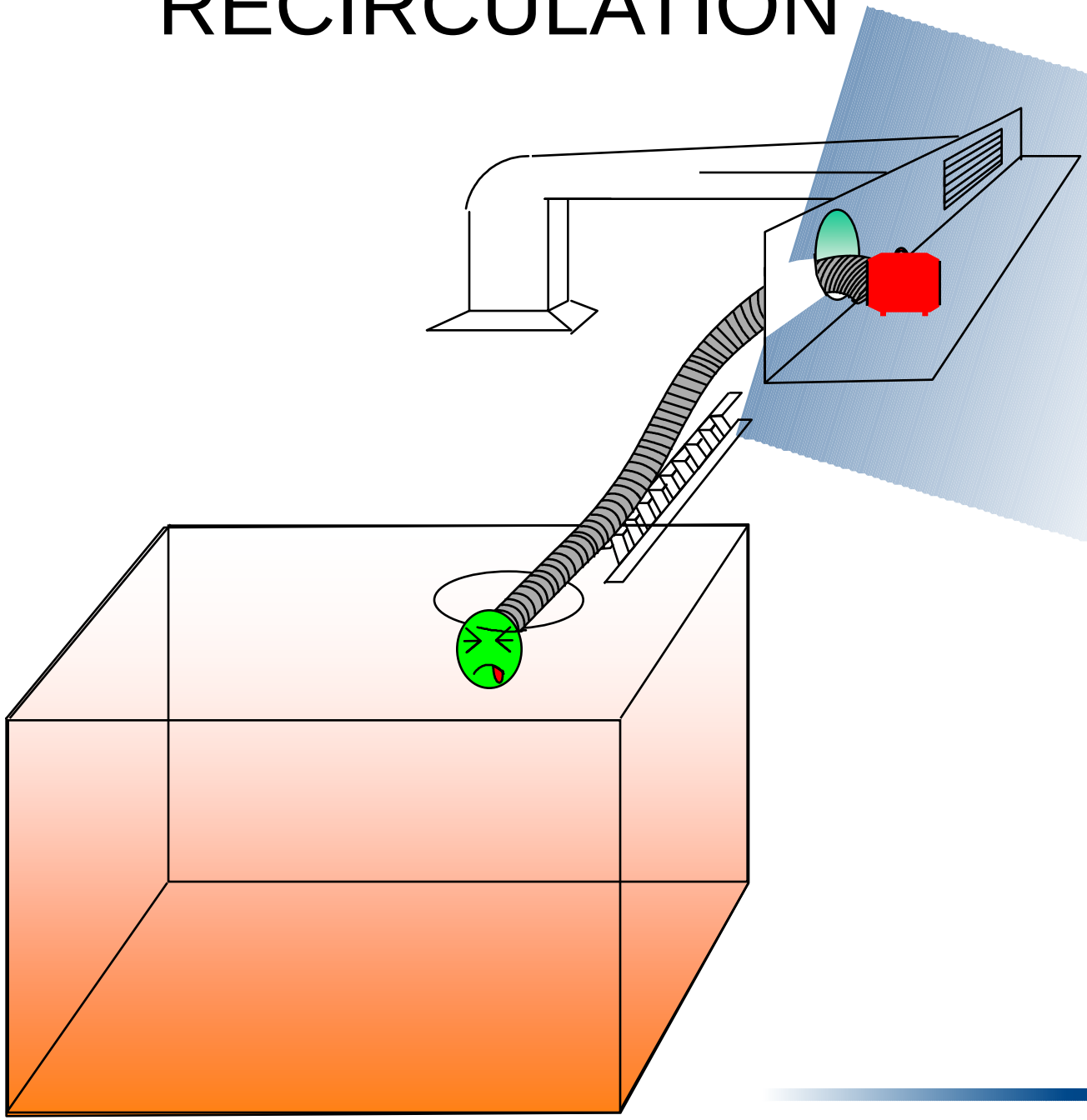
RECIRCULATION



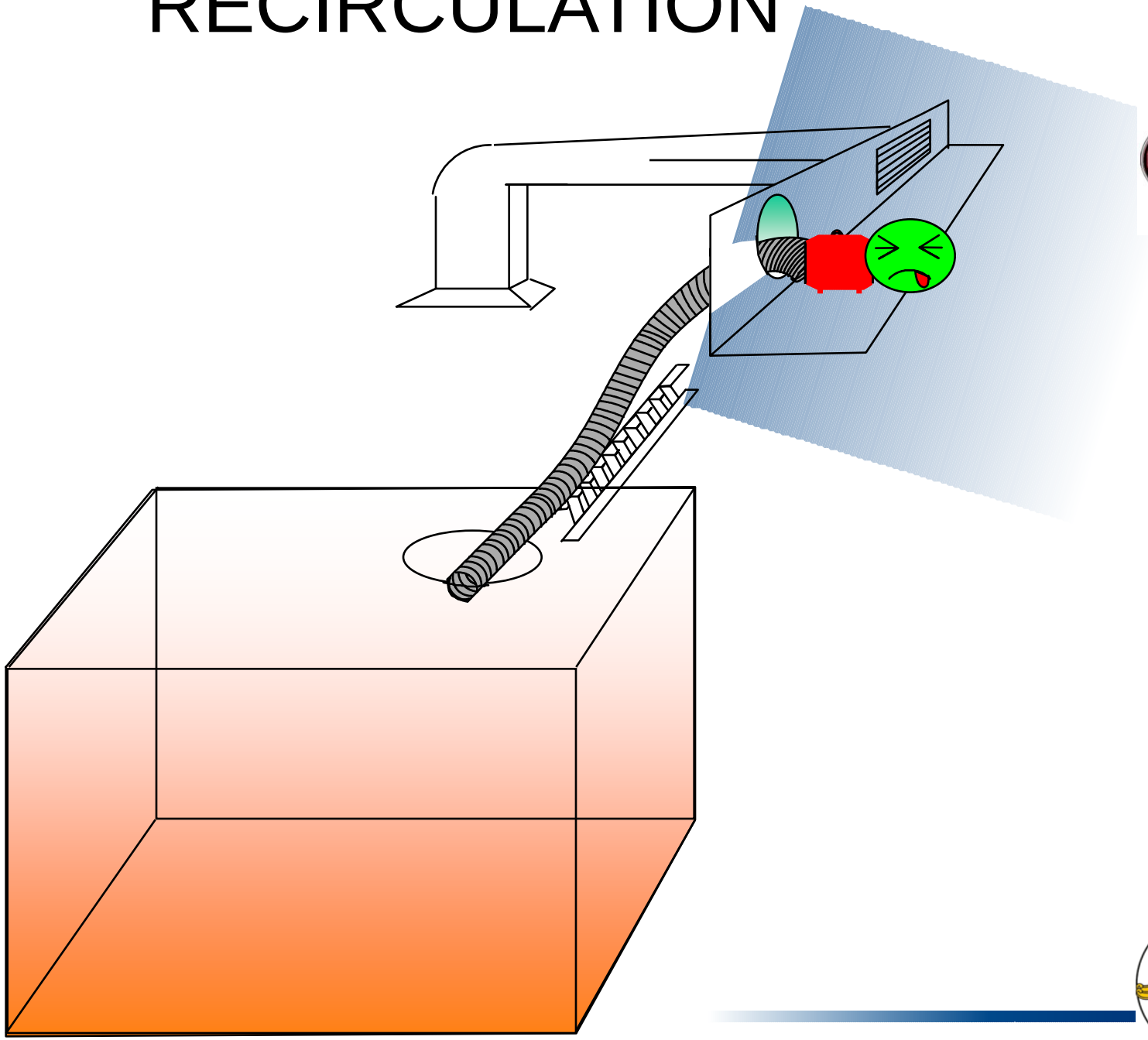
RECIRCULATION



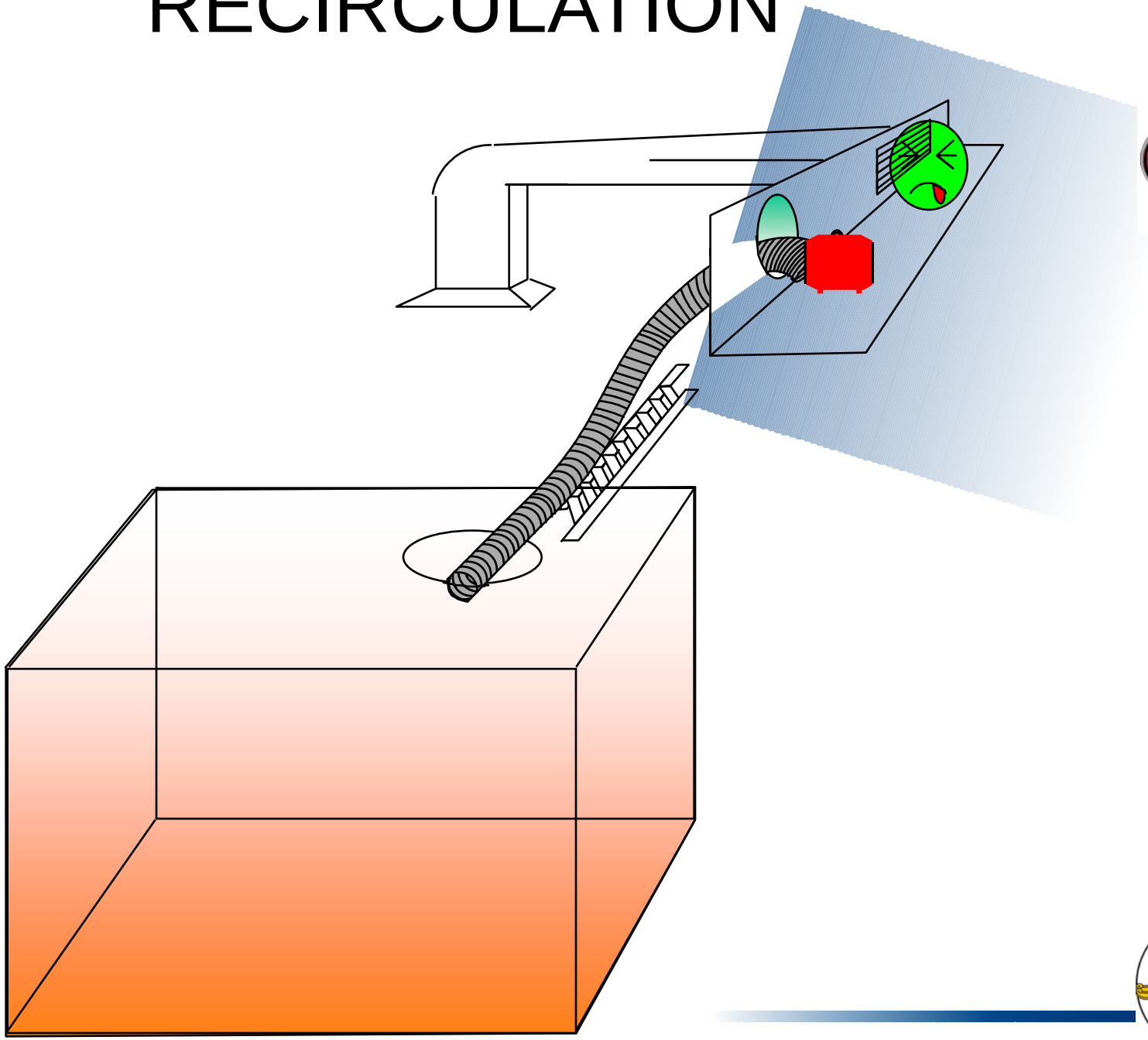
RECIRCULATION



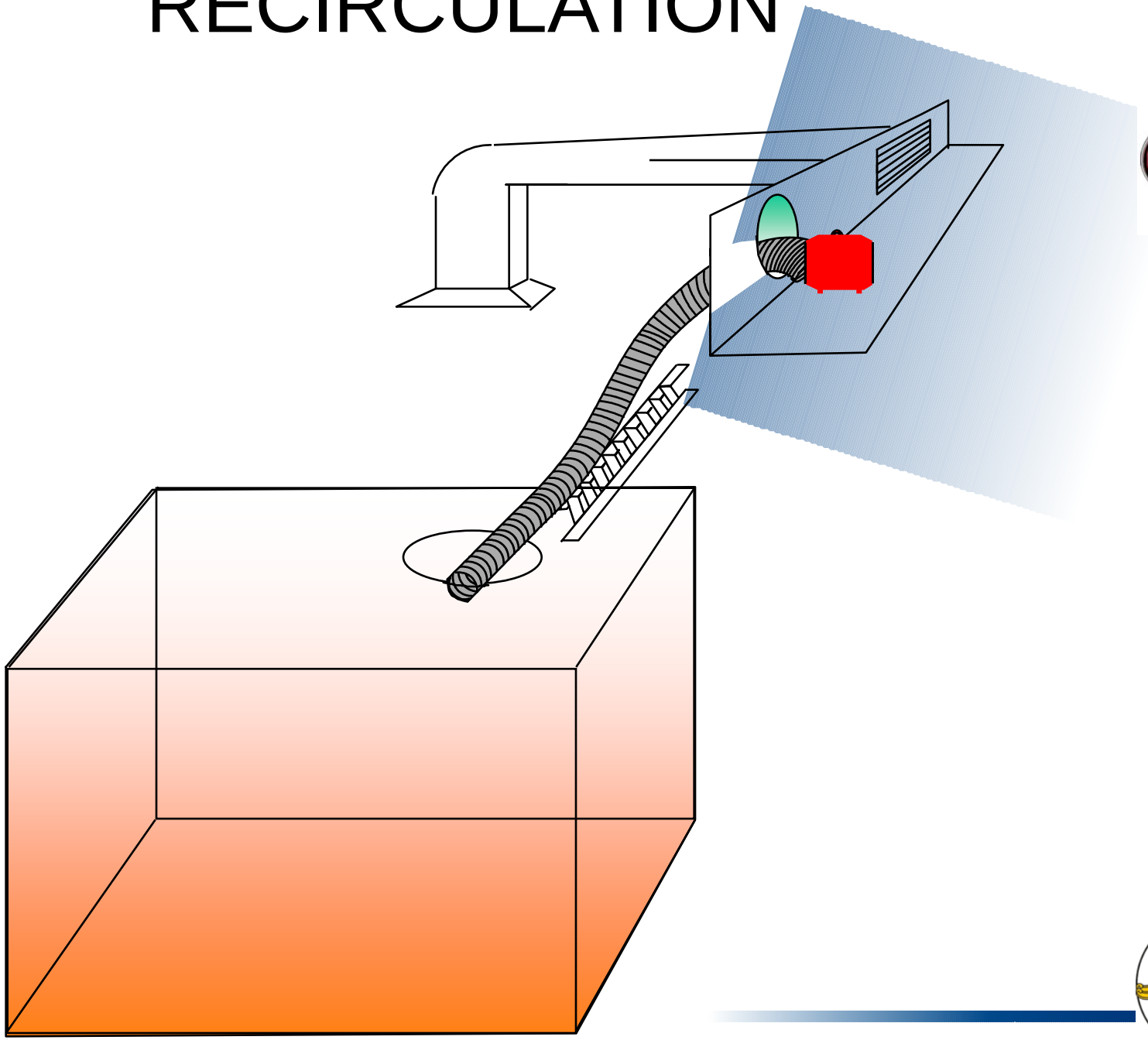
RECIRCULATION



RECIRCULATION



RECIRCULATION



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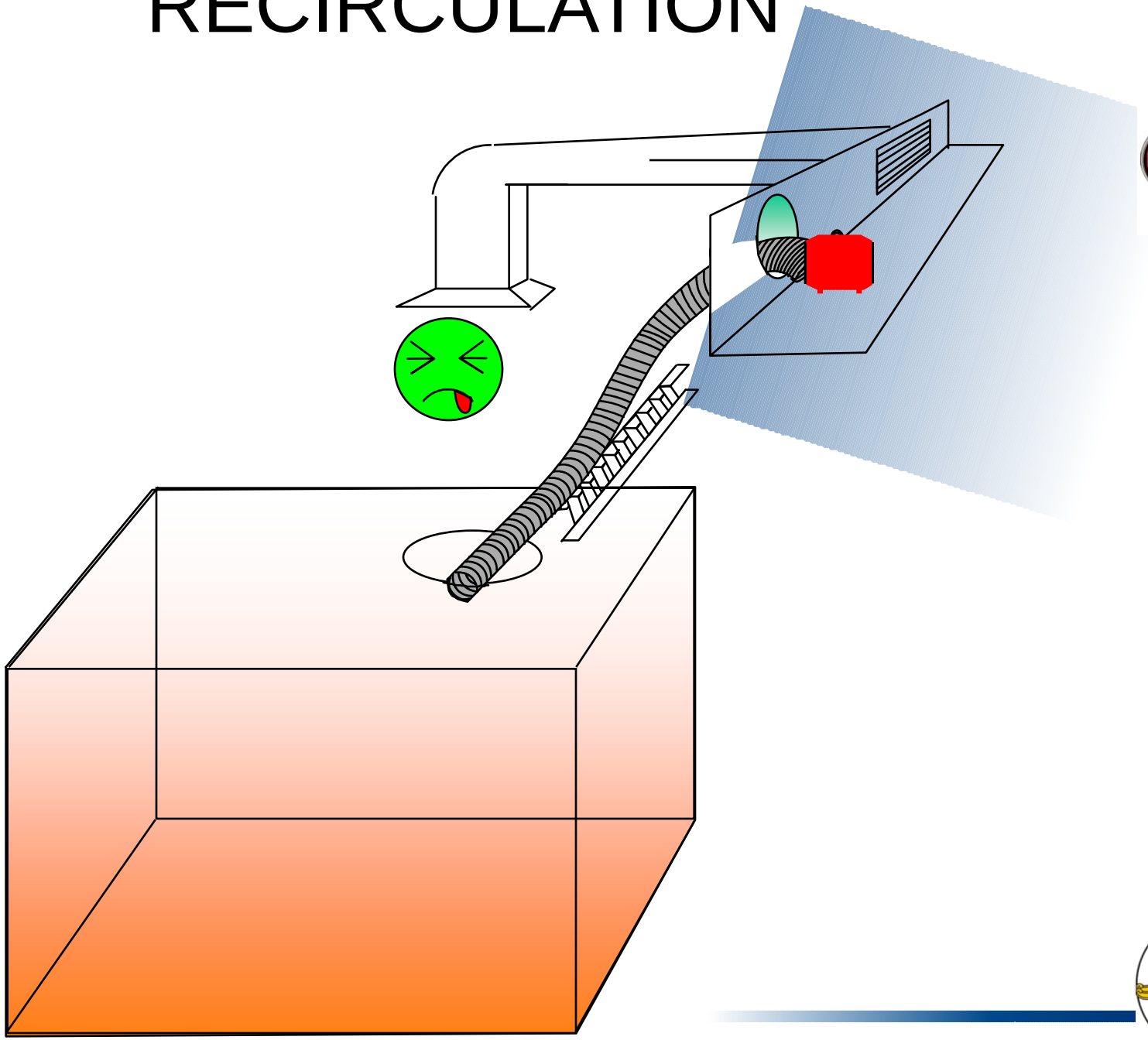
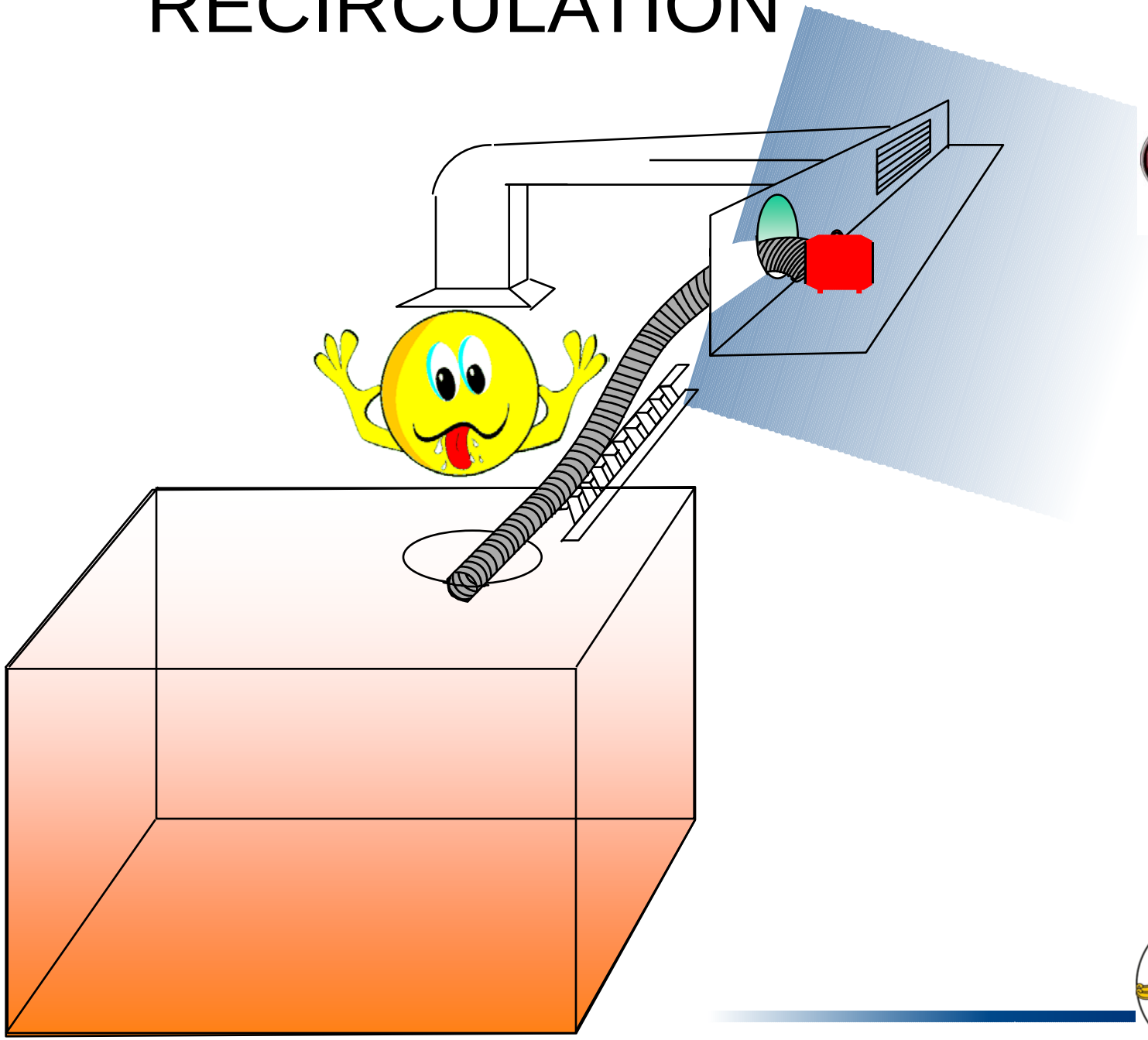


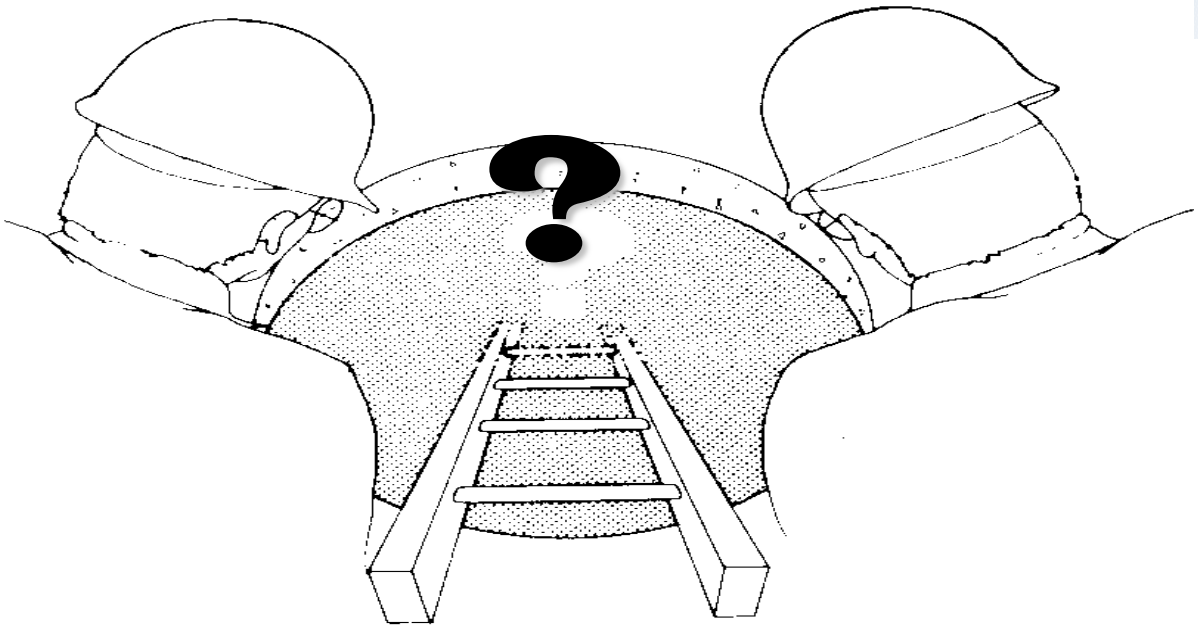
RECIRCULATION



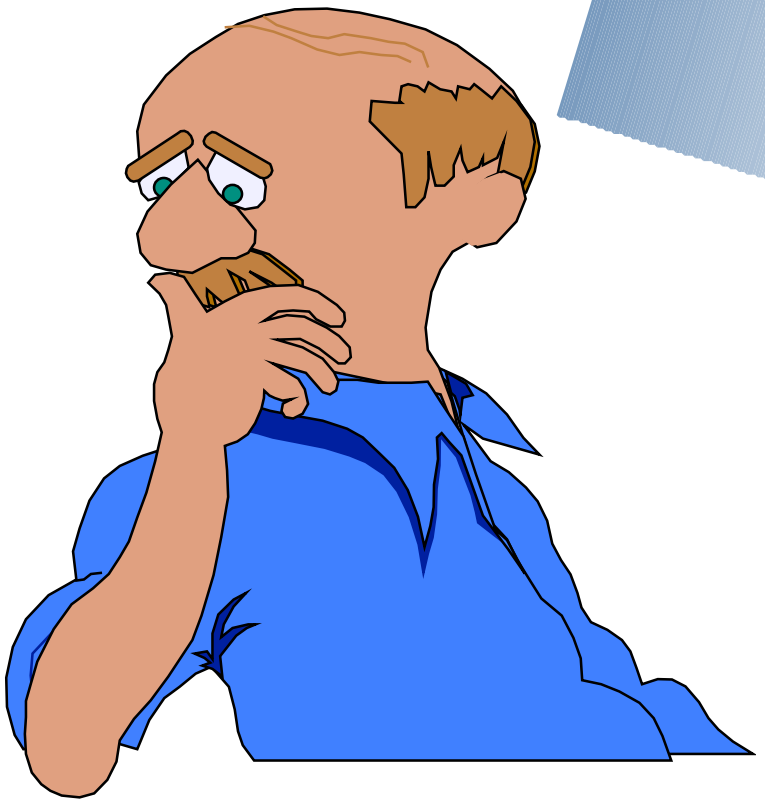
THUMBRULES FOR VENTILATION TO MAINTAIN A GAS FREE CONDITION

- Always suspect a hazardous condition to exist or be created
- Personnel involved in the work or space entry process must either wear or have ready the proper respiratory gear for the hazard suspected

When in doubt, expect the worst



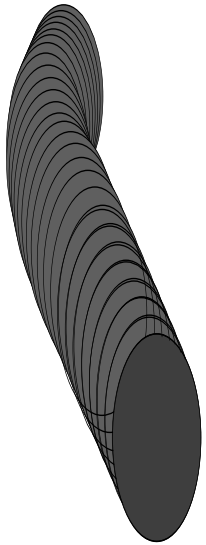
ANY QUESTIONS?



SUMMARY

We talked about objectives of ventilating, terms, procedures, difficulties, calculations, capacities, concentration in a paint mixture and flow rates required for local exhaust ventilation.

REVIEW QUESTION #1



- When may air be blown into a space vs. drawn out of a space?
- No flammables present or being generated
- No toxics present or being generated
- Only to provide clean air for breathing and comfort

REVIEW QUESTION #2

THE DILUTION VENTILATION FORMULA STATES YOU SHOULD HAVE ____ COMPLETE AIR CHANGE EVERY _____ MINUTES.

REVIEW QUESTION #2

THE DILUTION VENTILATION FORMULA STATES YOU SHOULD HAVE **ONE** COMPLETE AIR CHANGE EVERY **3** MINUTES.

$$Q = \frac{\text{VOLUME OF SPACE}}{3 \text{ MINUTES}}$$

WHERE Q IS VOLUMETRIC FLOW RATE

REVIEW QUESTION #3

- Explain “Short Circuiting” as it applies to Ventilation.
- Source of Make-Up air is too close to exhaust inlet ducting
- To remedy the problem?
- Place trunk further into space

THE END