CONFINED SPACE: VENTILATION CALCULATING WAIT TIME FOR AIR CHANGES

The person responsible for ventilating a confined space must know how long it will take to effectuate a given number of air changes before entering a confined space. The industry best practice for a pre-entry purge is to ventilate with six (6) times the volume of the confined space using positive ventilation from a clean air source.

Step 1: Calculate or estimate the volume of the confined space.

Most spaces can be estimated using the volume of cubes and cylinders.

Volume of rectangle = length x width x height

Volume of cylinder = π (approx. value is 3.2) x radius^2 x height (*Radius is ½ the diameter of the cylinder*)

Exercises (1-3):

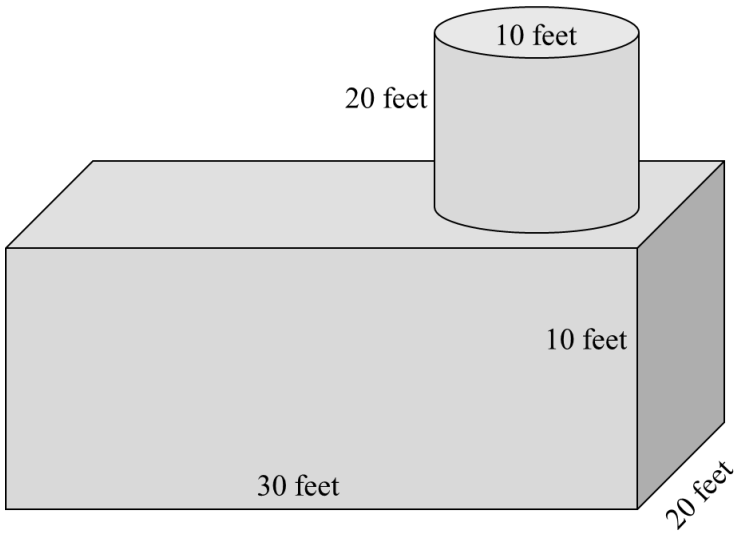
1. What is the volume of a rectangular confined space measuring 20 feet long, by 10 feet wide, by 8 feet high?

   Volume = 20 x 10 x 8 = 1,600 cubic feet

2. What is the volume of a water tank measuring 80 feet across by 30 feet high?

   Volume = 3.2 x 40^2 *(half of 80 ft. diameter)* x 30 = 153,600 cubic feet

3. What is the volume of the confined space vault pictured below?



Add the volumes of the rectangle and the cylinder:

Rectangle: 30 x 20 x 10 = 6,000 ft^3 + cylinder: 3.2 x 5^2 x 20 = 1,600 ft^3 Total: 7,600 ft^3

Step 2: Calculate or estimate the air flow provided by the blower, minus air flow loss from duct and attachments

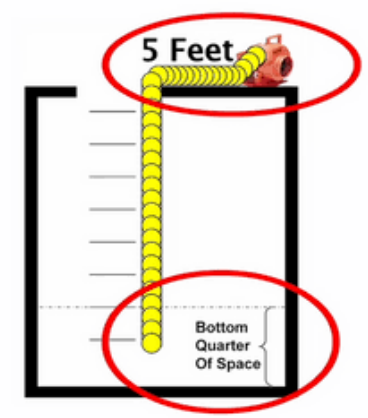
Use the department's blower owners' manual or specification plate to calculate or find the air flow in cubic feet per minute (cfm) at the end of the forced air system.

Exercise (4):

4. According to the Owner's manual, your blower is rated at 1,800 cfm maximum flow in free air. You will use the blower's integral 15' duct, fully extended and in a straight run except for one 90° bend at the opening to the manhole. What is air flow at the end of the duct?

   Answer: subtract 15% for the one 90° bend in the duct. This will provide the air flow rate at the end of the duct in the confined space.

   1,800 cfm x .85 = 1,530 cfm



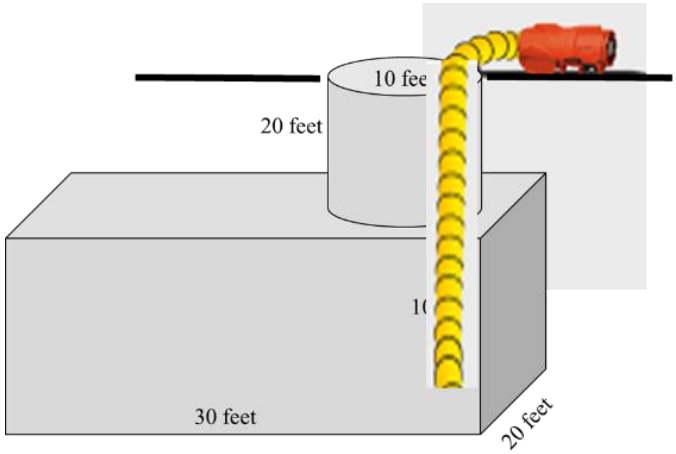
Step 3: Estimate wait time to achieve 6 air changes in the confined space described.

Wait time in minutes = volume of space in cubic feet / air flow in cfm x 6

Wait time in minutes = 7,600 ft^3 / 1,530 cfm x 6

Wait time in minutes = 29.8 or 30 minutes

This calculation assumes perfect air dilution. Something that is rarely achieved. It is good practice to add a safety factor based on the anticipated dilution rate, given the configurations of the confined space and air duct.



Agencies with permit-required confined spaces should calculate wait times for their spaces and include them in their confined space policy or post them at each space for easy reference.

Employees can use the wait time to set-up rescue or retrieval systems, fill out permits, and conduct a 360-degree sweep checking for hazardous conditions around the confined space.