$$\frac{\text{cubic feet of air}}{\text{pint of liquid}} = \frac{400{,}000{,}000\ (\text{specific gravity of liquid})}{(\text{allowable concentration})\,(\text{molecular weight})}$$

Thus, if the designer is given an allowable concentration for trichloroethylene of 100 p.p.m., the dilution ventilation for 100 per cent efficient distribution would be

$$\frac{\text{cubic feet}}{\text{pint}} = \frac{(400{,}000{,}000)\,(1.5)}{(100)\,(131)} = 45{,}000\ (\text{approx.})$$

C. DISPERSION OF AIR CONTAMINANTS BY GENERAL VENTILATION

One of the important disadvantages of general ventilation is that it permits the building or room to become a large settling chamber for any dusts, fumes, or mists suspended in the air, even though the concentration may be within acceptable limits so far as health and safety are concerned. This has been most dramatically demonstrated in plants manufacturing or using highly combustible dusts. Although the dust concentrations at any one time were not sufficient to constitute a nuisance or hazard, the accumulation over many months or years has resulted in disastrous explosions of dust that had been deposited on rafters and inaccessible machinery surfaces.

In some cases the settling or separation of contaminants from the air may represent condensation of materials, vaporized by high-temperature processes, which may accumulate on all surfaces with ever increasing danger. Serious flash fires have occurred where the interior surfaces of the building were well impregnated or saturated with condensed vapors of flammable liquids or waxes. Even in our homes, laboratory tests have shown "that some of the fish fried on the stove is likely to condense on an upstairs window pane in a matter of seconds."[7]

D. AIR-SUPPLY INLETS AND EXHAUST OUTLETS

The design of ventilating equipment for an industrial plant is not complete without full consideration of the routes by which air will enter and leave the working areas. In fact, the ventilation route is important not only to the occupants of the building, but also to the neighbors and community at large. The demand for better inside conditions may result in the transfer of contaminants from the inside to the outside, in the absence of air-cleaning equipment. Although the outdoor air has a tremendous ultimate capacity for absorbing air contaminants, the dilution process is by no means immediate, as those who are near some industrial plants will verify.

[7] G. Nelson and H. Wright, *Tomorrow's House.* Simon and Schuster, New York, 1945.

The location of air inlets and outlets has the following significant aspects:

1. *Air Inlets**

(*a*) Sufficient combined or total inlet area should be planned to accommodate the required volume of make-up air during the heating or cooling season, whichever needs the larger volume. This will prevent excessive inlet velocities that consume power, create drafts on workers, stir up dust, and interfere with local exhaust hoods. The chosen inlet velocity is likely to be an engineering compromise between low rates, which require large inlet areas, and high rates, which facilitate rapid dilution of contaminants.

(*b*) If widespread hazardous operations are controlled by dilution or general ventilation, inlets should be well distributed around the building to provide uniform circulation.

(*c*) If contaminants are controlled by *localized dilution,* or by forcefully diffusing them into the general room-air reservoir, inlets may be purposely located to give nonuniform air-supply distribution.

(*d*) Inlets should be located to take full advantage of any thermal or convection effects within the building. For this purpose the designer must avoid the location of inlets (and outlets) near the "neutral zone"[8] of inside-outside pressure differentials, which is approximately midway between the floor and roof.

(*e*) Inlets should be located remote from stacks or ventilators discharging contaminants from the same or neighboring structures.

2. *Air Outlets*

(*a*) Outlets should be located as far as possible from air inlets to prevent "short-circuiting." This advice should be followed for both natural and mechanical ventilation.

(*b*) As in the case of air inlets, if widely scattered operations are controlled by general dilution, outlets should be uniformly distributed around the building (see 1*b* above).

(*c*) As in the case of air inlets, if contaminants are controlled by localized dilution, air outlets may be purposely located to short-circuit a corner of a large room in order to create a high rate of air change there without involving the atmosphere of the entire space. This method of localized space ventilation requires a higher rate of exhaust air than supply air within the area to be controlled, so as to prevent the spread of contaminants throughout the room (see 1*c*).

(*d*) Outlets should be placed to take full advantage of thermal effects (see 1*d*).

* The distinction between inlets and outlets is based on point of view; in this discussion, the point of reference is the occupied space, and not the interior of air ducts.

[8] J. E. Emswiler, *Trans. ASHVE,* **32,** 59 (1926).