

Table 3 Odor Index for Type of Space

Locations A contain the lowest amount of odor and D the highest. B and C represent levels in between. Many of the designations are rather general so it was necessary to pick a typical or average condition. The odor index for a specific situation could vary somewhat from that given in the table if special

circumstances apply. In typical cases, one pound of 50-minute activated coconut shell charcoal will purify the following cubic feet of space for one year: 2000 at level A, 800 at level B, 300 at level C, and 100 at level D.

C—Adhesive manufacturing plants	B—Dining rooms	D—Meat packing plants	B—Restaurants
C—Air conditioning systems	B—Display parlors	C—Meat markets	C—Restaurant kitchens
C—Aircraft	C—Distilleries	C—Meat storage	A—Retail shops
B—Airline terminals	C—Doctors' offices	B—Metal industries	D—Rubber plants
	B—Drafting rooms	C—Military equipment	B—Rumpus rooms
D—Air raid shelters	B—Dressing rooms	B—Military installations	B—Sales rooms
B—Amusement places	C—Drug stores	C—Mixed cold storage	B—Sample rooms
D—Animal rooms	C—Dry cleaning plants	C—Morgues	C—Schools
A—Apartments	B—Educational institutions	B—Motels	C—Service departments
C—Apple storage	B—Electrical installations	C—Motion picture studios	C—Sewage disposal plants
B—Art studios	C—Elevators	B—Municipal offices	D—Sewer vents
C—Athletic clubs	D—Embalming rooms	B—Museums	C—Show cases
D—Atomic processes	C—Engine rooms	C—Night clubs	C—Show cases
B—Auditoriums	B—Equipment rooms	B—Nuclear processes	B—Silverware manufacture
C—Automobiles	C—Examination rooms	B—Nurses	C—Soap manufacture
B—Banks	D—Exhaust hoods	B—Offices	B—Soda fountains
C—Bank counting rooms	C—Factories	C—Office buildings	C—Specialty shops
C—Bank safe deposit departments	B—Federal offices	C—Officers' clubs	B—State institutions
D—Bank vaults	C—Fermentation plants	D—Oilfield production	B—Steamships
	D—Fertilizer plants	C—Operating rooms	B—Stock rooms
C—Banquet rooms	C—Fish markets		
C—Barber shops	C—Five and ten cent stores	C—Paint departments	B—Storage spaces
C—Bars	C—Food processing	C—Paint plants	B—Stores
C—Basements	A—Forced air furnaces	C—Penal institutions	C—Studies
B—Bathrooms	C—Fruit storages	C—Pet shops	B—Stuffy rooms
		C—Pharmaceutical plants	B—Super markets
C—Beauty shops	C—Funeral homes	C—Photo dark rooms	C—Surgical rooms
A—Bedrooms	C—Game rooms	C—Photographic industry	B—Switchboard rooms
B—Binderies	D—Garbage disposal plants	C—Photographic studios	C—Tanneries
D—Biological processes	A—Gravity return furnaces	B—Planes	D—Tar processing
D—Bomb shelters	B—Greenhouses	C—Plastics manufacturing	C—Taverns
B—Book stacks	B—Grocery stores	C—Plating shops	C—Telephone booths
C—Breweries	C—Grills	D—Pollution control	C—Telephone exchanges
C—Buses	A—Homes	C—Poultry processing	C—Television studios
B—Bus terminals	C—Hospital rooms	C—Poultry sales rooms	C—Test cubicles
B—Cafeterias	C—Hospitals	C—Prescription departments	B—Theaters
C—Canneries	B—Hotels	C—Printing plants	C—Theater lobbies
C—Central air conditioning systems	B—Hotel rooms	B—Private offices	C—Theater lodges
D—Chemical laboratories	C—Incinerators	C—Processing laboratories	B—Ticket booths
D—Chemical plants	C—Individual cubicles	C—Processing rooms	C—Toilets
	C—Industrial kitchens	D—Projection booths	B—Trains
D—Chemical storage	B—Industrial offices		
D—Chlorine manufacture	B—Institutions	C—Public assembly rooms	B—Train reservation offices
C—Churches	B—Instrument rooms	B—Public buildings	C—Undertakers
C—Clinics	B—Jewelry stores	C—Public toilets	C—Unit air coolers
C—Club houses	C—Kitchens	D—Pulp and paper plants	C—Unventilated spaces
		C—Radio studios	
D—Coating processes	D—Kitchen exhausts	C—Railway cars	D—Varnish manufacture
B—Cocktail lounges	D—Laboratories	B—Railway stations	C—Vegetable storage
C—Cold storage plants	C—Laundries	B—Reading rooms	D—Vent systems
D—Collective protection shelters	D—Leather processing	B—Reception rooms	C—Vestibules
	B—Libraries	C—Recovery room, hospital	C—Veterinary hospitals
B—Commercial establishments	D—Linoleum plants		
C—Conference rooms	C—Live poultry rooms	C—Recreation halls	B—Waiting rooms
B—Corridors	B—Lobbies	C—Recreation rooms	C—Wards, hospital
C—Creameries	C—Locker rooms	C—Refineries	B—Warehouses
		C—Refrigerated show cases	D—Waste treatment plants
C—Crowded rooms	B—Lounges	D—Rendering plants	B—Window ventilators
C—Dairies	C—Lunch counters		
C—Darkrooms	C—Lunch rooms	C—Refrigerators	B—Wood working plants
D—Decalcomania production	B—Maintenance departments	C—Research buildings	C—Work rooms
B—Department stores	C—Manufacturing plants	C—Reservation offices	C—X-Ray darkrooms
C—Dentists' offices	C—Mausoleums	A—Residences	B—Yachts
		D—Resin manufacturing	C—Youth clubs
		B—Restrooms	C—Zoological gardens

Odors

Although different adsorbents may be used, 50-min coconut-shell charcoal has been used as a standard. (The term 50-min refers to the length of time required for chloropierin vapor to break through in a particular laboratory test used by the U. S. Army Chemical Corps and the Bureau of Standards to rate gas-mask charcoals.)

The principle behind the use of charcoal adsorption in ventilating systems is that all or part of the recirculated air can be rendered free of odors. Air that has been completely purified by adsorption is capable of diluting odorous air and purified by adsorption for air brought in from outdoors. As can be seen in Fig. 2, most of the outdoor air in ventilating systems is required for odor control. The small percentage re-quired to supply oxygen and remove excess carbon dioxide is ordinarily supplied by infiltration in all except the most tightly sealed spaces.

When the activated charcoal in adsorber cells has become loaded with odor-producing vapors, the cells can be recharged with virgin activated or reactivated charcoal. The spent charcoal can be discarded or returned to the factory for reactivation. In some cases, it is possible to reactivate or regenerate the charcoal in place. If the charcoal has been loaded with vapor caused by the evaporation of low-boiling solvents, as in many process applications, it may be possible to recover the solvents for reuse or resale with the same equipment that is used to purify, and recover, the recirculated air.

The main advantage in using a sorption process for odor control, rather than outdoor air, is that it is often possible to save on heating and cooling capacity and operating costs. In addition, it is useful where the outside air is polluted or where it is remote, i.e., where it would be necessary to use considerable ductwork in order to bring outdoor air into the odor-contaminated space.

Suitable impregnation of an active hydrophilic substrate provides chemical destruction of the adsorbed odor mole-

cules.²² Potassium permanganate on activated aluminum has been used for the removal of some reactive odors. As with any adsorptive process, the odorous species must contact the solid substrate before adsorption can take place. Hence, the air stream must pass through the bed of adsorbent material at a velocity which will provide a maximum of contact time. The oxidation-reduction reactions which occur on the surface of the porous solid substrate are dependent upon the coaction of the chemical oxidant and its activated substrate.

Washing and Scrubbing

Where odorous vapors are soluble or emulsifiable in a liquid, with or without chemical reaction, odor removal by liquid absorbents may be suitable.²³ Absorbents may be water, modified water solutions, or oils. Odors as vapors may be removed by spray washers, packed scrubbers, and wet cooling coils, but not by the usual dry filters, unless the filter is made of special adsorbent materials. The effectiveness of all sorbent processes depends on two mechanisms:

1. Contacting the air containing the odor with the sorbent materials. The efficiency is directly related to the time in contact or inversely related to the velocity.
2. Maintaining the sorbent materials in the sorbing condition. Adsorbent solids must be reactivated or replaced and absorbent liquids must be regenerated or replaced.

Some of the equipment designed to contact the air with liquids include spray washers, wetted-wall columns, bubble cap columns, and venturi scrubbers.^{24,25}

A spray tower (Fig. 4) is one type of absorber used to remove objectionable aerosols from air streams. Atomization of liquid absorbent, and uniform distribution of air to provide maximum contact between absorbent and gas are necessary

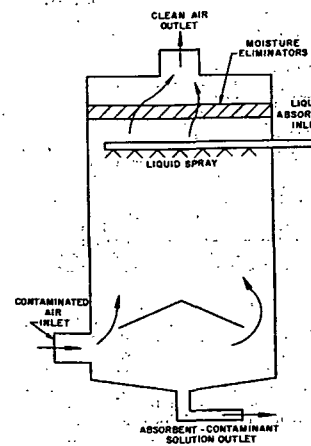


Fig. 4 Spray Tower

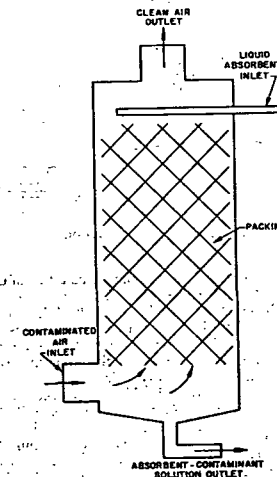


Fig. 5 Packed Tower