

Methods for Investigating Odor Complaints Related to Nail Salons

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In the course of investigating indoor air quality issues involving odor complaints, both the status of ventilation systems of a building and use of hazardous/odorous materials should be identified. Nail salons pose a vexing problem for investigation, since these types of businesses can be located in an ordinary storefront/strip mall without adapting the ventilation of the space. Local health departments are frequently asked to investigate the source of odor complaints in businesses or residences that are in close proximity to nail salons. This type of business uses a number of hazardous materials that can be sources of odors. An awareness of the type of materials used in a nail salon can provide clues concerning the sources of odors impacting on adjoining building spaces.

Nail Salon Products

The practice of manicuring and lacquering of nails is an ancient art. In present day, nail cosmetics can be formulated with a number of chemicals that evaporate rapidly. Table 1 lists possible volatile organic solvents (VOCs) that can be found in typical formulation and can cause irritation to the eyes and respiratory system. After application, these materials rapidly evaporate. Each of these chemicals has a warning concentration, which frequently is much lower than worker safety standards.

Table 1
Chemicals Associated with Different Type of Nail Cosmetic Products

Type Of Nail Products	Chemicals	Lowest Established Worker Safety Standards * ppm	Warning Concentration Ranges * ppm	
			Lowest Concentration	Highest Concentration
Nail enamel	1. Ethyl acetate	400 ^{a,b,c}	0.01	50
	2. Butyl acetate	150 ^{a,b,c}	0.03	20
	3. Ethyl alcohol	1000 ^{a,b,c}	71.0	5100
Nail finishes	1. Acetone	250 ^c	0.1	699
Nail basecoat	1. Xylene	100 ^{a,b,c}	0.05	200
	2. Toluene	100 ^{b,c}	0.02	70
	3. Acetone	250 ^c	0.1	699
	4. Ethyl alcohol	1000 ^{a,b,c}	1.0	5100
Nail polish removers	1. Acetone	750 ^c	0.1	699
	2. Ethyl acetate	400 ^{a,b,c}	0.01	50
	3. Butyl Acetate	150 ^{a,b,c}	0.037	20

- a. Occupational Safety and Health Administration, Permissible Exposure Limit (PELs)
 - b. American Conference of Governmental Industrial Hygienists, Threshold Limit Values (TLVs)
 - c. National Institute for Occupational Safety and Health, Recommended Exposure Limits (RELs)
- *ppm-parts per million

Source: Gosselin, R.E., Smith, R.P., Hodge, H.C. 1984, US EPA, 1990, CAMEO, 1999.

Methods for Investigating Odor Complaints Related to Nail Salons

Table 2
Chemicals Associated with Different Type of Artificial Nail Products

Type Of Artificial Nail Product	Chemicals	Lowest Established Worker Safety Standards* ppm	Warning Concentration Ranges* ppm	
			Lowest Concentration	Highest Concentration
Acrylics	Ethyl methacrylate	None	0.0067	0.0067
	Butyl methacrylate	None	No listing	No listing
	Methacrylic acid	20 ^{b,c}	No listing	No listing
	Methyl ethyl ketone	200 ^{a,b,c}	0.25	85
Tips	Ethyl cyanoacrylate	None	No listing	No listing
	Acetone	250 ^c	0.1	699
	Ethyl ether	400 ^{a,b}	0.1	9
Porcelain	Methacrylate compounds	None 20 ^{b,c}	No listing	No listing
	Methacrylate		No listing	No listing
	Methacrylic acid		No listing	No listing
Wraps	Ethyl cyanoacrylate	None	No listing	No listing
Solid gold nails	Ethyl acetate	400 ^{a,b,c}	0.01	50
	Toluene	100 ^{b,c}	0.02	70
	Methylene chloride	50 ^{b,c}	25	227
	Acetone	250 ^c	0.1	699
	Ethyl ether	400 ^{a,b}	0.1	9

^a Occupational Safety and Health Administration, Permissible Exposure Limit (PELs)

^b American Conference of Governmental Industrial Hygienists, Threshold Limit Values (TLVs)

^c National Institute for Occupational Safety and Health, Recommended Exposure Limits (RELs)

*ppm-parts per million

Source: HESIS, 1989, US EPA, 1990, CAMEO, 1999.

Application of artificial fingernail extensions is now common practice. Nail extension products also frequently contain both VOCs as well as acrylate products (see Table 2). Acrylate products can have a low odor threshold that is associated with a pungent aroma.

The warning threshold for a chemical is defined as a concentration at which a person can smell, taste or experience irritation to the eyes, nose or throat. Please note that worker safety standards exceed the warning properties by a magnitude of 1,000 or more. Under the worker safety standards set by the Occupational Safety and Health Administration (OSHA), employees can be exposed to chemicals up to the Permissible Exposure Level (PEL) established for that chemical. The PEL is an airborne concentration, if exceeded over the course of a work period, it can result in OSHA taking administrative action to reduce exposure. Please note that a workplace can use chemicals, as long as that employer meets OSHA exposure standards. Meeting these standards within a work area does not prevent possible symptoms in customers visiting the establishment or those in neighboring spaces adjacent to the nail salon. An examination of the material safety data sheets (MSDS) for nail products present in the salon as well as evaluating the building wall configuration and the heating ventilating, and air-conditioning (HVAC) system can provide clues as to the means for movement of odors through a building.

MSDS Chemical Information

An MSDS is a document that provides health and safety information concerning hazardous materials that are

Methods for Investigating Odor Complaints Related to Nail Salons

contained in a product used in the workplace that are required by state and federal law to be produced by manufacturers of products that contain hazardous materials. MSDSs are a summary of the properties, health effects, protective precautions used to reduce exposure, and spill cleanup procedures for each particular hazardous substance. MSDS are written with worker protection as the goal. The health and safety information is relevant to occupational exposure to chemicals. Employers who use these products are required to retain these files at the workplace. State law requires that the employees who use these products be properly trained in personal protection and safe use practices. MSDSs are written to provide information to the individual who works with these products. The health effects listed on the MSDS address the type of exposure by individuals who manufacture or use these products.

The MSDS will list the chemical constituents for a product. Also listed is the worker safety airborne standard for the chemical constituents. Knowing the chemical constituents of nail salon products present in the workplace can help narrow the search for the identity of the odor. In addition, knowledge of possible chemicals of concern will help in selecting air-testing equipment. The most economical air testing is the use of colorimetric tubes, but please note that there are drawbacks to using this equipment. Colorimetric tubes frequently do not measure air concentrations at the lowest warning concentration for a chemical. As an example, the lowest concentration detectable using a Dräger colorimetric tube for xylene is 10 ppm, which is a thousand-fold higher than the lowest warning concentration. Using standard colorimetric air sampling equipment alone to detect the presence of odor/irritating producing material may not be sufficient to address nuisance complaints from adjoining space. Other testing equipment that can be used for air testing can be both costly and require special training and/or available at a chemical analysis lab.

Air Movement

While air concentration may be helpful to identify the presence of airborne chemicals, how odors move between one building space to another must be identified. As a chemical evaporates and becomes airborne, the material will generally move through a building along the same path as airflow. Air can move through a building through intended and unintended pathways. In order to ascertain the pathway by which an odor is moving from the nail salon to other areas within a building the following equipment or conditions should be examined.

1. Intended Pathways

Intended pathways are those that are those designed to move air through a space. These systems can either be an HVAC system or exhaust ventilation. A ventilation system usually consists of ductwork that is connected to a mechanical fan. If multiple spaces are serviced by a single air-handling unit (AHU), odors from a nail salon can be drawn to the AHU and distributed to other occupied spaces (see Figure 1).

Methods for Investigating Odor Complaints Related to Nail Salons

Figure 1 Transport of Odors from Nail Salon to Adjacent Space by Ventilation System

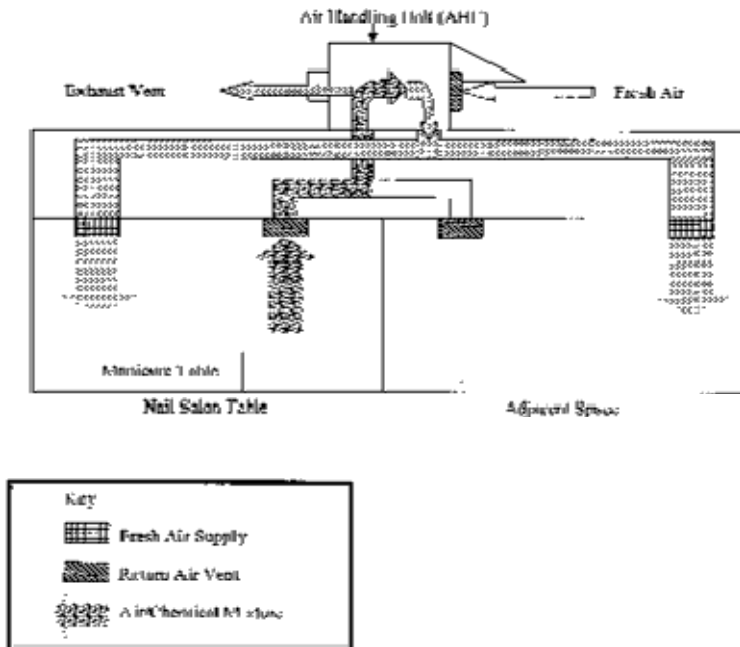
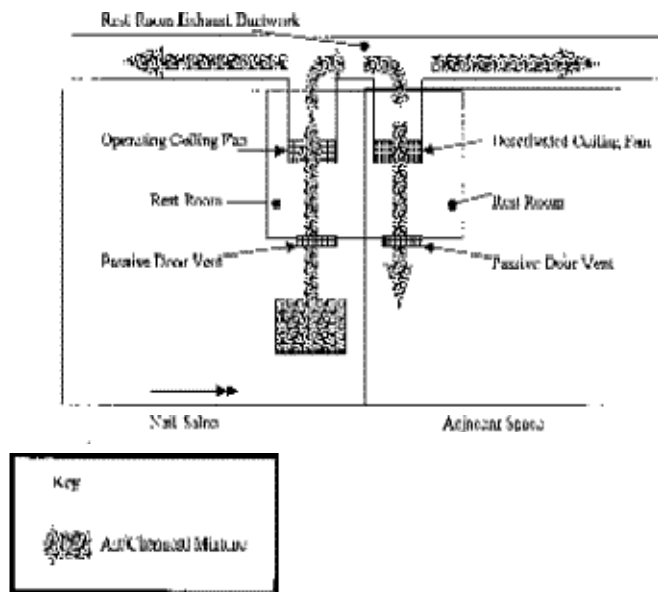


Figure 2 Pathway of Smoke from Nail Salon Rest Room to Adjacent Space through Exhaust Vent Ductwork (Top View)



Return air vents can draw evaporating chemicals from the nail salon side and distribute odors to adjacent space. Return vents can usually be found in ceilings or walls.

Methods for Investigating Odor Complaints Related to Nail Salons

Another means for distributing odors is shared exhaust vents. In strip malls, it is not uncommon to have restroom exhaust vents feed air into a single duct. The proper operation of this system depends on all restroom vents operating simultaneously. Each restroom usually is equipped with a ceiling mounted fan that can be activated by a light switch. As this fan operates, air is forced into the duct. If the restroom in the nail salon is operating when adjacent space restroom vents are deactivated, the exhaust duct can become over pressurized to force odors into the adjacent rest room (see Figure 2)

to spread odors into adjacent space. In both of these cases, the evaluation of the ventilation system can help identify pathways for odors.

2. Unintentional Pathways

Odors may move through buildings following pathways other than those provided by the ventilation system. Ventilation systems are generally designed to create positive air pressure in each conditioned space in order to force air out through cracks, crevices and other spaces that exist in walls, floors and ceilings. If a ventilation system creates negative air pressure, air can be drawn into the space, resulting in the transport of dust, dirt, and odors from wall cavities, crawl spaces and adjacent areas. If pressure differentiation between spaces exist, odors can move from one space to another. The following conditions should be examined:

- Are light switches/electrical outlets rendered airtight?
- Are spaces for utility pipes sealed where shared between adjoining space sealed?
- Are there cracks in wall materials in adjoining walls?
- Is the seam between the adjoining wall and roof deck airtight?
- Are there unsealed abandoned pipes between adjoining walls or floors?
- Is there a service elevator/dumbwaiter in the nail salon space?

If any of these questions are answered in the affirmative, then an intentional pathway may exist between the nail salon and adjacent area with odor complaints.

Solutions to the Problem

A multi-step process can be used to alleviate odor complaints from the operation of nail salons. Perhaps the simplest involves keeping stock containers of products closed as much as possible. This will limit the release of hazardous materials. The sealing of spaces in walls, ceilings and floors spaces can provide a physical barrier to air movement between the nail salon and adjacent spaces.

The most direct method for removing nail salon-generated odors is to provide local, specially dedicated exhaust ventilation at the area where the products are applied. One method is to use a designed bench that has exhaust ventilation at the sight of application that directs odors outdoors.

If not feasible, adjust the ventilation system to provide an adequate amount of fresh air and make sure that the nail salon is under negative air pressure. This action, when combined with adjusting adjacent space ventilation systems to provide positive air pressure would serve to prevent air movement from the nail salon to other areas. Under current building code regulations, HVAC systems for beauty salons are required to deliver 25 cubic feet per minute (cfm) per person of fresh air to both provide for occupant comfort and dilute odors from salon products. This method has drawbacks in that odors from adjacent spaces can be drawn into the nail salon space. The other drawback is that this system adjustment will not prevent odor movement if the ventilation system is designed as depicted in Figure 1. The other limitation is the location of the exhaust vent to the outdoors. If located in an area near an AHU fresh air intake, exhausted odors can be captured (called entrainment) and reintroduced into the building.

Conclusion

The best method for investigating odor complaints related to nail salons is the use of a step-by-step process of odor identification and remediation. The combination of identification of odor, identification of odor movement pathways and provision of local exhaust ventilation should serve to reduce or eliminate odor penetration into adjacent areas.

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Methods for Investigating Odor Complaints Related to Nail Salons

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