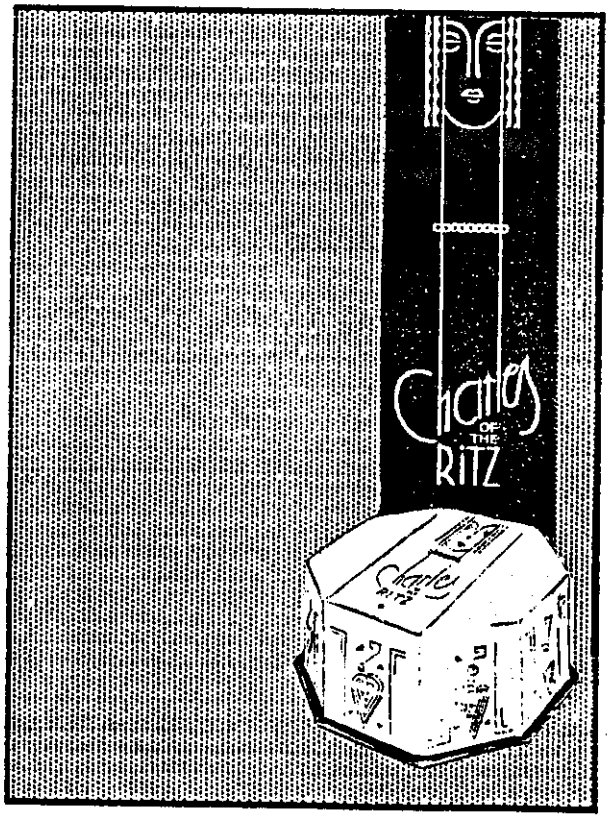
Health Hazards Manual

for

Cosmetologists
Hairdressers
Beauticians
and Barbers



By Nellie J. Brown
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Chemical Hazard Information Program
New York State Department of Labor Grant #87044

HEALTH HAZARDS MANUAL FOR COSMETOLOGISTS, HAIRDRESSERS, BEAUTICIANS AND BARBERS

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FOR COSMETOLOGISTS, HAIRDRESSERS, BEAUTICIANS, AND BARBERS

Why hairdressers?

Because studies indicate that approximately 20% of hairdressers leave the profession because of health problems such as allergies or dermatitis. After such an investment in time, money, training, and experience - what a waste!

Because studies show that there are increased cancer risks and reproductive risks for hairdressers (male and female) compared to the general population.

But, if you knew in advance what the problems could be, you could take the appropriate precautions. Much of the information in this manual is not necessarily intended for immediate use, but can serve as future references and resources -

To help you select products to minimize hazards; to ask intelligent questions when purchasing;
To provide information on chemical exposures and routes of entry and how these are related to the use of appropriate ventilation, gloves, use or form of a product;
To help you read product material safety data sheets; and
To help you to troubleshoot health problems and trace possible work-related health problems.

When we look at product health hazards and case histories, see if the experiences of these hairdressers/ cosmetologist/ barbers sound familiar. Have they happened to you or others you know or have heard of who are in this profession?

We will look at the principal occupational health hazards and exposures themselves and some of the related issues. We will look closely at the chemical composition of hairdressing products to see what components appear to be particularly hazardous, how you are exposed to them, and what you can do to minimize exposure. The health effects discussed for these products are based upon the exposure of the professional, not the consumer; for example, we will examine the health effects of hair dyes for the hairdresser who dyes hair several times a day, not for the patron whose exposure is once every one or two months.

We will not be looking at products used to clean the salon, but information on this subject is available upon request.

REGULATIONS OF INTEREST TO COSMETOLOGISTS

Food, Drug and Cosmetic Act and the Coal Tar Exemption:

The Food and Drug Administration does not have the legal authority to require pre-market testing of products by their manufacturers. For cosmetics, the FDA has the burden of proof of demonstrating that a product is a hazard to the public rather than the industry demonstrating that their product is safe. Also, the FDA does not have the authority to require a cosmetic manufacturer to provide them with the necessary information to enable the FDA to conduct its own pre-market testing. Consumer products such as hair dyes which are sold for professional use in salons and shops do not have to have ingredients listed on the label. If a cosmetic contains a substance considered to cause harm under its normal conditions of use, it is considered to be adulterated and the FDA may ban or restrict its use. However, in 1938, industry and labor argued successfully before Congress that coal tar dyes should be exempt from regulation.

It should be noted that FDA warnings on products were primarily aimed at consumers who use hair dyes every few weeks, not at hairdressers who apply the products on a daily basis.

The OSHA Hazard Communication Standard:

A principal complaint of cosmetologists, hairdressers, and barbers is the difficulty they have in obtaining information on the ingredients of the chemicals they work with. Without this information, it is difficult to assess workplace hazards and trace health effects to their source and choose products so as to minimize hazards and avoid serious health problems. More information on ingredients is required for sale of the same or similar products to consumers than is required for sale to professionals. This lack of information will hopefully be filled now that the Occupational Safety and Health Administration's Hazard Communication Standard has been expanded to cover all workplaces. On June 16, 1987, prior to the expansion of the Standard, OSHA spokesman Terry Mikelson indicated that the barber and beauty trades would be covered by this regulation. Expansion of the Standard was urged by groups such as the United Food and Commercial Workers International Union (AFL-CIO and CLC) and opposed by industry groups such as the Cosmetic, Toiletry and Fragrance Association.

The OSHA Hazard Communication Standard is an occupational safety and health regulation which was extended to all Standard Industrial Classifications (SIC 01-8999) as of August 24, 1987 - thus it applies to the service sector as well. The purpose of this regulation is to ensure that the hazards of all chemicals produced or imported are evaluated and that information

concerning their hazards is transmitted to employers and employees. This Standard requires the manufacturers and importers of chemicals to assess the hazards of the chemicals which they produce or import. Then, employers are required to provide information to their employees about the hazardous chemicals to which they are exposed by means of a hazard communication program, labels and other forms of warning, material safety data sheets, and information and training. Distributors are required to transmit the required information to employers.

For cosmetologists, this means that the hazardous ingredients and health effects of the chemical products which you use are now available in the form of Material Safety Data Sheets (MSDSs). The labeling of cosmetic products as covered by the Federal Food, Drug and Cosmetic Act has not changed. Chemical manufacturers, importers and distributors must provide MSDSs with the next shipment of hazardous chemicals to employers after September 23, 1987. All employers must be in compliance with all provisions of this regulation by May 23, 1988.

You may wish to take advantage of this newly expanded Regulation to obtain material safety data sheets on all the products you use by asking the manufacturer or your distributor or sales representative to provide them. Try to obtain MSDSs before you purchase products to compare them with respect to their health hazards. MSDSs are useful for writing bid specifications as well to help you to obtain the products you want. You may wish to deal only with manufacturers who respond to your requests for product information.

AN OVERVIEW OF OCCUPATIONAL DISEASES TYPICAL OF HAIRDRESSERS

HEALTH STUDIES:

The principal health problems confronting hairdressers tend to involve:

1. Inhalation of solvents and dusts or particles,
2. Skin contact instruments or equipment,
3. Skin absorption of liquids or skin contact with dusts (this includes eye hazards as well),
4. An elevated cancer risk compared to the general population, and
5. An increased risk of reproductive effects relative to the general population.

Beauticians are especially exposed to the risks of sensitization - becoming allergic to the products or instruments that they work with. Generally speaking, atopic individuals, that is, individuals with a history of allergies prior to becoming cosmetologist, do not tend to do well as hairdressers. In small workplaces, if only one person experiences a health problem in relation to a product, for example, that person tends to think of him/herself as an isolated case and the problem as not being work-related. Since many of the reactions to chemicals are allergic-type reactions, only the sensitive individual will respond anyway, so numbers are not significant in indicating risk.

Adverse reactions to products seem to have changed over the years as the formulation of products has changed. For example, younger workers tend to have allergic contact dermatitis due to p-phenylenediamine and hair dyes; older workers tend to have allergies to formaldehyde. Allergies tend to develop faster in younger workers due to these chemicals. In fact, chronic exposure of young hairdressers to irritant effects of shampoos predisposes them to allergic contact sensitization when they use dyes, waving solutions, and other chemicals later on. <u>This is why it is so important to inform young hairdressers and apprentices of the occupational risks with irritants and how to minimize these risks</u>.

Many allergic reactions to products involve fragrances, and frequently dyes used to color products also, and can be forestalled by using unscented products (including those without masking fragrances) and by changing colors.

In most cases of occupational allergy, improvement tends to occur when away from the job so long as the exposure really ceases; for example, you are not likely to see improvement with hairdressers sensitized to rubber gloves who continue to use them at home.

INHALATION of particulates and solvents can occur from the use of hairsprays and other aerosol products, from the solvents and dusts from artificial nail preparations, or from the asbestos in some hairdryers. These exposures can lead to pulmonary and respiratory abnormalities; even cosmetologists with only a few years of exposure have shown early signs of chronic obstructive lung disease which appears as a reduction in the functional volume of the lung. (Consider having your function diagnosed with inhalation testing.) Possible thesaurosis due to aerosol product use has been linked to an accumulation of inhaled nonbiodegradable macromolecules, especially PVP (polyvinylpyrrolidone) and copolymers. Usually these lesions regress when exposure is discontinued, but accumulation of these chemicals in the lower lung can result in alveolar-capillary-block syndrome.

Inhalation of dusts from methacrylate powders and solvents used in making sculptured nails.

Propellants and solvents or solvent carriers such as fluorocarbons (Freon 11), methylene chloride, isobutane, propane and ethanol have been linke to a variety of health problems. Because of the clsoe contact between the air sacks of the lungs and the blood stream, these chemicals can be inhaled and enter the blood and thus be carried throughout the body to cause effects on other body systems. Moreover, hydrocarbon propellants and solvents are highly flammable and can cause a blowtorch effect if ignited.

SKIN CONTACT: Hairdressers tend to have a high rate of nickel allergy, experiencing contact sensitization to the nickel in scissors. It may be possible to avoid this by using silver-plated scissors. Contact allergy to rubber gloves is also a frequent cause of sensitization; this appears to be due to antioxidants in the rubber and could probably be avoided by using gloves of other materials such as PVC.

SKIN ABSORPTION is a major route of exposure to permanent hair dyes, especially the oxidation-tyupe hair colorings. These products may cause sensitization and thus allergies (skin rashes, asthma, etc.) and are considered mutagenic and thus potentially or definitely carcinogenic. Permanent wave solutions also tend to be absorbed through the skin; these are linked with sensitization and/or irritation. Other types of dermal effects are increased skin pigmentation (phytophotodermatitis) caused by perfumes and eau de cologne (especially those belonging to the furocoumarines chemical family) followed by exposure to long-wave UV light (320-400nm) in sunlight.

Epidemiological evidence indicates that cosmetologists, hairdressers and barbers amy experience an ELEVATED CANCER RISK when compared to the general population for cancers of the bladder, lungs/respiratory system, digestive organs, breast and genitals. NIOSH epidemiological studies show increased cancer incidence among cosmetologists, especially bladder cancer and multiple myeloma. The difficultu with these studies is that the risk covers the profession as whole, but does not show which particular chemicals may be responsible among many potential exposures.

However, bladder cancer, a predominantly male disease, has appeared in workers exposed to dyes such as b- and a-napthylamine, benzidine, 4-aminodiphenyl, aromatic nitro-, amino- and azo-compounds. For example, the human body metabolizes the bladder carcinogen 2-amino-1-naphthol from the dye b-napththylamine. Among the workers potentially exposed to these dyes are hairdressers.

The cosmetologist should avoid skin exposure to permanent hair dyes. Studies with animals have shown that dyes such as 2,4-diaminoanisole (4-methoxy-m-phenylenediamine) do penetrate the skin. Although substitute dyes have been suggested, a cautious use of substitutes is best since some of these are chemically virtually identical to the original chemical. Certainly protective gloves should be worn in working with these dyes. Although the IARC concluded that there was an elevated risk of cancer in those with occupational exposure to certain hair dyes (barbers and hairdressers) they suggested that the evidence was inconclusive relating specific cancer sites to hairdressing.

There appears to be a possible higher laryngeal cancer incidence in males in this profession. Females appear to experience a higher incidence of uterus and ovarian cancer, stomach cancer and lung cancer. Some of these studies were either not controlled for smoking or provided no information on smoking habits.

Exposure to carcinogens is not limited to the known ingredients in hairdressing products, but has also been linked with chemicals such as dioxane and NDELA (a nitrosamine), contaminants which are formed during the manufacture of hair care products and cosmetics.

REPRODUCTIVE EFFECTS: Epidemiological studies indicate that there appears to be more toxemia of pregnancy, (high blood pressure, protein in urine, and leg swelling), miscarriages, premature deliveries and smaller babies among cosmetologists.

SHAMPOOS AND CONDITIONERS

At the base of each hair follicle are the sebaceous glands which secrete the oily substance called sebum. Sebum passes along the hair shaft by capillary action and coats the hair with a greasy layer. It lubricates and conditions hair, but tenDs to collect dirt. So, cleaning the hair involves the removal of this greasy layer of sebum. This is usually done with liquid shampoos consisting of surfactants or detergents along with additives such as colors, fragrances, preservatives, antidandruff agenst, opacifiers, viscosity modifiers, solubilizers and conditioners (which may be packaged separately as cream rinses).

PRINICPAL SURFACTANTS: To foam and clean hair. These are generally anionic surfactants (detergents) based on sulfated fatty alcohols such as lauryl and myristyl alcohols which are derived from coconut and palm kernel oils. Lauryl alcohols produce good lather and myristyl alcohols give rich foams. Triethanolamine- or ammonium-laurylsulfate tend to be preferred over sodium-laurylsulfate (despite its better degreasing action) because it is believed to be too harsh. This harshness could also be overcome by coupling sodium lauryl sulfate with conditioners or other surfactants.

sodium lauryl sulfate
sodium laureth sulfate
triethanolamine (TEA) lauryl sulfate
diethanolamine (DEA) lauryl sulfate
monoethanolamine (MEA) lauryl sulfate
ammonium lauryl sulfate
polyethylene glycol sulfates

MODIFYING SUFRACTANTS: these are usually other detergents used as secondary surfactants, such as fatty acid alkanolamides; usually ethanolamides of lauric, myristic, palmitic, stearic or oleic acids. Most commonly used is lauric monoethanolamine. Modifying additives may be used to improve foam characteristics, improve condition of hair, modify eye-irritancy effects of primary surfactant, or improve cleansing power.

lauric monoethanolamine
monoglyceride sulfates
secondary alkyl sulfates
sodium decyl (or dodecyl) benzene sulfonate
alkyl sulfosuccinates such as sodium dioctyl sulfosuccinate
isothionates
cocamides such as cocamide DEA
methyl taurides
acyl amino acids acyl peptides
acyl sarcosines
amine oxides

OPACIFIERS: if present these give the shampoo an opaque or pearlized, rather than transparent, appearance. Cream shampoos

may actually be liquid shampoos to which an opacifier gives a thicker appearance, such as:

glycol stearates such as polyethylene glycol 400 stearate
metal stearates such as magnesium stearate
alkylolamides such as stearic amides
stearyl alcohol
cetyl alcohol

VISCOSITY MODIFIERS: these make the shampoo more viscous so it is thicker and less able to flow easily.

electrolytes such as sodium chloride
alkylolamides
sodium stearate
stearic amides

SOLUBILIZERS - COUPLERS: enable the product to stay mixed, that is, keep the ingredients from separating; such as:

ethyl alcohol
isopropyl alcohol
glycerol
propylene glycol monethyl ether
diethylene glycol monoethyl ether

PRESERVATIVES: these are usually germicides which are used because mild surfactants readily spoil. The choice of germicide is important since some detergents tend to interfere with the antibacterial action of some germicides. Preservatives include:

p-hydroxy benzoic acid and its esters (methyl or propyl paraben)
formaldehyde
2-bromo-1,2-diol (Bronopol)
methyl- or methylchloro-isothiazolinone
dibromosalicylanilide
bithionol

ANTIDANDRUFF AGENTS: the causes of dandruff are not fully understood; many of them are not microbiological in origin, yet the majority of antidandruff preparations tried have been germicidal. Sometimes the white scale called dandruff is actually residue from incomplete rinsing of the hair after shampooing. Antidandruff additives include:

salicylic acids such as dibromosalicylanilide
resorcinol
hexachlorophene
cadmium oxide
tellurium oxide
selenium disulfide
zinc pyridinethione, zinc pyridinium-thiol-N-oxide (Zinc Omadine)
zinc undecylenate
undecylenic acid and diethanolamine (Loramine DU185)
sodium salt of undecylenic acid monoethanolamide sulphosuccinate (Loramine SBU185)
trimethyl-mercapto-4-cyclohexene-2,2-dicarboximide
quaternized polythionates

hydroquinolines
tar
biphenamine hydrochloride
polyvinylpyrrolidone-iodine complexes
allantoin

CONDITIONERS: these are cationic compounds which are used to counteract the anionic nature of shampoo which causes the tangling of hair and static fly-away. Conditioners increase the lubricity of hair (making wet combing easier) and make the texture smoother. Protein-containing conditioners add body, gloss and luster to hair. Conditioners include:

beer
egg
balsam
proteins such as hydrolyzed animal proteins
lanolin
polyvinylpyrrolidone (PVP)
silicones
secondary surfactants (see above)
stearyldimethyl benzylammonium chloride
glyceryl esters
glycol esters

ADVERSE HEALTH EFFECTS ASSOCIATED WITH SHAMPOOS AND CONDITIONERS

Skin irritation, dermatitis or allergies associated with shampooing may result from the detergents/surfactants or from the additives such as the preservatives, fragrances or colors. The hairdresser experiences repeated exposure of the hands in shampooing which may involve many cycles per day of wetting, defatting by detergents and drying. In addition to this, some shampoo ingredients are skin irritants such as isopropyl myristate and triethanolamine. Irritant dermatitis, the most common form of dermatitis in hairdressers, is especially prevalent among the younger workers (such as apprentices) and appears to be due to shampooing. The younger or newer workers in a salon tend to be the ones doing a large proportion of shampooing, rather than other hairdressing tasks.

Allergic contact dermatitis to germicides in shampoos has been observed with formaldehyde, isothiazolines and dibromosalicylanilide. Individuals sensitive to dibromosalicylanilide may also be sensitive to other germicides such as hexachlorophene and bithionol.

Shampoo colors and fragrances have also been found to sensitize. Some fragrances have also been linked with increased skin pigmentation.

Case History: occupational allergy to lavendar oil

"An 18-year old female hairdresser had a red, scaly, itchy dermatitis on the back of her hands and fingers and front of the wrists. She had worked as an apprentice hairdresser for 4 years, mainly shampooing but also in contact with permanent wave liquids and dyes. She usually had dry fissured skin on the back of the hands, but in the previous 6 months it had become worse with extension to the fingers and itching. She had a history of nickel allergy but not atopy. She was patch tested with the standard and hairdresser's series with several shampoos and other products with which she was in contact in her job. The lavender shampoo was the one she used several times a day. Although we could not obtain its composition from the manufacturer, she was patch tested some weeks later with lavender oil and several formaldehyde release preservatives. A strong positive reaction to lavender oil was observed."

Some coal tar-derived colors used in shampoos may be carcinogenic

Allergies to other hairdressing chemicals can be enhanced by shampoo exposures. For example, allergies to hair dyes can be aggravated by handling the detergents in shampoos. Chronic exposure of young hairdressers to the irritant effects of shampoos seems to predispose them to allergic contact sensitization when they later use dyes, waving solutions and other chemicals.

PROTECTION AND PREVENTION

Substitution:

____ Try milder detergents such as lauryl sulfates buffered with monoethanolamine, diethanoloamine, triethanolamine or ammonium ions.

____ Try different preservatives; avoid formaldehyde or formaldehyde- releasing preservatives and use parabens or isothiazolinones instead.

____ Try different fragrances or avoid scented products or those containing a masking fragrance. Try unscented products. Change fragrance families.

____ Consider natural rather than artifical colors. Avoid coal tar- derived colors.

____ Change color families. For example, D & C Green No. 5 is an anthraquinone color and is a possible skin irritant. An individual who reacts to one anthraquinone color, may react to others of this family.

Protective equipment:

____ Wear protective gloves when using shampoos or conditioners.

BLEACHING, BLANCHING AND DYE REMOVAL

These procedures involve the use of chemicals to destroy either the natural or artificial pigments in the hair cortex to lighten hair color or to provide a light background color for subsequent hair dyeing with blonde, light-gray and light-brown shades.

BLEACHIING

Bleaching agents consist of the oxidizing agent, activator, accelerators/ boosters, and conditioners/ fillers. Bleaching may be followed by applying a colored toner.

OXIDIZING AGENT: this chemically alters the melanin pigments in the cortex of the hair by converting them to oxymelanins. Such as:

hydrogen peroxide (stabilizers such as phenacetin are used to prolong the oxidizing strength of the hydrogen peroxide)
sodium peroxide

ACTIVATOR: swells the hair fiber to enable penetration of the peroxide into the hair.

ammonium hydroxide (ammonia)
urea peroxide

ACCELERATORS/BOOSTERS: added to the hydrogen peroxide-ammonia mixture just before use to improve its bleaching activity.

ammonium persulfate
potassium persulfate
sodium perborate
sodium percarbonate
magnesium carbonate

CONDITIONERS/FILLERS: to improve the condition of bleached hair. These alter the cuticle (outer surface of the hair) to decrease its porosity or replace the cuticle if it is damaged or missing. Conditioners give the hair a uniform consistency so that it absorbs or responds evenly to hair dyes, waving solutions, etc.

ammonium soaps
lipophilic surfactants (detergents)
lanolin derivatives
cholesterol
cream bases
hexamethylenediamine
polyvinyl pyrrolidone or other pyrrolidone resins

COLORED TONERS: usually a blue rinse, since the human eye considers a blue-white color to be "whiter" than white.

methylene blue
other blue colors

BLANCHING

Blanching is usually done to mixed gray hair to produce an even snowy white appearance. Blanching agents include:

sulfur dioxide
potassium permanganate followed by sodium thiosulfite

DYE REMOVAL

Removal of oxidation dyes is accomplished using reducing agents such as:

sodium hydrosulfite
sodium thiosulfate
formaldehyde sulfoxylate
formadine sulfinic acid

Removal of metalic dyes using chemicals is a dangerous process since metals catalyze many chemical reactions and may result in the violent production of heat which could damage hair and skin.

Removal of semi-permanent dyes may be accomplished by vigorous washing with shampoos, especially if ammonia is added. More resistant dyes may use reducing agents (see above) and bleaches (see above) to assist the shampoo.

ADVERSE HEALTH EFFECTS ASSOCIATED WITH BLEACHING, BLANCHING AND DYE REMOVAL

Bleaching appears to be safer than dyeing with anything other than a vegetable dye since the chemicals involved have not been associated with the long-term health effects of mutagenicity or carcinogenicity, although sensitization has been reported.

Ammonium hydroxide (ammonia) and hydrogen peroxide can cause skin and eye irritation. Irritations caused by hydrogen peroxide do not tend to subside upon flushing of the skin with water.

The ammonium and potassium persulfate boosters have been found to cause a variety of reactions. Skin reactions include irritant dermatitis and allergic eczematous dermatitis of a delayed variety. It has been suggested that potassium persulfate is more likely to cause irritant dermatitis than ammonium persulfate. However, ammonium persulfate appears to be more frequently implicated in allergic-type responses.

Besides allergic dermatitis, other reported allergic effects include urticaria (pale wheals or papules often accompanied by severe itching), rhinitis (nasal inflammation, often with runny nose, sneezing and crusting), asthma, shortness of breath upon exertion and fainting. The severity of the reaction depends upon the strength or amount of the persulfate in the bleach - higher concentrations produce stronger reactions. Also, since persulfate loses its strength with time, fresher boosters produce more severe reactions than older ones. A study of occupational asthma among hairdressers appears to show that the response in the lungs seems to be a restriction in the size of the airways and not a decrease in lung volume. Animal studies have shown that persulfate salts can directly cause the release of histamine (thus bringing about the allergic response); but this does not explain why some individuals are affected and others are not.

The severity of the allergic reaction (especially the asthma) has caused hairdressers to leave the profession; however, some have been reported to continue their work by avoiding bleaching altogether.

The allergic reaction is illustrated by the following case history:

"A 29 year-old woman had had atopic eczema since childhood, but had never had asthma. Soon after she began working as a hairdresser, she experienced rhinitis and asthma whenever she worked at the beauty salon. She was free of respiratory symptoms on weekends or when she did not work. An allergist was not able to determine the cause of the asthma. None of the allergists consulted were aware that ammonium persulfate hair bleach formulations could be a cause of rhinitis and asthma. A scratch test was performed with a 1 percent aqueous solution of ammonium persulfate. A wheal immediately appeared, followed by a mild asthma attack that required administration of epinephrine. On follow-up examination, the patient reported that no further attacks occurred since she stopped working as a hairdresser. In this instance, the rhinitis and asthma would appear to have been allergic reactions."

PROTECTION AND PREVENTION

Product Substitution:

____ Try doing bleaching without adding the boosters.
____ Use nonpersulfate boosters such as sodium perborate, sodium percarbonate or magnesium carbonate.
____ Try potassium persulfate rather than ammonium persulfate boosters and see if the allergic response is lessened.

Engineering Controls or Safe Work Practices:

____ Avoid doing bleaching and see if the health effect diminishes.
____ Avoid attempting to remove metallic dyes.
____ Do not eat or smoke when doing bleaching.
____ Use good personal hygiene. Do not touch the face or eyes when bleaching.

Protective Equipment:

____ Wear protective gloves when doing bleaching.

HAIR COLORING: DYES AND RINSES

Hair colorants are usually classified according to how long the color lasts and how durable it is on the hair. There are temporary, semipermanent and permanent colors - these also imply the degree of coverage of depth of coloring. We will look at each color type in detail below. Chemical names for dye components are given to assist you in interpreting labels and material safety data sheets.

TEMPORARY COLORING PREPARATIONS

These are typically applied in shampoos (rinses) or hair sprays. They are temporary dyes because they only produce a film over the hair shaft, so the color tends to be completely removed by the first shampooing. These products generally contain 0.5 - 2.0 % of the color, but may also contain urea or other compounds which increase the solubility of the color in the shampoo or hairspray.

There are 3 types of rinses:

One type consists of water soluble acid dyes (generally azo dyes; see table) with weak acids (such as citric or tartaric) in an anionic shampoo base.

Another type consists of basic (cationic) dyes such as methylene blue, rhodamine, safranine, Bismark brown, chrysoidine, methyl violet, throflaven or nigrosine.

The third type are the anionic-cationic complexes.

COLORS USED IN TEMPORARY HAIR COLORING:

FDA Designation	Classification	Color Index No.	Common Name
FD&C Yellow No. 5	pyrazolone	19149	Tartrazine
FD&C Yellow No. 6	monoazo	15985	Sunset Yellow FCF
D&C Orange No. 4	monoazo	15510	Orange II
Ext D&C Orange No 3	monoazo	14600	Orange I
FD&C Red No. 4	monoazo	14700	Ponceau SX
Ext D&C Red No. 8	monoazo	15620	Fast Red S or A
D&C Red No. 13	monoazo	15630	Lithol Red Sr
D&C Red No. 22	xanthene	45380	Eosin YS, Eosin G
FD&C Green No. 3	triphenylmethane	42053	Fast Green FCF
FD&C Blue No. 1	triphenylmethane	42090	Brilliant Blue FCF
FD&C Violet No. 1	triphenylmethane	42640	Wool Violet 5BN or Acid Violet 6B
D&C Brown No. 1	disazo	20170	Resorcin Brown

Semipermanent coloring preparations

These are also typically applied in shampoos, but tend to dye more deeply and are retained longer by the hair than are the temporary colorants because they penetrate the hair somewhat and are only gradually washed out by repeated shampooing. They may be applied as rinses or may be used full strength and left on the hair for 5-30 minutes before being rinsed out. Many of these dyes are the same chemicals used in permanent oxidation dyes but without the addition of the oxidizing agent. These tend to be aromatic, nitro and amino dye compounds such as the nitrophenylenediamines or nitro-aminophenyls. Some color directly, others are air-oxidized to colored compounds. Some also contain metal-complex dyes, usually azo dyes

complexed with either cobalt or chromium; the metal is bound within the molecule and does not appear to cause sensitization.

Permanent coloring preparations:

These almost exclusively use oxidation dyes to produce a permanent color which lasts until the hair grows out. Typically this is a two-part preparation: an alkaline solution of dye intermediates (small colorless molecules) which is mixed with an oxidizing agent just before application to the hair. The alkali causes the hair to swell, allowing dye penetration. Within the hair shaft, the dye oxidizes to form an insoluble irreversibly bound lightfast pigment in the hair itself. The resulting giant colored molecules are too large to exit through the hair cuticle and thus remain inside the hair cortex. (The coloring preparation contains dye "intermediates" because the actual dye pigment is formed within the hair by a chemical reaction.) There are also one-part preparations which are oxidation dyes not requiring chemical oxidation. Considerable research has gone into developing dyes of this type which can be used under normal (non-oxidizing) conditions. Permanent coloring preparation typically contain 1 - 4 % of dye intermediates.

The permanent chemical oxidation type dyes consist of the dye intermediates, color modifiers/couplers, color vehicles, solubilizing agents, conditioners and antioxidants; the separate oxidizing agent (developer) is added just before application to the hair.

Oxidation dye intermediates, the main color producers, are generally p- and o- benzenediamines such as p- phenylenediamine, 2, 5-diaminotoluene, p-amino-diphenylamine, or other diamino and phenolic amines used to produce intense shades (see table). These so-called "para dyes" (indicated by "p-" or 4-amino...) are usually used for black shades or as mixtures for lighter shades.

Color modifiers/couplers such as m-diamines, m-aminophenols, naphthols, or polyhydroxyphenols also function as antioxidants, stabilizers and chemical timers to control the rate of color development.

Color vehicles or dye bases are the aqueous solutions of soaps or detergents which enable the product to wet the hair, spread and penetrate as needed. These are ammonium oleate soap, alkanolamides, fatty alkyl sulfates, fatty acid-polypeptide condensates, or oxyethylated fatty alcohols.

Solubilizing agents are used to increase the solubility of the dye intermediates; usually propylene glycol, ethyl alcohol or isopropyl alcohol.

Conditioners enable more even coloring by decreasing the porosity of the hair cuticle or replacing it as a filler if it has been damaged or lost. These are usually glycerol lanolin, oleyl alcohol or cetyl alcohol.

Antioxidants, which help to prevent premature oxidation for better color control, may be sulfite or bisulfite compounds (such as sodium sulfite) or thioglycolic acid.

A pH adjuster such as ammonium hydroxide is used to raise the pH of the dye base to 9 - 10 to swell the hair cuticle and enable dye penetration.

The oxidizing agent or developer is usually hydrogen peroxide (especially a 6% solution) because it tends to be easy to use, completely oxidizes the dye, is fairly safe to work with, and tends not to produce undesirable by-products. Urea peroxide is the typical oxidizer in cream type developers.

COLORS PRODUCED BY VARIOUS OXIDATION DYE INTERMEDIATES, COLOR COUPLERS AND MODIFIERS

BLACK:

p-aminodiphenylamine
p,p'-diaminodiphenylamine
2,5-diaminophenol-4-sulfonic acid
1,8-diaminonaphthalene
o-phenylenediamine
p-phenylenediamine
m-toluenediamine
p-toluenediamine

DARK/MEDIUM BROWN:

p-aminodiphenylamine
o-aminophenol
p-aminophenol
N-(p-aminophenyl)-glycine
o-anisidine
2,4-diaminophenol
N,N-dimethyl-p-phenylenediamine
N-(p-hydroxyphenyl)-glycine
p-methylaminophenol
4-nitro-o-phenylenediamine
m-phenylenediamine
p-phenylenediamine

LIGHT BROWN:

o-aminophenyl
p-aminophenol hydrochloride
p,p'-diaminodiphenylamine
2,4-diaminophenol
2-nitro-p-phenylenediamine
m-phenylenediamine
p-phenylenediamine hydrochloride
p-tolylenediamine

REDDISH:

2-amino-4-nitrophenol
4-amino-2-nitrophenol
2,4-diaminophenol
4,6-dinitro-2-aminophenol
5-nitro-m-phenylenediamine
4-nitro-o-phenylenediamine
2-nitro-p-phenylenediamine
2,4,6-trinitroaniline

BLONDS:

p-aminodiphenylaminesulfonic acid
4-amino-2-nitrophenol
p-aminophenol hydrochloride
2-aminophenol-4-sulfonic acid
4-aminophenol-2-sulfonic acid
5-aminophenol-2-sulfonic acid
2,5-diaminophenol-4-sulfonic acid
N-(2-hydroxy-5-nitrophenyl)glycine
N-(p-nitrophenyl) glycine
m-phenylenediamine hydrochloride
p-phenylenediamine sulfate

BLUE/GRAY MODIFIERS:

p-aminodiphenylamine hydrochloride
N-(p-aminophenyl)-glycine
2,4-diaminoanisole (also called 4-MMPD or 4-methoxy-m-phenylene-diamine
p,p'-diaminodiphenylmethane
2,4-aminophenetole
1,5-naphthalenediol
m-phenylenediamine
pyrocatechol
pyrogallol
resorcinol
p-tolylenediamine

Oxidation dyes which do not require chemical oxidation may be:

(a) aromatic polyhydroxy compounds (di- and trihydroxybenzene derivatives);
(b) aromatic polyamino compounds (substituted diaminobenzenes, aminophenols, polyaminophenols, polyamino benzenes);
(c) substituted naphthalene compounds (aminohydroxynaphthalene); or
(d) substituted pyridine compounds

Another type of permanent coloring is the metallic dye - metals which form insoluble metal oxides and/or sulfides. Lead acetate is the most commonly used (contained in some shades of Grecian formula); others are silver, nickel, cobalt, bismuth, copper, or iron salts.

Permanent vegetable dyes include substances such as henna.

ADVERSE HEALTH EFFECTS ASSOCIATED WITH HAIR COLORANTS

When considering the adverse health effects of hair dyes, consider not only how severe the health effect can be, but also how frequently you are exposed. Where available, the health effects discussed here were drawn from the actual experiences or health studies of hairdressers; however, the skin absorption and resulting health effects (such as cancer-causing potential) are the result of studies examining adverse effects on the person whose hair is being dyed - that is, effects on the consumer or patron. Effects on the professional whose work involves repeated exposure to dyes may have to be inferred.

Serious injury or possible blindness could result if hair coloring chemicals are accidentally gotten into the eyes. Ammonia-containing pH adjusters can severely injure the eyes (especially strong ammonia solutions) because ammonia has a particular tendency to penetrate the cornea and damage the deeper structures within the eye. Speed is essential in washing the eye immediately with clean water. Strong ammonia solutions can also burn the skin; weak solutions, especially upon repeated exposure, can cause skin irritations. Hydrogen peroxide is also irritating to the eyes and can cause skin irritations; immediate flushing with water is necessary.

Dyes and color modifiers can be sensitizers, that is, can cause allergic reactions such as rashes and other skin irritations. Those dyes and modifiers with the amine in the para position (the "para" dyes discussed above) tend to be sensitizers. In fact, intolerance to "para" dyes is the most frequent of all sensitizations observed in hairdressers. The reaction is a dermatitis which appears most often on the left hand between the index and middle finger and on the dorsal face of the last three fingers; the hairdresser holds the hair being dyed between the index and middle fingers which can then contaminate the other fingers. p-Penylenediamine has been known to be an allergen since 1898. Suggested substitutes for it, such as p-toluylenediamine, p-aminophenol and diaminophenol, also tend to be allergenic, as is p-aminodiphenylamine (Diphenyl Black). See the table for other "para" dyes.

Henna, a vegetable product, is also a potential sensitizer.

Allergy to dyes can be enhanced by handling detergents (such as shampoo) or irritants (such as thiogycolic acid in liquids for permanents). Permanent liquids can induce sensitization to dyes. For example, hairdressers which used cold perms for several months could not then handle dyes which their skin had previously tolerated.

Other dye health hazards include:

p-Aminophenol which has also been linked with bronchial asthama and methemoglobinemia (a condition of the blood in which some of the hemoglobin has been rendered incapable of transporting oxygen).
Azo dyes of the Disperse Red 1 type (or Cibacete 2B Scarlet) used in temporary rinses which can also be sensitizing.
4-EMPD which can cause irritation of skin and eyes.

Aniline derivatives which may cause dermatitis.
Resorcinol which may also cause methemoglobinemia and restlessness.

Hair dyes may be carcinogenic in man. This issue has been examined in studies of cancer mortallity and incidence among beauticians and hairdressers with occupational exposure to hair dyes, and in studies of hair dye use and cancer among individuals (patrons). Studies among both beauticians and patrons have largely been negative; the only positive finding was among patrons showing an excess of cancers of the cervix, vagina and vulva.

However, aromatic amine hair colorants do exhibit possible carcinogenic or mutagenic effects in animal studies and these are suggestive of potential human health problems. For example, 2,4-diaminotoluene (banned in hair dyes since 1971) was demonstrated to be a carcinogen in animals. Of 169 commercial oxidative-type permanent hair colors tested, 150 were found to be mutagenic in "in vitro" testing which involved investigating effects on the genetic material in bacteria. Hair dyes and components found to be mutagenic include:

4-amino-2-nitrophenol
p-phenylenediamine
2,4-diaminoanisole sulfate
1,2-diamino-4-nitrobenzene
2,5-diaminoanisole sulfate
1,4-diamino-2-nitrobenzene
2,5-diaminoanisole
2,4-diaminotoluene
2,5-diaminotoluene
2-amino-5-nitrophenoL
m-phenylenediamine
2-amino-4-nitrophenol

Hair dyes found to be carcinogenic in animals involved feeding studies which give the test animal a far higher systemic exposure than is experienced by an individual have his/her hair dyed; these dyes include:

4-amino-2-nitrophenol
2-nitro-p-phenylenediamine
2,4-diaminotoluene
2,4-diaminoanisole

Hair dyes containing aromatic amines (mixed with 6% hydrogen peroxide) have been found to be teratogenic (cause birth defects or spontaneous abortion) in animals following skin exposure to the dye. These studies were performed with the intention of simulating scalp absorption by the patron; as much as 1% of hair dye chemicals in general could be absorbed through the scalp. Further, dyes have been found in the urine of patrons. Extending this information to the hairdresser who is exposed by the hands several times a day could amount to considerable absorption of coloring preparation ingredients.

Those found to be teratogenic in animals following skin exposure include:

2,4-diaminoanisole sulfate
2,5-diaminotoluene sulfate
p-phenylenediamine
m-phenylenediamine
o-phenylenediamine

PROTECTION AND PREVENTION

Product substitution:

Use dyes of lesser health hazard such as henna or other vegetable dyes.
Use semipermanent colors rather than permanent colors.
Avoid temporary dyes containing metals, especially lead acetate.
Bleaching is safer than dyeing with anything other than a vegetable dye; although bleaches contain irritants, they do not appear to have the long term health effects of mutagenicity or carcinogenicity.
Consider new coloring techniques, such as alternating henna and semi-permanent hair colors each month.

Engineering controls or safe work practices:

Do not eat or smoke when using dyes; this avoids the hand-to-mouth contact problem of ingesting dyes unintentionally.

Protective equipment:

Wear gloves to protect against possible amine irritation and sensitization, irritations from ammonia and peroxide solutions, and prevent skin absorption of hair colorants and components.

HAIR SPRAYS AND HAIR SETTING LOTIONS

HAIR SPRAYS:

These consist of a film-forming agent (shellac or synthetic polymer) which holds the shape of the hair; modifiers or plasticizers to alter the properties of the film (such as making it possible to comb the hair after spraying); emulsifiers to keep the product from separating; solvents to carry the film onto the hair and then evaporate and leave the film behind; humectants or moisture occluders to keep the product from drying out on the hair and yet keep moisture from destroying the set; perfumes; and propellants if the product is an aerosol.

The FILM-FORMING AGENT holds the shape of the hair.

LACQUERS were the first hair sprays marketed. These contain about 1 - 4% shellac which has been dewaxed, decolored, and sometimes bleached as well. If bleached there may be residual chlorine from the bleaching process. The shellac may be coupled with dimethylhydantoin- formaldehyde. The resulting films tend to be hard to remove from the hair so lacquer modifiers are added to make shellac more water-soluble; these include castor oil; glycols or glycol esters such as propylene glycol or polyethylene glycol dilaurate; or lanolin or lanolin products such as ethoxylated lanolin.

NONLACQUER BASES are resin-like synthetic polymers, typically 3% in alcohol solution, which are water soluble and wash out easily. These include:

PVP, polyvinyl pyrrolidone
PVP/VA, copolymers of PVP with vinyl acetate
dimethyl hydantoin formaldehyde resin
partially esterified copolymers of methylvinyl ether and maleic anydride
amphoteric or carboxylated acrylic resins
poly-N-vinyl-5-ethyl-2-oxazolidone
copolymer of lauryl methacrylate and diethylaminoethyl methacrylate quaternized with dimethyl sulfate
vinyl terpolymers, or
carboxylated vinyl acetate polymers (vinyl acetate-crotonic acid copolymers) or N-vinyl-5-methyl-2-oxazolidone-vinyl acetate copolymer.

NEUTRALIZING AGENTS:

The polymers which are acidic in nature are neutralized with a base (usually an amine or amino-alcohol) such as:

morpholine
2-amino-2-methyl-1-propanol (AMP)
2-amino-2-ethyl-1,3-propanediol (AEPD)
tris hydroxy methyl-amino methane (THMAN)
ammonia
2-amino-2-methyl-1,3-propanediol (AMPD)

diethylaminoprophylamine
triisopropanolamine

The amount of neutralizing agent added determines the solubility of the film and the film hardness (which controls the flexibility of the set).

PLASTICIZERS:

Unfortunately the nonlacquer resins tend to take up moisture and become tacky under humid conditions: to avoid this, plasticizers and moisture occluders are added to increase sheen, reduce the tendency to pick up moisture, and to give the film the flexibility to enable combing without destroying the set. Humectants may be used to prevent flaking of the spray in dry conditions. Plasticizers include:

lanolin and derivatives
silicones
vinyl acetate
shellac (which lowers the cost of the product as well)
dimethyl or diethyl or dibutyl phthalate
isosteareth

SOLVENT-CARRIER FOR FILM:

specially denatured ethyl alcohol (such as SD alcohol 40)
(denatured with sucrose octa-acetate, cetrimide or diethyl phthalate)
isopropyl alcohol
methylene chloride
glycol ethers.

PROPELLANTS: (if aerosol products) these are usually present as solvent-propellant systems such as:

methylene chloride/hydrocarbon (isobutane/propane in a 90/10 ratio)
methylene chloride/carbon dioxide
water/hydrocarbon (isobutane/propane in a 90/10 ration)
water/carbon dioxide
fluorocarbons (or freons) such as propellant 11:
(dichlorodifluoromethane) or propellant 12:
(trichloromonofluoromethane)

Flammability with the hydrocarbon-containing aerosols is still a problem; using water in the formulation is an attempt to limit this hazard. Even most fluorocarbon aerosols contain a large proportion of alcohol which can ignite when sprayed as a fine mist through a naked flame.

HAIR SETTING LOTIONS:

These tend to be basically the same formulations as used in hair sprays, only the method of application differs (that is, no propellant).

ADVERSE HEALTH EFFECTS FROM THE USE OF HAIR SPRAYS OR HAIR SETTING LOTIONS

Hair spray in the eyes could be quite irritating due to the solvents and other ingredients in the formulation.

Vogue

incorporating Vanity Fair

Up-swept hair, up-swept hat—
Schiaparelli's bejumed velvet
(Saks-Fifth Avenue)

Inhalation of spray particulates:

Hair spray particles are respirable with as much as 77 to over 95% of the particles less than 1u in diameter (<5u is respirable). Droplets from a pumpspray can be as small as with an aerosol, although the proportion of small particles may be less. It appears that inhalation risk with handsprays may be less than with aerosols; however, studies of particle size distributions from aerosols and handsprays show considerable disagreement on this issue.

Some individuals who have been repeatedly exposed to hair spray have exhibited clinical symptoms such as acute upper respiratory infections, shortness of breath on exertion, frequent colds, or chronic cough and have shown x-ray abnormalities. These conditions (called thesaurosis, sarcoidosis or "storage disease") are believed to result from the storage of nonbiodegradable molecules or particulates (principally polyvinylpyrrolidone and its copolymers) in the lung tissue. PVP has been found in lesions in the lungs and in the lymph nodes; the lesions usually regress when exposure to the hair spray is discontinued. The existence of this condition has not been conclusively established since it has not been confirmed by animal studies nor by surveys of hairdressers; in fact, PVP has not been found in the lungs of several people with so-called thesaurosis. However, once deposited in the lungs, PVP appears to be taken up by pulmonary macrophages and deposited in the lymph nodes, so it is not surprising that it often does not appear in the lungs.

Some cases may result in alveolar-capillary-block syndrome in which the airsac walls of the lungs increase in thickness; the result is that less oxygen can reach the blood from the lungs. Although there is not a definite correlation of PVP with thesaurosis, there seems to be some reaction occurring -- it does appear that hairdressers as a group do have a higher incidence of pulmonary abnormalities. It is possible that sarcoidosis may require susceptible or hypersensitive individuals, thus its relative infrequency in persons exposed to hair sprays may indicate that an allergic reaction is involved and that the dose-response relationship simply is not known at present.

Gum shellac tends to exhibit a foreign body reaction in the lungs as well as causing lung fibrosis. In shellac-containing sprays, the high oil content may be a major part of the problem.

A study involving student and graduate cosmetologists demonstrated that cosmetologists have more early chronic

obstructive lung disease which may progress toward more severe changes. The length of time in the industry is important in the development of respiratory disease since the graduate cosmetologists showed more dysfunction than the student cosmetologists. Since poorer ventilation systems tend to be found in small salons, they tend to have the highest concentration of airborne particulates; theus the cosmetologists working in small salons showed increased prevalence of chronic respiratory disease (abnormal chest x-rays, reduced vital capacity and atypical sputum).

The International Agency for Research on Cancer (IARC) reviewed the data on polyvinylpyrrolidone, but concluded that there was insufficient evidence to determine if it were carcinogenic in humans. Animal studies indicated that PVP may be carcinogenic to mice, rats and rabbits following subcutaneous and intravenous injection. They did note that PVP is retained in the body, since only low molecular weight polymers (<25,000) can be excreted by the kidneys.

Inhalation of solvents and propellants:

Methylene chloride is a skin and eye irritant, a narcotic, and a possible carcinogen. Since a risk estimate made by the FDA in 1985 which estimated that one out of every 100 hairdressers will develop cancer from continued use of methylene chloride-containing hairsprays, no action has been taken on the FDA's proposed ban of methylene chloride use in cosmetics. Industry groups representing manufacturers and distributors of chlorinated solvents feel that that statistic is not appropriate since epidemiological and biochemical studies conducted since 1985 appear to have downgraded the risks. Animal studies on exposure to methylene chloride in air showed cancers and tumors of the lung, liver, salivary glands and mammary glands. Although epidemiologic data from workers in industries using methylene chloride exposed to methylene chloride are inconclusive, OSHA criteria have been met with these animal studies and OSHA's cancer policy considers methylene chloride a potential occupational carcinogen. NIOSH recommends that worker exposure to methylene chloride be controlled to the lowest feasible limit.

Isobutane and propane propellants principally constitute a fire hazard; they are possible asphyxiants at high concentrations. Since their vapors are heavier than air, properly located ventilation could be used to minimize the inhalation hazard.

PROTECTION AND PREVENTION

Substitution:

---- Use carbon dioxide propellants instead of fluorocarbons or hydrocarbons.
---- Use pump aprays instead of aerosols.
---- Use alcohol solvent carriers instead of methylene chloride.
---- Use hair setting lotions rubbed into the hair instead of hairspray.

Engineering controls or work practices:

---- Use good ventilation; if no vent system, open doors and windows.
---- No smoking due to breakdown products of fluorocarbons or methylene chloride.

Protective equipment:

---- Wear protective gloves when using hair setting lotions.

PERMANENT WAVES AND STRAIGHTENERS

Heat waving, the oldest procedure, involved using heat from 180-200 degrees and wetting the hair with an alkaline solution followed by cooling. Alkaline solutions contained ammonia, sodium carbonate or triethanolamine.

Cold permanent waving and straightening are also 2-part procedures which involve these basic steps:

The hair is first softened with a wave solution which breaks chemical bonds in the hair. While in this state, the hair is wound upon rollers to give the desired waving or straightening result.

Then the hair is hardened again with a neutralizing agent which reforms most of these chemical bonds in the hair but in its new shape, making the permanent wave or straightened hair.

Lukewarm permanents fall in between these procedures. Other methods for permanents involve chemicals such as epoxies; for example, ethylene glycol diglycydyl ether.

PERMANENT WAVING:

The waving solution consists of reducing agents, emollients, conditioners, surfactants and opacifiers. The neutralizer consists of oxidizing agents, surfactant-thickener/ opacifiers, catalysts/ reaction controllers, and fire retardants.

1. Waving Solution:

REDUCING AGENTS: these break the disulfide chemical bridges dbetween the neighboring protein strands within the hair which give it much of its strength and shape. These are chemicals such as:

sodium thioglycollate
potassium thioglycollate
ammonium thioglycollate
thiodiglycollic acid
monoethanolamine thioglycollate
thioglycerol
2,5-dimercaptoadipic acid

(Early waving solutions used ammonia, sodium carbonate, ammonium carbonate, sodium borate, sulfite and sodium bisulfite.)

EMOLLIENTS AND CONDITIONERS: these alter the cuticle (outer surface of the hair) to decrease its porosity or replace the cuticle if it is damaged or missing. Conditioners give the hair a

uniform consistency so that it absorbs or responds evenly to the waving chemicals. Proteins act as fillers to fill in damaged areas on the cuticle. These proteins are clear gels of chemically extracted and purified proteins derived from sources such as scrap leather, cattle hooves or turkey feathers. Conditioners containing mild acids tend to shrink and harden the cuticle. These include:

mineral oil
sulfated oils
lanolin and its derivatives
amino acids
hydrolyzed proteins

SURFACTANTS: these are non-ionic type detergents which help to keep the other ingredients well mixed and prevent them from separating. Such as:

oxyethylated fatty alcohols
oxyethylated alkylphenols
fatty acid-polypeptide condensates

OPACIFIERS: these give the waving lotion a thick appearance; they tend to be suspensions of synthetic resins or polymers, for example:

urea-formaldehyde resins
melamino-formaldehyde resins
latex emulsions
polyacrylates

2. Neutralizing Solution:

OXIDIZING AGENTS: these harden the hair by rebuilding the disulfide bridges between the cysteine amino acids to form cystine amino acids, thus reforming the links between neighboring protein strands within the hair. These include:

hydrogen peroxide (stabilized; no bleaching effect)
potassium bromate
sodium bromate
perborate compounds; such as sodium or potassium perborate
percarbonate compounds; such as sodium or potassium percarbonate

SURFACTANT-THICKENERS/OPACIFIERS: these give the product a thicker appearance and help to keep the ingredients from separating. Such as:

polyglycol palmitic amid
alkyloamides
oxyethylated lauryl alcohol

CATALYSTS/REACTION CONTROLLERS: promote the neutralization reaction and control the rate of neutralization. These include:

dehydroascorbic acid

iron salts
sodium nitrate

FIRE RETARDANTS: these are generally added to combat the vigorous chemical reactivity of the borates, such as:

urea
ammonium salts

HAIR STRAIGHTENING:

1. Straightening Solution:

REDUCING AGENTS:

ammonium thioglycolate adjusted to pH> 9.0 with ammonia or ammonium monoethanol amine
sodium hydroxide (pH = 10 - 11)
ammonium sulfite

EMOLLIENTS AND CONDITIONERS:

stearic acid
oleic acid

SURFACTANTS:

sodium lauryl sulfate
glycerol monostearate

OPACIFIERS:

ceresin (wax)
paraffin

2. Neutralizing Solution:

OXIDIZING AGENTS:

potassium bromate
sodium perborate
hydrogen peroxide

OTHER INGREDIENTS: similar to those in permanent waves (see above).

ADVERSE HEALTH EFFECTS ASSOCIATED WITH PERMANENT WAVES AND STRAIGHTENERS

Permanent liquids tend to be irritating or corrosive to the skin and can be expecially damaging to the eyes, possible causing blindness. This is due to the high alkalinity of waving solutions, as well as to the presence of thioglycollates. Skin and eye damage is facilitated by the detergent- surfactant additives which defat the skin and assist in skin penetration. Thioglycollates may also cause dermatitis or eczema of the hands with reddening, fluid retention or swelling, or subcutaneous hemorrhages possible due to prolonged or repeated contact with the skin. Waving solutions which have been buffered to pH = 6.5 - 6.9 tend to have the least irritation potential. The thioglycollates in general are more irritating than are other constituents such as thiodiglycollic acid compounds,

monoethanolamine thioglycollate, thioglycerol and 2,5-dimercaptoadipic acid.

Waving solutions are not usually sensitizing, but allergic reactions have been observed to thioglycerol and to the synthetic plastic resin opacifiers. Sensitization is also possible to the epoxy-type waving solutions.

Permanents induce sensitization to hair dyes. Hairdressers using cold perms for several months could not then handle dyes which their skin had previously tolerated.

Some of the additives used for pH adjustment - monoethanolamine, diethanolamine and triethanolamine - may be hazardous due to the presence of nitrosamine (carcinogenic) contaminants.

Neutralizing solutions containing bromate and perborate may be strongly irritating. Bromate-containing solutions may have serious systemic effects on the body if ingested (central nervous system effects, hemoglobin effects, kidney failure).

PROTECTION AND PREVENTION:

Product Substitution:

--- Avoid permanents containing triethanolamine (TEA), diethanolamine (DEA), and monoethanolamine (MEA).
--- Use the heat-pressing method of hair straightening instead of chemical straighteners.
--- Use hair straighteners containing bisulfite rather than sodium hydroxide.
--- Use neutralizers containing hydrogen peroxide rather than bromates.
--- Substitute other permanent wave constituents for thioglycerol.

Engineering Controls or Safe Work Practices:

--- Use good personal hygiene; wash hands before eating or smoking to avoid hand-to-mouth contact and the accidental ingestion of hair products.
--- Do not eat or smoke when giving permanents to avoid accidental ingestion of hair products.
--- Do not touch the face or rub the eyes when giving a permanent.

Protective Equipment:

--- Wear gloves when giving a permanent.

NAIL PRODUCTS

NAIL POLISH, ENAMEL, BASECOATS AND HARDENERS:

These nail products consist of film-formers, resins, plasticizers, solvents, colors, pigment-dispersers and mixers.

FILM-FORMERS: these provide gel structure and give body and gloss to nail enamel. Such as:

nitrocellulose (cellulose nitrate)
ethyl cellulose

RESINS; these are thermoplastic resins which provide adhesion to the nail, gloss and flexibility of the polish when dry. Such as:

toluene sulfonamide formaldehyde resin
alkyl polyester resin (used in hypoallergenic products; tends to wear poorly since it chips and peels easily)

PLASTICIZERS: help to minimize shrinkage of the polish as it dries and contribute to the flexibility of the dry enamel. These include:

dibutyl phthalate
butyl acetate
castor oil
camphor

SOLVENTS: act as carriers to solubilize the films and resins, then evaporate to leave the enamel behind. Such as:

ethyl acetate
xylene
toluene
acetone
ethanol
methanol
glycol ethers
methyl ethyl ketone

COLORS: these may be fluorescent or nonfluorescent colors.

Fluorescent colors:
- eosin
- erythrosin
- fluorescein
- rhodamine B

Nonfluorescent colors:
- D&C Red No. 19
- D&C Red No. 31
- crystalline quanine (produces an irridescent, pearlized or frosted look

PIGMENT DISPERSERS: these prevent pigment settling by keeping it evenly dispersed in the product. Such as:

organically modified clay and bentones
dammar gum
sandarac gum

MIXERS: these are usually pellets of nickel or plastic which help to mix the polish when the bottle is shaken.

CUTICLE SOFTENER OR REMOVER

CUTICLE SOFTENER: used to soften or dissolve the keratin protein of the cuticle. Such as:

potassium hydroxide
sodium hydroxide

HUMECTANTS: these keep the product or the skin from losing moisture and drying out. Such as:

glycerin

FRAGRANCE: usually an essential oil.

NAIL BLEACHES:

citric acid
potassium binoxalate

NAIL WHITES

Cream:

COLOR:

titanium dioxide (white)

VEHICLES: provide the substance of the cream. For example:

beeswax
cetyl alcohol
oxycholesterin
petrolatum
cocoa butter

PRESERVATIVES: prevent spoilage. Such as:

tincture of benzoin
sodium borate

Liquid:

COLOR:

titanium dixoide (white)

VEHICLES: provide the substance of the liquid or lotion. For example:

glyceryl monostearate
beeswax
petrolatum

FRAGRANCE:

almond oil

NAIL POLISH REMOVER

SOLVENTS: to dissolve the polish or enamel.

acetone
ethyl acetate
butyl acetate
butyl stearate

EMOLLIENT/MOISTURIZER: to moisturize the skin or combat the skin drying effects of the solvents.

lanolin
cetyl alcohol
castor oil
olive oil
spermaceti
ethyl oleate

FRAGRANCE: an essential oil.

ARTIFICIAL NAILS

Stick-on type nails consist of a plastic tip and an adhesive to attach the artifical nail to the human nail.

Sculptured artificial nails are made from synthetic monomers ("nail liquid") and polymers ("nail powder") which are mixed and molded onto the natural nail or an artificial nail extension. When the resin hardens (cures or polymerizes), it is filed into shape and then nail polish or enamel, etc., is applied.

Nail liquid:

methyl ethyl methacrylate
butyl methacrylate
isobutyl methacrylate
ethylene glycol dimethacrylate
trimethylolpropane trimethacrylate
methacrylic acid
tetrahydrofurfuryl methacrylate
diethylene glycol dimethacrylate

Nail Powder:

POLYMER POWDER:

polymethyl methacrylate

INITIATOR: acts as a catalyst for the curing or polymerization chemical reaction.

benzoyl peroxide
N,N-dimethyl-p-toluidine

ADVERSE HEALTH EFFECTS ASSOCIATED WITH NAIL PRODUCTS

When using nail products, the patron's hand is 1 - 2 feet below the manicurist or nail sculptor's breathing zone. As a result, both are exposed to dusts and solvent vapors for however long it takes to do that particular service; but the professional has the repeated or prolonged exposure of doing many customers in a day.

The film-forming resin used in nail polishes or enamels, toluene sulfonamide formaldehyde resin, is a sensitizer when wet. cosmetologists have experienced nail enamel dermatitis on the face (including the upper eyelids) and neck from contact with the wet enamel and then touching or scratching the neck or face. However, as the enamel dries, it loses its sensitizing potential and becomes a weak allergen. These sensitization reactions do not appear to be the result of free formaldehyde in the resin; but in persons allergic to the resin there is often a cross-sensitization with formaldehyde and only rarely with sulphonamide.

Nail polish colors, especially the fluorescent colors (eosin, erythrosin, fluorescein and rhodamine B) are photosensitizers. Photosensitization in this case involves the darkening of the skin after exposure to ultraviolet light (such as in sunlight or from tanning lamps) where the skin has absorbed or come into contact with these colors. Pigment dispersers, nonfluorescent colors and irridescent finishes rarely sensitize; but nonfluorescent colors have been knowN to stain the nail plate of the user.

The solvents in nail polish or remover may cause irritant dermatitis from skin exposure, or headaches or nausea by inhalation. Inhalation of higher concentrations may cause central nervous system effects. Chronic (long-term) exposure to toluene can cause liver disease. However, animal experiments with exposure to butyl stearate suggest that it has a low toxicity.

Nail hardeners have been banned by the Food and Drug Administration if they contain more than 5% formaldehyde, a sensitizer. In the past, the formaldehyde in nail hardeners has been linked to nail loss, discoloration of the nail plate, inflammation of the nail and even bleeding of the lips in nail biters. Newer nail hardeners containing toluene sulphonamide formaldehyde resin should not contain the free formaldehyde which cause these nail problems.

The sodium hydroxide and potassium hydroxide in cuticle removers are strong caustics; they can be skin irritants, cause skin burns, or be damaging to the eyes.

The adhesive used for stick-on nails may be a sensitizer for some individuals.

The nail powder used in sculptured nails contains methacrylates which are possible sensitizers, causing allergic contact dermatitis. Formerly these resins were methylmethacrylates and polymethylmethacrylates; but these were banned by the Food and Drug Administration in 1974 due to consumer complaints involving nail discoloration, irritation and loosening or detachment of the nail from the nailbed. Sensitization to one of the methacrylates (or from past use of one of the now-banned methacrylates) may confer sensitization to others. For the nail sculptor, exposures can result from the methacrylate vapors and from the dust of the nail powder during mixing/preparation and during grinding to smooth and shape the nails. Dust on the arms, face or torso of nail sculptors has caused itching or rashes and should be minimized.

Animal studies to determine adverse effects such as embryonic-fetal toxicity and teratogenicity of methacrylates have shown that these effects do occur. However, these studies involved the injection of methacrylates into the animal body. It is unknown at present whether methacrylates pose any problem to nail sculptors who are chronically exposed to low levels of methacrylates by inhalation and skin absorption.

The nickel in pellet mixers is a potential sensitizer.

PROTECTION AND PREVENTION

Product Substitution:

--- Instead of sculptured nails, use plastic tips or linen strips.
--- Try a sculptured nail product containing a different methacrylate ingredient and see if this minimizes the health effects.

--- Substitute plastic pellet mixers for nickel ones in nail polish/enamel.
--- Use nonfluorescent instead of fluorescent colors in nail polishes or enamels.
--- Consider nail polish/enamel or remover having butyl stearate as the solvent.
--- Avoid products containing formaldehyde.

Engineering Controls or Safe Work Practices:

--- Avoid contact with the face and neck when handling wet nail polishes or enamels.
--- Wash the hands and face during the day to remove the dust from sculptured nail products. Do not eat or smoke without removing the dust.
--- When using cuticle removers, wash hands right away and do not rub eyes.
--- Use good ventilation to minimize vapor or dust inhalation.
--- Where vented manicure tables are used, replace the charcoal filters monthly to prevent their overloading with organic vapors.

Protective Equipment:

--- Use a barrier cream to block the dust from sculpture nail ingredients.
--- Where there is dust exposure to sculptured nail ingredients, wear long sleeves and high-necked clothing to cover the chest and neck as much as possible.

Table 2. Acrylic monomers in various nail preparations

Brand name	Contains
Mona Sculptured Nails Liquid	Ethyl methacrylate monomer Ethylene glycol dimethacrylate
Audette Artificial Nail Set	Ethyl methacrylate monomer Butyl methacrylate monomer Trimethylolpropane trimethacrylate monomer
Polynail Artificial Nail Set	Ethyl methacrylate monomer Isobutyl methacrylate monomer
Magic Sculptura Nails	Methacrylic acid monomer Ethyl methacrylate monomer Isobutyl methacrylate monomer
Pattinail Nail Extender	Ethyl methacrylate monomer Isobutyl methacrylate monomer
House of Nails Nail Extender	Ethyl methacrylate monomer Butyl methacrylate monomer
Super Nail Artificial Fingernail	Ethyl methacrylate monomer Isobutyl methacrylate monomer
Lee Nails Nail Extender	Ethyl methacrylate monomer Tetrahydrofurfuryl methacrylate monomer Diethylene glycol dimethacrylate monomer

BASIC COSMETIC/TOILETRY INGREDIENTS:*

- COLORS
- PRESERVATIVES: lanolin and cocoa butter can spoil; parabens, quats, ethyl and isopropyl alcohol, p-chloro-m-cresol; citrus oils and menthol.
- ANTIOXIDANTS: benzoic acid, BHA, tocopherols.
- pH ADJUSTMENT: citric acid, ammonium carbonate, ammonium bicarbonate, calcium carbonate, tartaric acid.
- MOISTURE CONTENT (HUMECTANTS): glycerin, propylene glycol, calcium silicate
- FLAVORINGS
- FRAGRANCES
- PROCESSING AIDS:
  - SURFACTANTS: emulsifiers, emulsion stabilizers; sodium lauryl sulfate, alunina gel, sodium sulfonate
  - TEXTURIZERS: acacia (gum)
  - CLARIFYING AND CHELATING AGENTS: tannin, EDTA
  - OPACIFIERS: stearyl and cetyl alcohol
  - FOAMING AGENTS: dodecyl benzene sulfonic acid

* Ingredients may have more than one function.

ALLERGIC OR SENSITIZATION REACTION: adverse reaction to a chemical resulting from previous sensitization to that chemical or to a structurally similar one. "Hypersensitivity" refers to individuals which are at the low end of the dose-response curve. Allergic reaction does not have a typically shaped dose-response curve. For allergic reaction to occur, the chemical of a metabolic product of the chemical must combine with a body protein to form an antigen; the body produces antibodies as a result and the antigen-antibody interaction provokes the allergy. In man, common responses include dermatitis and itching of the skin or inflammation of the eye membranes.

COMMON FRAGRANCES IN COSMETICS AND HAIRDRESSING PRODUCTS

These may be natural (such as herbs or essential oils) or synthetic products. Some cause allergies or skin pigmentation (especially after exposure to sunlight or tannin lamps). Sensitization can occur from:

the essential oil itself,
the fragrant chemical itself (which has been purified or extracted from the oil)
additives which retard the evaporation of perfumes (such as benzyl salicylate) or
additives used to strenthen the odor (such as the fixative musk ambrette)

NATURAL FRAGRANCES: (HERBS OR OILS)

NATURAL FRAGRANCES: (HERBS OR OILS)

sandalwood
cassia
oak moss
calamus
sweet orange
peppermint
sassafras
pine needle
spike
angelica root
bergamot
lemon
eucalyptus
citronella
petitgrain Paraguay
abies alba
Balsam of Peru
neroli
bay oil (eugenol, chavicol, methyleugenol, citral, myrcene, pinene, dip
entene, phellandrene)
lavender
thyme
juniper berries
coriander
bitter orange
clary sage
cedarwood
guaiac wood
clove
rosemary
camomile
ylang-ylang
geranium
petitgrain bigarade
vetiver
litsea cubeba
oak :moss" (atranorin)
Balsam of Tolu

Consider changing fragrance families such as terpenes vs. nonterpenes; or natural vs. synthetic.

Terpenes: limonene, geraniol, citronellol, linalool, citral
Nonterpenes: cinnamon oil (cinnamic aldehyde, "oriental bouquets"), clove oil (eugenol, vanillin), coumarin, Balsam of Peru (coniferyl benzoate)

COLORS/DYES:

These may be natural colors, minerals or synthetic colors such as coal tar colors.

Natural colors:

alkanet	
annatto	Natural Orange 4
carotene	
chlorophyll, a or b	Natural Green 3
cochineal	
saffron	
tumeric	Natural Red 3

Artificial and/or mineral colors:

helianthine
methyl red
methyl yellow
diethylaminoazabenzene
Sudan III

White:

Chinese White	Pigment White 4 (colloid clay)
magnesium silicates	Pigment White 26
pumice	Pigment White 20,26
talc	Pigment White 26
titanium dioxide	Pigment White 6
zinc sulfide	Pigment White 7

Blue:

peacock blue	D&C Blue 4

Red:

Red:

	Pigment Red 48:1
carmine	Natural Red 4 (anthraquinone)
phloxine toner	Pigment Red 90
Red Lake C	Pigment Red 53:1 53:2 (azo)
Scarlet GN (pure)	Food Red 2
Ponceau Sx	Acid Red 112
Sudan G	Solvent Red 23 D&C Red 17
erythrosine	Acid Red 51
eosine-bluish	Acid Red 92,91
eosine-yellowish	Acid Red 87

Brown:

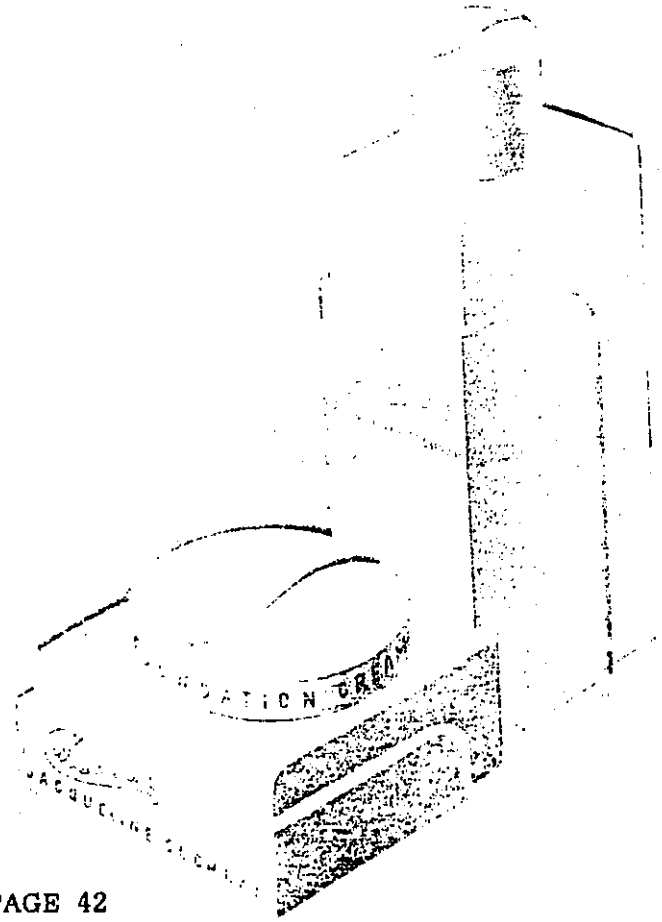
hydrated iron oxide Pigment Brown 6,7

Yellow:

fluoroscein yellow	Acid Yellow 73 D&C yellow No.7
fluoroscein sodium	
FD&C yellow No. 5	Food Yellow 4
FD&C yellow No. 6	Food Yellow 3
quinoline yellow	Food Yellow 13

Colors derived from coal tar may be carcinogenic.

Change color families; for example, D&C Green No. 5 is an anthraquinone color and is a possible skin irritant. An individual who reacts to one anthrquinone color may react to others of this family. Consider mineral colors rather than natural or synthetic colors.



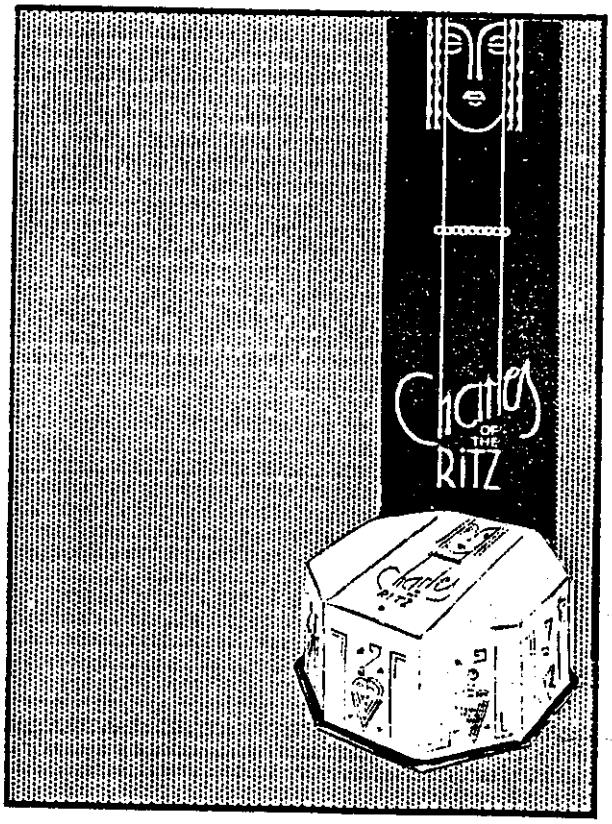
Salon-type Dryers Containing Asbestos

NAME	MODEL NUMBER
General Electric	
Portable Professional	UH-20 HD-55
Salon Style Speed	HD-30/UH31
Salon Style	HD-56, HD-54, HD-52 HD-51
Salon Style Mist	HD-63/63SS
Super Speed Salon	HD-63SS/5063-008
Salon Style Mist	HD-53
National Presto Industries	
Professional Hood	PP18A
Mist Hood	PP19A, PP19B
Shick Incorporated	
Salon Type	307, 315, 316, 317 320, 321, 322
Hatchet Type	339, 340
Westinghouse Electric Incorporated	
Salon Type	PHD-74-1 PHD-84-1 PHD-94-1

Health Hazards Manual

for

Cosmetologists
Hairdressers
Beauticians
and Barbers



By Nellie J. Brown
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