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UNIVERSITY OF CALIFORNIA

ENERGY & ENVIRONMENT DIVISION

HOSPITAL VENTILATION STANDARDS AND ENERGY CONSERVATION: CHEMICAL CONTAMINATION OF HOSPITAL AIR

FINAL REPORT

David Rainer and George S. Michaelsen

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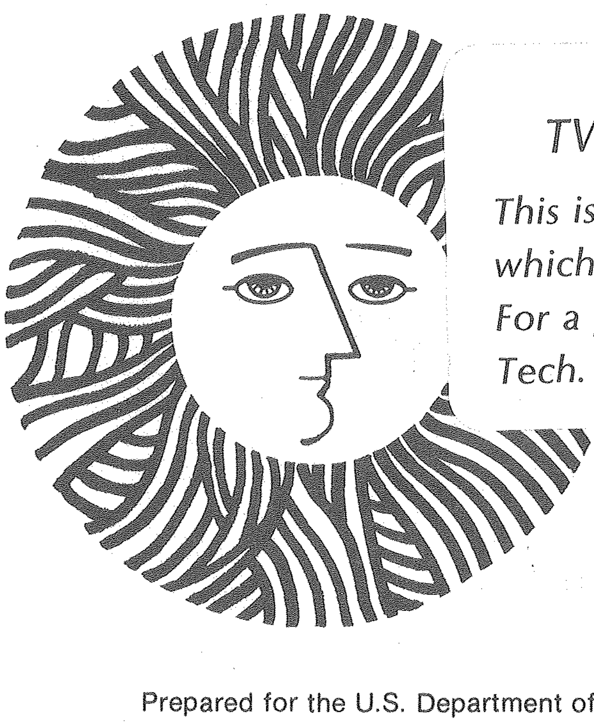

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Final Report

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March 1980

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CHEMICAL CONTAMINATION OF HOSPITAL AIR

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HEALTH SCIENCES

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Chapter I

INTRODUCTION

Since July 1977, the University of Minnesota School of Public Health has been studying hospital ventilation and thermal standards. There has been considerable reluctance by official agencies to consider lowering these standards because of concern over possible adverse impact on the health, safety and comfort of patients and staff. However, in an era of increasing energy-conservation consciousness, a critical reassessment of the validity of these standards is necessary. It is quite likely that if current standards are found to be excessively conservative, major energy conservation measures could be undertaken by rebalancing and/or modification of current heating, ventilating and air conditioning (HVAC) systems.

One of the major unanswered questions raised by this study deals with chemical loading of the hospital indoor air environment. The literature is deficient in this regard, and consequently, the influence of reduced ventilation rates on the chemical loading is unknown. To establish whether or not reducing ventilation rates would increase airborne chemical contamination to unacceptable levels, a field survey was conducted to develop an inventory and dosage estimates of hospital generated airborne chemical contaminants to which patients, staff and visitors are exposed. This report outlines the results of that study.

For as long as recognition has been given to the importance of providing hospital patients with clean air, attention has been primarily focused on eliminating biological contaminants and controlling the spread of infection. Ostensibly, the large volume of "clean" outside air that is brought into the hospital environment is used to dilute the biological contaminant load.

Today, in addition to the use of air to control biological contamination, numerous chemicals are used in the hospital to kill microorganisms and to clean surfaces with little regard of their effect on employee and patient health. The classic case of such exposure in the name of protection was Joseph Lister's practice of spraying carbolic acid (phenol, which has a Threshold Limit Value (TLV)* of five parts per million (ppm)) when he was operating or changing dressings to reduce the danger of airborne infection, a practice he followed and advocated from 1870 until 1887. In the interest of protecting patients from biological agents, hospitals have continued to expose both patients and staff to a wide variety of airborne toxic chemicals.

When considering possible chemical contamination of hospital air, distinction must be made between the effect of indoor air quality on patients and on hospital employees. Protection of the health of each population makes specific demands on the hospital ventilation system. Perhaps the most important consideration for patient health is that patients have 24-hour-per-day exposure to the same air supply. In this respect they differ from what would be considered a normal civilian population. In fact, existing air quality standards and criteria are all based on the assumption that humans divide each day between two environments, work and non-work. The only data based on continuous exposure to one indoor air source come from the Natural Aeronautics and Space Administration (NASA) and the U.S. Navy who have studied the effects on human health of air supplies in spacecraft and submarines, respectively. Although results from these studies can provide some useful

*The Threshold Limit Value (TLV) is that concentration of an airborne chemical to which a healthy worker may be repeatedly exposed, day after day, for a normal 40 hour work week, without adverse effect. "TLV" is a copyrighted term of the American Conference of Governmental Industrial Hygienists.

data on effects of continuous exposure to airborne contaminants, they have not lead to standards that would be applicable to hospitals. The differences between ventilation requirements in a closed cabin and in a hospital, in which air is continuously supplied from the outdoors, and between physically fit military personnel and hospital patients, limit the applicability of NASA and naval data to the hospital situation.

A second factor to consider in determining the effects of indoor air quality on patients is that their health may be impaired in such a way that could make them more susceptible than a healthy population might be to the same air contaminants. This could be a particular problem in the case of infants, the elderly, or people hospitalized with cardiopulmonary or eye problems.

Finally, air quality standards are for the most part based on eliminating health hazards rather than simply avoiding possible annoyances. In a hospital, in which people with illnesses are presumably being treated to improve and restore their health, it can be argued that air ought to do more than not pose a hazard. That is, the environment should actually be supportive to the patient.

Unlike the situation with indoor air quality and patient health, the question of the effect of chemical contamination on hospital employees has been examined to some extent in the literature. Three reasons can be cited for this attention:

1. High exposures have occurred in the hospital environment, primarily in the laboratory and operating room, but also occasionally with housekeeping operations. In these instances the offending agent has generally been readily recognized and thus easily studied and/or controlled.
2. Study design is straightforward using industrial hygiene techniques,

including the same analytical tools used in the industrial environment.

3. Recognition of the epidemiological significance of certain acute hospital occupational health problems, such as the rate of spontaneous abortions among female anesthesiologists, has focused attention on other hospital-related occupational hazards such as mercury, formaldehyde and xylene.

Protection of employee health requires different ventilation considerations from those needed for patient protection. Hospital employee exposure to chemical contaminants is a relatively typical occupational exposure, often occurring in 8-hour periods, with the possibility of acute accidental exposure, or long-term low-level exposure to toxic agents. The problems can be localized, as in laboratories or operating rooms allowing for local control; for example, fume hoods can be used in laboratories in which toxic chemicals are used. Problems can also be more generalized, such as those produced by chemicals used in housekeeping or in construction and maintenance activities in the hospital.

Thus the question of the effect of airborne chemical contaminants on hospital patients is unique, and the data-criteria used for development of public and occupational air quality standards and criteria cannot be applied to the hospital patient. Although the special circumstances of the hospital patient have been mentioned anecdotally in theliterature as an interesting area for possible study, serious methodological investigation of the presence and health effects of airborne chemical contamination in hospitals has not yet been undertaken.

The thrust of the present study is to provide the initial step of such an investigation and to develop a qualitative assessment of potential exposure to chemicals used in the hospital environment. As noted previously and as is documented herein, patients can be exposed to a wide variety of chemical agents, some of which are relatively toxic and a few are even suspected carcinogens.

While emphasis was on patient exposure, some examination of occupational exposure was inevitable. Personnel thought the hospital continually emphasized the concern that their exposure--not the patient's--was more detrimental. This point led to a more in-depth assessment of the laboratory air environment as documented in Chapter 3.

Chapter 2

PATIENT EXPOSURE

This chapter documents the results of an industrial-hygiene-type survey of hospital chemical usage in housekeeping operations with an objective of assessing potential patient exposure. Stress is placed on a qualitative evaluation of attendant hazard.

2.1 STUDY METHODOLOGY

Seven Twin Cities, Minnesota hospitals were selected for survey. In selecting these institutions, the following factors were considered:

1. Number of beds
2. Type (public vs. private vs. research)
3. Housekeeping service (in-house or contract).

Table 2-1 summarizes the characteristics of the seven hospitals.

Table 2-1

SURVEYED HOSPITALS

Hospital	Approximate Number of Beds	Type	Housekeeping Staff
1	566	Private	In house
2	530	Private	In house
3	298	Private	In house
4	546	Private	In house
5	774	City	In house
6	273	Private	Contracted service
7	788	Research	Contracted service

These factors ensured inclusion of a sufficient diversity of facilities with respect to size and operating practices to encompass the range of chemical agents to which the patient could be exposed. For example, size and operating complexity may increase the potential for greater contamination because more chemicals may be used, and contracted housekeeping services might use different strategies and equipment to clean hospitals.

Initial contact was made through the respective chief operating officers. After agreement for participation was reached, an operating engineer in each hospital was appointed to serve in a liaison capacity and to provide information on their hospital's physical plant operating procedures and ventilation systems. Each engineer was asked to provide the following information:

1. Type of ventilation system,
2. How patient rooms are ventilated.
3. How laboratories are ventilated,
4. Type of ventilation in janitor's closets,
5. Age and condition of hospital buildings and
6. Number of air changes in patient rooms and corridors.

The engineers each provided an introduction to the respective hospital's housekeeping director who, in turn, was asked for the following data:

1. Types of housekeeping products in use,
2. Chemical ingredients of each product
3. Use dilution,
4. Quantity used yearly,
5. Use pattern,
6. Occupational complaints associated with individual product
7. Patient complaints associated with individual product,

8. Painting procedures,
9. Aerosol use, and
10. Level of employee training.

2.2 RESULTS

The seven hospitals surveyed in this study, with one exception, are all over 10 years old,with some approaching 30 years and older. The newest hospital does comply with the current U.S. Department of Health, Education, and Welfare (DHEW) hospital construction requirements. For the older hospitals, design ventilation rates range from no mechanical ventilation in patient rooms and corridors to two total air changes per hour which complies with current DHEW requirements.

Several engineers voiced the opinion that due to lack of maintenance and checking, their ventilation systems undoubtedly do not meet their design requirements. Of the seven hospital operating engineers, only two had any idea of the number of air change rates in patient rooms and corridors. Both of these engineers had participated in the design of their hospital's ventilation system. Both systems were designed to comply with DHEW regulations and presumably had two air changes per hour in both patient rooms and corridors. Neither system had been checked recently to verify air flow rates.

Three of the seven hospitals contained some patient areas that had no mechanical ventilation. Most of the hospitals studied have been expanded time and again, usually with different DHEW requirements applying to each expansion. While each new building appendage complied with requirements in effect at the time of construction, the older portions have typically not been renovated. Consequently, in these older buildings, the airborne chemical loading should be assessed with particular concern since there may be no means of exhaust.

Discussions with the housekeeping directors revealed that a total of 88 different housekeeping products were used in the seven hospitals. These encompassed a wide variety of cleaning materials including detergents, disinfectants, cleaning fluids and solvents. Appendix A tabulates these products, including composition where such information is available.

Table 2-2 tabulates the number of products used by each hospital. It can be seen that of the 88 total products, any one hospital uses considerably fewer.

Table 2-2

NUMBER OF CLEANING PRODUCTS USED

Hospital	Number of Products *
1	25
2	11**
3	31
4	12**
5	8**
6	17
7	17

*These data were provided by hospital housekeeping directors. In all seven hospitals, it appears that nursing staffs are allowed to buy additional housekeeping products directly.

**These are likely to be gross underestimates as products counts may have been by category such as "waxes."

The number and variety of housekeeping chemicals is but one dimension of the problem. Of probably greater significance is the quantity used. The amount of material sprayed into hospital air is staggering. Further, the amount of cleaning products used yearly in the surveyed hospitals is measured often in hundreds of bottles and hundreds of gallons and hundreds of containers. For example Hospital 3 uses the following yearly:

1. 870 gallons general disinfectant cleaner, use dilution 1 ounce to 1 gallon water
2. 75 gallons all purpose cleaner, use dilution 2 ounces to 1 gallon water
3. 75 gallons glass cleaner
4. 30 cases of air freshener
5. 15 cases of heavy duty cleaner

All seven hospitals had employee training programs associated with their housekeeping departments and provided their staffs with fact sheets showing how, when, and why to use particular products. The contract housekeeping service in Hospitals 6 and 7 had the most efficient way to advise employees which product to use in a given situation. Most products used by the contract service prominently displayed a label explaining the product's use, although not all products had labels. In the other five hospitals, fewer products had attached labels, and when they were present, they generally provided less information.

Housekeeping directors did complain that in spite of labels, employees would sometimes take too much initiative by using too much of a product, assuming that "more is better," and sometimes even brought in their own concoctions thinking they were more effective.

2.3 HOUSEKEEPING PRODUCT COMPOSITION

The problems associated with determining the chemical ingredients of products used within the hospital are many. As noted, product labels are often not present; even when they are affixed to the container, they generally do not contain warnings and almost never cite product composition. There is no doubt that many ingredients contained in these products are toxic. This was confirmed by the Minneapolis Poison Control Center, Gleason et al, Clinical Toxicology of Commercial Products; or the National Institute of Occupational Safety and Health (NIOSH) book, Suspected Carcinogens: A Subfile of the Registry of Toxic Effects of Chemical Substances. Contacting manufacturers for chemical ingredient information is usually a fruitless venture because of the claim that it is proprietary information. Even the Poison Control Center could not provide chemical ingredients of many products. One manufacturer did provide an alphabetical list of all chemicals used in its line of housekeeping products. The list omitted percent concentrations and also omitted the name of the product that contained each ingredient. Of the chemicals listed by this particular manufacturer, 17 appear on the NIOSH list of suspected carcinogens.

The three appendices to this report were developed to determine product ingredients and the degree of hazard each product might present. Appendix A is a list of all housekeeping products used in the seven hospitals. Ingredients are listed when they were available. Appendix B lists the hazardous properties of chemicals that were found to be contained in individual housekeeping products. Appendix C lists probable product ingredients for general product categories. These can be used as assumed compositions for those products in Appendix A for which ingredients are not known.

2.4 EVALUATION OF AIRBORNE CONCENTRATIONS

No attempt was made to measure airborne concentrations of any housekeeping product ingredients. The problems in so doing are myriad. Most collection techniques as well as analytical methods have been developed based on occupational exposure limits for chemicals found in the work environment. For the most part, levels of chemicals in hospital air do not approach Threshold Limit Values (TLVs), precluding the use of many standard* collection and analytical techniques.

It has been suggested that a "shotgun" analytical method be used. In most cases this refers to collecting suspected contaminants on a substrate, and then analyzing it with a gas chromatograph. There are numerous shortcomings to this technique. The gas chromatograph is best used as a quantitative, not a qualitative tool. That is, the investigator should know what he is trying to evaluate and then collect a sufficient quantity of that material to obtain an accurate reading. In the hospital environment contaminants are multiple, present at low concentrations and may interfere with analysis of a particular chemical under study. Interference can markedly influence analytical results.

Present sampling strategies are suspect for evaluation of hospital related airborne chemical contamination problems for other reasons. These techniques are such that to collect an adequate amount of material in the hospital environment for analysis, extended sampling times are necessary, perhaps on the order of 24 hours. Because of the unique needs to determine extremely low chemical quantities in hospital air, it is likely that new and more sensitive collection methods will need to be developed before an accurate assessment can be made as to levels of chemicals in hospital air.

*NIOSH recommended practices.

Chapter 3

LABORATORY OCCUPATIONAL EXPOSURE

Almost all hospitals contain laboratory facilities used for diagnostic work or research. As noted previously, the exposure to chemicals and physical agents in these laboratories is considered an occupational hazard with federal limits set for permissible exposure. However, only the Occupational Safety and Health Administration's (OSHA) general workplace regulations are applicable,as no specific laboratory regulations have been promulgated as yet.

3.1 STUDY METHODOLOGY

To evaluate the chemical hazards involved with working in hospital laboratories, five extensive walk-through surveys were conducted in the laboratories of the five private hospitals, with emphasis on evaluation of ventilation system and design, including consideration of the potential for contamination of patient areas from laboratory operations. In addition, chemical sampling was also conducted in the Hospital 6 laboratories.

The laboratories studied did not include those of Hospital 7. This is a research hospital with unique problems not representative of other types of public and private hospitals.

By far the two most common chemicals used in laboratory areas are formaldehyde and xylene. Both of these chemicals are extensively used in tissue and slide preparation areas in large quantities. They have extremely low odor thresholds (below 1 part per million (ppm)) and can be annoying to staff. Another possible chemical hazard is cyanide.

Cyanide is used in most hospitals' automatic blood gas analyzers, and concern was expressed by laboratory workers that they would be adversely affected by exposure to this chemical. Because these chemicals are so widely used in hospitals and because concern was expressed as to the hazards associated with them, sampling was conducted in Hospital 6 to ascertain if in fact laboratory chemicals are a problem for patients or staff.

3.2. RESULTS

As a general observation, ventilation was inadequate in all laboratories. Some individual laboratories did not even have mechanical (general dilution) ventilation. In one laboratory in Hospital 6, a fan was used to circulate air (and thus disperse contaminants) within the room.

There was no evidence of fume hoods being properly used. In some instances, benches under hoods were used for chemical storage, indicating that the hoods were not used at all. In Hospital 6, the pathology laboratory used a biohazard safety cabinet as a fume hood, clearly the wrong use for this device. Another laboratory in the same hospital had the only point source control system among the seven hospitals surveyed. However, it was constructed from "off-the-shelf" components and not capable of fulfilling its intended function.

Results of the chemical sampling in Hospital 6 are as follows:

3.2.1 Formaldehyde

Formaldehyde sampling was conducted in the pathology laboratory using impingers for sample collection and a gas chromatograph for analysis. In this laboratory, tissue is cut on an open bench top without any form of local exhaust ventilation. The OSHA standard for formaldehyde exposure is 2 ppm over an 8-hour period with a maximum allowable exposure for 15 minutes also of 2 ppm. The concentrations of formaldehyde measured at the work site ranged from .13-.26 ppm. At these exposures, no permanent or residual adverse effect has been demonstrated in humans. It should be noted, however, that these levels of exposures have been associated with complaints of annoying odors, irritation of the eyes, nose, or throat, and headaches. The odor threshold of formaldehyde is below 1 ppm. (2)

3.2.2 Xylene

Xylene sampling was conducted in two laboratories, those utilizing the biohazard safety cabinet and the point source control system, respectively. Charcoal tube samplers were used, with analysis done on the gas chromatograph. Xylene concentrations ranged from 1.15 ppm in front of the cabinet in one laboratory to 3.97 ppm in the vicinity of the worker near the point source control system in the other laboratory. The OSHA standard for xylene is 100 ppm. Exposure to xylene at the levels measured may cause irritation of the nose, eyes and throat , but supposedly no lasting effects. (3)

3.2.3 Cyanide

Cyanide sampling was conducted utilizing the same techniques as for formaldehyde. Samples were drawn near an automatic blood analyzer which discharges cyanide into the drain. The air concentration of cyanide was too low for the standard analytical method to measure.

Chapter 4

DISCUSSION

4.1. HOUSEKEEPING PRODUCTS

In the hospital environment there are many different types of surfaces requiring cleaning. These include: carpeted floors, painted walls, tile floors, stainless steel fixtures, and porcelain bowls and sinks. Manufacturers tend to designate their products for cleaning only certain types of surfaces, thus encouraging housekeeping departments to use a greater diversity of housekeeping products.

In addition, some manufacturers sell products that duplicate or counteract the performance characteristics of other products in their own line, with each product having slightly different chemical ingredients. For example, one manufacturer sells both "high concentrate high foam formula" and "low sudsing" carpet shampoos, both to be used for the same purpose. Another manufacturer sells a "defoaming agent" which can be used to eliminate suds in any detergent solution.

The reliance on chemical action as a substitute for physical labor has been evident throughout the survey. That some of these products contain hazardous ingredients is beyond question as is documented in the appendices to this report. However, what is not as clear, is whether all housekeeping departments recognize the injurious potential of these materials to both patients and staff. Discussions with the housekeeping directors in the seven surveyed hospitals indicated that cleaning product use was well controlled in some institutions, but not in others. The lack of awareness in these latter institutions is evident in terms of both quantities used and lack of concern over potential synergistic and antagonistic effects between similar and counteracting products.

In all of the surveyed hospitals there were only a few housekeeping procedures that could be characterized as presenting an outright hazard to patients. The most notable are wax stripping and waxing both of which involve spreading of large volumes of chemicals on floors and allowing them to stand. In the case of waxing, drying time by evaporation can take as long as 30 minutes which is sufficient time for vapors to spread throughout an entire hospital. Concern was expressed by some housekeeping personnel about "new" fast evaporating waxes. These products dry extremely fast but due to their odoriferous nature their use had been discontinued in these hospitals. Almost none of the wax and wax stripping products used had warning labels in evidence nor use instructions.

Other housekeeping procedures do not generate as much airborne contamination as waxing and wax stripping. Still, many chemicals are very caustic and contain possible sensitizers.

One familiar counter argument is that in use, many of these products are greatly diluted, thus decreasing their hazardous potential. While this may be a mitigating factor in some instances, in others it is not. For example, many paints, varnishes, and floor sealers used in hospitals contain sensitizers such as epoxides and isocyanates. Formaldehyde has also been identified as a sensitizer. Concentrations of these products at less than measurable concentration may cause adverse reactions in sensitive individuals. In addition, one of the metal cleaners contains 13 percent phosphoric acid, at its use dilution.

None of the housekeeping departments used aerosol sprays in their housekeeping operation. Those products that were sprayed were contained in pump type spray bottles and include such materials as disinfectants and detergents. However, in most hospitals, nursing staffs can purchase disinfectants and deodorizers, and they are prone to use aerosol containers. In one hospital the nursing staff used an aerosol disinfectant air freshener that contained 5 percent o-Benzyl-p-Chlorophenol, 4.5 percent Tertiary Amyl Phenol, 2.6 percent Phenyl Phenol, 0.4 percent Hexachlorophene and 87.5 percent inert ingredients. Phenol can be absorbed through the skin and mucous membranes; thus the practice of spraying it in the air should be closely scrutinized. The effect of phenol on any airborne bacteria is transient at best and influenced by many factors such as contact time and type of bacteria. Manufacturer advertising is very biased and only shows why a given product is effective and almost never discusses why it might be ineffective. Scientific data should be evaluated by product users and common sense should show that some of these products are ineffective and/or dangerous. For example, even Lister re-evaluated his practice of spraying phenol into air, a practice he encouraged and then abandoned after realizing it was dangerous.

4.2 LABORATORY OPERATIONS

The results of the laboratory study are in themselves deceiving. Concentrations of the surveyed chemicals were well below occupational exposure limits; however, laboratory workers expressed concern over adverse health effects related to formaldehyde and xylene exposure such as tearing and throat irritation. It is well-documented that exposure well below occupational exposure limits for these contaminants can precipitate these symptoms.

The laboratory ventilation systems surveyed were totally inadequate from a design standpoint. Only one hospital had point source control ventilation in use in its laboratories, but these systems were inadequate and not designed for their present use.

The primary method used to eliminate chemical exposure is dilution ventilation. From a health standpoint this is very undesirable because it allows chemicals to be drawn into the main ventilation system where they are recirculated, and also allows direct exposure to the worker. In the case of formaldehyde, the amount released and drawn into the ventilation system is in addition to that formaldehyde which can normally be found indoors being released from formaldehyde urea resins contained in building materials and many household products such as mattresses. The problems associated with the release of low levels of formaldehyde are already well-documented and an attempt should be made to keep airborne formaldehyde concentration to a minimum.

A question raised but unanswered by this study concerns the movement of airborne laboratory chemicals by convection currents to adjacent patient areas. Many hospital laboratories are in very close proximity to patient areas and the potential exists for contamination of patient areas. Another unanswered question also arises as to the synergistic effects of laboratory chemicals. Many laboratories serve as a chemical repository, unfortunately, without proper storage. There is great potential for contamination of patient areas from these facilities.

4.3 CONCLUSIONS

The hospital is an extremely complex environment, with the general public believing that hospitals are the epitome of good sanitation practices and that the staff are the fountainhead of knowledge of hazards to health. The fact is that most hospital workers dismiss general chemical contamination of air as a problem to patients and instead focus on their own occupational exposure. This is understandable. The patient population is transient and they are usually primarily concerned about their immediate medical problems, not environmental problems. Everyone entering a hospital is familiar with the pervasive smell of deodorants and deodorizers and most people associate these odors with cleanliness. The average patient is comforted by these odors which indicate that the air and environment are presumably clean. In reality, the chemical makeup of hospital air probably adversely affects both patient and worker health.

As far as the concern about possible over-exposure to chemical agents in the laboratories, operating rooms, morgues and maintenance shops, no particular new efforts need to be initiated. The contamination control techniques borrowed from industrial hygiene technology, such as local exhaust ventilation when properly applied, will keep the potential hazard under control.

The far more vexing problem is the uncontrolled use of a wide variety of chemical agents by the housekeeping department, maintenance staff, and on nursing stations. In our limited survey we found 143 different chemical compounds used in 88 different formulations for sanitizing agents, air fresheners, deodorizers, detergents and solvents. Of these 143 chemical compounds, 12 are considered very toxic, 29 moderately toxic, and 23 are suspected of being carcinogenic. About half of those suspected of being carcinogenic are also moderately to very toxic. All of these materials present a potential hazard to the patients, because they are used extensively in the patient care areas of the hospital. See Appendix B for the specific compounds with toxicity ratings of 4 and 5 and those identified as suspect carcinogens.

It is doubtful that the airborne concentrations of these compounds in the patient areas ever reach hazardous concentrations in the sense of exceeding established threshold limit values. However, it is, in the opinion of the writers, a serious violation of good contamination control practices to introduce moderately and very toxic, and particularly carcinogenic, materials into the hospital environment. It is a widely held opinion that, in the case of the carcinogenic materials, there is no limit below which carcinogenisis will not take place.

For toxic and potentially carcinogenic agents ventilation should not be depended upon as a control measure. Instead, they should be banned from the hospital environment.

Appendix A

HOUSEKEEPING PRODUCTS USED IN SURVEYED HOSPITALS

The trade name, manufacturer or distributor, and product use information contained in this appendix was obtained from product labels. Product ingredients were found on the product label, through the Hennepin County Poison Control Center, or from Gleason et al. (1969). Probable ingredients for some products with unknown ingredients can be found in Appendix C. The information contained in Appendix C was obtained from Gleason et al.(1969).

Trade Name	Manufacturer or Distributor	Product Use	Product Ingredients
Above Floor Finish	Butcher's Floor Wax	Floor finish for smooth surface floors	*
Acrylic Stripper	Dalco	Wax remover	*
Air Freshener Bulk Liquid	American Linen Supply	Air freshener	*
Beaucoup	Huntington Labs	Germicidal cleaner	Active ingredient 22.24%, 3 Sodium lauryl sulfate 5.24%, 3 Sodium O-phenylphanate 4.95%, Sodium O-benzyl-p-chlorophenate 4.20%, Sodium p-tertiary amyl phenate 2.10%, Tetrasodium ethylene diamine tetra acetate 2.0%, Sodium carbonate 1.90%, Isopropyl alcohol 1.65%, Essential oils 0.20% Inert ingredient 77.76%, Water, Hexylene glycol, Urea, Sodium tripolysphosphate, Sodium sulfite
Bedrock Floor Sealer	Butcher's Wax	For sealing vinyl asbestos, vinyl, linoleum, terrazo, and concrete floors	*
BK AntiStat	Brissman-Kennedy	Eliminates static electricity on carpets	*
BK Asphalt Tile Lite Sealer	Brissman-Kennedy	For sealing asphalt and rubber floors	*
BK Defoamer	Brissman-Kennedy	Water based defoaming agent to be used to eliminate suds in any detergent solution	*

*ingredients unknown.

Trade Name	Manufacturer or Distributor	Product Use	Product Ingredients
BK Flash	Brissman-Kennedy	Cleans bathroom fixtures, ceramic walls and floors, and tile grout	*
BK Furniture Polish (aerosol)	Brissman-Kennedy	To clean and dust wood, metal, plastic and vinyl furniture	*
Bleach	Apex	Used to whiten	Sodium hypochlorite
Blue Satin Stainless Steel Cleaner	Warren Conley Corporation	Cleans stainless steel	*
Carpetsheen	Hillyard Chemicals	Carpet cleaner	Petroleum distillate
Colonel Cutter	Butcher's Wax	For stripping finish and seal from all types of floor surfaces	*
Comet	Procter & Gamble	Porcelain cleaner	Quartz powder, Trisodium phosphate 12.9%, Dodecylbenzenesulfonate 1.9%, Sodium hypochlorite 0.4%, Sodium tripolyphosphate, Sodium sulfate
Concrete Seals	Chem Pride	Concrete sealer	*
Deep Gloss	Johnson Wax - Dalco	Stainless steel cleaner	*
Envy	Johnson Wax - Dalco	Used to remove black marks from tile; grease, soap, scum dissolver	Sodium metasilicate .231%, Essential oil .190%, N-alkyl (60% C_{141}, 30% C_{16}, 5% C_{121}, 5% C_{18}), Dimethyl benzyl ammonium chloride .106%, N-alkyl (50% C_{12}, 30% C_{14}, 17% C_{16}, 3% C_{18})

*ingredients unknown.

Trade Name	Manufacturer or Distributor	Product Use	Product Ingredients
Fiber Fresh MBI	Service Master	Microbiological inhibitor	Ortho-Benzyl para-chlorophenol 9.20%, Bis (tri-n-butyltin) Oxide .73%, Isopropyl alcohol 60.87%, Inert ingredients 29.20%
Fiber Fresh Pro	Service Master	Shampoo for cleaning carpet and upholstery	*
Flashback Prespray for Heavy Soiled Carpets	Butcher's Wax	Spray-on cleaner that gives a headstart on shampooing	*
Floor Star Duo Chene	Service Master	Cleaner for hard and resilient floors	*
Floor Star Exceed	Service Master	Spray buffable finish for hard and resilient floors	*
Floor Star Review	Service Master	Spray buffable finish for hard and resilient floors	*
Floor Star Satin Gloss	Service Master	Buffable finish for hard and resilient floors	*
Floor Star T.F.R.	Service Master	A total finish remover for use on hard and resilient floor surfaces	*
Fountainhead Basic Detergent for Water Extraction Carpet Cleaning	Butcher's Wax	Low sudsing fast working shampoo	*
Flying Colors Carpet Shampoos	Butcher's Wax	Shampooing carpets of all fibers and colors. High concentrate high foam formula	*

*ingredients unknown.

Trade Name	Manufacturer or Distributor	Product Use	Product Ingredients
Furniture Polish	Harrison House Co.	Used on wood surfaces	*
Germa Medica	Huntington Labs	Handwash disinfectant	Hexachlorophene 1%, Potassium soap, Olive oil, Sodium xylene sulfonate, Glycerin, Isopropyl alcohol, Tetrasodium ethylene diamine tetra acetate, Lecithin, Hexylene glycol, Coconut amide, Formaldehyde, Certified color, Perfume
GlassClene Pro	Service Master	Volatile water base cleaner and spotter for use on glass, plastic laminates, other hard non-porous surfaces; and certain textiles and vinyl upholstery fabrics	*
Glide Rinse Disinfectant	Service Master	Disinfectant and deodorizer	Alkyl (60% C_{14}, 30% C_{16}, 5% C_{12}, 5% C_{18}) dimethyl benzyl ammonium chlorides 4.0%, Alkyl (68% C_{12}, 32% C_{14}) dimethyl ethylbenzyl ammonium chlorides 4.0%, Inert ingredients 92.0%
Good Sense 7	Johnson Wax	Continuous air freshener to eliminate unpleasant odors. Use in bathrooms, patient rooms - wherever there is a continuous odor problem	*
Hibiclens	Stuart	Disinfectant	Chlorhexidine gluconate 4%, Soapless solution of mild detergent, Foam booster, Colorant, Fragrance

*ingredients unknown.

Trade Name	Manufacturer or Distributor	Product Use	Product Ingredients
Hilex Liquid Bleach	Hilex	Bleach	Sodium hypochlorite 5.25%
Hospital Germicide and Deodorizer (aerosol)	Dow Chemical Company	To eliminate odors and disinfect all hard surfaces (center of room sprayed 1-2 seconds)	*
Huntolene Mop-treatment	Huntington Labs	Dust mop treatment to pick up and hold dust and dirt in the mop	Dilauryl dimethyl ammonium bromide 0.25%, Petroleum distillate 99.75%
Johnson Industrial Wax	Johnson and Johnson	Floor wax	*
Johnson Over and Under Sealer	Johnson and Johnson		*
Johnson Stepoff Stripper	Johnson and Johnson	Wax stripper	Water 80-90%, monoethanolamine 5-10%, Sodium metasilicate 2-6%, Surfactants 2-4%, Perfume approv. 0.1%, pH 12.4-13.2
K-99 Low Foam Cleaner	Rochester Germicide	Specially formulated detergent for automatic scrubbers. Low foam detergent	Fatty alcohol, Water, Inorganic salts, sulfate, Ethylene diamine tetra acetic acid, Linear alcohol ethoxylate
Knock Out Odor Control Granules	Savoie	Odor control in incinerators, dumpsters	*
Lime Away	Economics Labs	Toilet cleaner	Water, Phosphoric acid, Hydroxyacetic acid, nonionic surfactant, pH 2.45
Liquid Good Sense	Johnson Wax	To eliminate unpleasant odors, leaving a clean pleasant smell. Clears the air of stale, musty, objectionable odors.	Water 75-80%, Ethanol 15-20%, Nonionic surfactant less than 1%, Perfume less than 0.5%, Propylene glycol - trace, Preservative - trace

*ingredients unknown.

Trade Name	Manufacturer or Distributor	Product Use	Product Ingredients
Magestic Stainless Steel Polish (aerosol)	Majestic Wax Company	For routine maintenance of structural or decorative stainless steel	Petroleum distillates
Mikro-Bac	Economics Lab	General cleaning and disinfection of all hard surfaces	Isopropanol 10.0%, Potassium ortho-phenylphenate 4.0%, Potassium 4-chloro-2-cyclopentyl phenate 2.9%, Tetrasodium ethylenediamine tetra-acetate 2.0%, Sodium dodecyl benzene sulfonate 1.2%, Potassium p-tertiary amylphenate 1.0%, Sodium xylene sulfonate .4%, inert ingredients 78.5
Mon-O-Gold Glass Cleaner	Carm Distributing	For cleaning glass, doors, mirrors, windows	*
National Labs Creme Cleanser	Gentex		*
Novaseal	Huntington Lab		*
"Oh Dear"	Dalco	Vomit neutralizer spray	*
Per-diem		Toilet bowl cleaner	*
Quarternary Detergent Germicide	UKG	Used on all hard surfaces	n-Alkyl dimethyl ethyl benzyl ammonium chloride 3.2%, n-Alkyl dimethyl benzyl ammonium chloride 3.2%, Sodium carbonate (soda ash) .4%, Inert ingredients 89.6%

*ingredients unknown.

Trade Name	Manufacturer or Distributor	Product Use	Product Ingredients
Routine Bowl Cleaner	Service Master	Cleans, disinfects, deodorizers	Hydrogen chloride 7.50%, n-Alkyl 60% C_{14}, 30% C_{16}, 5% C_{12}, 5% C_{18}) dinethyl benzyl ammonium chlorides .30%, n-Alkyl (50% C_{12}, 30% C_{14}, 17% C_{16}, 3% C_{18}) di-methyl ethyl-benzyl ammonium chlorides .30%, Inert ingredients (contains 3% Octyl phenoxy polyethoxy ethanol) 91.90%
Sani Master Phenolic	Service Master	Cleaner, disinfectant, deodorizer	Ortho-phenylphenol 5.5% Ortho-benzyl-para-chlorophenol 3.0%, Isoproponol 2.5%, Para-tertiary-amylphenol 2.0%, Trisodium N-hydro-xyethylene diaminetriacetate .3%, Inert ingredients 86.7%
Sani Master II	Service Master	Cleaner, disinfectant, dedorizer	Alkyl 60% C_{14}, 30% C_{16}, 5% C_{12}, 5% C_{18}) Dimethyl benzyl ammonium chlorides 4.5%, Alkyl (68% C_{12}, 32% C_{14}) dimethyl ethylbenzyl ammonium chlorides 4.5%, Tetrasodium salt of ethylene diamine tetra-acetic acid 2.0%, Sodium carbonate 4.0%, Inert ingredients 85.0%
Sani Stat	Service Master	Bacteriostatic cleaner and polish for non-porous surfaces	2,2'-Methylene Bis (3,4,6-trichlorophenol) 0.2%, Inert ingredients (includes all the polishing and protecting agents) 99.8%

*ingredients unknown.

Trade Name	Manufacturer or Distributor	Product Use	Product Ingredients
Soilax	Economics Labs	All-purpose cleaner	Sodium phosphate, Sodium sesquicarbonate, Sodium bicarbonate, Synthetic wetting agent, Fluorescein color
Solv Oil	Service Master	Oil, gum, grease, tar, paint removal	* (contains petroleum distillates)
Sol-Zol Toilet Bowl Cleaner	Napolean Barbeau Chemicals Inc.	Cleans, deodorizes, disinfects toilet bowls and urinals	HCl
Speedball Cleaner	Brissman-Kennedy	Hard surface cleaner	*
Stain-Ex	Dalco Co.	Carpet stain remover	Water 95%, Detergents 5%
Staphene	Vestol Labs	Disinfectant spray and air sanitizer	Detergents 19.3%, O-benzyl-p-chlorophenol 5%, Tertiary amyl phenol 4.5%, Phenyl phenol 2.6%, Hexachlorophene 0.4%, Inert ingredients - balance
Sudsy Ammonia	Parsons		Active ingredients: Ammonium hydroxide solution, Linear alkylbenzene sulfonate, Ethoxylated alkyl alcohol, Opacifier, clarifying agent
Sundance Cleaner	Brissman-Kennedy	Automatic floor scrubber	*
Stainless Steel Cleaner-Polish	Service Master	Maintenance and protection of brushed stainless steel surfaces	*
Ta-Poff	Hospital Supply	Grease remover on carpets; tape adhesive remover	Perchloroethylene, Low volatile petroleum distillates, Amyl acetate

*ingredients unknown.

Trade Name	Manufacturer or Distributor	Product Use	Product Ingredients
Temp	DuBois Chemicals	All purpose smooth cream cleaner for bathroom surfaces and painted surfaces	*
3-M Spray Cleaner A-101 (aerosol)	3-M	For cleaning and spraying buffing all hard surfaced floors	*
Three Star Carpet Deodorizer	Savoie	Carpet cleaner	*
Three Star Dusting, Cleaning and Waxing Polish	Savoie	Wooden furniture polish	*
Three Star Extracts Magic Shampoos	Savoie	Extraction carpet cleaner	*
Three Star Gum & Candle Wax Remover	Savoie	Gum and candle wax remover	*
Tile and Grout Cleaner	Sanitory Products	Cleans tile and grout	*
Tile Clene	Service Master	Removal of soap scum, stains, hard water residues from ceramic or plastic tile	Phosphoric acid, other ingredients unknown
Toilet Bowl Cleaner	Professional Maintenance	Toilet cleaner	Hydrogen chloride 23%, n-alkyl (60% C_{14}, 30% C_{16}, 5% C_{12}, 5% C_{18}) dimethyl benzyl ammonium chlorides .025%, n-alkyl (68% C_{12}, 32% C_{14}) dimethyl ethyl-benzyl ammonium chlorides .025%, inert ingredients 76.95%
Top Shape Floor Finish and Seal 341	Hillyard	Terrazzo floor finish	*

*ingredients unknown.

Trade Name	Manufacturer or Distributor	Product Use	Product Ingredients
Tor	Huntington Labs	Germicidal cleaner on sinks, chrome, carpet stains, naugahyde, shower tile	Active ingredients 7.2%, sodium carbonate, N-alkyl dimethyl benzyl ammonium chlorides, N-alkyl dimethyl ethyl benzyl ammonium chlorides, Sodium meta-silicate, inert ingredients 92.8%, water, Z-alkanoxy polyethoxy ethanol, Tetrapotassium pyrophosphate
Trouble Shooter	3-M, Dalco	Removal of wax and dirt from hard surfaces.	2-Butoxy ethanol 15%, Monoethanolamine 5%, Water, Surfactants and stabilizers
Trove Floor Finish	Huntington Labs	Tile floor cleaner	Water 93%, Acrylic styrene polymer emulsion 10%, Alkali-soluble resin 3%, Polyethylene Emulsion 2%, Diethylene glycol monoethylether 2%
Turgasept	Ayerst Lab	Aerosol disinfectant for odors	Active Ingred: Paradiisobutyl phenoxy-ethoxyethyl dimethyl benzyl ammonium chloride 0.2%, triethylene glycol 3.4%, Dipropylene glycol 3.4%, Isopropyl alcohol 9.6%, Metho p-Hydroxybenzoate 0.2%, Sorbic acid 0.05%, Inert Ingred: 83.15%, essential oils, aromatics, propellant
Vandalism Mark Removers	Chem Pride	Public restroom stall cleaner	*
Vani-sol	National Lab Div.	Toilet bowl disinfectant	Hydrochloric acid 23%

*ingredients unknown.

Trade Name	Manufacturer or Distributor	Product Use	Product Ingredients
Viro-Tel	Davis & Geck	Disinfectant/dedorant-aerosol	O-pehno phenol 0.114%, N-alkyl N-ethylmorpholinium ethyl sulfates 0.039%, O-chloro-p-phenol 0.022%, Alcohol 71.994%
Vo Ban Absorbent		Used to remove vomit from carpets	Isopropanol Alkyl (N-alkyl 60% C_{14}, 30% C_{16}, 5% C_{12}, 5% C_{18}) 0.27%, Dimethyl benzyl ammonium chloride .35%, Methyl salicylate .75%, Pine oil 3%, Inert ingredients 95%
Wall Glide Pro	Service Master	Cleaner for non-fabric surfaces, such as painted surfaces, appliances, etc.	*
Walton March Drain Treatment	Savoie	Patient shower and sink cleaner	Sodium chloride, Sodium thiosulfate, Sodium bicarbonate
Window Cleaner	Harrison House Co.	Window cleaner	*

*ingredients unknown.

Appendix B

HAZARDOUS PROPERTIES OF HOUSEKEEPING CHEMICALS

The columns in this appendix contain the following information on the hazardous properties of commonly used hospital housekeeping chemicals; this information is included to facilitate evaluation of the injurious potential of individual chemicals.

I. Chemical name

The chemical name is that obtained directly from the product label, the Minneapolis Poison Control Center, or from Gleason et al (1969).

II. Toxicity Rating

The toxicity ratings assigned to some of the chemicals were obtained from Gleason et al (1969). The defining of the toxicity rating is as follows:

Toxicity Rating	Probable Lethal Dose (Human)	
	mg/kg	70 kg Individual (150 lb)
6 Super Toxic	less than 5	a taste (less than 7 drops)
5 Extremely Toxic	5-50	between 7 drops and 1 teaspoonful
4 Very Toxic	50-500	between 1 teaspoonful and 1 ounce
3 Moderately Toxic	500-5 gm/kg	between 1 ounce and 1 pint (or 1 lb)
2 Slightly Toxic	5-15 gm/kg	between 1 pint and 1 quart
1 Practically Non-toxic	above 15 gm/kg	more than 1 quart

III. Threshold Limit Value

The Threshold Limit Value (TLV) is the maximum concentration of the chemical to which a healthy worker can be exposed over an eight-hour day, 40-hour work week without adverse effect. Concentrations are expressed in parts per million (ppm) by volume.

"TLV" is a copyrighted trademark of the American Conference of Governmental Industrial Hygienists.

IV. Suspected Carcinogen?

The classification of a chemical as a suspected carcinogen was obtained from a National Institute of Occupational Safety and Health (NIOSH) report (December 1976; see references). The preface to this report states:

> *This publication does not indict a substance as a human carcinogen. Rather it reports published data which suggest that the substance has caused neoplastic or carcinogenic effects. The experimental designs used in the cited studies may be unsuitable for prediction of human effects. Their inclusion in the Registry does not reflect an evaluation with respect to the adequacy of the data, or consideration of negative or contradictory studies.*
>
> *The National Institute for Occupational Safety and Health (NIOSH) identifies a substance as a potential human carcinogen by means of the criteria document process. This involves exhaustive literature review and careful consideration by experts leading to a definitive conclusion. This subfile is published to serve as a guide to the literature, and as an indication of those substances which may require further research and evaluation.*

Chemical Name	Toxicity Rating	Threshold Limit Value (ppm)	Suspected Carcinogen?
acetic acid	0	10	
2-alkanoxy polyethoxy ethanol			
alkylamine dodecylbenzene sulfonate			
alkyl dimethyl benzylammonium chloride	4		
alkyl dimethyl ethylbenzylammonium chloride	4		
alkyl phenol	2, 3		
N-alkyl-n-ethylmorpholinium ethyl sulfates			
alkyl phenol polyglycol ether	2, 3		
2-amino ethanol	0	3	yes
ammonium silicofluoride	4		
amylacetate	3(?)	12.5	
anthraquinone dye			yes
aqua ammonia	0	25	
benzaldehyde	3		
bis (tri-n-butyltin) oxide			yes
n-butyl phthalate	2		
carboxy vinyl polymer			
castor oil	2(?)		
certified color			
chlorine dioxide - stabilized		0.1	
citric acid			
coconut amide			
coconut fatty acid			
coconut fatty acid - protein condensate			
corn dextrine			
diazo dye			yes

Chemical Name	Toxicity Rating	Threshold Limit Value (ppm)	Suspected Carcinogen?
diethylene glycol butyl ether	3		
diethylene glycol ethyl ether	3		
dihexyl sodium sulfosuccinate			
dilauryl dimethyl ammonium bromide			
3,4-dimethyl - 4,chlorophenol			
dioctyl sodium sulfosuccinate			
dipropylene glycol			
dodecylbenzenesulfonate			
essential oil	4		
ethanoldiglycine disodium salt			
ethyl alcohol-190P, denatured	2	1000	yes
ethylenediamine tetraacetic acid - sodium salt	2(?)		trisodium salt yes
ethylene glycol	3	100	
ethylene glycol butyl ether	4		yes
ethylene glycol ethyl ether	3		
fluorescein color			
fluorochemical emulsion			
fluorochemical surfactant			
formaldehyde with 13% methanol	3	2	yes
formic acid	0	5	
glycerin	1		
hexachlorophene	4(?)		yes
hexylene glycol	2 or 3	25	
hydrated calcium silicate			
hydrogen chloride		5	
hydroxyacetic acid			

Chemical Name	Toxicity Rating	Threshold Limit Value (ppm)	Suspected Carcinogen?
isopropyl alcohol	3	(skin) 980 mg/m^3	
lanolin	1		
latex polymer emulsion			yes
laurel sulfate, mg-na blend			
lecithin			
lignosulfonate			
linear aliphatic polyether - nonionic			
linear alkylbenzene sulfonate			
metal crosslinked uni-polymer			
methyl salicylate	4		
mineral spirits - rule 66	3		
modified coco diethanolamide			
modified linear aliphatic polyether			
myristyl-trimethyl ammonium bromide			
neatsfoot oil	1		
nitroso dye			
nonylphenol poly (ethyleneoxy) ethanol			
odorless mineral spirits			
oil emulsion			
oleic acid	1		yes
olive oils			
opacifier, clarifying agent	1		
optical brightener			
organic phosphate ester			
orthobenzyl parachlorophenol - isopropyl solution	3		yes

Chemical Name	Toxicity Rating	Threshold Limit Value (ppm)	Suspected Carcinogen?
orthochloro paraphenyl phenol	4		yes
oxyethylated straight chain alcohol			
paradiisobutyl phenoxy-ethoxy ethyldimethyl-benzyl ammonium chloride	4		
paraffin	1	2 mg/m^3	
perchloroethylene	3	670 mg/m^3 (skin)	yes
perfume - various			
petroleum distillates	3		yes
petroleum naptha	3		
o-phenyl phenol	3		yes
phosphoric acid		1 mg/m^3	
phthalocyanine dye			yes
pine oil	3		
poly (methyl vinyl ether/maleic acid)			
potassium hydroxide		2 mg/m^3	
potassium 4-chloro-2-cyclopentylphenate			
potassium laurate			
potassium ortho phenylphenate			
potassium soap	2		
potassium p-tertiary amyl phenate			
primary alcohol ethoxysulfate - sodium salt			
propylene glycol methyl ether	3(?)	100	
proteolytic enzyme			
pumic	1(?)		
quartz powder			yes
silicone emulsion			

Chemical Name	Toxicity Rating	Threshold Limit Value (ppm)	Suspected Carcinogen?
silicone emulsion, dimethyl-polysiloxane			
soap - high titer tallow	2		
sodium bicarbonate	3		
sodium bifluoride			
sodium carbonate			
soidum carboxymethylcellulose			
sodium chloride	3		yes
sodium dichloroisocyanurate dihydrate	3		yes
sodium dodecyl benzene sulfonate	3		
sodium 2-ethylhexyl sulphate	3		
sodium hydrosulphite			
sodium hydroxide		2 mg/m^3	
sodium hypochlorite			
sodium linear alkylate sulfonate			
sodium metasilicate	3(?)		
sodium orthosilicate	3(?)		
sodium perborate monohydrate	4		
sodium phosphate			
sodium sesquicarbonate			
sodium silicofluoride			
sodium sulfate			
sodium tetraborate pentahydrate	3		
soidum tripolyphosphate	3(?)		
sodium xylenesulphonate			yes
surfactants			
terpineol	3		yes

Chemical Name	Toxicity Rating	Threshold Limit Value (ppm)	Suspected Carcinogen?
p-tertiary amyl phenol			
tetrahydro-1,4-oxazine	4		
tetrapotassium pyrophosphate			
tetrasodium pyrophosphate	3(?)		
thermoplastic polyester resin			
triazinty stilbene brightener			
triazole stilbene brightener			
tributoxyethyl phosphate			
1,1,1 trichlorethane	3	350	yes
triethylene glycol	2(?)		
3,5,5 trimethyl hexanal			
trisodium n-hydroxy ethylene diamine triacetate			
trisodium phosphate			yes
wax emulsion			
white mineral oil	1		
xylene	4	435 mg/m^3 (skin)	

Appendix C
PROBABLE PRODUCT COMPOSITION

This appendix tabulates the probable composition of general classes of products used for routine hospital housekeeing. These formulae are included to provide guidance as to the chemical formulations of those trade name products in Appendix A of unidentified composition. See Appendix B for Toxicity Rating criteria.

Source: Gleason et al. (1969).

Air Sanitizers

Toxicity Rating 4

Alkyl dimethyl ethyl benzyl and alkyl dimethylbenzyl ammonium compounds*	20%
Water	
Versene	

May contain:
- Essential oils
- Isopropanol*
- Propellants
- Propylene glycol
- Triethylene glycol

Deodorizers

Bathroom Dedorant

1. Naphthalene*	Toxicity Rating 4
2. Paradichlorobenzene*	Toxicity Rating 3
3. Sodium bisulfate*	Toxicity Rating 3

(These compounds may or may not contain a trace of perfume)

Cleanser Type — Toxicity Rating 3

1. Pine oil*	60% minimum	always
Anhydrous soap	30% maximum	90%
Water	10%	

2. Quarternary ammonium compound*	2.5-10%
Non-ionic surfactant	0.6-2.5%
Phosphates	2-3%
EDTA	0.5-1%
For metal surfaces, sodium nitrate	
Synthetic phenols	3.5-5% maximum
Isopropanol	2-3%
Anhydrous soap	5-15%
EDTA	0.5-1%
Water to make	100%
Trace amounts of color and fragrance	
May contain: Magnesium sulfate	

Deodorant Blocks — Toxicity Rating 3

1. Paradichlorobenzene*	99%
Essential oils	1%

	Toxicity Rating 4
2. Naphthalene*	80%
Cedar wood	0-20%
	Toxicity Rating 4
3. Paraformaldehyde*	85%

Spray Type Dedorizers	Toxicity Rating 2
1. 1, 1, 1-Trichloroethane	10%
Isopropanol	6.9%
Triethylene glycol	4.1%
Dipropylene glycol	4.0%
Di-isobutyl phenoxy ethoxy ethyl dimethyl benzyl ammonium chloride	0.5%
Essential oils	
Propellants	
	Toxicity Rating 2 or 3
2. Metazene	4.0%
Petroleum distillates	6.0%
Propellants (Freons)	up to 90.0%
May contain: Aluminum chlorhydrol	
2,3,4,5-bis(2-Butylene)tetrahydrofurfural	
Carbon tetrachloride*	
Cellosolve acetate	
Dichlorodifluoromethanol	
Ethanol	
Fatty esters	
Formaldehyde	
Hexachlorophene	
Lauryl methacrylate	
Methoxychlor	
Methylene chloride	
Orthophenylphenol	
Paradichlorbenzene*	
Pine oil	up to 10%
Piperonyl butoxide	
Pyrethrin	
Synthetic surfactants	
Trichloromonofluoromethane	
Wax	
Zinc phenolsulfonate	

Wick Type Deodorizers	Toxicity Rating 3
Formaldehyde (37%)	2-3%
Water soluble perfume	203%
Coloring	trace
Water	to 100%
Emulsifiers	
Essential oils	
Aromatic chemicals*	
Chlorophyll	

Disinfectants

Acids	Toxicity Rating 4
Acetic acid	
Alkyl C_8 to C_{18}) dimethylbenzylammonium chloride	
Ammonium chloride	
Benzoic acid	
Boric acid*	
Butyric acid	
Carbonic acid	
Chloroacetic acid*	
Citric acid	
Formic and related acids*	
Lactic acid	
Propionic acid	
Pyroligenous acid	
Salicylic acid*	
Sulfurous acid*	
Alkalis	No rating
1. Ammonium hydroxide*	3-29%
Water	71-97%
2. Sodium hydroxide*	94%
Sodium carbonate	2%
Sometimes contain:	
Borax	
Calcium hydroxide*	
Sodium silicates	
Trisodium phosphate	
Halogens	
1. Liquid	No rating
Sodium hypochlorite*	5-16%
Sodium hydroxide	0.1-1.0%
Sodium chloride	5-10%
Water	84-90%
2. Powder:	Toxicity Rating 3-4
a. Organic chlorine compound*, e.g.	50-100%
Heptachlor*	
Hexachlorobenzene*	
Dichlorobenzene*	
Dichloroisocyanurate*	0-92%
Pelletizing binders, etc.	0.50%
b. Calcium hypochlorite*	50-100%
May contain:	
Trisodium phosphate	0-92%
Halazone	
Pine oil	
Soap	
Soda ash	
Sodium borate*	

Iodophor Disinfectants	Toxicity Rating 2
Polyethoxy polypropoxy ethanol-iodine complex	7-10%
Nonyl phenyl ether of polyethylene glycoliodine complex	7-10%
Hydrogen chloride	0-10%
(provides 1.6% available iodine)	
or Phosphoric, citric or butyronic acid	
Dairies mostly use organic acids.	
Miscellaneous Disinfectants	Toxicity Rating 3
Formaldehyde*	20%
May contain:	
Mercury compounds	small amount
Phenol Disinfectants	
Chlorophenols e.g., ortho benzyl-p-chlorophenol or chloro-2-phenyl phenol (also sodium salts)	3-8%
Phenols* (often from coal tar)	Toxicity Rating 4
Phenol) Tertiary amyl phenol) Cresol) O-Phenylphenol)	20-50%
Versene	1-3%
Complex phosphates, e.g., tetrapyrophosphate, tripolyphosphate, as K and Na salts	1-3%
Glycerine	1%
Soap	4-30%
Isopropyl alcohol	0-20%
Surfactants, e.g., sodium dodecyl benzyl sulfonate	
Water	
May contain:	
Aromatic hydrocarbon solvents* ("coal tar hydrocarbons or coal tar neutral oils")	44-58%
Quarternary Ammonium Compounds	Toxicity Rating 4
1. Quarternary ammonium compounds*	20-50%
Mostly derivatives of dimethyl benzyl-ammonium chloride	
Water	to 100%
	Toxicity Rating 3
2. Quarternary ammonium compounds*	3-6%
Ethylene oxide condensate	6-10%
Sodium carbonate	2-3%
Versene	0-2%
Inert ingredients, probably liquid	
Glycerine	1%
Soap	4-30%
Isopropanol	7-20%
Sodium dodecyl benzyl sulfonate	

May contain:
- Dyes
- Essential oils
- Ethanol
- Nonyl phenol polyethylene glycol ether
- Nonylphenoxy polyoxy ethylene ethanol
- Sodium tripolyphosphate

Spray Type Disinfectants	Toxicity Rating 3
1. Isopropanol*	up to 30%
4'5-dibromsalicylanilide	up to 0.45%
3,4'5-tribromsalicylanilide	up to .45%
Other polybrominated salicylanilides	up to .1%
Inert ingredients, about 70%	
(e.g., propellants such as Freon 11 and 12)	
2. Vancide B (sodium bithionolate)	0.5%
Ethanol*	25.0%
Water	54.5%
Propellant 12	4.0%
Propellant 114	16.0%

Window Cleaners

Glass	Toxicity Rating 2
1. Butyl celloxolve	3-5%
Alcohol	3-5%
Wetting agent	0.5-1%
Isopropanol	0-15%
Dyes	trace
Silicone	trace
Water	to 100%

May contain:
- Alkali
- Ammonia
- Bentonite
- Celite
- Essential oils
- Hydrated lime
- Maphthas
- Nonyl phenoxy polyethoxy ethanoliodine comples
- Organic solvents
- Phosphoric acid
- Polyethoxy polypropoxy polyethoxy-ethanol-iodine comples
- Sodium polyphosphate
- Turkey red oil
- Waxes (carnauba, Japan)

	Toxicity Rating 2
2. Isopropyl alcohol	6-25%
Glycol ether	10-11%
Ethylene glycol	1%

Surfactant (usually an anionic but occasionally a nonionic such as Triton X-200 or Turkey red oil)	
Water	60-85%
	Toxicity Rating 2
3. If a spray, a small amount of Freon	ca. 6%
May contain:	
Dyes)	
Perfumes) small amounts	
Phosphates)	
Fillers	
	Toxicity Rating 2 or 3
4. Window waxes	
Silica abrasive	
Amine soaps	
Waxes	
Petroleum solvent*	
Ammonium hydroxide	trace

General Purpose Waxes	Toxicity Rating 3
Natural and synthetic waxes and/or resins	
Fatty acid emulsifiers	
Morpholine	
Alphatic* and/or aromatic* (tixicity rating 4 if over 25%) petrolsum solvents	5-80%
Ortho-benzyl-p-chlorophenol	0.1%
May contain:	
Alkali	
Ammonia	
Alkyl sodium sulfate	
Borax*	
Burnt umber	
Essential oils	
Greases	
Oil dyes	
Shellac	
Silica	
Silicone	
Turpentine	

Toilet Bowl Cleaners (Acid Cleaners)	
Toilet bowl	
1. Solid	Toxicity Rating 3
Sodium acid sulfate*	70-100%
Octyl or nonyl phenoxy polyethoxy ethanol	
Sodium sulfate	0-3%
Sodium acid oxalate*	0-2%
1,3-Dichloro-5,5-dimethyl hydantoin* (probably similar to chlorinated isocyanurates)	0-95%
Sodium chloride	0-100%
Sodium carbonate	0-10%
Perfume (pine oil, methyl salicylate, etc.)	0-1%
May contain: Alkyl aryl sodium sulfonate	0-2%

o- or p-Dichlorobenzene	
Hepta decyl hydroxyethyl imidazoline	
Iodine	
Soda ash	
Sodium metasilicate	
Sodium nitrate	
Sodium tripolyphosphate	
Turbifying agents, e.g.,	
Polystyrene resin	
Polyacrylate resin	
Tetra sodium pyrophosphate	
2,2' Thiobis (4,6 dichlorphenol)	
Tris(hydroxymethyl)nitromethane	0.1-0.5%
Versene	
Zinc chloride*	

*Starred ingredients(*) may be responsible for major toxic effects.

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