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U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
CENTER FOR DISEASE CONTROL
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
CINCINNATI, OHIO 45226

HEALTH HAZARD EVALUATION DETERMINATION REPORT NO. 78-96-595
SAMSONITE INC.
DENVER, COLORADO
MAY 1979

1. TOXICITY DETERMINATION

It has been determined that:

1) The repairmen on assemby line #9 were exposed to potentially toxic airborn concentrations of 1,1,1-trichloroethane. This is based on environmental data that showed the air concentration was at least two times the 15-minute evaluation criterion and 1.4 times the eight-hour time-weighted average OSHA standard.

2) The painter in the powdered paint room was exposed to potentially toxic concentrations of powdered paint. This is based on environmental samples that showed air concentrations of powdered paint that were 1.5 times the evaluation criterion. The painter wore a disposable dust respirator.

3) The hardware maintenance welder was exposed to potentially toxic concentrations of welding fumes. This is based on sample results which showed that on one day he was exposed to an airborne nickel concentration that was 6.5 times the NIOSH recommended criterion, and on the following day to an airborne zinc oxide concentration that was 1.7 times the evaluation criterion and a total particulate concentration that was 2.7 times the evaluation criterion.

4) All other environmental airborne concentrations for materials sampled were less than their corresponding evaluation criteria.

5) On the basis of employee interviews, skin examinations, and observation of production processes and work practices, it appears that a substantial proportion, probably a majority, of subassembly and putty and file employees have had a work-related rash, primarily during hot weather. In the putty and file departments, the cured epoxy resin dust generated by filing operations appears to be a more likely cause of rash than does the uncured resin or other constituents of the resin system. The rash is more likely an irritant contact dermatitis than an allergic phenomenon. The cause(s) of rashes in the subassembly department could not be determined; it is unlikely that nickel dermatitis accounted for most of the cases, but residual chromates on the plated parts may have been involved in some cases.

II. DISTRIBUTION AND AVAILABILITY OF DETERMINATION REPORT

Copies of this complete Determiniation Report are currently available upon request from NIOSH, Division of Technical Services, Information Resources and Dissemination Section, 4676 Columbia Parkway, Cincinnati, Ohio 45226. After ninety days, the report will be available through the National Technical Information Service (NTIS), Springfield, Virginia. Information regarding its availability through NTIS can be obtained from NIOSH, Publications Office at the Cincinnati address.

Copies of this report have been sent to:

1. Samsonite Inc., Denver, Colorado
2. United Rubber Workers Local Union 724, Denver, Colorado
3. United Rubber, Cork, Linoleum and Plastic Workers of America Akron, Ohio
4. U.S. Department of Labor, Occupational Safety and Health Agency (OSHA), Region VIII, Denver, Colorado

For the purpose of informing the approximately 175 affected employees, the employer shall promptly post this Determination Report in a prominent place(s), near the work area of the affected employees for a period of 30 calendar days.

III. INTRODUCTION

Section 20(a)(6) of the Occupational Safety and Health Act of 1970, 29 U.S.C. 669(a)(6), authorizes the Secretary of Health, Education, and Welfare, following receipt of a written request from any employer or authorized representative of employees, to determine whether any substance normally found in the place of employment has potentially toxic effects in such concentrations as used or found.

The National Institute for Occupational Safety and Health received such a request from a representative of the employees to determine if the various chemicals present in ten specific areas at Samsonite Inc. are toxic as used or found. The chemicals involved in each area are:

1) Assembly line #9 - toluene and 1,1,1-trichloroethane;
2) Powdered paint room - powdered paint;
3) Tool and die area - total particulates;
4) Bright dip area (frame cleaning department) - nitrogen dioxide, chromic acid and phosporic acid;

5) Plating department - iron, nickel and zinc;

6) Hardware maintenance - welding fumes, iron oxide, zinc oxide, cadmium, nickel and copper;

7) Hardware plant casting - aluminum, magnesium, total particulates, chlorides, fluorides and chlorine;

8) Hardware subassembly - skin contact with nickel and chrome plated parts;

9) Putty and file department - skin contact with epoxy resins;

10) Buffing department - skin contact with plated parts and polishing rouge.

IV. HEALTH HAZARD EVALUATION

A. Description of Process

The Samsonite Corporation manufactures suitcases and briefcases. The operations involved in this request are a portion of the total effort in the manufacturing process.

1. Assembly Line #9 repair - As the completed cases reach the end of the assembly line, they are inspected, minor repairs made and black marks cleaned off. The cleaning solvent, 1,1,1-trichloroethane, is applied to a cleaning cloth with a plunger container. The repairman then wipes the case with the cloth containing the solvent.

2. Powdered Paint Operation. The metal frames for certain suitcase designs are painted. The painting is conducted in an enclosed room that contains a ventilated booth. The parts pass through the spray booth on a conveyor. The painter sprays the frames with a dry powdered paint as they pass by. The painter wears a NIOSH approved disposable dust respirator.

3. Tool and die Area. The tool and die shop produces tools and dies used in various plant equipment. These tools and dies require one or more machining operations. The workers in this area are concerned about the powdered paint that may drift over from the nearby painting operation.

4. Bright Dip Area (Department 18). The metal suitcase frames are bright-dipped. They are attached to an overhead conveyor and automatically pass through solutions of chromic acid, phosphoric acid and nitric acid. One operator works in this area.

5. Plating (Department 96). The barrel plating operations of the plating department are involved in this request. Small unassembled stamped metal parts are plated with chrome or nickel using barrel plating techniques. The process involves cleaning, plating and the application of a rust inhibitor. There are two employees per shift conducting this operation.

6. Hardware Subassembly (Department 97). Finished parts, such as locks and catches, are assembled from small parts that may have been top-plated with either chrome or nickel. There are about 100 employees in this department.

7. Buffing (Department 95). Stamped metal parts, which have been chrome- or nickel-plated, are buffed using a polishing rouge on a buffing wheel. There are five employees doing the buffing.

8. Putty and File (Department 94). Defects in cast metal suitcase frames are filled with a two-part, high-temperature-cure resin. After the resin is cured, the metal and resin are filed and sanded. There are thirty-two employees in this department.

9. Welding, Hardware Maintenance. There is one employee who does maintenance welding. Welding is conducted in the shop and also on site in the factory. Various metals are welded and brazed. They include mild steel, stainless steel, galvanized steel and others. On occasion, he will silver-solder.

10. Hardware Plant Casting. Metal suitcase frames are die-cast with a magnesium-aluminum alloy. Molten metal is injected into the die, cooled and removed. The melting pot, containing the molten alloy and the fluxes, is located next to the casting unit. There are four casting units in the area.

B. Evaluation Design and Progress

1. General

An initial survey was conducted June 16, 1978. An environmental-medical survey was conducted on August 30 and 31, 1978. An interim medical report was sent to the company and the union in January 1979, and an interim environmental report in March 1979.

2. Environmental Air Sampling

The sampling was designed to determine the workers' eight-hour time-weighted average exposure to the various airborne materials present. The sampling was accomplished by placing the collection

device in the breathing zone (BZ) of the worker (attached to the shirt lapel) and connecting the device to a small battery-operated pump attached to the belt. Where this could not be accomplished, the collection devices were placed in the general area (GA) where the employee worked.

3. Medical

As a result of the findings of the initial survey, the medical investigation focused on dermatologic problems among employees in the putty and file department and the subassembly department. Also included, in a less formal manner, were dermatologic and other medical problems among employees in the buffing, plating, and paint departments, the foundry, and the tool and die shop.

C. Evaluation Methods

1. Environmental - the air sampling and analysis methodolgy is shown in Table 1.

2. Medical

The medical investigation included the following activities:

a. Private interviews with employees, including (a) systematic samples of employees in the putty and file and subassembly departments, and (b) several employees from these and other departments who requested interviews or were named by others as having pertinent information. Also interviewed were some employees encountered during a walk-through survey of the plant.

The sample of subassembly employees was obtained by choosing from a seniority list of employees present on the day of the interviews a random starting position among the first five employees on the list and selecting this person and every fifth person thereafter (without recycling through the list). The sample of putty and file employees was obtained by choosing from an alphabetical list of employees present on the day of the study a random starting position from among the first 3 employees on the list and selecting this person and every third person thereafter (without recycling through the list). (A seniority list was used in one department, and an alphabetical list in the other, because these happened to be the employee lists available. The samples were intended to be of sufficient size to qualitatively assess the prevalence of dermatologic

problems; they were not designed to be quantitatively representative in the statistical sense).

b. Examination of (a) the "exposed" skin - hands, arms, face and neck - of almost all employees interviewed, and (b) examination of the eyes, nasal mucosa, mouth, and/or "unexposed" areas of skin of those employees who reported a problem affecting these areas.

c. Review of company medical records of those employees whose interviews suggested that the records might contain additional relevant information.

d. Observation of production processes and work practices.

D. Evaluation Criteria

1. Environmental - the environmental criteria used in this evaluation are listed in Table 2.

2. Medical - the primary health effects are shown in Table 2.

E. Evaluation Results and Discussion

1. Environmental

a. Assembly Line #9. There were eight samples for toluene and 1,1,1-trichloroethane collected in the breathing zone of the repairmen. This resulted in 4 eight-hour time-weighted average (TWA) samples. These results are shown in Table 3. All the toluene concentrations were extremely low (2% or less of the evaluation criterion). The evaluation criterion for 1,1,1-trichloethane is a 350 ppm ceiling for any fifteen-minute period. One sample showed a minimum average of 756 ppm for 258 minutes. Since breakthrough occurred on this sample, the actual concentration was higher than 756 ppm. During the afternoon, this person's exposure dropped to 59 ppm. The eight-hour TWA exposure was at least 496 ppm or 1.4 times the eight-hour TWA OSHA standard. On the next day, another employee's exposure was 238 ppm or 68% of the criterion. The other individual on the two days had exposures that were 26% or less than the evaluation criterion. It was noted that the two highest exposures were not to the same individual.

The exposure can be lowered by eliminating or greatly reducing the use of 1,1,1-trichloroethane. It was noted that this assembly

line had a black conveyor belt which left black marks on the cases. The black marks were cleaned off with solvent. The other lines use colored conveyor belts which do not leave marks on the cases that require cleaning. It is recommended that the black conveyor belt be replaced with a colored belt.

Until the use of 1,1,1-trichloroethane is decreased or engineering controls (e.g. local exhaust ventilation) or other controls installed, the repairmen should wear NIOSH-approved respirators for use with organic solvents.

b. Powdered Paint Room. There were three samples collected for total particulates in the breathing zone of the painters. The results are shown in Table 4. The powdered paint that is used is a mixture of titanium dioxide, calcium carbonate and polyester resin. The evaluation criterion applied was that of nuisance dust (10 mg/cu m). The concentration on one day was 1.5 times this criterion and the next day, the exposures were 72% and 66% of the criterion. The painter was wearing a disposable paper respirator. It is recommended that the painter be provided with and wear a supplied-air hood. This will provide complete respiratory protection as well as eye protection.

This evaluation did not address the potential safety and fire problems associated with this type of process.

c. Tool and Die Area. The tool and die area is near the powdered paint room. Four breathing zone samples were collected on employees in the tool and die area to determine if there was much powdered paint drifting into their area. The results are shown in Table 4. The leadman had a total particulate exposure of 0.07 mg/cu m. This amount is about what one would find as a background level in any area of the plant. The three machinists sampled were exposed to 0.27, 0.61 and 0.69 mg/cu m of total particulates. The evaluation criterion applied here is 10 mg/cu m. The samples were all 7% of less than this value. The machinists' exposures were all higher than the leadman's. Since they are all in the same area, the additional exposure to airborne particulates that the machinists have, could originate from operations in the tool and die area.

d. Bright Dip Area (Department 18). The following samples were collected in the bright dip area: three for chromic acid (1 BZ and 2GA), two for phosphoric acid (1 BZ and 1 GA) and six for nitrogen dioxide (2 BZ and 4 GA). The results are shown in Tables 5 and 6. The chromic acid samples contained less than 0.04 ug/sample or less than 0.001 mg/cu m, which is far less

than the evaluation criterion of 0.05 mg/cu m. The phosphoric acid concentrations were 0.007 and 0.023 mg/cu m, which are less than 5% of the evaluation criterion of 5 mg/cu m. Nitrogen dioxide was visible at the point where the conveyor removes the parts from the nitric acid. The samples show that nitrogen dioxide does reach the breathing zone of the operator, as his exposure was 0.16 ppm on his right side and 0.11 ppm on his left side. These concentrations are less than 16% of the evaluation criterion of 1 ppm. A general area sample attached to the top of the conveyor showed a concentration at that point of 0.39 ppm Since the operation is continuous and the operator moves about the entire area, it is unlikely that the ceiling value of 1 ppm for a fifteen minute period would be exceeded.

e. Plating (Department 96). Four samples for iron, nickel and zinc were collected in the barrel-plating operations of the plating department. The results are shown in Table 7. Two were in the breathing zone of the barrel plater and two were by the nickel-iron tank. The iron and zinc air concentrations in the barrel plater's breathing zone were all less than 1% of the evaluation criteria for iron and zinc. His exposure to nickel on two days was 9.3 and 8.3 ug/cu m of air. These concentrations are 62 and 55% of the nickel evaluation criterion of 15 ug/cu m. A sample taken directly above the edge of the nickel-iron tank was 168 ug/cu m which indicates that nickel is being emitted from this tank. This tank is not equipped with local exhaust ventilation. Because nickel may cause nasal or lung cancer, this tank should be equipped with a local exhaust system.

Some tanks in the barrel-plating area are equipped with local exhaust ventilation; however, measurements taken indicated that the ventilation rates are less than those listed in the OSHA Standards (1910.94d) for open-surface tanks. Smoke-tube tests confirmed that the current ventilation rates are not adequate to capture the vapors and gases emitted from these tanks. A spot-cooling fan was in use near one of the ventilated tanks. The air from the fan was blowing directly across the tank surface, rendering the exhaust system ineffective. Fans should not be used near these tanks as any draft affects the efficiency of the ventilation system.

f. Hardware Subassembly (Department 97). Environmental air samples were not collected. The employees in this department handle small parts that have been chrome-or nickel-plated. A quantity of these parts were removed from parts storage, rinsed with water, and the water was then analyzed for either chromium VI or nickel. The results are shown in Table 8. Small amounts of chromium VI and nickel were present in the rinse water.

A more complete rinse or the use of rinsing aids, such as ultrasonic devices, may aid in a more complete removal of the residual chromium VI and nickel.

g. Buffing (Department 95). Environmental air samples were not collected. Protective coverings such as arm gauntlets and gloves will aid in preventing skin contact with the plated parts and the buffing rouge.

h. Putty and File Department (Department 94). Environmental air samples were not collected. Rubber gloves and impervious clothing that cover the arms will aid in reducing skin contact with resin and filing dust. Skin should be washed immediately after contact with the resin. At the time of this survey, there were no hand-washing facilities in the putty and file area. Several hand-washing facilities should be installed in this area. The best method for controlling these problems is to eliminate or reduce the amount of defects in the frames. The company should determine the cause of the defects and correct the problems at that point.

i. Welding, Hardware Maintenance. Environmental air samples were collected under the welding hood in the breathing zone of the welder on two days. The results are shown in Table 9. The welder does maintenance welding as opposed to production welding; therefore, the type of metal welded and welding rods used vary from day to day. On August 30, he welded mild and stainless steel. The total particulate air concentration was 2.69 mg/cu m, which is 54% of the evaluation criterion. The iron oxide and copper fumes were 13% of the criteria. The nickel airborne concentration was 0.098 mg/cu m, which is 6.5 times the NIOSH recommended criterion of 0.015 mg/cu m. On August 31, while welding mild and galvanized steel, the total particulate air concentration was 13.7 mg/cu m, which is 2.75 times the evaluation criterion of 5 mg/cu m, the iron oxide concentration was 31% of the criterion, and the zinc oxide air concentration was 8.55 mg/cu m, which exceeded the zinc oxide criterion of 5 mg/cu m by 1.7 times.

Some of the welding is conducted in the shop, while the remainder is done in the factory. A local exhaust system should be installed in the maintenance shop and a portable system used when welding in the factory. When local exhaust ventilation cannot be utilized, the welder should wear a respirator approved for use with fumes of the metal to be welded. There are respirators available that fit under the welding helmet.

j. Hardware Plant Casting. Air samples were collected in the casting operation for aluminum, magnesium, total particulates,

chlorine, fluorides and total chlorides. The sample results are shown in Tables 10, 11 and 12. The total particulates consisted of aluminum fume, magnesium fume, potassium chloride and magnesium chloride, all of which have evaluation criteria of 10 mg/cu m. The four samples collected in the breathing zone of the casters showed the total particulate concentrations were 1.82 mg/cu m or less, which is 18% or less than the evaluation criterion of 10 mg/cu m. Chlorine and fluorides were not detectable in the area. Four general area samples were collected for total chlorides. As chlorides they were 3.47 mg/cu m or less. Calculated as potassium chloride, they were 7.82 mg/cu m or less, and calculated as magnesium chloride they were 5.85 mg/cu m or less, all of which are less than than the criterion of 10 mg/cu m.

On August 30, three of the exhaust ducts were disconnected from the casting units. They have to be connected for the fumes to be drawn off the units during casting. The ventilation rates should be measured and checked against original design specification. The ventilation systems on the melting pots do not adequately capture the fumes being emitted from the pots. Enclosures are presently being constructed and are scheduled to be installed by September 1979.

2. Medical

a. Results

Table 13 enumerates the various employees interviewed.

All 12 subassembly employees in the selected sample were women; 11 were white, one was black. Age and seniority data are presented in Table 14. Five of the 6 putty and file employees in the selected sample were women; all 6 were white. Age and seniroity data are presented in Table 15.

Six (50%) of the 12 subassembly employees in the selected sample reported a dermatologic disorder,* as did 4 (67%)of the putty

*For the remainder of this report the common term "rash" will be used to signify any dermatologic disorder.

and file employees in the selected sample. In the subassembly department the employees who had a rash were comparable to those who did not with respect to age and time at the company, but tended to have been in the department longer. In contrast, the putty and file employees with and without a rash tended to have comparable departmental and company seniority, but those who had a rash were younger than those who didn't. However, this difference may be an artifact of the limited number of employees without dermatitis (2) in the sample.

In the putty and file department employees tended to describe their rashes similarly. All 4 cases from the selected sample consisted of erythema (redness) and papules (small, solid bumps) on the arms, without involvement of the hands; in 3 cases the face or neck was involved at least some of the time. In 3 of the 4 cases itching usually accompanied the rash. The rash developed 5 weeks to 3 months after being in the department, cleared up after 2 days to one week of absence, and recurred within 3 or 4 days after returning. There was general agreement that hot weather aggravated the problem, but no consensus on whether long sleeves had a protective effect. None of the sampled employees had a rash on the day of the interviews.

Of the 4 other putty and file employees interviewed, all women, 3 reported a rash similar to that of the employees in the selected sample. Two of these also reported nasal congestion that they associated with their work. Only one of the 3, an employee who had recently transferred out of the department, had any observable dermatologic abnormalties: several solitary excoriations (sores caused by, or further damaged by, scratching or picking) and scars on her arms.

In the subassembly department the descriptions of the rash were less consistent than in the putty and file department. In 4 of 6 cases from the selected sample there was erythema, but in only 2 of these were there papules. Five of the 6 cases involved arms and/or wrists; hands were involved in 2 of the 5. In the sixth case the hands, but not the arms, were involved. In this case, and in one other, the face or neck was also involved. There was itching in 5 of the 6 cases, and in the remaining one there was a burning sensation. The rash developed 3 weeks to 3 years after being in the department. Information on the time required for the rash to clear up was inadvertently not obtained. Based on information from 3 affected employees, the rash recurs within one day after returning to work. No consistent relationship between occurrence of the rash and either hot weather or a specific subassembly operation was apparent. Excluding a black discoloration of the hands that results from

handling small metal parts, there were dermatologic abnormalties in 2 of the 6 affected employees: one had erythema of one wrist, and the other had a few red macules (flat lesions that can be seen but not felt) on one wrist.

Of the 5 other subassembly employees interviewed, 4 had a rash, and the other had eye and nasal irritation. The rashes were similar to those of the employees in the selected sample, but in 3 of the 4 cases the onset did not occur until the employee had been in the department at least 10 years. One of these 5 employees, but none of the subassembly employees in the selected sample, reported a dermatologic reaction to jewelry (much of which presumably contains nickel). This reaction consists of erythema only and is similar to the rash she gets at work, except that the work-associated rash itches, whereas the jewelry-associated rash does not.

Two buffing department employees were interviewed. Both were women in their 40's; both worked with polishing rouge. One reported erythematous macules of the arm with which she holds the rouge. The rash, which began after she worked at the job for a year, does not affect her hand; she wears a glove when holding the rouge. The other reported erythematous, coalescent papules on both hands and arms; the rash has occurred intermittently for several years. Neither had any dermatologic abnormalities at the time of the interview.

Nine other employees, in 4 other departments, were interviewed; 7 had one or more of a variety of medical problems, 1 of which was primarily dermatologic but dissimilar to those already described. Four of the other 6 had obvious potential occupational exposures to various substances in the foundry, plating, or paint departments that might account for their symptoms. The other two, employees in the tool and die shop, had redness and irritation of their eyes; the cause was not apparent, although vapors escaping from the paint room are a speculative explanation.

b. Discussion

To the extent that the selected samples represented their respective departments, it would appear that at least half of the subassembly and the putty and file employees had a rash in the recent past. Although the incidence or prevalence of rash in the population from which the employees come is not known, it would not likely be high enough to account for the high rate of reported rashes in these departments, especially since many of the cases seem to have similar features, more notably in the putty and file department.

Neither the medical nor temporal characteristics of the subassembly employees' rashes, nor their work activities or environment, suggest a likely explanation of the rashes. Nickel dermatitis was considered because employees handle metal parts containing nickel. However, since only one employee - who was not among the selected sample - reported a dermatologic reaction to jewelry, nickel is probably not the cause of the general problem. Allergic chromate dermatitis does not occur if contact with chromium is limited to metallic chrome or chrome alloys,[12] but could possibly result from residual soluble chromates on inadequately rinsed parts. However, the reported appearance of the rash and its distribution, frequently sparing the unprotected hands, is not suggestive of the irritant effects of chromates. Substances on the surface of the parts received in the subassembly department could conceivably cause dermatitis, but the data from the employees is not particularly suggestive of either irritant or allergic contact dermatitis.[13]

The only apparent cause of dermatitis in the putty and file department was the epoxy resin used to repair defects in the magnesium luggage frames. The distribution of the rashes, especially the absence of involvement of the hands, and the employees' work practices suggest that the rashes are more likely due to the cured resin dust generated by filing than to the uncured resin or other constituents of the resin system. The temporal characteristics of the occurrence of the rash are more suggestive of an allergic than an irritant contact dermatitis, but the high attack rate makes an allergic phenomenon less likely. Moreover, the reported appearance of the rashes is not characteristic of a recurrent allergic dermatitis.

Since dermatologic abnormalities were infrequently observed at the time of the medical investigation, when weather conditions were mild, but were reported by many affected employees to be more prevalent during hot weather (a claim consistent with the NIOSH industrial hygienist's observations at the time of the initial survey), heat and/or humidity apparently play an important role. In fact, some case descriptions were consistent with miliaria (prickly heat), but it does not seem likely that this could explain the majority of cases.

F. Summary and Conclusions

1. The repairmen on Assembly Line #9 were exposed to potentially toxic airborne concentrations of 1,1,1-trichloroethane. This

is based on environmental data that showed the air concentration was at least two times the fifteen minute evaluation criterion and 1.4 times the eight-hour time-weighted average OSHA standard.

2. The painter in the powdered paint room was exposed to potentially toxic concentrations of powdered paint. This is based on environmental samples that showed air concentrations of powdered paint that were 1.5 times the evaluation criterion. The painter wore a disposable dust respirator.

3. The hardware maintenance welder was exposed to potentially toxic concentrations of welding fumes. This is based on sample results which showed that on one day he was exposed to an airborne nickel concentration that was 6.5 times the NIOSH recommended criterion, and on the following day to an airborne zinc oxide concentration that was 1.7 times the evaluation criterion and a total particulate concentration that was 2.74 times the evaluation criterion.

4. All other environmental airborne concentrations for materials sampled were less than their corresponding evaluation criteria.

5. On the basis of interviews with a selected sample of subassembly employees and putty and file employees, half of the employees in these departments have had a rash with a suspected occupational etiology. The occurrence of rashes appears to be greater in hot weather. The cured epoxy resin dust generated by filing operations in the putty and file department may be a cause of rash in that department's employees, and unique exposures seem to be the cause of a few unrelated rashes and other medical problems of employees in other departments, but the cause(s) of the rashes among subassembly employees could not be identified.

G. Recommendations

1. 1,1,1-trichloroethane is used by the repairmen in Assembly Line #9 to clean black marks off the suitcases. All assembly lines do not have this problem with black marks. These lines have colored conveyor belts, while assembly line #9 has a black belt. Changing to a colored belt on Assembly Line #9 could prevent black marks on the cases, hence the use of cleaning solvent could be discontinued or greatly reduced.

Until the use of 1,1,1-trichloroethane is decreased or engineering controls (e.g. local exhaust ventilation) or other controls installed, the repairmen should wear NIOSH-approved respirators for use with organic solvents.

2. The painter in the powdered paint room should wear a supplied-air hood. This would provide both eye and respiratory protection.

3. Barrel-plating area:

a. Local exhaust ventilation should be installed on the nickel-iron tank.

b. The ventilation rates should be checked on all the hoods and increased to the ventilation rates specified in the OSHA standards 1910.94d.

c. All the slots of the existing tank-exhaust hoods should be cleaned and maintained in a clean condition.

d. The slots on the existing lateral exhaust systems are five inches above the tanks. Smoke tube tests showed air coming from under the ventilation system. Baffles placed between the slots and the tanks will minimize this effect.

e. All tanks should be labeled as to their contents.

f. Spot-cooling fans should not be placed so that the air blows across the plating tanks.

4. Although the cause(s) of the rashes among subassembly employees was not determined, residual chromates on the on the plated parts may have been involved in some cases. Therefore, the parts should be thoroughly rinsed before delivery to the subassembly department.

5. Protective arm covers and gloves should be worn by the buffers in the buffing department.

6. Putty and file department.

a. Several hand-washing facilities should be installed in the putty and file department. The soap used should be non-abrasive. Resin contacting the skin should be washed off immediately. All employees should wash their arms and hands at breaks before lunch and before they leave work at the end of ths shift.

b. Rubber gloves with cotton liners should be worn by the workers who work with the uncured resin.

c. The workers should wear long-sleeve shirts or blouses or gauntlets. Disposable paper smocks would work well.

d. All personal clothing should be changed and washed daily.

e. The metal dust should be vacuumed off the tables in lieu of sweeping or blowing with compressed air.

7. Welding, hardware maintenance

a. A permanent or portable local exhaust ventilation system should be used when welding in the shop.

b. A portable local exhaust ventilation system should be used when welding in the factory.

c. When local exhaust ventilation is not used when welding, the welder should wear a respirator approved for use with the fumes of the metals to be welded.

8. Hardware plant casting

a. All the exhaust ventilation ductwork has to be connected to the casting unit whenever the casting unit is in operation.

b. The ventilation rates for each system should be measured on a regular basis and appropriate maintenance performed.

c. Install the new gas domes for the melting pots as presently planned.

9. For areas where respirators are used, a respirator program that includes such items as maintenance, fitting, cleaning, etc. should be in effect. This program must meet the OSHA standards for respirator programs.

10. The company should retain a dermatologist, preferably someone with an interest in occupational dermatology, to evaluate cases of suspected occupational skin disorders and to advise the company on potential dermatologic hazards.

REFERANCES

1. Threshold Limit Values for Chemical Substances and Physical Agents in the Workroom Environment for 1978. American Conference of Governmental Industrial Hygienists (ACGIH).

2. NIOSH Criteria for a Recommended Standard... Occupational Exposure to Cadmium. HEW Publication (NIOSH) 76-192.

3. NIOSH Criteria for a Recommended Standard...Occupational Exposure to Chlorine. HEW Publication (NIOSH) 76-170.

4. NIOSH Criteria for a Recommended Standard...Occupational Exposure to Chromic Acid. HEW Publication (HSM) 73-11021.

5. OSHA-U.S. Department of Labor, Code of Federal Regulations Dated July 1975, Part 1910, Title 29, Chapter XVII, Subpart 2, Tables Z-1, Z-2 and Z-3.

6. NIOSH Criteria for a Recommended Standard...Occupational Exposure to Inorganic Fluorides. HEW Publication (NIOSH) 76-103

7. NIOSH Criteria for a Recommended Standard...Occupational Exposure to Inorganic Nickel. HEW Publication (NIOSH) 77-164.

8. NIOSH Criteria for a Recommended Standard...Occupational Exposure to Oxides of Nitrogen. HEW Publication (NIOSH) 76-149.

9. NIOSH Criteria for a Recommended Standard...Occupational Exposure to Toluene. HEW Publication (NIOSH) 73-11023.

10. NIOSH Criteria for a Recommended Standard...Occupational Exposure to 1,1,1-Trichloroethane. HEW Publication (NIOSH) 76-184.

11. NIOSH Criteria for a Recommended Standard...Occupational Exposure to Zinc Oxide. HEW Publication (NIOSH) 76-104.

12. Fisher AA: Contact Dermatitis, Philadelphia, Lea and Febiger, 1973, pp 103-104

13. Ibid., p 3

14. NIOSH: Occupational Diseases: A Guide to Their Recognition, DHEW Publication No. 77-181, 1977.

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TABLE 1

AIR SAMPLING AND ANALYSIS METHODOLOGY

SAMSONITE INC.
DENVER, COLORADO
HHE 78-96

SUBSTANCE	COLLECTION DEVICE	FLOW RATE	ANALYSIS	DETECTION LIMIT	REFERENCE
Aluminum	Filter (1)	1.5 lpm	Atomic Absorption	15 ug/sample	NIOSH[3] P&CAM 173
Cadmium	Filter (1)	1.5 lpm	Atomic Absorption	2 ug/sample	NIOSH P&CAM 173
Chlorides	Impinger (Acetate buffer solution)	1.0 lpm	Selective Ion Electrode	2 ug/ml	NIOSH P&CAM 115
Chlorine	Detector Tubes	-	Direct Reading	0.05 ppm	-
Chromic Acid (as Chromium Trioxide)	Filter (1)	1.5 lpm	Colorimetry	0.04 ug/sample	NIOSH P&CAM 169
Copper Fume	Filter (1)	1.5 lpm	Atomic Absorption	2 ug/sample	NIOSH P&CAM 173
Fluorides	Treated Filter	1.5 lpm	Selective Ion Electrode	5 ug/sample	NIOSH P&CAM 212
Iron Oxide	Filter (1)	1.5 lpm	Atomic Absorption	3 ug/sample	NIOSH P&CAM 173
Magnesium Oxide	Filter (1)	1.5 lpm	Atomic Absorption	6 ug/sample	NIOSH P&CAM 173
Nickel	Filter (1)	1.5 lpm	Atomic Absorption	3 ug/sample	NIOSH P&CAM 173
Nitrogen Dioxide	Triethanolamine treated stainless steel screens	passive	Colorimetry	50 ng/sample	AIHA Journal Vol. 37 #10 Oct. 1976
Nuisance Particles	Filter (2)	1.5 lpm	Total Weight	0.01 mg/sample	-
Phosphoric Acid	Filter (1)	1.5 lpm	Colorimetry	1 ug/sample	NIOSH P&CAM 216
Powdered Paint	Filter (2)	1.5 lpm	Total Weight	0.01 mg/sample	-
Toluene	Charcoal Tube (150 mg)	30-50 cc/min.	Gas Chromatography	0.01 mg/sample	NIOSH P&CAM 343
1,1,1-Trichloroethane	Charcoal Tube (150 mg)	30-50 cc/min.	Gas Chromatography	0.01 mg/sample	NIOSH P&CAM 328
Welding Fume	Filter (2)	1.5 lpm	Total Weight (see also individual components)	0.01 mg/sample	-
Zinc Oxide	Filter (1)	1.5 lpm	Atomic Absorption	2 ug/sample	NIOSH P&CAM 173

1. Cellulose ester membrane filter
2. PVC filter
3. *NIOSH Manual of Analytical Methods* HEW Publication (NIOSH) 77-157A

TABLE 2

ENVIRONMENTAL EVALUATION CRITERIA

SAMSONITE INC.
DENVER, COLORADO

HHE 78-96

SUBSTANCE	RECOMMENDED ENVIRONMENTAL LIMIT	SOURCE	OSHA STANDARD	PRIMARY HEALTH EFFECTS
Aluminum (Nuisance particles)	10 mg/cu m*	ACGIH (Ref 1)	15 mg/cu m	Necrosis of cornea
Cadmium	0.04 mg/cu m 0.2 mg/cu m ceiling for any 15 minute period.	NIOSH (Ref 2)	0.1 mg/cu m	Respiratory tract irritation, cough, chest pain, chills, shortness of breath, pulmonary edema, emphysema, kidney damage, anemia.
Chlorides (Potassium and Magnesium Chlorides) See Nuisance Particles				See Nuisance Particles.
Chlorine	0.5 ppm** for any 15 min. period	NIOSH (Ref 3)	1 ppm	Irritation of skin, eyes, and respiratory tract; cough, choking, shortness of breath, pulmonary edema, tracheobronchitis.
Chromic Acid (as chromium trioxide)	0.05 mg/cu m 0.1 mg/cu m ceiling for any 15 min. period	NIOSH (Ref 4)	0.5 mg/cu m as chromium	Skin, eye, and respiratory tract irritation; skin and pulmonary allergic sensitization.
Copper Fume	0.1 mg/cu m	OSHA (Ref 5)	0.1 mg/cu m	Metal fume fever (see zinc oxide); skin and eye irritation.
Fluoride	2.5 mg/cu m	NIOSH (Ref 6)	2.5 mg/cu m	Bone changes (osteosclerosis)
Iron Oxide	10 mg/cu m	OSHA (Ref 5)	10 mg/cu m	Iron deposits in lungs (siderosis) not known to be harmful.
Magnesium Oxide Fume	10 mg/cu m	ACGIH Ref 1)	15 mg/cu m	Metal fume fever (see zinc oxide)
Nickel	0.015 mg/cu m	NIOSH (Ref 7)	1 mg/cu m	Allergic dermatitis; cancer of lung and nasal passages.

(continued on next page)

TABLE 2
(continued)
ENVIRONMENTAL EVALUATION CRITERIA

SAMSONITE INC.
DENVER, COLORADO

HHE 78-96

SUBSTANCE	RECOMMENDED ENVIRONMENTAL LIMIT	SOURCE	OSHA STANDARD	PRIMARY HEALTH EFFECTS
Nitrogen Dioxide	1 ppm ceiling conc. for any 15 min. period	NIOSH (Ref 8)	5 ppm	Eye and respiratory tract irritation; pulmonary edema
Nuisance Particles	10 mg/cu m	ACGIH (Ref 1)	15 mg/cu m	Chronic bronchitis
Phosphoric Acid	1 mg/cu m*	OSHA (Ref 5)	1 mg/cu m	Irritation of skin, eyes, and respiratory tract; pulmonary edema, bronchitis
Powdered Paint (Mixture of titanium dioxide, calcium carbonate, polyester resin. Classified as nuisance dust)	10 mg/cu m	ACGIH (Ref 1)	15 mg/cu m	See nuisance particles
Toluene	100 ppm**	NIOSH (Ref 9)	200 ppm	Skin, eye and respiratory tract irritation; dermatitis; headache, dizziness, fatigue, weakness, drowsiness, incoordination.
1,1,1-Trichloroethane	350 ppm ceiling for any 15 min. period	NIOSH (Ref 10)	350 ppm	Eye irritation, dermatitis, dizziness, incoordination, drowsiness
Welding Fume	5 mg/cu m	ACGIH (Ref 1)	standards are for individual components of the fume	Effect depends on the composition of fume (see zinc oxide cadmium)
Zinc Oxide	5 mg/cu m 15 mg/cu m ceiling conc. for any 15 min. period	NIOSH (Ref 11)	5 mg/cu m	Metal fume fever (cough, shortness of breath, weakness, fatigue, muscle and joint pain, fever, chills, sweats)

* mg/cu m - milligrams of substance per cubic meter of air.
** ppm - parts of vapor or gas per million parts of air.

T A B L E 3

ASSEMBLY LINE # 9

TOLUENE AND 1,1,1-TRICHLOROETHANE AIR CONCENTRATIONS

SAMSONITE INC.
DENVER, COLORADO

HHE 78-96

SAMPLE LOCATION	DATE	SAMPLE NUMBER	SAMPLE TIME MINS.	SAMPLE VOL. LITERS	TOLUENE CONCENTRATION TWA* PPM**		1,1,1-TRICHLOROETHANE CONCENTRATION TWA PPM	
Breathing Zone (BZ) of repairman	8-30-78	30	263	12.66	0.5	> 0.8	88	> 93
	8-30-78	34	155	7.74	1.3		102	
BZ of repairman	8-30-78	31	258	10.90	1.3	> 1.1	756+	> 496
	8-30-78	33	160	6.50	0.8		59	
BZ of repairman	8-31-78	35	235	8.67	0.5	> 0.4	68	> 52
	8-31-78	37	215	7.53	0.3		34	
BZ of repairman	8-31-78	36	233	10.15	2.4	> 2.1	217	> 238
	8-31-78	38	215	6.53	1.6		272	

* TWA - Time Weighted Average

** PPM - Parts of vapor per million parts of air

\+ Breakthrough occurred on this sample, thus the actual exposure was higher than this value.

T A B L E 4

POWDERED PAINT ROOM AND TOOL AND DIE AREA
TOTAL PARTICULATE AIR CONCENTRATIONS

SAMSONITE INC.
DENVER, COLORADO

HHE 78-96

POWDERED PAINT ROOM

SAMPLE LOCATION	DATE	SAMPLE NUMBER	SAMPLE TIME MINS.	SAMPLE VOL. LITERS	TOTAL PARTICULATES mg/cu m*
BZ Painter	8-30-78	894	396	594	15.2
BZ Painter	8-31-78	889	442	663	7.2
BZ Painter	8-31-78	941	422	633	6.6

TOOL AND DIE AREA

SAMPLE LOCATION	DATE	SAMPLE NUMBER	SAMPLE TIME MINS.	SAMPLE VOL. LITERS	TOTAL PARTICULATES mg/cu m*
BZ Machinist	8-30-78	891	402	603	0.61
BZ Lead Man	8-30-78	948	404	606	0.07
BZ Machinist	8-31-78	921	445	667	0.69
BZ Machinist	8-31-78	907	445	667	0.27

* mg/cu m - milligrams of substance per cubic meter of air.

T A B L E 5

BRIGHT DIP AREA

CHROMIC ACID AND PHOSPHORIC ACID AIR CONCENTRATIONS

SAMSONITE INC.
DENVER, COLORADO

HHE 78-96

SAMPLE LOCATION	DATE	SAMPLE NUMBER	SAMPLE TIME MINS.	SAMPLE VOL. LITERS	CHROMIC ACID as CHROMIUM TRIOXIDE mg/cu m*	PHOSPHORIC ACID mg/cu m
GA Bright Dip area	8-30-78	937	404	606	< 0.001	-
GA Bright Dip area	8-31-78	1247	434	651	< 0.001	-
BZ Bright Dip operator	8-31-78	1237	417	625	< 0.001	-
BZ Bright Dip operator	8-30-78	1	378	567	-	0.007
GA Bright Dip area	8-31-78	5	434	651	-	0.023

* mg/cu m - milligrams of substance per cubic meter of air.

T A B L E 6

BRIGHT DIP AREA

NITROGEN DIOXIDE AIR CONCENTRATIONS

SAMSONITE INC.
DENVER, COLORADO

HHE 78-96

SAMPLE LOCATION	DATE	SAMPLE NUMBER	SAMPLE TIME MINS.	NITROGEN DIOXIDE PPM*
BZ Bright dip operator sampler on his right collar	1-3-79	1	365	0.16
BZ Bright dip operator sampler on his left collar	1-3-79	2	365	0.11
GA On rail about 4 ft. from operator	1-3-79	3	365	0.03
GA Above operator's head (on conveyor)	1-3-79	4	364	0.39
GA Next to eye wash fountain	1-3-79	5	363	0.03
GA Opposite side of bright dip	1-3-79	6	364	0.03

* Parts of vapor or gas per million parts of air.

TABLE 7

PLATING - DEPT. 96 - HARDWARE PLANT
IRON, NICKEL AND ZINC AIR CONCENTRATIONS

SAMSONITE INC.
DENVER, COLORADO

HHE 78-96

SAMPLE LOCATION	DATE	SAMPLE NUMBER	SAMPLE TIME MINS.	SAMPLE VOL. LITERS	IRON ug/cu m*	NICKEL ug/cu m	ZINC ug/cu m
BZ Barrel Plater	8-30-78	4	355	532	15	9.3	9
BZ Barrel Plater	8-31-78	12	402	603	15	8.3	13
GA By nickel-iron tank directly above edge of tank	8-30-78	3	385	577	31	168.0	4
GA by nickel-iron tank about 18" from edge of tank	8-31-78	13	434	651	15	9.2	3

* ug/cu m - micrograms of substance per cubic meter of air.

T A B L E 8

PLATING - DEPT. 96 - HARDWARE PLANT

LIQUID SAMPLES FOR PRESENCE OF CHROMIUM VI, NICKEL AND SODIUM

SAMSONITE INC.
DENVER, COLORADO

HHE 78-96

SAMPLE NUMBER	SAMPLE INFORMATION	CHROMIUM VI ug/ml*	NICKEL ug/ml	SODIUM ug/ml
1	Rinsed parts water.** Parts were plated in Cyclemaster #1 Nickel base plate, chrome top plate.	1.7	-	-
5	Rinsed parts water. Parts were plated in Cyclemaster #2. Nickel base plate, chrome top plate.	4.0	-	-
14	Cyclemaster #1, water from the last chrome rinse tank.	< 0.2	-	-
15	Cyclemaster #2, water from the last chrome rinse tank.	0.5	-	-
3	Rinsed parts water. Parts were plated in Cyclemaster #1. Nickel plate only.	-	0.5	-
7	Rinsed parts water. Parts were plated in Cyclemaster #2. Nickel plate only.	-	0.8	-
12	Water from last barrel plate rinse tank.	-	< 0.1	46
13	Drops of water from barrel plating drum as it was being removed from the rinse tank. Nickel-iron top plate plus rust inhibitor.***	-	2.1	1800
9	Rinsed parts water. Parts were plated in barrel plater. Nickel iron top plate plus rust inhibitor.	-	0.1	4
11	Tap water (blank)	< 0.2	< 0.1	4
	Limit of detection	0.2	0.1	0.04

* ug/ml - micrograms per milliliter of solution.
** Plated parts were removed from storage and rinsed with tap water.
*** Rust inhibitor consisted of sodium hydroxide and triethanolamine.

TABLE 9

HARDWARE MAINTENANCE
WELDING FUMES (IRON OXIDE, ZINC OXIDE, CADMIUM, NICKEL, COPPER, TOTAL PARTICULATES)
AIR CONCENTRATIONS

SAMSONITE INC.
DENVER, COLORADO

HHE 78-96

SAMPLE LOCATION	DATE	SAMPLE NUMBER	SAMPLE TIME MINS.	SAMPLE VOL. LITERS	IRON OXIDE mg/m^3	ZINC OXIDE mg/m^3*	CADMIUM mg/m^3	NICKEL mg/m^3	COPPER mg/m^3	TOTAL PARTICULATES mg/m^3
BZ welder (inside the helmet) welded mild steel, stainless steel.	8-30-78	905	360	540	1.27	0.01	< 0.004	0.098	0.013	2.69
BZ welder (inside the helmet) welded galvanized metal, mild steel, brass, silver soldered.	8-31-78	1257	320	480	3.14	8.55	< 0.005	< 0.007	0.010	13.74

* mg/m^3 - milligrams of substance per cubic meter of air.

T A B L E 1 0

HARDWARE PLANT CASTING

ALUMINUM, MAGNESIUM AND TOTAL PARTICULATES AIR CONCENTRATIONS

SAMSONITE INC.
DENVER, COLORADO
HHE 78-96

SAMPLE LOCATION	DATE	SAMPLE NUMBER	SAMPLE TIME MINS.	SAMPLE VOL. LITERS	ALUMINUM mg/cu m*	MAGNESIUM mg/cu m	TOTAL PARTICULATES mg/cu m
BZ Casting Machine Operator	8-30-78	952	365	547	< 0.03	0.04	0.68
BZ Casting Machine Operator	8-30-78	955	373	559	< 0.03	0.14	1.82
BZ Casting Machine Operator	8-31-78	1243	345	517	< 0.03	0.05	0.81
BZ Casting Machine Operator	8-31-78	1253	370	555	< 0.03	0.03	1.15

* mg/cu m - milligrams of substance per cubic meter of air.

T A B L E 1 1

HARDWARE PLANT CASTING

CHLORINE AIR CONCENTRATIONS

SAMSONITE INC.
DENVER, COLORADO

HHE 78-96

SAMPLE LOCATION	SAMPLE NUMBER	DATE	TIME	CHLORINE PPM*
Between #3 and 4 pots	1	8-30-78	10:45 am	ND
By #4 caster	2	8-30-78	1:15 pm	ND
By #3 caster	3	8-30-78	2:45 pm	ND
By #1 caster	4	8-31-78	9:30 am	ND
By #2 caster	5	8-31-78	11:00 am	ND
By #3 caster	6	8-31-78	1:30 pm	ND

* PPM - Parts of vapor or gas per million parts of air.

** ND - Non detectable - less than 0.1 PPM.

T A B L E 12

TOTAL CHLORIDE AND TOTAL FLUORIDE AIR CONCENTRATIONS

SAMSONITE INC.
DENVER, COLORADO

HHE 78-96

SAMPLE LOCATION	DATE	SAMPLE NUMBER	SAMPLE TIME MINS.	SAMPLE VOL. LITERS	TOTAL CHLORIDES* mg/cu m **	TOTAL FLUORIDE mg/cu m
GA Between #2 & 3 casting machines	8-30-78	1	280	280	3.47	-
GA Between #3 & 4 casting machines	8-30-78	2	280	280	2.64	-
GA By rear of #4 casting machine	8-31-78	3	390	390	3.26	-
GA By #2 pot	8-31-78	4	390	390	1.42	-
BZ Casting Machine Operator	8-30-78	12	372	558	-	< 0.01
GA By #2 pot	8-30-78	11	365	547	-	< 0.01
BZ Relief Caster	8-31-78	13	351	526	-	0.01
BZ Casting Machine Operator	8-31-78	14	360	540	-	< 0.01
BZ During Sludging of Pots	8-31-78	15	14	21	-	< 0.2

* The chlorides were potassium and magnesium chloride.

** mg/cu m - milligrams of substance per cubic meter of air.

T A B L E 13

SUMMARY OF EMPLOYEES INTERVIEWED

SAMSONITE CORPORATION
DENVER, COLORADO
HHE 78-96

August 1978

	Employees interviewed			
	Selected sample			
Department	No. selected	No. interviewed	Others	Total interviewed
Subassembly	12	12	5	17
Putty and file	7	6	4*	10
Buffing	--		2	2
Other - primary problem rash	--		1	1
Total	19	18	12	30
Other - rash not primarily problem	--		8	8

*Includes one employee who had recently transferred out of the department.

TABLE 14

SELECTED SAMPLE OF SUBASSEMBLY DEPARTMENT
EMPLOYEES: AGE AND SENIORITY DATA

SAMSONITE CORPORATION
DENVER, COLORADO
HHE 78-96

August 1978

Employees in department >1 week		70
Number absent		12
Leave of absence	4	
Vacation	4	
Absent for unknown reasons	4	
Present on day of study		58

Sample	
Number selected (% of employees present)	12 (21)
Number interviewed (% of sample)	12 (100)

Interviewed employees	Rash	No Rash	Total
Number	6	6	12
Age (years)			
Range	26-54	20-57	20-57
Median	38	32	32
Time in department			
Range	2 mo.-16 yr.	3 wk.-24 yr.	3 wk.-24 yr.
Median	3 yr.	4 1/2 mo.	1 3/4 yr.
Time at company			
Range	2 1/2 mo.-16 yr.	3 wk.-27 1/2 yr.	3 wk.-27 1/2 yr.
Median	7 1/2 yr.	1/2 yr.	9 1/2 yr.

T A B L E 15

SELECTED SAMPLE OF PUTTY AND FILE DEPARTMENT
EMPLOYEES: AGE AND SENIORITY DATA

SAMSONITE CORPORATION
DENVER, COLORADO
HHE 78-96

August 1978

Employees in department >1 week	Information not available
Number absent	Information not available
Present on day of study	23
Sample	
Number selected (% of employees present)	7 (30)
Number interviewed (% of sample)	6 (86)

Interviewed employees	Rash	No Rash	Total
Number	4	2	6
Age (years)			
Range	20-31	44-51	20-51
Median	25	48	30
Time in department			
Range	3 wk.-1 1/4 yr.	3 wk.-7 mo.	3 wk.-1 1/4 yr.
Median	4 1/2 mo.	4 mo.	4 1/4 mo.
Time in company			
Range	4 mo.-1 1/4 yr.	6 mo.-11 yr.	4 mo.-11 yr.
Median	7 mo.	6 yr.	6 1/2 mo.