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. 77-55-583

BRUBAKER TOOL COMPANY
MILLERSBURG, PENNSYLVANIA

APRIL 1979

I. TOXICITY DETERMINATION

It has been determined that employees are exposed to a dermatitis hazard in the Wet Grinding Department of the Brubaker Tool Company. Cases of dermatitis were also found in the Thread Grinding Department and the Milling Department. This determination is based on data collected on April 10 and 11, 1978 during a survey which included an occupational medical interview and skin examination of 41 workers in the wet grinding, thread grinding, and milling departments of the Brubaker Tool Company. Detailed information concerning the results of this survey are contained in the body of this report. Recommendations in this report are designed to prevent the occurrence of dermatitis through proper skin care and protection.

II. DISTRIBUTION AND AVAILABILITY OF THE DETERMINATION REPORT

Copies of this Determination Report are available upon request from Division of Technical Services, Information Resources and Dissemination Section, 4676 Columbia Parkway, Cincinnati, Ohio 45226.

After 90 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:

a) The Brubaker Tool Company, Millersburg, PA 17061
b) Authorized Representative of the United Steel Workers of America (USWA) Local Union #14327, Harrisburgh, PA and United Steel Workers of America, 5 Gateway Center, Pittsburgh, PA 15222.
c) U.S. Department of Labor - Region III
d) NIOSH Region III

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

Employees have also been notified individually by mail of the results of their examinations and of proper skin care which will help prevent dermatitis.

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 a written request by an employer or authorized representative of employees, to determine whether any substance normally found in the case of employment has potentially toxic effects in such concentrations as used or found.

The National Institute for Occupational Safety and Health (NIOSH) received an employee representative request concerning skin rashes and irritation from work with grinding fluids.

IV. HEALTH HAZARD EVALUATION

A. Description of the Process - Conditions of Use:

The plant is engaged in the production of machine tools. This evaluation of the plant and employees was limited to the areas where dermatitis was a problem and adjacent departments where dermatitis was not considered a problem. The major processes in the departments under consideration were wet grinding, thread grinding and milling. In each of these processes coolants are used.

In the wet grinding department Houghtogrind 60(R) is used. This is a synthetic nitrate free grinding fluid. Its use had

begun in 1976 when the problem of nitrates in grinding fluids became known. The previous fluid was similar, however it was contaminated with nitrate.

In the milling department an emulsion is used. Information provided by the company indicates that this is probably Oakite Formula 59(R). Information on grinding oils made by Stuart Oil Company (Excelene 300(R)) and Mobile were not available.

In the thread grinding department, tools are hand dipped into Stoddard solvent, which is used in open cans next to the grinding operation. Each tool is then dried with a jet of compressed air.

The plant has operated on three shifts for the past three years. Evening and night shifts are smaller than the day shift. Women's jobs involve solely running the tool machines. Some of the male employees however, perform set-up operations (putting on gears, oiling the machines, dressing the grinding wheels, maintenance), as well as operating the tool machines. The coolants' oils are changed when the storage recirculation tanks become full of debris from the grinding process. Each worker is provided with two or more towels for wiping his/her hands during the work shift. Waterless hand cleaner is available in the work areas (but not in the bathrooms). Barrier cream is supposed to be available in each department, but again is not available in the bathrooms. An abrasive

hand soap is the only cleanser available in the bathrooms used by all women and in the bathroom used by the men in the wet grinding department. Apparently, men in the thread grinding and milling departments have a choice of two bathrooms, one with abrasive soap dispenser, and the other with dispensers of a milder liquid soap.

Skin contact with coolant or grinding fluid depends on several factors. These include the size and type of tool being made, the rate at which it is made and the machine and process which is being used to shape the tool. Rates of tool manufacture per operator range from 100-800 per shift in the wet grinding department; 200-1000 per shift in milling; and 30-1000 per shift in thread grinding.

Machine design is another factor which affects the degree of skin contact with the grinding fluid. Some machines have semi-automatic tool loading from a magazine. Some have high pressure fluid injection, within closed cabinets. The high pressure system in thread grinding causes greater hand contact with the emulsion because a large amount of the fluid remains in the cabinet after the thread grinding stops, and the operator must remove and reload the tools within the cabinet by hand.

B. Evaluation Methods

1) Industrial Hygiene Methods

On March 15, 1977 an initial visit was made to review the areas in question and the materials used. Samples of cutting and grinding fluids used were collected to aid in evaluating their potential to cause skin irritation.

Samples were first evaluated in the laboratory for pH and total alkalinity. The pH was determined electrometrically by using a glass electrode. The pH meter was standardized with the buffer solutions at pH 4.00, 7.00 and 10.00. Total alkalinity was measured by the potentiometric titration method. An aliquot of each sample was titrated with standardized 0.02 N acid titrant to a pH for total alkalinity.

After samples were evaluated for pH and total alkalinity, samples were tested for skin irritation using 5 white albino rabbits. A 0.1 ml amount of each material was applied to separate 20 mm^2 shaved intact and abraded skin test sites. The test sites were covered by patches for 24 hours, then the patches and materials removed. The test sites were then observed at 24 and 48 hours. Cumulative irritant effect of materials not found to be irritant

were then tested. Application of test materials was identical to that described above except that this was done for 5 consecutive days applying the materials to the same test sites.

When it was determined that only the "neat" or concentrate fluids were considered irritants it was decided that a medical review should be conducted to define the nature and extent of the dermatitis problem. An interim report summarizing these findings was transmitted to the Company and the union on April 4, 1977.

No environmental samples were collected since this problem appeared to be one of identification and control of a dermatological problem. Airborne levels for oil mist did not appear to be warranted.

2) Medical Evaluation Methods

On April 10 and 11, 1978 a physician services team from the Mt. Sinai School of Medicine on contract to NIOSH were given a walk-through tour of the major tool departments in the plant to obtain familiarity with the plant operations and layout. A list of all workers in three departments: thread grinding, wet grinding, and milling was then obtained. The major problem with dermatitis was reported to have occurred in the wet grinding department.

The original intention was to examine workers from departments other than the wet grinding department as "internal controls." However, the presence of dermatitis among these "control" workers invalidated this group as a control group. Time did not permit a complete survey of the workers in these other departments (milling and thread grinding) to assess the prevalence of the dermatitis problem in these other departments, or possibly elsewhere in the plant.

A meeting room above the plant offices was used to conduct interviews. Screens were available for privacy during the dermatologic examination. Each worker was informed of the reason for the investigation, and the relationship of NIOSH, and the Mt. Sinai investigators. Informed consent was obtained prior to the interview and examination. The interview was divided into two parts, occupational and medical history; and dermatologic history. Questionnaires had been prepared (prior to the field survey) to standardize the information obtained. A prepared examination form was also used for the dermatologic examination. The information obtained in the interview included: prior occupational history, present and prior job categories and work description at Brubaker Tool Company, history of the use availability and convenience of various hygienic measures (e.g. gloves, aprons,

frequency of hand washing, type of soaps, cleansers available, use and availability of barrier creams, and frequency of clothing change). The interview also included questions on the past medical history, current use of medications, allergies, and questions as to whether the worker experienced acute mucous membrane or upper respiratory symptoms in the workplace, and if so, the frequency, duration, and identifiable specific cause(s). The dermatologic history inquired about current or previous episodes of dermatitis, their cause, exacerbating factors, and treatment. Specific skin symptoms and anatomic locations were also elicited. All members of the wet grinding department from all three shifts were examined (19 individuals). In addition, 18 workers from the thread grinding department were examined, 3 from the day shift and 15 from the evening shift. This represents 14% of the total on these shifts in thread grinding. None of the workers on the night shift in thread grinding were seen. Four workers from the milling department were examined. They all worked the night shift, and represent 12% of the work force employed in the milling department, and the entire night shift of that department.

C. Evaluation Criteria

Metal working, lubricants, coolants and greases.

Approximately 40% of industrial dermatitis is attributed to cutting oils and other petroleum products. In addition to mineral and

vegetable oils, these products contain an almost innumerable variety of ingredients including soap, emulsifiers, detergents, waxes, resins, water conditioners, corrosion inhibitors, deoderants, anti-foaming agents, dyes, and biocides to retard spoilage and rancidity. The oil components are often sulfurized, chlorinated or phosphorized to provide special characteristics such as pressure resistance.

Two major types of dermatitis result from exposure to these products, i.e., primary irritant contact dermatitis and oil folliculitis (oil acne). Oil folliculitis is commonly seen in machinists who utilize insoluble oils.

Primary irritant contact dermatitis from coolants has been increasing in recent years as more and more soluble cutting oils have come into widespread usage. These fluids are often quite alkaline (usually pH 9 to 11) and lead to defatting of the skin with dryness, redness, scaling and cracking. In addition to the alkaline nature of most such coolants, they often contain many additives which may contribute to the irritation. The hands are the usual site of involvement. Allergic contact dermatitis is rarely encountered from lubricants in general although known sensitizers are occasionally included in the formulation of these products. Such cases are usually of a severity which precludes

continuation on that particular job.

Because dermatitis is so frequently encountered among workers utilizing various lubricants and coolants, it is regarded by many employees as a "badge of the trade." Workmen commonly, but mistakenly, believe that bacteria in the fluids are responsible. While cutting oils may contain, and frequently do contain large numbers of bacteria and fungi, these are nearly always species that are incapable of causing human infection.

D. Evaluation Results and Discussion

1) pH and Total Alkalinity

Results of pH test indicated that cutting fluids other than the Oakite 59(R) were in the range (pH 9 to 11) that could cause an irritant dermatitis. As expected the "neat" concentrations were the most alkaline (total). The results of these tests are presented in Table 1 of this report.

2) Rabbit Skin Test

Test sites observed after 24 and 48 hours with single application indicated that the "neat" Oakite 59(R), Hocut 4206(R) and Houghto grind 60(R) produced an average intact skin reaction of 1 which is considered a mild irritant and may be safe for human intact

skin contact provided that appropriate skin protective equipment be used during skin contact. The same "neat" materials, however, produced an average abraded skin reaction of 2 which is considered a cellular toxin and is too irritating for human abraded skin contact and such contact should be avoided. All remaining samples that were tested at "normal" working concentrations produced reactions of 0 on both intact and abraded skin which is considered a non-irritant when tested for cumulative irritant effect. All materials produced reactions of 0 at all test sites on all animals for 120 hours. The effect was considered to be non-irritating.

3) Medical

Forty-one workers were examined. Some demographic characteristics, including sex, average ages, and average duration of work in the plant of the examined workers from each department are shown in Table II. Detailed description of skin findings considered to be irritant dermatitis and skin abnormalities are presented in Tables IV and V. Dermatitis, which was considered to be occupational in origin, was observed in 8 of the 19 workers in the wet grinding department (42%). There were also 3 cases of what was considered to be an occupational dermatitis in the thread grinding department (17% of those examined) and an additional worker had severe atopic dermatitis which may have been aggravated by skin exposure to grinding oil. Of the four workers from the milling department, one

had dermatitis (Table III). The sex distribution, average ages, and length of work in the plant of those with dermatitis were not statistically different from these characteristics among the remainder of the workers in the departments where they worked.

Only one person with dermatitis at the time of the examination had not had a previous episode of dermatitis. However, there were 10 additional workers who reported typical cases of dermatitis in their medical and dermatological history. Twelve (12) of the workers with prior dermatitis were in the wet grinding department, one (1) was in milling and four (4) were in thread grinding. Two workers in the thread grinding department attributed their prior dermatitis to hand contact with Stoddard solvent. They did not have dermatitis at the time of our examination.

Only five (5) workers reported that they had been treated for their dermatitis. Three (3) were from the wet grinding department. Indeed, two of the workers in the wet grinding department had seen doctors for dermatitis as early as 1968 and 1975, before the current grinding fluid was used. Two workers in the thread grinding department were also able to give fairly accurate dates for the prior dermatitis because they had had medical encounters. The reported dates of these problems were 1972 and 1977.

The skin findings in those with dermatitis were very similar, regardless of the department from which they came. Tables IV and V show the frequency of different types of dermatologic abnormalities by department. Redness, cracking and dryness of the skin were the most frequent findings in all the departments. The left hand was more often involved with dermatitis than the right hand. In 9 workers, including all the affected workers in the wet grinding department, the left hand only was affected, in one (in thread grinding), the left hand was more involved than the right, and in another worker (also in thread grinding) both hands were equally involved. The unusual involvement of only one hand by dermatitis is an observation that suggests that the left hand is more in contact with the substances causing the dermatitis. The work of the wet grinding department, especially, may employ a left handed motion, which brings this hand in greater contact with the cooling fluid.

There were three (3) pairs of workers who worked on the same machines on different shifts who had dermatitis at the examination. The machines they operated were the Norton numbers 1 and 2, and 8 and 9 in the wet grinding department; and the Shobie numbers 80, 83 and 100, in thread grinding department. Additional clusters of dermatitis appeared when all the workers who had a prior history of

a characteristic dermatitis were considered in the analysis. The Sparrow machines, numbers 80, 90 and 105, in thread grinding, the Bohle, number 8 in the milling department, and the Van Norman, numbers 6 and 11 in the wet grinding department had each appeared to cause more than one case of dermatitis.

The results of the interviews also indicate that there are several work practices which may affect the skin of workers in three departments we studied. Seven (7) workers in the wet grinding department (37%) commented on the grit or dirt which accumulates in the grinding fluid between times when the fluid is replaced. They believed that the fluid was changed when the storage tank was filled with settled dirt (mostly particulate matter from the metal tools and grinding wheels). They reported that the fluid was changed approximately every 4-5 weeks. The fluid was far more irritating to the hands when it was "dirty", because the suspended particles then acted as an abrasive, causing existing cuts to heal slowly, and causing new cuts and abrasions on the skin, thus adding to the irritating effects of the fluid itself. One worker of the 4 examined in the milling department had a similar observation, as did three (3) in the thread grinding department. There were no complaints of biologic decay of the grinding fluids or coolants.

Another aspect of the work which affected the skin contact with coolant fluids was the use of oil saturated rags for wiping the hands. A number of workers requested that more clean rags or towels be available.

Only one worker had ever tried to use gloves as hand protection. The individual described the practice as a "disaster". The gloves were hot and cause the hands to perspire and swell. In addition, he nearly caught his glove and finger in the grinding machine.

All of the women in the plant departments we studied, and the men in the wet grinding departments use bathrooms which have an abrasive soap as the only cleaner available in the bathroom. The men in the milling and the thread grinding departments apparently can choose between bathrooms which contain the abrasive soap or a milder liquid soap. Seven (7) of 13 workers made the choice of using the bathroom with the milder soap. Those who use the liquid soap often combine its use with the use of waterless hand cleaner. Among the 10 workers in these two departments who had current or prior dermatitis, 5 used the liquid soap hand cleaner.

Waterless hand cleaner was reported to be used regularly (repeatedly, during the shift) by nine (9) workers and less regularly (occasionally,

or at the end of the shift) by eight (8) workers. Of those using waterless cleaner regularly, three (3) had current, and four (4) had a prior episode of dermatitis. No information was obtained on the history of the use of waterless hand cleaner by individuals that did not have dermatitis. Those workers who used the waterless cleaner as their main hand cleaner, using it repeatedly during the shift, were all from the wet grinding department.

Fourteen (14) workers used barrier cream, however, only two (2) used it after each hand washing. (Both of these workers had active dermatitis.) The remainder used the barrier cream at the beginning of the shift, or only when their hands were particularly irritated and they suspected that they were about to have "skin trouble." Only three of the people using the barrier cream had <u>never</u> had a clinical rash, but used it when their hands had become dry or roughened. A worker in the thread grinding department noted that the barrier cream was removed as soon as she hand dipped her tool in the Stoddard solvent. One worker in the thread grinding department said that the barrier cream was not available in her work area.

Some workers who had had a prior dermatitis, reported that with careful use of the waterless hand cleaner and the barrier cream, they could prevent a reoccurrence of incipient dermatitis.

Each of the departments investigated were in adjacent areas in one large building. There was some noise in the building, especially near grinding or machining operations. The air jets also created a high pitched loud noise when in use. The air also appeared somewhat cloudy, due to the mists generated from the oils, emulsions and coolants in the grinding operations. There had been a 17 week strike in the plant from April to August 1977. During this period, a number of cases of dermatitis had cleared up completely, or improved. New cases of dermatitis had only reoccurred several weeks before our hazard evaluation visit.

As part of the medical interview, questions were asked on the frequency of symptoms of the type which workers may experience due to exposure to airborne dusts, mists of vapors. The number of workers experiencing any of these symptoms; including burning or irritation of the eyes, nasal stuffiness, running, or sneezing, sore throat, cough or tightness in the chest, is indicated in Table VI. The workers were often able to identify the cause of their symptoms. In the wet grinding department, dust from the grinding, and burning machines were identified as a cause of nasal irritation. Coughing and chest tightness occurred only when the mist in the air was "heavy." In the thread grinding department, hoarseness or sore throat, and chest tightness were brought on by fumes from smoking machines, or when a large tap was being cut.

Symptoms were not usually persistent, or frequent, the maximum frequency in one worker in the thread grinding department was several times weekly. He complained of stuffy nose and sore throat and has an underlying sinus condition. An additional worker with chronic sinusitis believed that her condition was worsened by the general atmosphere in the plant. She had chronic cough and nasal stuffiness, but could not identify specific substances or operations which aggravated her condition. It did, however, improve after long periods away from the work environment. The remainder of the workers described their symptoms as occurring monthly, occasionally or seldom.

V. CONCLUSION

Dermatitis is occurring in the Wet Grinding Department. It has characteristics of an irritant type dermatitis. Occupational dermatitis is also occurring, although not as frequently, in the Thread Grinding and Milling Departments. The type of dermatitis appears similar to that observed in the wet grinding department. The occurrence of occupational dermatitis may have been caused or aggravated by the following items individually or in combination:

a) The pH of the cutting and grinding fluids (9 to 11). "Neat" concentrations in particular have been shown to be irritants to both abraded and unabraded skin. "Normal" concentrations do not appear to be irritating by themselves, however, interaction

between the defatting alkaline properties and other factors must be considered as a possible cause.

b) The presence of excessive dirt (particulate matter from the tools and grinding wheels).

c) The use of abrasive-type soap as a routine hand cleaner in the bathrooms.

d) Hand contact with solvents in the Thread Grinding Department.

Possible Benzene Exposure

A potential hazard exists if the Stoddard solvent which is used in Thread Grinding contains any benzene. Since Stoddard solvent is a petroleum distillate it is not uncommon to find benzene as a contaminant. Benzene has been identified as being capable of causing cancer and exposure should be eliminated where ever possible. Assurances should be obtained from the supplier that the Stoddard solvent used is benzene free.

Noise

A potential problem may exist with the noise of the air jets used to dry lids in the Thread Department.

Miscellaneous

On the basis of information collected in the survey, no statement can be made about the presence of hazards to the upper respiratory tract or mucous membranes, although some workers experience irritation from occasional episodes of smoking machines, or subjectively observed plant pollution from oil mists.

VI. RECOMMENDATIONS

a. Alleviation of the dermatitis hazard:

a) Dermatitis apparently can be prevented or made to resolve by the scrupulous use of barrier cream, and waterless hand cleaner repeatedly during the shift, especially as an alternative to abrasive soap which is normally used when a worker is in the bathroom.

b) Efforts should be made to ask the manufacturer or supplier for a product which has less alkalinity, and is generally less irritating to the skin; which, has no other hazardous effects; and which would be suitable as a substitute in the Wet Grinding Department.

c) The fluid should be kept at the minimum concentration necessary for the work. The concentration, as well as

the alkalinity should be monitored in between fluid changes, and evaporative water loss which increases the concentration and alkalinity should be replaced.

d) The fluid should be changed to remove waste (abrasive) particles as often as is practicable.

e) Hand contact with Stoddard solvent should be reduced by using baskets or other appropriate methods for dipping the tools in solvent.

f) Waterless hand cleaner and barrier cream should be generally available in all work areas where hand contact with grinding fluid, coolants or machine oils are occurring, as well as in the bathrooms where hand washing commonly occurs.

g) Mild soap should be available as a choice in all bathrooms, as an alternative hand wash to the abrasive soap, which may aggrevate dermatitis.

h) Worker education: New and current workers should receive instructions on the factors which lead to dermatitis; skin protection in the plant and the proper use of barrier

cream and waterless hand cleaner. Successful worker education might be aided by participation of union representatives and workers who have used the hand protective materials successfully as well as management in the education process.

2. Workers who develop dermatitis should be seen by a dermatologist who acts as a regular consultant to the plant, and is familiar with the operations and skin hazards in the plant. Pre-employment skin examinations should prevent assignment of persons with dermatitis or eczema to areas where skin exposure to grinding fluids, coolants or oils occurs. This should not, however, restrict employee hiring for other areas.

3. The possible presence of a benzene contaminant in the Stoddard solvent should be evaluated by the company. This may require only a consultation with the supplier or manufacturer of the solvent.

4. All solvent containers should be kept under enclosures or hoods to avoid inhalation of solvent vapors.

5. Air jets used to dry the tools should be fitted with noise reducers or mufflers.

VII. REFERENCES

1) Standard Methods for the Examination of Water and Waste Water, 13th Edition, American Public Health Association, 1971, pp 52-56.

VIII. AUTHORSHIPS & ACKNOWLEDGEMENTS

Report Prepared by:

NIOSH Project Officer and Principal Environmental Investigator	Wesley E. Straub Regional Consultant Region I, Boston, MA
Principal Medical Investigators	Susan M. Damm, M.D. Mt. Sinai School of Medicine New York, NY
	David Bickers, M.D. The University Hospitals of Cleveland, Ohio Cleveland, OH
Originating Office:	Jerome P. Flesch Acting Chief Hazard Evaluation and Technical Assistance Branch

Acknowledgements

Laboratory Analysis	Soo Wang Kim Chemist Measurements Services Section Cincinnati, Ohio

BRUBAKER TOOL COMPANY
MILLERSBURG, PENNSYLVANIA
HEALTH HAZARD EVALUATION 77-55

TABLE I

SAMPLE	pH	TOTAL ALKALINITY AS G/L $CaCO_3$	CONCENTRATION
Oakite 59	7.1	.4	2%
Oakite 59	7.2	.4	2%
Oakite 59	5.2	10.9	"Neat" (100%)
Oakite 59	5.1	11.0	"Neat" (100%)
Hocut 4206	9.3	6.1	4%
Hocut 4206	9.3	6.7	4%
Hocut 4206	10.3	122.3	"Neat" (100%)
Hocut 4206	10.3	132.4	"Neat" (100%)
Houghto Grind 60	9.4	5.4	3% Waste drum
Houghto Grind 60	9.4	5.3	3% Waste drum
Houghto Grind 60	8.8	2.0	2% Blanchard
Houghto Grind 60	8.7	2.0	2% Blanchard
Houghto Grind 60	10.9	289.9	"Neat" (100%)
Houghto Grind 60	10.9	282.6	"Neat" (100%)

BRUBAKER TOOL COMPANY
MILLERSBURG, PENNSYLVANIA
HEALTH HAZARD EVALUATION 77-55

TABLE II

Demographic Characteristics of Examined Workers

Department	Sex	Number	Average age	Age range	Average duration in plant (yrs.)	"Duration" range (yrs.)
Wet Grinding	M	15(79%)	39	20-60	9	1-26
	F	4(21%)	39	28-57	6	4-10
Milling	M	2	32	22-43	5	-
	F	2	30	22-37	5	4-6
Thread Grinding	M	11	32	20-60	7	2-26
	F	7	39	21-51	3	0.17-5
All Departments	M	28(68%)	38		8	
	F	13(32%)	36		4	
Total		41	36		7	

BRUBAKER TOOL COMPANY
MILLERSBURG, PENNSYLVANIA
HEALTH HAZARD EVALUATION 77-55

TABLE III

Prevalence of dermatitis, or a history of dermatitis among workers in three departments of a tool plant

Department	Workers with a prior history of (probable) occupational dermatitis	Workers with occupational dermatitis at the examination
Wet grinding n=19	11 (58%)	8 (42%)
Thread grinding n=18	6 (33%)	3*(17%)
Milling n=4	2	1
Total n=14	19 (46%)	12 (29%)

* One additional case: worker with atopic dermatitis, aggravated by skin exposure in the plant.

BRUBAKER TOOL COMPANY
MILLERSBURG, PENNSYLVANIA
HEALTH HAZARD EVALUATION 77-55

TABLE IV

Description of skin findings
considered to be irritant dermatitis

Case 1	Fissured lichenified dermatitis of left hand.
2	Exanthematous papules on left hand, mottled erythema on both forearms.
3	Mottled erythema on left hand.
4	Redness on left hand.
5	Lichenification of left hand Erythema both hands L>R.
6	Pigmentalis left hand, probably post inflammatory ½cm scaly red patch on right forearm.
7	Lichenification, redness and some plaques on left hand.
8	Erythema and xerosis on left hand.
9	Redness and erythema of left hand.
10	Lichenification, redness and plaques, both hands, L>R.
11	Redness on hands.
12	Redness and exudate both hands.
13	Red macule over right knuckle.

BRUBAKER TOOL COMPANY
MILLERSBURG, PENNSYLVANIA
HEALTH HAZARD EVALUATION 77-55

TABLE V

Skin abnormalities among the
workers with occupational dermatitis

Abnormality	Wet grinding	Thread grinding	Milling
Redness	8	3	1
Cracking	5	1	-
Dryness	3	-	1
Thickening	4	2	-
Papules	1	1	-
Macules	1	-	-
Plaques	1	1	-

BRUBAKER TOOL COMPANY
MILLERSBURG, PENNSYLVANIA
HEALTH HAZARD EVALUATION 77-55

TABLE VI

Prevalence of symptoms of irritation
of the mucous membrane

Department	Irritation of eyes, nose and/or throat (n)	Cough or chest tightness (n)
Wet grinding n=19	8	3
Thread grinding n=18	7	3
Milling n=4	1	0