U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES ■ Public Health Service
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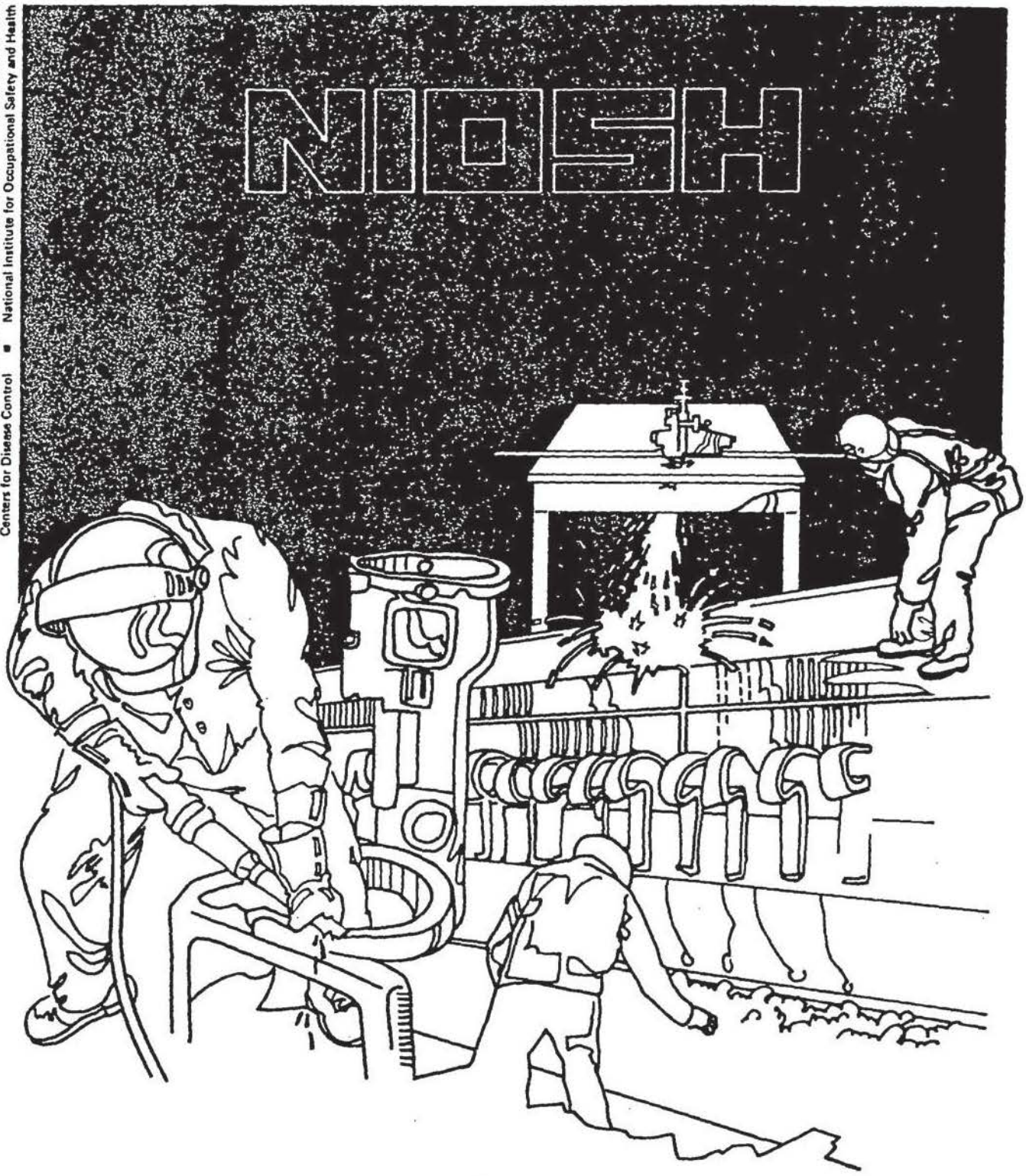

Health Hazard Evaluation Report

HETA 83-142-1431
ICI AMERICAS, INC.
CHARLESTOWN, INDIANA

PREFACE

The Hazard Evaluations and Technical Assistance Branch of NIOSH conducts field investigations of possible health hazards in the workplace. These investigations are conducted under the authority of Section 20(a)(6) of the Occupational Safety and Health Act of 1970, 29 U.S.C. 669(a)(6) which authorizes the Secretary of Health and Human Services, following 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 Hazard Evaluations and Technical Assistance Branch also provides, upon request, medical, nursing, and industrial hygiene technical and consultative assistance (TA) to Federal, state, and local agencies; labor; industry and other groups or individuals to control occupational health hazards and to prevent related trauma and disease.

Mention of company names or products does not constitute endorsement by the National Institute for Occupational Safety and Health.

HETA 83-142-1431
FEBRUARY 1984
ICI AMERICAS, INC.
CHARLESTOWN, INDIANA

NIOSH INVESTIGATORS:
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I. SUMMARY

In February 1983, the National Institute for Occupational Safety and Health (NIOSH) received a request for a Health Hazard Evaluation at ICI Americas, Charlestown, Indiana, to investigate cases of ganglionic cysts and tendinitis occuring among quality assurance (QA) personnel.

On May 11-13, 1983 NIOSH conducted an investigation at ICI Americas. The investigation consisted of observation of work practices, informal employee interviews, videotape and still photography of job tasks, and a questionnaire survey of 36 of the 37 QA personnel.

The jobs in the middle aisles are the most physically stressful of those done by QA personnel because at this stage, when the charge is its heaviest, it must be handled (lifted, turned, etc.) for final inspection and then carried for short distances. The most stressful transport posture noted is carrying the charge with the hands at both ends of the charge. This involves grasping the charge and then squeezing or pushing both hands together, a static, somewhat forceful posture which could be stressful to the hands, wrists, and forearms. Although ganglionic cysts are considered one of the group of cumulative trauma disorders, evidence relating their occurrence to occupation or usage patterns is inconclusive.

The proportion of employees reporting various somatic complaints involving upper extremities, back, and lower extremities ranged from 19% to 42%; 31% percent of the employees reported a lesion diagnosed as being consistent with ganglionic cyst. Most of the ganglionic cysts were on the left hand. The reported presence of a ganglionic cyst was not epidemiologically associated with gender, age, seniority, or a job involving repetitive lifting.

Based on the results of this survey, NIOSH has determined that QA personnel perform certain work activities which may be associated with the development of cumulative trauma disorders such as ganglionic cysts. Recommendations are made in this report (Section VIII) for reducing biomechanical stresses and for surveillance of work-related health problems.

KEYWORDS: SIC 3483 (Ammunition loading and assembling plants), musculoskeletal disorders, ganglionic cysts, tendinitis, tenosynovitis, repetitive tasks, cumulative trauma disorders, ergonomics.

II. INTRODUCTION

On February 7, 1983 the National Institute for Occupational Safety and Health (NIOSH) received a request from the International Chemical Workers Union (ICWU) for a health hazard evaluation at ICI Americas, Inc., Charlestown, Indiana. The request was for an evaluation of occurrences of ganglionic cysts and tendinitis among QA personnel working on Load Lines 5A, 6A, 6B, and 2B. NIOSH conducted an investigation on May 11-13, 1983. An interim report presenting preliminary findings was distributed in August 1983.

The request reported that nine cases of ganglionic cysts and two cases of tendinitis occurred among QA personnel working in these areas over an unspecified period.

III. BACKGROUND

ICI Americas is a contractor operating the Indiana Army Ammunition Plant. The facility is owned by the United States Army. The entire facility covers in excess of 10,000 acres and has a current work force of approximately 1,700. Forty of the 1,700 are Army personnel (2 military and 38 civilians); the remainder are civilians employed by ICI Americas.

The facility was purchased and built by the Army in 1940-41. At one point, the work force was approximately 20,000. The reduction in the work force was due to modernization of manual operations and to an accumulation of ammunition stockpiles. The principal cause however, has been a dramatic decrease in production demand during peace time.

The manufacturing process consists of assembling, packing, and shipping propellant charges. Bulk amounts of propellant (referred to as "powder") in the form of grains or cylindrically-shaped pellets are obtained from the Radford Army Ammunition Plant, Radford, Virginia. The propellant is delivered to the plant in various sized containers. Approximately 20 to 25 million pounds of propellant are received each year.

The containers, with propellant, are emptied into elevated holding bins and then the propellant is gravity-fed to load booths below. There it is weighed, check-weighed, packed into cylindrical cloth bags using a vibration unit, and then sealed via a machine sewing operation. The bags are finally wrapped in packing materials such as corrugated cardboard, packed, and sealed in metal containers for shipment or storage.

The plant layout is based on a principle of limiting the amount of propellant that can be present in one location to minimize the danger of fires and/or explosions. The maximum amount of propellant allowed in a specific location depends on the distance between that location and the surrounding accumulation points. The number of people (both workers from the area and transients) allowed in the various processing areas is also limited.

In the areas of concern, several different types or sizes of propelling charges are produced which weigh approximately 6, 23, and 48 pounds each. The heaviest charges (48 pounds) were produced on Load Line 2B for about a year. Production of this charge ceased a few months before the NIOSH visit. Line 5A produces the smaller 6-pound charge; on Lines 6A and B, the 23-pound charge is assembled.

The number of employees varies somewhat with the demand for ammunition. Of the 1700 current workforce, 80 to 90 are QA personnel. Fifty to 55 QA personnel work in the areas of concern.

QA personnel inspect charges during all phases of production checking for defects, such as holes, foreign matter, improper seams, and improper weight. Some activities involve visual inspection without handling, such as observing the diameter of the charge as it passes through a ring gauge on the conveyor line and watching air pressure gauge indicators for defective containers. Other duties involve handling the charge while sliding it onto a scale, placing it on end to measure height and to inspect for defects, and carrying it for short distances.

The number of charges handled daily varies according to the number of orders. At the time of our visit, on Load Line 6A, for example, four QA inspectors were working and each handled about 500 charges a day. To perform this task, each charge had to be handled two to three times by each inspector. By contrast, when only three inspectors are working (as sometimes occurs according to QA personnel), each worker may handle over 700 charges a day.

IV. METHODS AND MATERIALS

The ergonomic evaluation consisted of observation of work processes and practices, informal interviews with employees, videotape and still photography of job tasks performed by QA personnel in Load Lines 5A, 6A and B. The film and other information were analyzed to determine if the work performed was potentially stressful to the hands and wrists, areas where ganglionic cysts were reported to have occurred, among these workers.

All QA personnel on Lines 5 and 6 were given a self-administered questionnaire that addressed job activities and musculoskeletal problems. Thirty-one questionnaires were distributed at the worksite; in addition, survey forms were mailed to the employees who were absent during our visit.

V. EVALUATION CRITERIA

Few quantitative criteria (frequency, number, force) exist to determine the presence or extent of ergonomic hazards related to cumulative trauma disorders. NIOSH is currently sponsoring research in this area. In the absence of such data, however, determination of the presence or extent of an ergonomic problem is based on an analysis of the type of postures associated with a task, their frequency or repetitive nature, and comparison with findings in the literature.

Evidence exists that work requiring certain repetitive hand/wrist postures especially in conjunction with high forces, is associated with the development of cumulative trauma disorders such as carpal tunnel syndrome, tendinitis, bursitis, and ganglionic cysts.[1-3] Although usually included in a list of cumulative trauma disorders, the data available concerning the relationship of occupation or pattern of usage to the development of ganglionic cysts is sparse and inconclusive.[4-6]

Ganglion, a benign cystic tumor filled with mucoid material usually surrounded by a thin wall, has been known since the time of Hippocrates. However, even today, there is little agreement about its prevalence, etiology, pathology, and treatment.[5] It is associated with age (most common in third, fourth, and fifth decades of life), gender (more common in females), and occurs with equal frequency on the right and left. Although occupation has not been strongly associated with its occurrence, a history of trauma proceeding its development is often reported.[4] Repetitive motion, (especially twisting with certain hand/wrist postures in combination with high forces) as found in this sample, has been known to result in microtrauma to the musculoskeletal system.[5,7] A ganglionic cyst is one of a class of tendon sheath disorders such as tendinitis and tenosynovitis. The cyst occurs because rather than the inflammation spreading to a large area such as with tenosynovitis, it is concentrated in a small area, usually at the wrist, and a cyst or "bump" results. Originally ganglions were referred to as "bible bumps" because the bible, then the most available book, was used to hit, and rupture, the ganglion. Today, ganglions are more likely to be aspirated or incised by a hand surgeon.

VI. FINDINGS

Thirty-six (97%) of 37 questionnaires were completed and returned. The study group was predominantly female (66%), ranging in age from 24 to 65 years, with the number of years working at ICI Americas ranging from less than one to more than 17. Heights of female workers ranged from 60 to 69 inches and for males from 66 to 73 inches. Weights ranged from 110 to 210 pounds for females, and from 140 to 210 for male workers.

The proportion of workers reporting various somatic complaints involving upper extremities, back, and lower extremities ranged from 19% to 42%; 31% reported a lesion diagnosed as or consistent with ganglionic cyst (Table I). The several ganglions observed during the investigation varied in size, consistency, and location; most were on the left hand/wrist.

Risk factors considered potentially associated with ganglionic cyst development included age, gender, job senority, and jobs that involved repetitive lifting. None of these factors appeared to be associated with ganglionic cysts (Table 2).

In middle aisles where the fully assembled charge is check-weighed and given final inspection before being packed in shipping containers. On Load Lines 6A and B, and 2B, QA inspectors lift, inspect, and carry charges for short distances. In these areas, the charges weigh about 23 pounds (6A and B) and 48 pounds (2B). The charge is first pulled from a chute (which is about 32 inches from the floor) onto a table of similar height. From here it is slid onto a scale platter to obtain tare weights. It is then inspected for defects; those which pass inspection are placed onto a conveyor (Lines 6A and B) or into a drum (5A and 2B) for final packing.

In these areas the charge is lifted either by grasping it at both ends or by placing one or both hands underneath for support. Lifting the charge at both ends involves squeezing or pushing both hands toward each other - a static and somewhat forceful posture which could be stressful to the hands, wrists, and arms.

According to QA personnel who work in Lines 6A and B, it is necessary to lift the charges straight up and out to recheck and weigh them. This movement, some workers feel, causes stress and strain on their wrists, forearms, arms, shoulders, and/or back. Reportedly their hand and wrist problems began about a year ago when fewer than usual QA personnel were working which, required each inspector to handle more (up to 200) charges each day.

While conducting the evaluation of QA personnel NIOSH investigators observed that the job tasks of some of the production personnel involve much more repetitive and strenuous hand/wrist movements than do those of the QA inspectors. These individuals were not included in the HHE request (they are not in the same union as QA personnel) and the number of production personnel made it logistically impractical to include them in the evaluation. Some of these individuals talked informally to NIOSH investigators and expressed that they too had hand/wrist problems.

VII. DISCUSSION AND CONCLUSION

On the basis of this evaluation, QA personnel in Load Lines 5A, 6A, and 6B perform certain work activities, i.e., lifting and carrying charges in the middle aisles when the charges are heaviest, which may be associated with the development of cumulative trauma disorders such as ganglionic cysts. Specifically lifting and carrying the charges by grasping them at both ends involves a static, somewhat forceful posture.

VIII. RECOMMENDATIONS

1. The daily health clinic log should include specific information about the type of illness or injury being reported or treated and the exact location of the injury or illness. In addition, the location of and type of work being performed should be listed. These modifications will allow the nurse to monitor the nature and frequency of health problems and focus attention on those suggesting a need for control and prevention.

2. QA personnel in the middle aisles should carry charges by cradling them, i.e., by keeping at least one hand underneath, for support. This is to avoid lifting or carrying the charge by grasping it at both ends.

3. When moving cylinders of charge from scales to conveyor lines (area 6A), management should encourage workers to keep the load close to and in front of the body. Workers should also avoid twisting movements when lifting which could put a torsional stress on the low back muscles.

4. For seated workers, management should provide chairs that are adjustable in height and that have backrests and footrests so that the work can be performed as comfortably as possible. Chairs with a height adjustment feature are particularly important for seated work at a conveyor.

5. Management should evaluate the production personnel for biomechanical health problems (ganglionic cysts, tendinitis, etc.).

6. Management should conduct training courses to make the workforce aware of the types of movements and postures associated with cummulative trauma disorders. (A copy of some general information on ergonomics[8] has been forwarded to both management and the union.)

7. Management should provide angled fixtures for inspection tasks so that handling ammunition materials is minimized when looking for defects.

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X. DISTRIBUTION AND AVAILABILITY OF REPORT

Copies of this report are currently available upon request from NIOSH, Division of Standards Development and Technology Transfer, 4676 Columbia Parkway, Cincinnati, Ohio 45226. After 90 days, the report will be available through the National Technical Information Service (NTIS), 5285 Port Royal, Springfield, Virginia 22161. 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. Indiana Army Ammunition Plant
2. ICI Americas
3. International Chemical Workers Union
4. ICWU - Local No. 761
5. NIOSH, Region V
6. OSHA, Region V

For the purpose of informing affected employees, copies of this report shall be posted by the employer in a prominent place accessible to the employees for a period of 30 calendar days.

TABLE I

Musculo-Skeletal Complaints Reported By QA Personnel (N=36)

ICI Americas, Inc.
Charlestown, Indiana
HETA 83-142
May 1983

Complaint	Number (%)
Ganglionic Cyst (or unidentified lesion compatible with ganglionic cyst)	11 (31)
Wrist/Hand (Other than Ganglionic Cyst)*	7 (19)
Shoulders*	11 (31)
Arms*	11 (31)
Lower Extremities*	15 (42)
Back*	14 (39)

*One or more of the following symptoms; pain, soreness, or ache; lump; numbness or tingling; redness or warmth

Table II

Potential Risk Factors for Development of Ganglionic Cysts

ICI Americas, Inc.
Charlestown, Indiana
HETAB 83-142
May 1983

	Ganglionic Cyst Reported	No Ganglionic Cyst Reported
Number of workers	11	25
Number of women and (% of column)	7 (64)	17 (69)
Age: median and (range)	36[A] (25-65)	41[A] (24-65)
Years of employment, median and (range)		
Current job	2 1/2[B] (2/3-15)	2 1/2 (1/26-17)
Company	3 1/2 (2/3-17)	3 1/2 (7/12-20)
Jobs involve repetitive lifting, number of workers and (% of column)	8 (73)	17 (69)

A - $p > 0.1$, Mann-Whitney U Test
B - Excludes 3 workers who noticed their ganglionic cysts prior to their current jobs.

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