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Health Hazard Evaluation Report
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Jerome, Idaho

(U.S.) National Inst. for Occupational
Safety and Health, Cincinnati, OH

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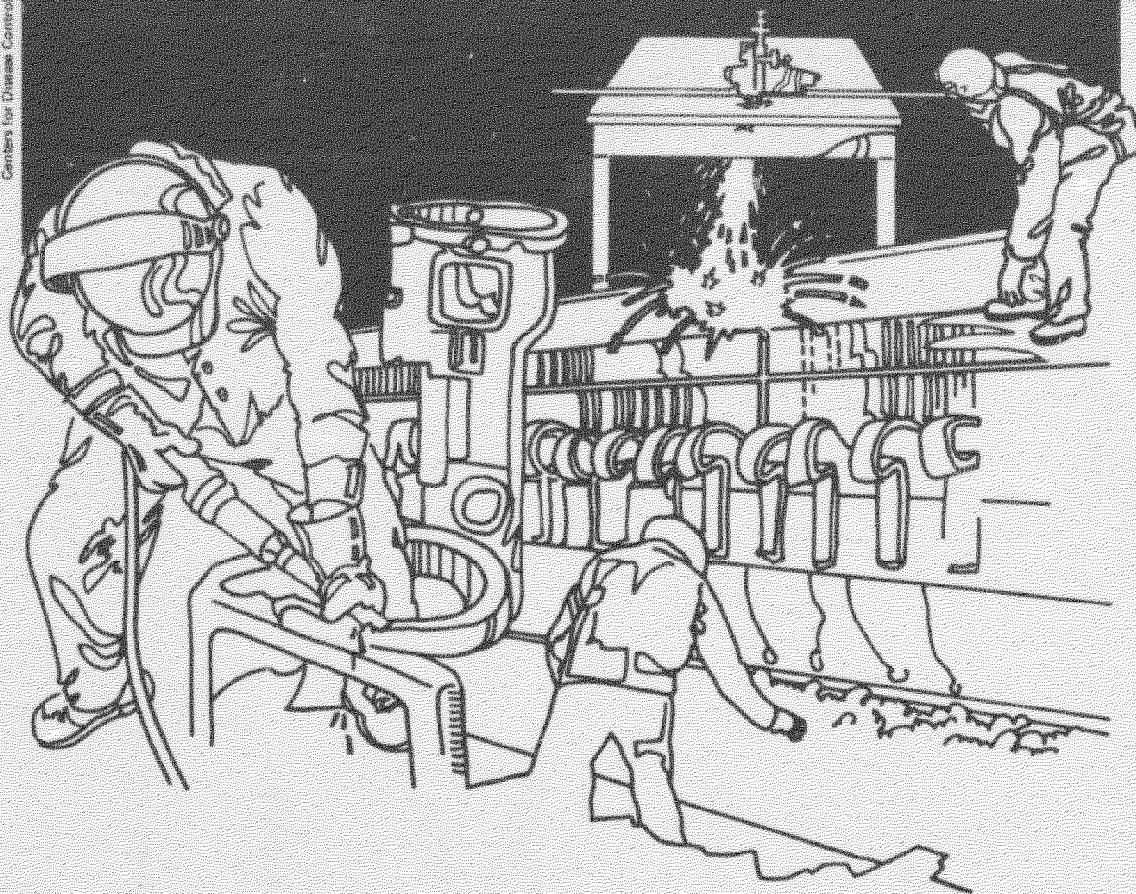
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16. Abstract (Limit: 200 words) In August 1980, the National Institute for Occupational Safety and Health (NIOSH) provided technical assistance to the Idaho Area Office of the Occupational Safety and Health Administration (OSHA) at the Jerome, Idaho, plant of Dart Industries, Incorporated (Tupperware). NIOSH conducted an ergonomic evaluation of plastic molding and packing jobs whose demands upon the musculoskeletal system (MSS) were thought to be associated with several recorded OSHA Code 26 (hand, wrist, and forearm) MSS complaints. During 1978, in an effort to reduce the number of MSS complaints, the company made several job changes designed to reduce fatiguing hand motions and awkward body postures. Trimming tools were redesigned, barriers were constructed to prevent excessive reach distances, some packing operations were automated, and job rotation was instituted. The ergonomic changes were observed and found to be effective in reducing repetitive motion fatigue. A few awkward postures were observed, particularly in packing operations where excessive reaches were frequent, and some wrist hyperflexion was noted when employees handled cartons. Pinch grips were seen occasionally in both molding and packing operations. NIOSH determined that Dart Industries, Incorporated, had made significant progress in effecting changes designed to reduce muscular soreness and fatigue. Postures and motions requiring closer scrutiny were identified along with suggestions for making further job changes. By the very repetitive nature of these jobs, some muscular soreness and fatigue will continue to be present in a few employees, although it is not likely to represent a serious health hazard.				
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Health Hazard Evaluation Report

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TA 80-096-973
DART INDUSTRIES, INC.
JEROME, IDAHO

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.

TA 80-096-973
OCTOBER 1981
DART INDUSTRIES, INC.
JEROME, IDAHO

NIOSH INVESTIGATOR:
DONALD W. BADGER, Ph.D.

I. SUMMARY

In August, 1980, the National Institute for Occupational Safety and Health (NIOSH) provided technical assistance to the Idaho Area Office of the Occupational Safety and Health Administration (OSHA) at the Jerome, Idaho plant of Dart Industries, Inc. (Tupperware). NIOSH conducted an ergonomic evaluation of plastic molding and packing jobs whose demands upon the musculoskeletal system (MSS) were thought to be associated with several recorded OSHA Code 26 (hand, wrist and forearm) MSS complaints.

The plant manufactures a variety of laminated plastic products. The predominantly female workforce is employed either in the molding department where plastic objects are molded, trimmed and stacked, or in the packing department involving embossing and packing jobs. Both kinds of jobs require repetitive motions of the hand, wrist and forearms. Such motions are thought to be associated with an increased risk of developing carpal tunnel syndrome, tendonitis or other MSS complaints.

During 1978, in an effort to reduce the number of MSS complaints, the company made several job changes designed to reduce fatiguing hand motions and awkward body postures. Trimming tools were redesigned, barriers were constructed to prevent excessive reach distances, some packing operations were automated, and job rotation was instituted. In 1979 MSS complaints were reduced to 1 repeat case; however, an OSHA evaluation indicated that muscular complaints were still present.

On August 25, 1980, the NIOSH investigator inspected and photographed both molding and packing operations. The ergonomic changes instituted by Dart Industries, Inc., were observed and found to be effective in reducing repetitive motion fatigue. A few awkward postures were observed, particularly in packing operations where excessive reaches were frequent, and some wrist hyperflexion was noted when employees handled cartons. Pinch grips were seen occasionally in both molding and packing operations.

On the basis of these observations, NIOSH determined that Dart Industries Inc., had made significant progress in effecting changes designed to reduce muscular soreness and fatigue. Postures and motions requiring closer scrutiny were identified along with suggestions for making further job changes. By the very repetitive nature of these jobs, some muscular soreness and fatigue will continue to be present in a few employees, although it is not likely to represent a serious health hazard.

KEYWORDS: SIC 2841 (plastic manufacturing), musculoskeletal disorders, hand, wrist and forearm postures and forces, ergonomics.

II. INTRODUCTION AND BACKGROUND

In August, 1980, the National Institute for Occupational Safety and Health (NIOSH) provided technical assistance to the Idaho Area Office of the Occupational Safety and Health Administration (OSHA) at the Jerome, Idaho plant of Dart Industries, Inc. (Tupperware). The objective was to conduct a preliminary ergonomic evaluation of jobs whose demands upon the musculoskeletal system (MSS) were thought to be associated with several recorded OSHA Code 26 (hand, wrist and forearm) MSS complaints.

Located in a rural community in Idaho, the plant manufactures a variety of laminated plastic products. During peak employment, about 700 workers are employed, many of them females with little previous industrial experience. The majority of workers are employed in either the molding or packing departments (4:1 ratio) where all MSS complaints originated. Most of the molding department employees operate molding machines. Tasks involve removing extruded pieces from the machines, trimming, and stacking. Packing operations deal with embossing and packing items in boxes. Jobs involve highly repetitious hand, wrist, and forearm movements. Objects handled are lightweight and not particularly bulky.

Prior to requesting NIOSH assistance, OSHA conducted a medical evaluation of a sample of workers at this plant. Information indicated that 19 OSHA Code 26 injuries were recorded in 1978, declining in 1979 to 1 repeat case. Interviews with a sample of workers indicated that complaints of muscular soreness and weakness persisted among employees in the molding and packing departments even though the number now requiring medical treatment was small. There were also complaints of headaches and memory loss, and several employees associated this with purging operations in the molding department. Extensive air sampling by an OSHA industrial hygienist indicated that no exposures to chemicals in concentrations that could be considered hazardous were present in the molding and packing departments. The OSHA medical evaluation suggested that the MSS complaints might be based upon ergonomic factors and recommended that NIOSH provide technical assistance.

III. EVALUATION PROCEDURES

On August 25, 1980, the plant was visited by the NIOSH investigator, accompanied by the OSHA industrial hygienist who had conducted the air sampling of this plant in 1979. Prior to observing molding and packing jobs, the plant safety engineer reviewed general plant operations, described problem jobs, and job changes in the plant that had been made since 1978. A walk through inspection was carried out and problem areas were photographed. These photographs were analyzed for ergonomic problems.

IV. RESULTS

A. Plant Management Interviews

When plant management became aware of the increase in the number of MSS complaints in 1978, the plant safety engineer was assigned the responsibility of consulting with industrial engineers to identify hazardous and stressful factors associated with molding and packing operations. He consulted Professor Erwin Tichauer, New York University, and Professor Richard Pearson, North Carolina State University, both recognized experts in job redesign. Following this consultation, a series of pilot projects, designed to reduce the number and kinds of stressful motions required for jobs at this time, were instituted in the plant; some of these are discussed below:

After plastic products are extruded from a molding machine, sprues (nubs) must be trimmed from the product. Initially fingernail clippers were used, requiring many pinching motions during the shift. A sprue knife was substituted, consisting of a handle designed to maintain the wrist in a neutral position, and a razor blade to cut the sprue. A simple pushing motion was substituted for the pinch motion (see Figure 1).

To eliminate worker tendencies for reaching excessive distances for plastic products, wooden guards were placed around machines in such a way as to restrict excessive trunk bending and shoulder extension (see Figure 2).

"Lazy Susan" shelves were constructed to eliminate excessive reach. Benches with adjustable bench heights were designed and made available to the workers.

Sealing and embossing procedures were automated in many instances.

Rather than snapping lids onto containers, containers were nested in bags with loose lids.

Job rotation was initiated in both departments. High speed production runs were rotated with less rapid runs.

B. Plant Walk Through Observations

1. General Impressions

The plant was immaculate, brightly lit with fluorescent fixtures, relatively quiet with uncrowded workstations. Temperatures were not uncomfortable. There was a pervasive odor, particularly in the molding department which apparently is

typical of plastics molding operations. Floors were polished, and there appeared to be a significant amount of glare in both departments. The workforce appeared to be predominantly female. The plant was operating at about one third of capacity, however typical molding and packing jobs were observed and photographed.

2. Molding Operations

Wooden guards were in place at several workstations, and reach distances did not appear to be excessive, except on occasions requiring reaching into molding machines (see Figure 3). All molders were using push knives for trimming. Floor mats were present to minimize foot and leg discomfort. Repetitive hand motions, mostly involving holding plastic objects, were present in most trimming operations. Hand positions generally did not involve excessive hyperextension or hyperflexion. Some pinch grips were used during trimming. Workspace in the operations observed was moderate.

3. Packing Operations

These jobs require motions that are often awkward. Reach distances in some instances were considerable (Figure 4). Placement of objects in plastic bags often required finger extension. Nesting of objects has eliminated many pinch grips. Wrist positions for lifting cartons required hyperflexion (Figure 5). Observed workspace appeared to be moderate.

V. DISCUSSION

A considerable body of evidence exists which indicates that cumulative trauma disorders of the hand, wrist and forearm (e.g. carpal tunnel syndrome, tendonitis, tenosynovitis, ganglionic cysts, etc.) are common problems for workers who perform repetitive manual work.¹⁻⁶ In many instances, object weight is not a particularly important factor. It has also been shown that the disorders can be caused or aggravated by repeated exertions with certain hand and wrist positions, including extreme wrist flexion or extension, pinching motions or repetitive forceful, fast movements. Job designs that require such movements are associated with risk of MSS disorders, and should be examined closely to eliminate these motions.

VI. CONCLUSIONS

Dart Industries, Inc. has instituted several practical and inexpensive changes, particularly in molding operations. In particular, the push knife has been an excellent substitution for a stressful pinch motion.

Other changes which minimize trunk flexion and shoulder extension should reduce the risk of MSS injuries to these structures. Problem areas still exist in packing operations, primarily because of the repetitive motions required. Muscular soreness and weakness are likely to persist with current packing procedures. Two specific motions should be avoided, namely, spreading the fingers to keep plastic bags open, and hyperflexion of wrists while handling cartons. On the whole, however, Dart Industries, Inc. has utilized job redesign concepts to eliminate some stressful hand, wrist, forearm and shoulder positions. The decreased number of MSS complaints suggests that these changes have been effective. By the very repetitive nature of these jobs, some muscular soreness and fatigue will continue to be present in a few employees, although it is not likely to represent a serious health hazard.

Complaints of headaches and memory impairment among Dart employees are beyond the scope of this report. It is possible that combinations of factors such as persistent odor and glare may underlie these complaints, but this is only speculative.

VII. RECOMMENDATIONS

1. Dart Industries, Inc. should continue to be aware of the MSS complaints among their employees, and should continue to urge employees to report such complaints promptly to plant medical personnel.
2. Packing operations should continue to be reviewed to identify other stressful hand, wrist and forearm positions and ways to reduce them. When feasible, such tasks should be automated.
3. Excessive trunk flexion and shoulder extension in both molding and packing operations has in many instances been dealt with effectively. The company should continue to remain alert to possibilities for alleviating these motions through alternative job redesign.

VIII. AUTHORSHIP AND ACKNOWLEDGEMENTS

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IX. DISTRIBUTION AND AVAILABILITY

Copies of this report are currently available upon request from NIOSH, Division of Standards Development and Technology Transfer, Technical Information Branch, 4676 Columbia Parkway, Cincinnati, Ohio 45226. After ninety (90) days the report will be available through the National Technical Information Service (NTIS), Springfield, Virginia 22161. Information regarding its availability through NTIS can be obtained from the NIOSH Publications Office at the Cincinnati, Ohio address.

Copies of this report have been sent to:

- a) Dart Industries, Inc.
- b) U.S. Department of Labor Region X
- c) U. S. Department of Labor, Washington, D.C
- d) NIOSH Region X

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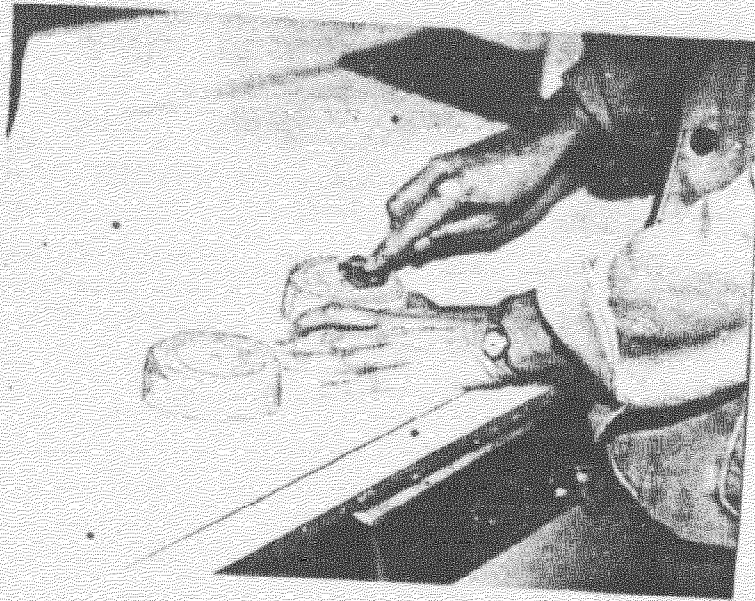


Figure 1. The sprue knife is used to trim objects after molding. The wrist is in a neutral position and the grip requires little force.



Figure 2. Wooden barriers erected around curing racks prevent the worker from reaching into the machine, minimizing shoulder extension and trunk flexion.

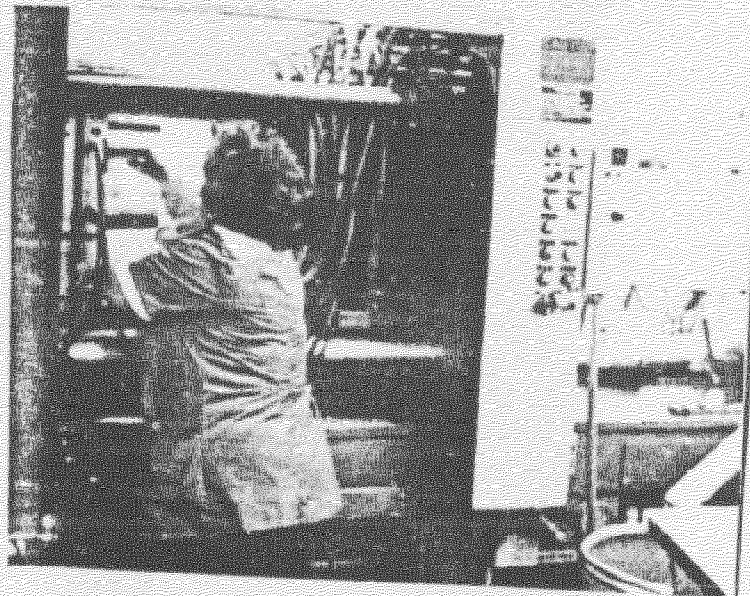


Figure 3. An example of awkward, excessive reach in molding operations.

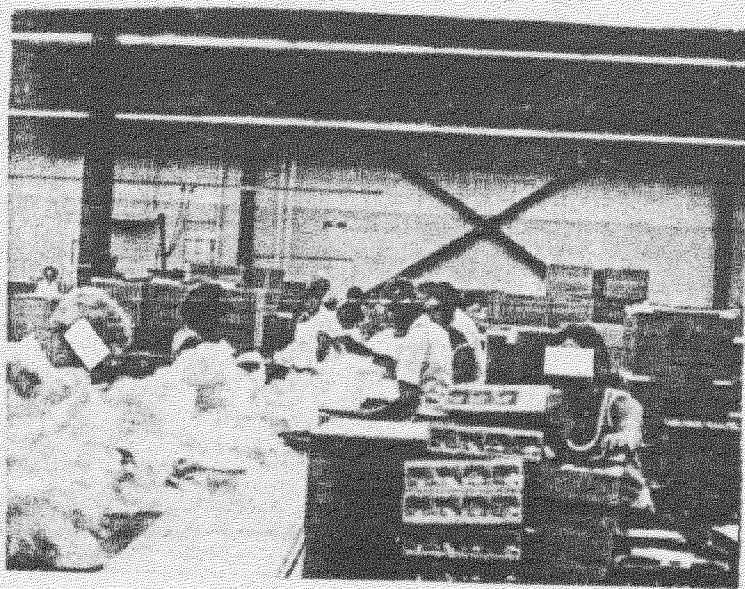


Figure 4. Two workers are shown reaching excessive distances to grasp objects.

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Figure 5. An example of an awkward lift. The wrist is hyperflexed and the shoulder is elevated excessively.