CASE STUDIES

PARTICIPATORY ERGONOMICS DEMONSTRATIONS IN THREE MEATPACKING PLANTS

Three year-long demonstrations of participatory approaches to identifying and solving ergonomic problems in meatpacking plants are described in this section. The work at each site was directed by one of three different university investigative groups. NIOSH coordinated and supported these demonstration cases with funds made possible through part of the settlement agreement previously mentioned. In each case, the setting is described with mention made of the plant processes, products, and production volume, the size and nature of the work force, management's level of attention to ergonomic concerns and commitment to solving them through a team approach. The make-up of ergonomic teams, their training and conduct in defining and proposing solutions to ergonomic problems are discussed. Evaluative information is presented concerned with aspects of the team-building process (i.e., interactions of parties represented, quality of leadership, effectiveness of role and functions) and performance (i.e., jobs analyzed, solutions proposed, and implemented). Some data reflecting the benefits gained through implementing the developed ergonomic solutions are given; however, opportunities for making these kinds of observations after the changes were introduced were limited greatly by the relatively short time-frame for the intervention project. One case study elaborates on both plant and corporate changes in workers' compensation and injury/illness statistics that occurred as a corporate-wide ergonomic program progressed over several years.

Two added comments need to be made in prefacing the three demonstration cases. The first is that the reporting of each case is a scaled-down, edited version of a more expansive stand-alone document as received from the university investigators involved. The latter reports were quite voluminous and included much common introductory material which the reader would find redundant. The second comment has to do with the interpretation or significance of the findings from these case studies. It is freely admitted that the intervention work as reported lacks many of the study design conditions for yielding a reliable and valid research product. Absent were independent control groups for comparisons against the participant teams in establishing whether the expected effects were due to team-directed intervention efforts or caused by other factors unmentioned. The teams themselves were few in number, raising questions about whether they were representative of other situations. Appraisals of their actions and results were in many instances based on subjective or qualitative observations. Additionally, because the time-frame of the interventions was short, any positive effects from the process may be underestimated. Despite these limitations, descriptions of team progress or achievements in meeting objectives did offer some insight into factors that are of consequence in these kinds of approaches. Similarly, evaluations of the ergonomic job changes were also illustrative of useful control techniques. Neither of these outcomes from the case studies reported here should be downplayed in terms of their importance.

CASE STUDY #1

Based on the Final Report of:

A Cooperative Agreement* with
Department of Industrial and Management
Systems Engineering
Center for Ergonomics and Safety Research
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CASE STUDY #1

THE SETTING

The plant site was a pork slaughter and processing facility which has been in operation for over 35 years. The plant slaughters 7,500 to 7,800 hogs per day (about 980 hogs per hour on a single shift) and employs 1,200 people of whom 914 are unionized production workers. About 35% of the worker population live in the town where the facility is located and 65% live within a 50 mile radius. The typical employee is about 38 years old and has been with the company for approximately 10 years.

Plant processing capability includes full edible and inedible rendering operations. Storage capacity for frozen product is 2.15 million lbs. and 12.8 million lbs. for refrigerated items. Processed product capability is 1,000,000 lbs./week of bacon and 1,000,000 lbs. of smoked meats/week. Fabrication capability is 900,000 lbs./week consisting of two shifts of ham boning and one shift of picnic boning. The production line process is divided into eight basic areas: kill, rendering, cut, loading, process, boning, specialty meats, and case ready. All areas operate on first shift. Second shift generally includes all areas of production except the kill and cut floor. Third shift is used for clean-up and certain maintenance activities.

As is characteristic for the meatpacking industry as a whole, production requirements vary seasonally with the heaviest demands occurring during the Thanksgiving/Christmas and Easter holiday seasons. The typical workload during a heavy production period is 10 hours/day, 6-7 days per week for 3-5 months running. At the time of the project, the plant had just completed three years of major facilities and management systems improvements, including a new livestock warehouse, cutting department refrigeration and workstation upgrades, and installation of a new business planning and control system. A major flood occurred during the one-year period of the intervention which destroyed certain areas of the plant and damaged others. Remarkably, sandbagging efforts were able to control water levels within the building so that only three full production days were lost. The impact on the ergonomics demonstration project was more significant. The timetable was set back 6-8 weeks and even longer on some planned elements.

PRE-EXISTING LEVEL OF ERGONOMICS CONCERNS/ EFFORTS

In November, 1991, thirteen months prior to the start of the intervention project, this company initiated steps toward developing a plant ergonomics program at the site of the study. During this period, university consultants were engaged to train a newly formed 40-member plant ergonomics committee on ergonomic fundamentals. The consultants furnished more problem-specific instruction following a plant tour, videotaping of several jobs and review of plant injury/illness data. Subsequently, the plant ergonomics committee was reformed into five departmental task groups who continued to receive further training on ergonomics and other safety matters given by the company safety and health officials.

In July 1992, the ergonomics task groups had begun work on job improvement projects and to document progress. In August 1992, company management and the union agreed to work with the university consultant group in submitting a proposal to NIOSH to undertake an ergonomics demonstration project which was seen as a way to advance their activities. Coincident with the development of this proposal was the formulation of a set of company guidelines expressing management's commitment to fully support efforts to identify and eliminate ergonomic hazards, to promote total staff cooperation in adopting safer work methods, procedures, equipment and work station designs, and to treat these matters as having the same priority importance as productivity and cost reduction efforts. Employee involvement was acknowledged in the guidelines through employee membership on the task groups already mentioned and employee participation in various program elements such as worksite analysis, work hazard prevention and control, medical management, training and education, and the documentation and monitoring of results. As explained, this expression was taken to mean a team approach in addressing opportunities for ergonomic improvements. The guidelines were approved by company management and the local union leadership in January 1993, which was also the start date for the ergonomics demonstration project.

SCOPE/OBJECTIVES OF THE CASE STUDY

The purpose of the NIOSH cooperative agreement with the university group directing this demonstration was to create functional ergonomics teams that could develop, document and validate ergonomic activities that could reduce cumulative trauma disorders and other related injuries and illnesses in the meatpacking industries. Four phases of activities were designed by the university contractors to meet this goal in one year. They were:

Phase I- Direct/implement efforts on tasks involving program development, team-building and team-training.
Phase II- Assist in team efforts on tasks involving job selection and analysis of problems, and development/implementation of solutions.
Phase III- Survey and evaluate the effectiveness of ergonomics solutions once in place, worker attitudes and perceptions of the ergonomics program, and ergonomics team effectiveness.
Phase IV- Draft a final report of all findings.

METHODS AND OPERATIONAL PROCEDURES

A number of methods were used to satisfy these different tasks and in furnishing technical assistance. The following elaborates on some of these procedures:

Team Formation/Member Selection

The five department-based ergonomics task forces mentioned earlier were established as the participant teams to carry out the objectives of the program. Each team included 7-9 persons representing production employees, management, medical staff, and maintenance. Employees were selected from those who expressed interest in participating in the program and those who had experience in a number of different jobs within the designated area. The role of management and the medical staff in the start-up phase was to facilitate access to information needed for job and cumulative trauma disorder (CTD) analyses and to readily obtain financial resources needed to make ergonomic changes. Maintenance representatives were involved because they were the personnel that would actually implement the changes. Teams reported directly back to their departments and the plant manager. Teams had autonomy to implement low cost solutions, but needed to document and justify substantial changes to upper management. Such justification usually involved an analysis of the CTDs involved in the affected jobs, number of employees affected, and a cost/benefit analysis of the proposed ergonomic change.

Team Training

Following the teams' formation, the ergonomics task force members participated in team-building sessions designed to enhance their ability to work together, in addition to receiving team ergonomics instruction in defining risk factors for cumulative trauma disorders and ways to prioritize jobs for ergonomic solutions. The ergonomist associated with the human resources group of the corporation and university faculty involved in the project assisted in this training. The team-building activities included: (a) defining a team; (b) determining the goals of an ergonomics team; (c) establishing group meeting rules and team roles; (d) reviewing guidelines for effective group discussion and constructive feedback; and (e) practicing brainstorming exercises and techniques for consensus building. Consistent with the approach advocated by experts in the team-building area (Dyer, 1987; Parker, 1991), the team-oriented skills focused both on how to develop task-oriented skills and interpersonal processes within the group. Forms for documenting team member responsibilities, records of meetings and actions taken, plus other handouts served to reinforce these points.

In reviewing the causes of CTDs (e.g., posture, force, repetition, and the general work environment), the ergonomics training given to the teams emphasized methods for their characterization through the use of videotape and job analysis techniques. The video techniques used a rating system to determine the extent of hand, wrist, arm, and shoulder movement, as well as the position of the back and neck during work. Job analysis included reference to OSHA 200 log entries, observations of job tasks and gaining worker input as to ease/discomfort of certain operations. Practice in job analysis was included. General ergonomics training was later offered to all plant employees.

Team Activities re Defining/Solving Problems

Once formed and trained, each of the five ergonomics teams were encouraged to review, describe, and document on videotape all jobs in their areas of responsibility as a first step in the program. Based on a job description and a review of the job requirements, the most stressful jobs were to be identified for job analysis and ergonomic improvement in accordance with ergonomics team training. The ergonomics teams met formally at least twice every month to develop and review their recommendations for job redesign. Team members also met informally throughout each month to discuss ergonomics issues. Medical staff supplied the teams with information about the frequencies of CTDs for particular jobs. In addition, self-reported physical pain symptoms and primary tool usage data were summarized and presented to the teams by the university investigators in order to facilitate the processes of problem identification. This information, plus their own observations and experience in the jobs, were used by teams to establish priorities and to suggest ergonomic changes. Teams frequently asked for input from employees to aid in the early detection of CTD symptoms and potential problem jobs. Some of the teams found it very helpful to couple the videotaping of each job in their department area and discussions with the employees who performed the jobs. The corporate ergonomics specialist encouraged teams to start with ergonomic changes that could be easily accomplished. Early success built team members' efficacy in their roles as change agents and their credibility with non-team members.

Records of the ergonomic changes in the plant were maintained by each task force with the aid of the corporate ergonomics specialist and university personnel. Photographs and descriptions of changes were posted in the cafeteria area to inform plant employees. While teams were the primary force for change, university faculty members assisted the teams in identifying engineering solutions. Plant maintenance personnel were largely responsible for the implementation of these ergonomic solutions.

TEAM ACCOMPLISHMENTS

The total number of jobs selected for analysis and improvement by each department team is summarized in Table 1 below, as is their status of completion at the end of the one-year project period.

Table 1: Number and Status of Job Projects Undertaken by Teams

Department/Team	# Projects Initiated	Implementation
Boning/Special Meats	14	13 completed, 1 in process
Cut/Loading	17	3 completed, 14 in process
Kill/Rendering	24	21 completed, 3 in process
Process	28	12 completed, 16 in process
Night Shift	21	15 completed, 6 in process

To illustrate the type of information collected and reviewed by each team and the resultant activity that took place in finding a solution for improving a given job, details are given in Exhibits 1-4 of four completed job modifications. Each was from a different department team. The information provided in each instance was taken directly from each team's ergonomics project documentation notebook and involved jobs rated as posing a high risk of ergonomic-musculoskeletal disorders.

EXHIBIT 1: DETAILED ERGONOMICS INTERVENTION EXAMPLE—BONING/SPECIAL MEATS

Job Data

1. Job Name: clean square metal tubs
2. Work Shifts: 1 & 2
3. Number of Workers Assigned: 11
4. Job/Task Objective: high pressure wash of metal tubs
5. Ergo Problem Identification Date: 10-92
6. Assigned Priority: immediate (high risk)
7. Job/Task Description: Move metal tanks by mule to tub wash area to steam hose clean. Worker remains outside the tub with steam hose, then push tub to tilt position to drain water out of bottom drain hole. Worker is required to reach and twist to clean lower/bottom tub surfaces. Tub weighs 250-275 lbs.
8. Physical Stressors:
- a) high force (arms, shoulders, legs)
- b) full extension of upper extremities
- c) compression load on upper torso from tub edge

9. Other Stressors:
- a) some workers cannot perform job due to physical abilities requirements
- b) keeping up with line speed (work pace)

10. Estimated Number of Task Repetitions/Worker:
pulls, pushes, twists = 4,830/shift; = 24,150/week; = 1,255,800/year
11. Estimated Work Cycle Task Time: Not available
12. OSHA 200 Log Incidence/Severity History:

1993 Severity of Cases		***1993 Number of Entries***	
OSHA Recordable:	20	CTD Cases:	4
Physician Cases:	16	Injury Cases:	16
Restricted Work Cases:	4	Lost Work Days:	8
Lost Day Cases:	5	Restricted Days:	55
1992 Severity of Cases		***1992 Number of Entries***	
OSHA Recordable:	16	CTD Cases:	4
Physician Cases:	14	Injury Cases:	12
Restricted Work Cases:	5	Lost Work Days:	5
Lost Day Cases:	2	Restricted Days:	44

13. OSHA 200 Log 1992+1993 Cost Impact:

Direct Workers' Comp Cost	= $8305.00
Direct Medical Cost	= unknown
Indirect Cost	= unknown

14. Expected Production/Safety Factors:
- a) job bidding open to more workers
- b) reduce job overload w/service operators
- c) increased shelf life of products
- d) improved sanitation controls (methods)
- e) reduced risk of accident and injury
- f) reduced process time to clean

Ergonomic Job Analysis

1. Summary of committee's observations and facts related to ergonomic job stress and problem identification:

Material handling of tubs for cleaning requires extremely high upper extremity and whole body force and awkward posture to move and balance tubs for cleaning. The danger exists that the tub can fall on the worker's legs or feet while cleaning.

2. Summary of possible solutions considered:

a) mechanical assist design criteria
b) one person does all the cleaning

3. Final solution estimate of stressor elimination or reduction:

All force required to push, pull, tip and position tubs during high pressure steam cleaning would be eliminated by providing a mechanical/hydraulic lifting fixture.

4. Work Order Date: 4-93

5. Estimated Cost of Solution:

Material= $ 9,600.00
Labor = $ 4,758.00
Total= $14,358.00

Modified Job Analysis and Solution Follow-up Evaluation

Analysis and evaluation in process.

EXHIBIT 2: DETAILED ERGONOMICS INTERVENTION EXAMPLE — CUT/LOAD TEAM

Job Data

1. Job Name: pack loin ends
2. Shift: 1
3. Number of Workers Assigned: 3
4. Job/Task Objective: pack loin end pieces in boxes
5. Ergo Problem Identification Date: 6-93
6. Assigned Priority: immediate (high risk)
7. Job/Task Description:

Empty cartons are lined with plastic and carried to line. Loin end pieces or sirloin pieces (approx. 3 lbs. each) come off conveyor from the center cut saw. Pieces fall into a stainless steel tub which stands 42 inches off of floor surface. About 4,200 loin end cuts are processed per day. The workers use a metal hook to snag each piece individually, lift it out of the tub, then pack and arrange the loin ends in one carton, and sirloins in a different carton (15 pieces per carton). The cartons are placed on a stand. Once each box is filled the worker labels the box, lifts the box, carries it to a scale, checks weight, lifts again and takes it to a conveyor where it then goes to the cooler.

8. Physical Stressors:
- a) forward bending at the waist
- b) extend legs and toes to reach work
- c) static hand grip
- d) flexion and extension of the shoulder
- e) high pulling and lifting forces
- f) lift and carry load
- g) high repetition

9. Other Stressors:
None identified

10. Estimated Number of Task Repetitions/Worker:
pushes, pulls, twists = 4,200/shift; =21,000/week; =1,092,000/year
boxes processed/worker = 280/shift;= 1,400/week; =72,800/year

11. Estimated Work Cycle Task Time: 160 sec/box

12. OSHA 200 Log Incidence/Severity History:

1993 Severity of Cases		*1993 Number of Entries*	
OSHA Recordable:	0	CTD Cases:	0
Physician Cases:	0	Injury Cases:	0
Restricted Work Cases:	0	Lost Work Days:	0
Lost Day Cases:	0	Restricted Days:	0
1992 Severity of Cases		*1992 Number of Entries*	
OSHA Recordable:	0	CTD Cases:	0
Physician Cases:	0	Injury Cases:	0
Restricted Work Cases:	0	Lost Work Days:	0
Lost Day Cases:	0	Restricted Days:	0

13. OSHA 200 Log 1992+1993 Cost Impact:

Direct Workers' Comp Cost	= $ 0.00
Direct Medical Cost	= $ 0.00
Direct Cost	= $ 0.00

Potential back injury/surgery could be $50,000/case.

14. Expected Production/Safety Factors:
No significant factors identified.

Ergonomic Job Analysis

1. Summary of committee's observations and facts related to ergonomic job stress and problem identification:

If possible, the solutions would eliminate or decrease the following motions/actions: bending forward at the waist, hooking and lifting loins, manually carrying 30-45 lb. boxes.

2. Summary of possible solution considered:
- a) install chute to bring empty boxes to the line
- b) install roller table at end of line (lower than conveyor)
- c) relocate conveyor scale to avoid box lifting

3. Final solution estimate of stressor elimination or reduction:

a) install chute to bring empty boxes to the line

b) install roller table at end of line

c) relocate conveyor scale

4. Work Order/Date: #28981/6-93

5. Estimated Cost of Solution:

Material = $ 7,400.00

Labor = $ 4,618.00

Total = $12,018.00

Modified Job Analysis

Modified job analysis and evaluation in process.

EXHIBIT 3: DETAILED ERGONOMICS INTERVENTION EXAMPLE - KILL TEAM

Job Data

1. Job Name: hog shackler

2. Shift: 1

3. Number of Workers Assigned: 1

4. Job/Task Objective: re-shackle hogs that have come loose or fallen from hanging conveyor (live/semi-live)

5. Ergo Problem Identification Date: 8-93

6. Assigned Priority: immediate (high risk)

7. Job/Task Description: Hogs are shackled after stunning on a table and are conveyed to the end of the table. At the end of the table the hogs fall to the floor causing the shackled leg to be picked up by the sticking conveyor chain. Hogs are lifted and conveyed to the next workstation which is the sticker who bleeds the animal. Some hogs (about 200/day) kick the shackle off before the chain lifts them to the sticker workstation. These hogs must be herded and picked up to replace the shackle.

8. Physical Stressors:

a) bending forward and backward (lower back)

b) neck forward posture fatigue

c) arm extension under load

d) high repetition

e) lifting

9. Other Stressors:

a) fear of getting hit or kicked by hogs

b) fear of getting behind (work pace)

10. Estimated Number of Task Repetitions/Worker:

pulls, pushes, twists = 1,500/shift; = 7,500/week;= 390,000/year

11. Estimated Work Cycle Task Time: 4.5 sec

12. OSHA 200 Log Incidence/Severity History:

1993 Severity of Cases		*1993 Number of Entries*	
OSHA Recordable:	0	CTD Cases	0
Physician Cases:	0	Injury Cases	0
Restricted Work Cases:	0	Lost Work Days	0
Lost Day Cases:	0	Restricted Work Days	0
1992 Severity of Cases		*1992 Number of Entries*	
OSHA Recordable:	1	CTD Cases	1
Physician Cases:	0	Injury Cases	0
Restricted Work Cases:	0	Lost Work Days	0
Lost Day Cases:	0	Restricted work Days	0

13. OSHA 200 Log 1992+1993 Cost Impact:

Direct Workers' Comp Cost = $ 0.00
Direct Medical Cost = $ 0.00
Indirect Cost = $ 0.00

Potential cost from a single face or back injury might be $10,000 to $50,000. Current job design requiring 200 hogs/day to be re-shackled requires a full-time equivalent employee at about $28,622/yr (includes benefits). Product (hog) loss (100 "blowouts"/day with stunning and subsequent trim loss) is estimated at $626,000 annual equivalent loss in product value.

14. Expected Production/Safety Factors:

a) reduced re-shackling
b) reduced "blowout" product
c) reduced risk of injury
d) reduced psychological stress

Ergonomic Job Analysis

1. Summary of committee's observations and facts related to ergonomic job stress and problem identification:

a) fear of being injured
b) back injury potential
c) head/face injury potential
d) high repetition (needless work in re-shackling)

2. Summary of possible solution considered:

a) have stick chain rail raise the hog before it reaches the end of the table and touches the floor
b) add staff to help with overload of re-shackling work

3. Final solution estimate of stressor elimination or reduction:

Shortening of the shackle chain will reduce the need to handle and lift hogs; reduction of injury fear

4. Work Order Date: 9-93

5. Estimated Cost of Solution:

Material = $1,200.00
Labor = $1,617.37
Total = $2,817.37

Modified Job Description/Analysis

Modified job analysis and evaluation of ergonomic change still in process. Initial review estimated that there has been a 70% reduction in injury risk (as perceived by workers), a 70% reduction in product value loss, and reduced the worker need by 1 person for this work area. Direct annual cost saving due to this improvement is estimated at $436,000.

EXHIBIT 4: DETAILED ERGONOMICS INTERVENTION EXAMPLE - NIGHT SHIFT TEAM

Job Data:

1. Job Name: lean shank trimmer
2. Shift: 2
3. Number of Workers Assigned: 3-4
4. Job/Task Objective: line balancing for trimmers
5. Ergo Problem Identification Date: 9-93
6. Assigned Priority: urgent (extreme risk)
7. Job/Task Description:

Position ham-separate shank meat from shank bone. Remove and trim 95% lean shank from ham-place in tub. When tub is full, twist and turn and dump small tub into large tub-steel knife. Repeat workload 96%.

8. Physical Stressors:

a) awkward wrist postures under twisting load
b) "winging" elbows
c) shoulder abduction
d) bending forward at the waist
e) high grip forces
f) cold

9. Other Stressors:

a) workload pace is 96%
b) knives not sharp enough, long enough for job

10. Estimated Number of Task Repetitions/Worker:

pushes, pulls, twists= 12,040/shift; = 60,200/week; = 3,130,400/year

11. Estimated Work Cycle Task Time:

16.2 sec work cycle; 0.5 sec rest cycle; 16.7 sec total cycle

12. OSHA 200 Log Incidence/Severity History:

1993 Severity of Cases		**1993 Number of Entries**	
OSHA Recordable:	1	CTD Cases	1
Physician Cases:	0	Injury Cases	1
Restricted Work Cases:	0	Lost Work Dayt Cases	0
Lost Day Cases:	0	Restricted Work Days	0
1992 Severity of Cases		**1992 Number of Entries**	
OSHA Recordable:	0	CTD Cases	2
Physician Cases:	4	Injury Cases (1 was back)	1
Restricted Work Cases:	2	Lost work Days	4
Lost Day Cases:	2	Restricted Work Days	7

13. OSHA 200 Log 1992+1993 Cost Impact:
Direct Workers' Comp Cost = $421.30
Direct Medical Cost = $1,113.00
Indirect Cost = $ not available
Total Direct Cost (WC+medical) = $1,534.30

14. Expected Production/Safety Factors:
Reduction of work cycle load from 96% to 79% (boner) while increasing workload of trimmer from 80 to 88%.

Ergonomic Job Analysis

1. Summary of committee's observations and facts related to ergonomic job stress and problem identification:
a) shank boner work cycle load is 96%
b) trimmer work cycle load is 80%
c) shank boner physical stressors are present
d) work load cycle balancing is needed

2. Summary of possible solution considered:
a) IE job work analysis showed inside knuckle trimmers could remove and trim lean shank to reduce shank boner workload and raise workload of trimmers.

3. Final solution estimate of stressor elimination or reduction:
a) reduced wrist posture/force/repetition stressors
b) eliminated bending at waist and lifting

4. Work Order Date: Work order not required

5. Estimated Cost of Solution:
Material= $ 0.00; Labor= $50.00; Total= $50.00

Modified Job Analysis

A preliminary evaluation of the modified job estimated that a shank boner work cycle load has been reduced causing a reduction in the bone yield and an increase in the lean shank yield. Since the workload change was incorporated (9-93) it has been estimated that $14,000.00 in increased lean shank yield has been attained with a concomitant positive change in lean shank work cycle and rest times:
a) work cycle time from 16.2 sec to 13.2 sec (18.5% decrease)
b) rest cycle time from 0.5 sec to 3.5 sec (700% increase)
c) total work cycle time of 16.7 sec stayed the same

EVALUATION OF TEAM EFFECTIVENESS AND PROGRAM OUTCOMES

In addition to the number of jobs for which team-directed solutions were implemented, as shown in Table 1, various other measures and observations served to assess team functioning and performance as well as to gauge its impact. Methods for evaluating team function and effectiveness were:

- Questionnaire surveys of team members who individually rated their team efforts and experiences in undertaking the ergonomics intervention activities.
- University investigators' observations and records of team activities.

Methods for evaluating the impact or benefits of the intervention program included:

- Questionnaire surveys of production employees on attitudes toward the ergonomic program, level of pain and comfort experience resulting from implementing team-directed job improvements.
- Comparisons of the plant-wide and individual department incidence rates for cumulative trauma disorders as recorded in OSHA logs, physician cases, production days lost, and restricted duty days at various time points before, during and at the endpoint of the intervention project study.
- Comparisons of plant-wide and individual department rates of absenteeism and turnover at time point before and at the endpoint of the intervention project study.

What follows are descriptions of the data collection procedures and summaries of the results for these two kinds of evaluations.

Measures of Team Function/Effectiveness

Surveys of Ergonomics Team Members: At the one year endpoint for the project, team members individually rated questionnaire items as to their perceptions of: a) team success in redesigning jobs and implementing ergonomic changes; b) belief in their capabilities for doing so; c) overall satisfaction with the effort; d) openness in communication among members; e) quality of team interactions in defining goals, developing workable plans and priorities; f) availability of resources to support the team's efforts; and g) personal commitment to the work of the team. Mean results for all 30 team members, using a 7-point rating scale (1=strongly disagree, 2=disagree, 3=disagree slightly, 4=Neutral, 5=agree slightly, 6=agree, 7=strongly agree), are shown in Figures 1-7 as are results averaged for members of each team. In terms of overall ratings, team

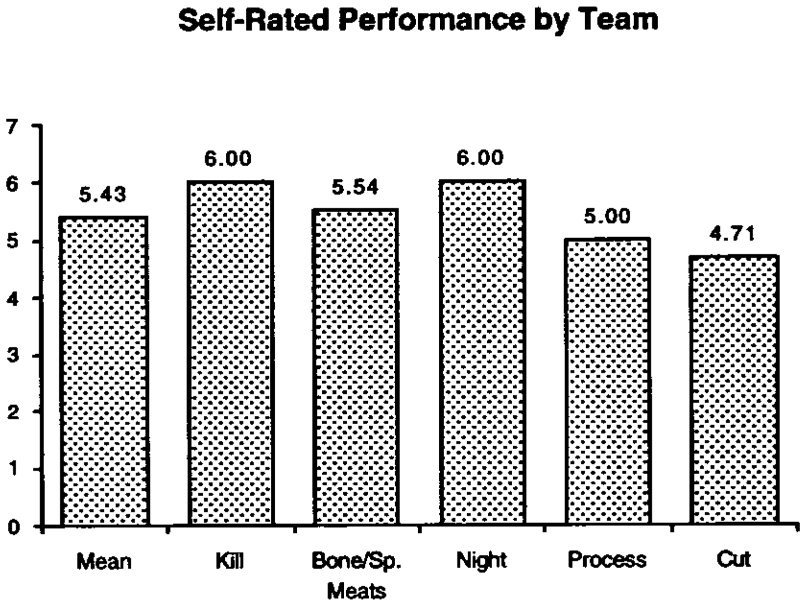

Figure 1. Mean (Overall) and Team Self-Rated Performance Ratings

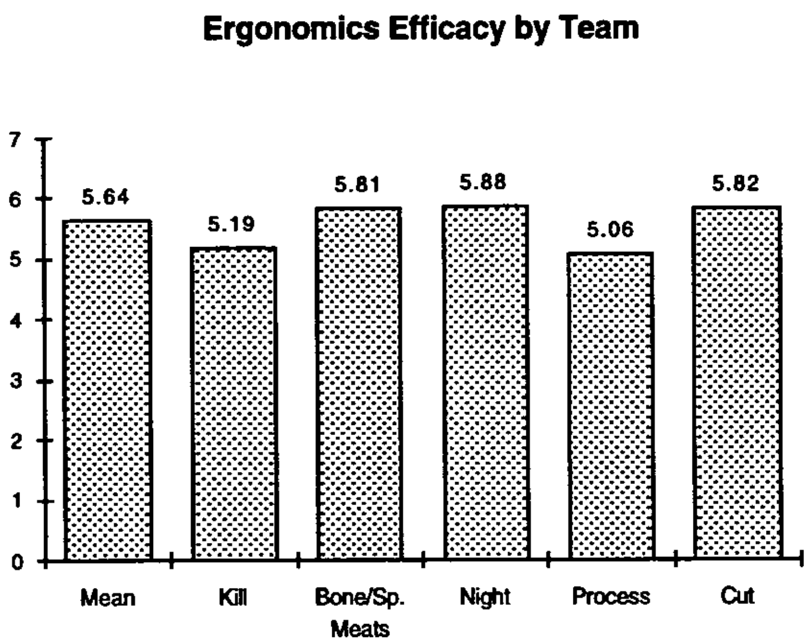

Figure 2. Mean (Overall) and Team Ratings of Self-Efficacy

members as a whole agreed that their teams had been successful overall in generating ideas for redesigning jobs and in implementing those ergonomic changes (Self-Rated Performance Mean=5.43), and expressed somewhat higher levels of beliefs in their efficacy for undertaking such assignments (Team Efficacy Mean=5.64). Members generally felt even more positive about their ability to communicate with one another (Communication Process Mean=5.97) and expressed satisfaction with their teams (Team Satisfaction Mean=5.83).

Communications Process by Team

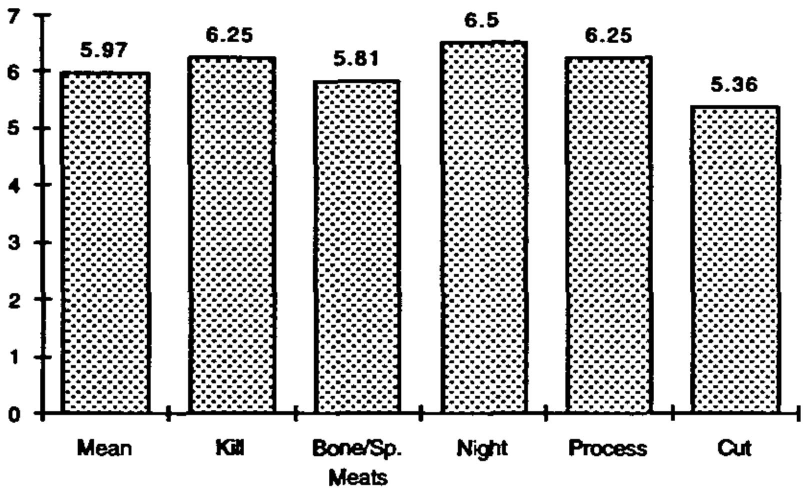

Figure 3. Mean (Overall) and Team Ratings of Communication Process

Team members were less certain that their groups performed well in defining goals, developing workable plans, and prioritizing work (Work Process Mean=5.15) and that they had the necessary information and resources to do their job (Resource Adequacy Mean=5.23). It was assumed that with added help in refining their team work processes and more resources to do their job, the teams should be able to improve their performance given their overall high commitment to their work on the ergonomic teams (Work Commitment Mean=6.22).

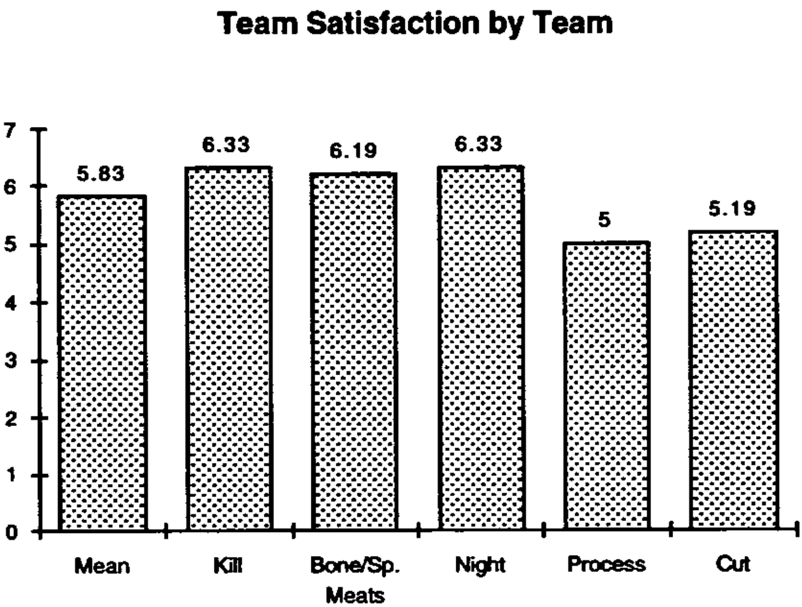

Figure 4. Mean (Overall) and Team Ratings of Team Satisfaction

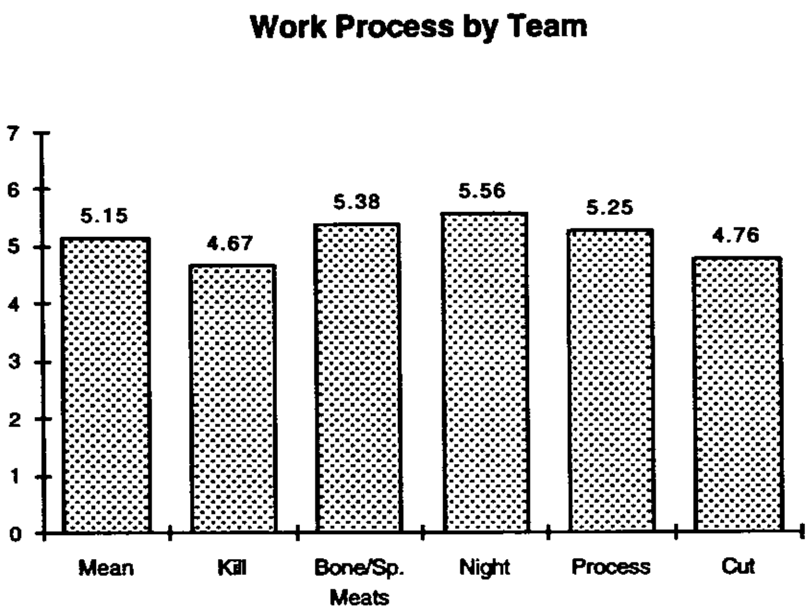

Figure 5. Mean (Overall) and Team Ratings of Work Process

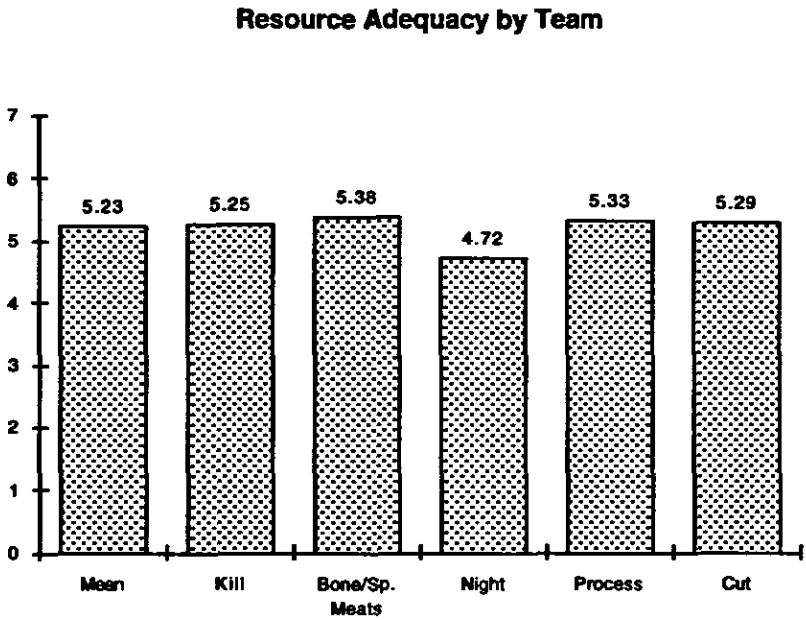

Figure 6. Mean (Overall) and Team Ratings of Resource Adequacy

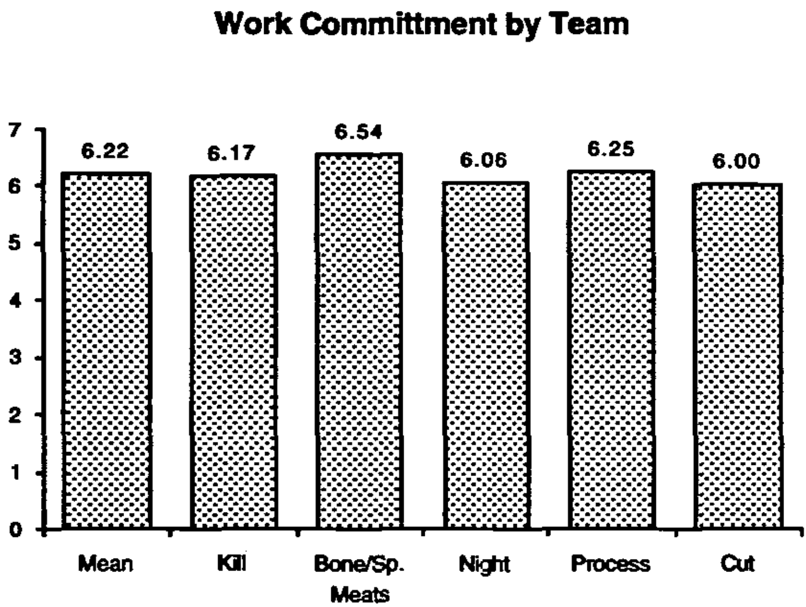

Figure 7. Mean (Overall) and Team Ratings of Work Commitment

Overall, written responses to open-ended questions in the ergonomics team survey suggested that team members felt that a number of factors contributed to the effectiveness of the teams. First, many members mentioned that the diversity of the backgrounds of team members helped them perform better. Thus, teams seem to operate better when they have members from all parts of their department and who have experience in multiple jobs within their department. Secondly, members felt that the ability to listen to one another and talk openly helped them perform effectively. Finally, talking with the employees actually doing the jobs in their department also appeared to facilitate their effectiveness as a team. Written responses to open-ended questions also suggested a number of factors that have prevented the teams from performing optimally. Some groups felt that they did not receive adequate assistance from maintenance personnel in the plant. This was significant since these employees are ultimately responsible for implementing many ergonomic changes. Secondly, there were problems in getting everyone to attend meetings due to production pressures in the plant. Lack of adequate time for team members to work on ergonomics projects was seen as the primary factor inhibiting the teams' productivity on ergonomics. Third, in some groups there was a lack of balance in the workload among members. Some members tried to do too much of the work and group members felt that they could have accomplished their tasks better if work were better distributed among all members.

The survey findings by individual ergonomics teams suggests that some teams appeared to function better than others. The Bone/Special Meats, Kill, and Night Department teams tended to show higher (more positive) ratings in viewing the graphical representations for the various dimensions shown in Figures 1-7. However, even within these teams there was evident room for improvement. Though their ratings of team performance, team satisfaction, and communication were among the highest noted, Kill Department team members perceived needs to improve the quality of their team work processes (see Figure 5) and confidence in their ability to do such tasks (see Figure 2). Similarly, ratings for the members of the Night shift team suggested needs for greater access to resources to improve their efforts in ergonomic job redesign (see Figure 6).

The ergonomics teams that appeared to function less well were the Cut and Process Teams. Team members of these groups rated themselves the lowest of the five teams in terms of self-rated performance and team satisfaction (see Figures 1 and 4). Members of the Cut team also rated the team low in communication and work processes relative to the other teams (see Figures 3 and 5).

Observations by University Research Staff: Members of the university research team involved in the ergonomics intervention program met regularly with the individual department ergonomics teams and observed their activities during the term of the study. Particular attention was paid to task-related processes, team leadership issues, intergroup cohesion and conflict, plus overall effectiveness. Such observations were largely in accord with those from the team survey data summarized above and offered some basis for the differences in team performance. For example, it was observed that the Bone/Special Meats ergonomics team appeared to be one of the most productive groups, primarily due to an especially strong and highly motivated leader who was clearly an advocate for ergonomic change in the plant. The Kill group worked well primarily because of the democratic style of decision-making adopted by the leader of this group and the clear access to resources needed by the team. Observations also revealed that the job analysis efforts in this group were not as deliberate as they could have been. This group's decisions on ergonomics projects were based mostly on what items were brought to the team's attention and how easy it would be to implement them, versus a more systematic analysis of injury and illness rates for jobs. The Night Shift team was seen as being an effective group in terms of democratic leadership, idea generation, and other internal work processes. However, members of the Night Shift team often had complaints about lack of coordination with day shift employees. The Cut group appeared to have some differences in perspectives of what issues to address and how to prioritize them. These dynamics led the group to perform less than optimally since little agreement could be reached on what ergonomics projects to focus their attention. Some disagreement also appeared to center on the level of effort given to the ergonomics project by either side of employees and management. The Process team initially had problems establishing their goals and direction regarding ergonomic analyses of the jobs in their area. However, once they systematically videotaped each job in their department and discussed ergonomic-related issues with the employees themselves, the team became much more focused and productive.

It is to be noted that the apparent differences just described among the teams, based on their survey ratings and the observations of the university investigators, parallel their performance outputs in terms of the number of job projects completed through the implementation stage. As shown in Table 1, the Kill, Night Shift and Boning/Special Meats teams, which drew the most favorable ratings and observations, were also the most productive in terms of completion figures. The Process and Cut teams, exhibiting less favorable reactions, had fewer completed projects although the Process group seemed to perform better than originally thought.

Measures of Impact/Benefits

Employee Attitude-Pain Survey: All production employees (approximately 815 employees) were given the opportunity to participate in surveys conducted at two points in time (March 1993 and January 1994). These surveys were composed of both employee attitude, and pain and discomfort questions. Analyses were conducted that compared participants' responses in March 1993 with those in January 1994. 311 employees chose to participate in the first survey (39% response rate), and 202 employees participated in the second survey (25% response rate). The analyses below are based on the 127 employees that responded to both surveys. As to pain indicators, individuals were asked to fill out a physical symptoms survey adapted from Silverstein (1989). They were asked to indicate if they "had any pain and discomfort that doesn't go away." If so, to indicate up to two areas of their bodies where they felt the most pain and then the next most pain. Thus, participants could indicate 0-2 body areas affected by persistent pain. Frequency analyses of this data revealed that in March 1993 the number of people reporting zero, one, and two body areas affected by persistent pain were 48, 9, and 70, respectively. In January 1994, the number of people reporting zero, one, and two body areas affected by pain were 54, 28, and 45. Thus, fewer people were reporting pain, and of those people that did, fewer were reporting pain in two body areas. Overall, the mean number of body areas affected by persistent pain decreased significantly from 1.17 prior to the ergonomics project to 0.93 after the ergonomics interventions.

Employees were then asked to indicate "how well each of the following described their problem: aching, burning, cramping, loss of color, numbness (asleep), pain, swelling, stiffness, tingling, and weakness." Employees responded to these items on a 1-7 scale with 1=Not at all to 7=Very well. Their responses to these ten items were then tabulated and the average taken for the body areas affected by persistent pain to create an overall index of the "severity" of the pain experienced. Employee pain severity was significantly reduced by the ergonomics intervention in the plant, from 4.24 to 2.86.

With regard to attitudes, employees were also asked to indicate their feelings about the ergonomics program at the plant. They were asked four questions regarding their satisfaction with the program, management's commitment toward the program, and the effects of the program on employees. Based on a 7-point rating scale (1=very unfavorable to 7=very favorable), employees attitudes toward the ergonomics program were relatively positive (4.72) in March 1993, yet decreased to 4.11 in January 1994. This decrease in attitudes related to the ergonomics program probably represents high, unrealistic expectations for the program initially, followed by low satisfaction with it once employees saw that jobs were changed more slowly than they had expected.

Analyses were also conducted to examine the effects of ergonomic job changes on employee attitudes and perceptions of pain. Ergonomics teams informed university researchers of the employee identification numbers for those whose jobs had been changed. A total of 39 of the 127 employees who responded to both surveys had some change in their job, tools, or workstation. Thus, the sample was divided into two groups based on whether their job had been changed (N=39) or not (N=89). First, regression analyses were conducted to determine if the two groups were significantly different based on the particular dependent variable at Time 1 (March 1993). Since no significant differences emerged between the groups in these analyses, the employees who did not have their jobs changed served as a control group to compare with the job change group's responses. It was expected that employees who had their jobs changed would have less severe pain overall at Time 2 (January 1994) when compared to those whose jobs remained the same. Accordingly, mean ratings for pain were found to be significantly lower in the job change group (2.39) than in the no job change group (3.11).

It was also expected that those individuals who had experienced some form of job change would feel more positively toward the ergonomics program than those who had not experienced a change. Those who did have a job change maintained a relatively positive attitude toward the ergonomics program (mean rating of 4.46), while those that did not experience a change expressed a less positive attitude (3.96).

Employees' intentions to leave the company were also rated on a 1-7 point scale (1=Strongly Disagree to 7=Strongly Agree) with those scoring high on this scale expressing a desire to leave the company, while those having lower scores were seen as more likely to want to remain. Those who had experienced a job change showed significantly lower intentions to leave the company (3.10) than those whose jobs had not undergone any form of change as part of the intervention program (3.79).

Plant-wide Reports of Cumulative Trauma Cases, Lost Days, Restricted Duty, Absenteeism and Turnover: Plant-wide data gathered to establish the relative success of the ergonomic effort included OSHA 200 logs of employee injuries and illnesses. From this data, incidence levels were calculated for: Cumulative Trauma Disorders (CTDs), physician-referred CTD cases, lost production days, and restricted duty days. Information was also obtained from company records on the overall amount of absenteeism and turnover in the plant. Findings on these different indicators are summarized and discussed below. The data represent aggregated information for the plant departments of Kill and Rendering, Cut, Process, Boning, Special Meats, and Case Ready.

Cumulative Trauma Disorders (CTDs): One of the most convincing pieces of evidence that the ergonomics intervention program was a success is the reduction in the incidence rates of CTDs in the overall plant. As stated above, data were obtained on the number of total CTD cases in the major plant departments and the relative incidence of CTDs per 200,000 work hours, calculated by the following formula: (Number of CTD cases) x 200,000/Total Work Hours for the given period of time. Using these incidence rates allowed one to control for any seasonal or annual fluctuation in the number of hours worked and the associated increase in CTDs.

Each of the yearly time periods examined here began on March 1, the beginning of the major thrust of the ergonomics project at the plant site. Only OSHA logs of CTDs from 1991 or later were used because the plant changed its CTD reporting procedures in 1991 when it adopted the new OSHA guidelines for the meatpacking industry. These changes made comparisons to previous years uninterpretable. Recognizing that the effects of the ergonomic changes may take some time to become apparent, incidence rates for the post-intervention period (March 1, 1993 to February 28, 1994) were analyzed in two separate six-month periods. Lower incidence rates in CTDs were anticipated for the second six-month (labeled 1993b) period of the study, but not necessarily for the first six-month period (labeled 1993a).

As the data show in Figure 8, the incidence rate of CTD cases in the plant rose from 55.30 in the benchmark year of 1991 to 75.46 in 1992. The incidence rate continued to rise in the first six months of the 1993 period to 80.46, but then fell over 27% to 58.64 in the second six month period following the commencement of ergonomic interventions.

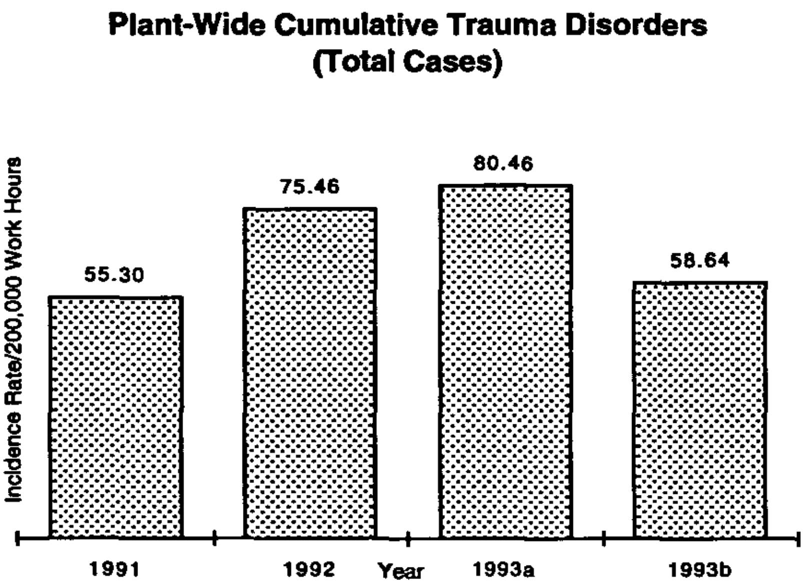

Figure 8. Plant-wide Cumulative Trauma Disorders Incidence Rates

Physician CTD Cases: To assess the impact of the ergonomic interventions on the severity of these CTD cases, incidence rates were examined for the CTD cases that required a visit to a medical physician. Figure 9 shows that physician-referred CTD rate for the 1991 benchmark year was 31.56, rose to 36.74 in 1992 and then began to fall once the ergonomics program was initiated. For the first six months of the 1993 period the physician CTD rate was 35.16, while in the latter six-month period it had fallen to 24.04 (down nearly 32% from the previous time period).

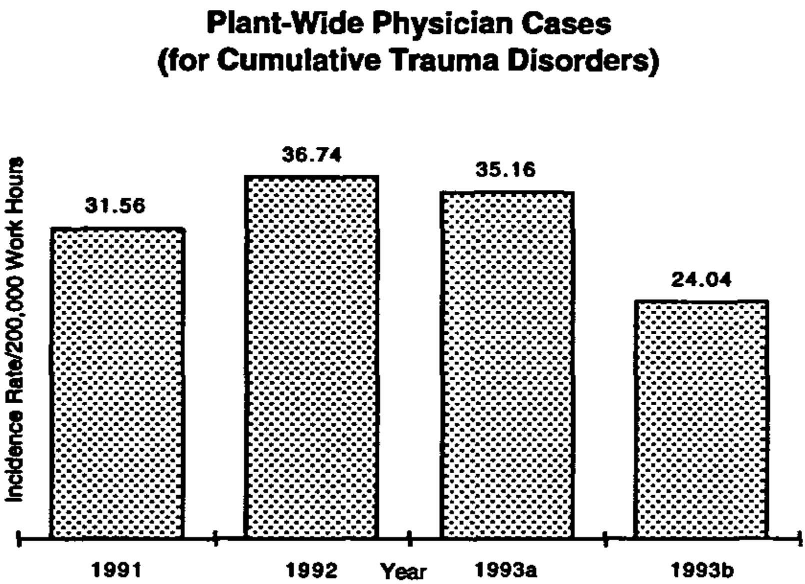

Figure 9. Plant-wide Physician CTD Cases Incidence Rates

***Production Days Lost*:** Two types of data were examined to determine the effects of the ergonomics program on the productivity of plant personnel. One was the rate of lost production days due to CTD cases, the other was "restricted duty days." As shown in Figure 10, the "production days lost" incidence levels decreased steadily across the 1991-1993 time periods. Discussions with plant management revealed that these decreases were, in part, due to an active effort on the part of plant management since 1991 to reduce the number of production days lost to injuries and illnesses. Medical management personnel mentioned that plant personnel were trying to develop as many "light duty" or "restricted duty" jobs as possible for injured personnel. Thus, these decreases in lost production days should not be interpreted as being totally associated with ergonomic changes in the plant.

Restricted Duty Days: Based on the movement to more restricted duty jobs in the plant when possible, a continual rise in restricted duty days across the 1991-1993 time period was expected. Figure 11 does show that the restricted duty days incidence rate increased

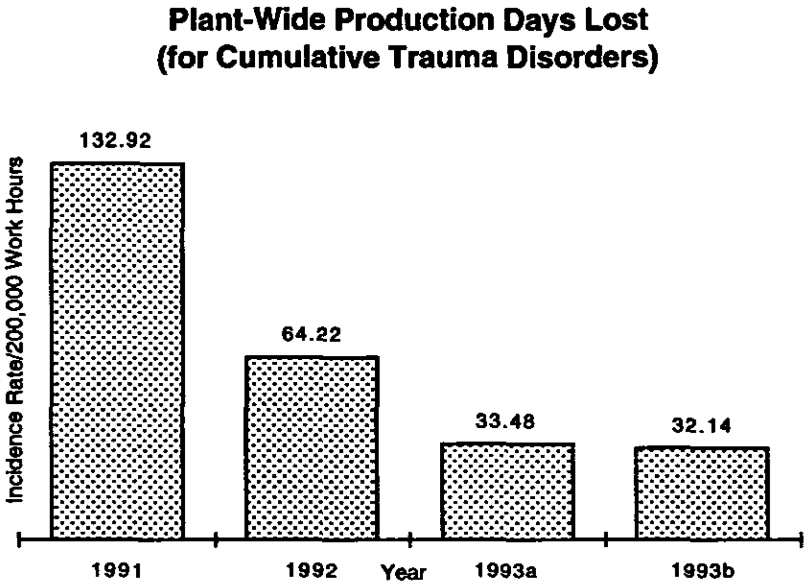

Figure 10. Plant-wide Production Days Lost Incidence Rate

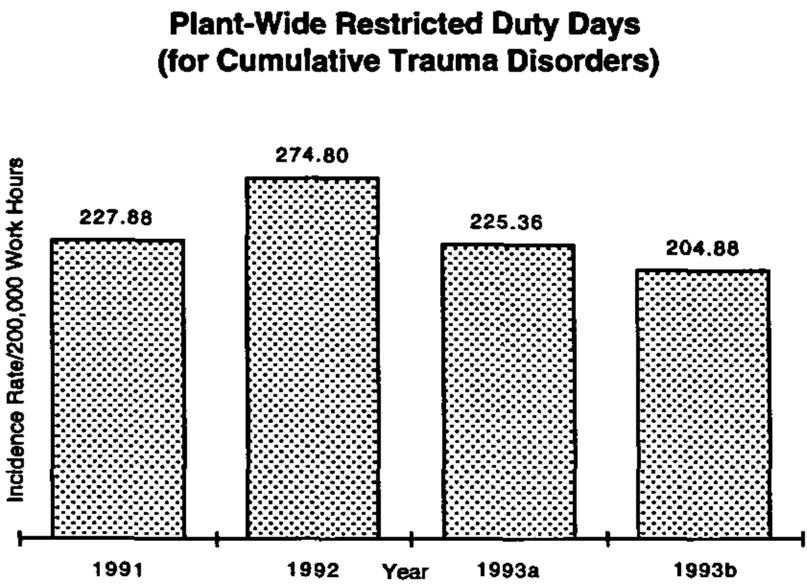

Figure 11. Plant-wide Restricted Duty Days Incidence Rates

from 227.88 in 1991 to 274.80 in 1992. However, after the ergonomic interventions began, the incidence rate of restricted duty fell to 225.36 in the first six months of the 1993 time period, and even further to 204.88 in the second six months of the 1993 period. This latter figure represents a 25.5% decrease in the restricted duty days incidence rate since the 1992 peak. Thus, it appears that the lower severity rates of CTDs also resulted in fewer restricted duty days for plant employees.

Employee Absenteeism: Information was collected on the number of days lost to absenteeism in the plant for 1991-1993. This absenteeism information includes all employee absences from work except vacations, birthdays, and days lost due to industrial illness. As depicted in Figure 12, overall absenteeism did not change much in the time periods of the research study. In 1991, 12.17 days were lost per person in the plant, while in 1992 and 1993, 11.15 and 11.57 days were lost, respectively.

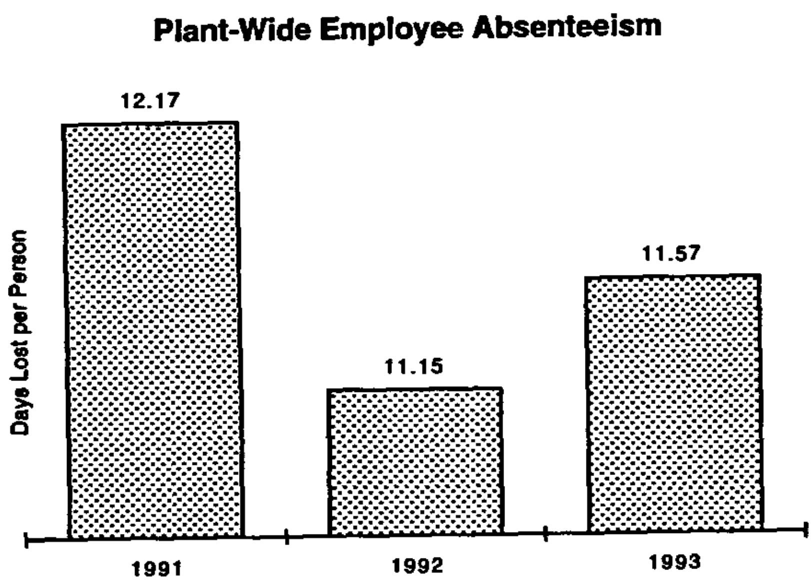

Figure 12. Plant-wide Employee Absenteeism

Employee Turnover: Information was also collected on the number of terminations and the number of employees in each of the departments during each of the years in the 1991-1993 period.

From this information, the turnover percentage was calculated in the plant for time periods of the study. Figure 13 shows that the percentage of turnover in the plant remained steady from 20.77% in 1991 to 20.70% in 1992 before the ergonomic changes took place. After the ergonomics program became active, the plant-wide turnover percentage fell to 17.67% in 1993. Thus, the costs of recruiting, hiring, and training approximately 25 employees may have been saved, at least in part, by the ergonomics project. Conservatively, it was stated that the plant experienced increased retention of employees without an associated increase in CTD incidence levels. Indeed, as noted earlier, CTD incidence rates actually fell.

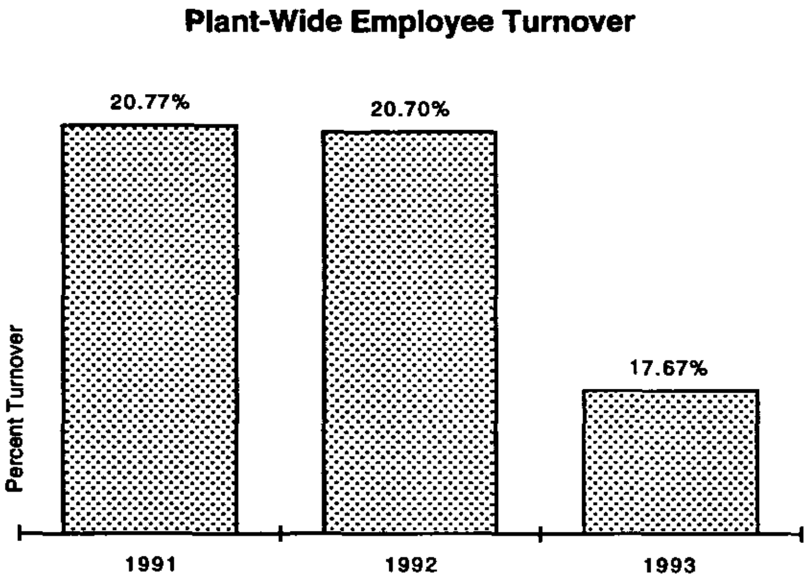

Figure 13. Plant-wide Employee Turnover Percentages

Departmental Reports of CTDs, Physician Cases, Days Lost, Restricted Duty Cases

Cumulative Trauma Disorders(CTDs): Information on the incidence rate of cumulative trauma disorders by plant departments is displayed in Figure 14. The Kill Department tended to have the highest incidence of CTDs of all departments for each of the years. The trend of CTD incidence rates across the four time periods generally reflected the plant-wide changes discussed above. That is, three of the four departments experienced increases in their CTD incidence rate from 1991 through the first part of 1993. However, incidence rates were lower for the latter half of 1993 for all four departments, with three of the departments (Cut, Kill, and Bone/Special Meats) exhibiting large reductions from the previous six month period (19%, 33%, and 42%, respectively).

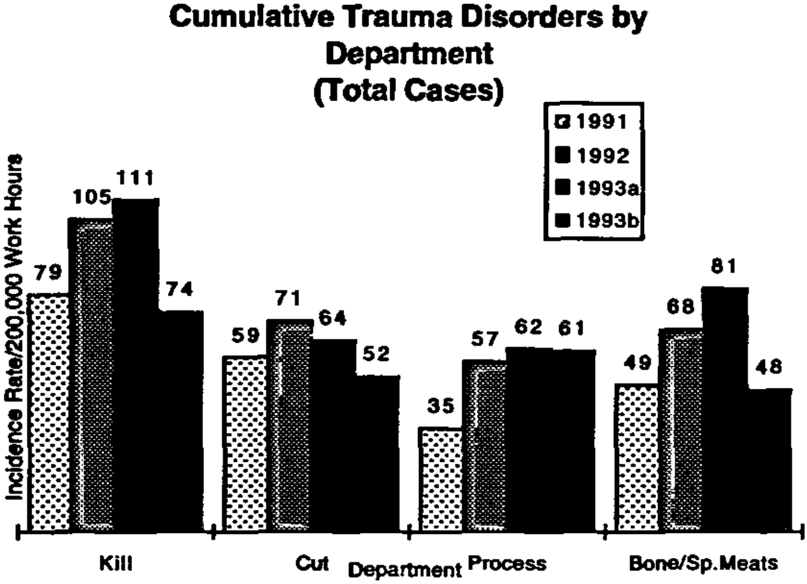

Figure 14. Cumulative Trauma Disorders Incidence Rates by Department

Physician CTD Cases: The objective measure of employees' CTD severity, the physician-referred incidence rate, is displayed by department in Figure 15. These graphs demonstrate that severity of CTDs experienced by plant personnel decreased across three of the four departmental areas in the latter part of 1993. The largest percentage reductions in physician-referred cases were in the Kill and Boning/Special Meats departments with 51.7% and 47.3% decreases, respectively. In contrast to the other departments, the Process area had a slight increase in the incidence of more serious CTDs.

Production Days Lost: The "production days lost" incidence rate across the departmental areas is depicted in Figure 16. The overall trend in the plant toward fewer production days lost since the 1991

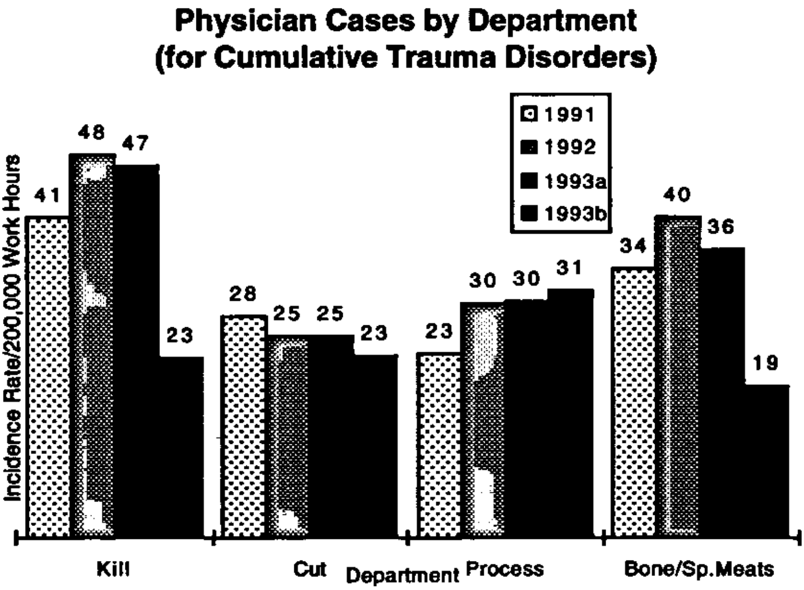

Figure 15. Physician CTD Cases Incidence Rates by Department

benchmark year is reflected in all of the departments except the Cut area. The largest percentage abatements from the first part of 1993 to the latter part of 1993 were again displayed by the Kill and

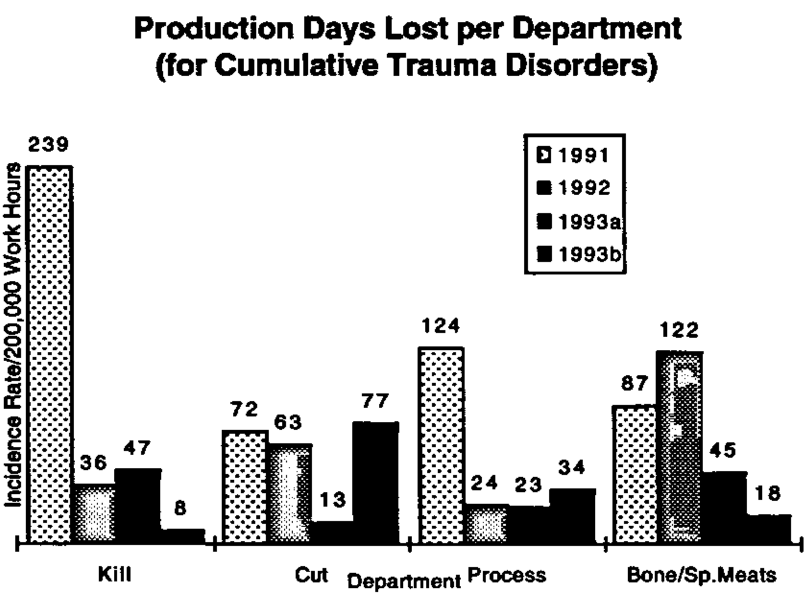

Figure 16. Production Days Lost Incidence Rates by Department

Bone/Special Meats areas which had reductions of 83.9% and 59.2%, respectively. As stated above, these results are likely due to a combination of the plant's change in policies (i.e., reduced lost days due to injuries through developing more light-duty jobs for injured personnel), and the ergonomics program.

Restricted Duty Days: Figure 17 illustrates the restricted duty days for the departments across the four time periods. The plant-wide pattern of an increasing incidence of restricted duty days from 1991 to 1992 and then steadily decreasing figures, is best exhibited by both the Cut and Bone/Special Meats areas. Indeed, the percentage decreases from the beginning six months of 1993 to the latter portion were 44% and 33% for the Cut and Bone/Special Meats departments, respectively. Contrary to this trend, the Process department had consistent increases in restricted duty days, consistent with the increases in CTD severity for this department discussed above.

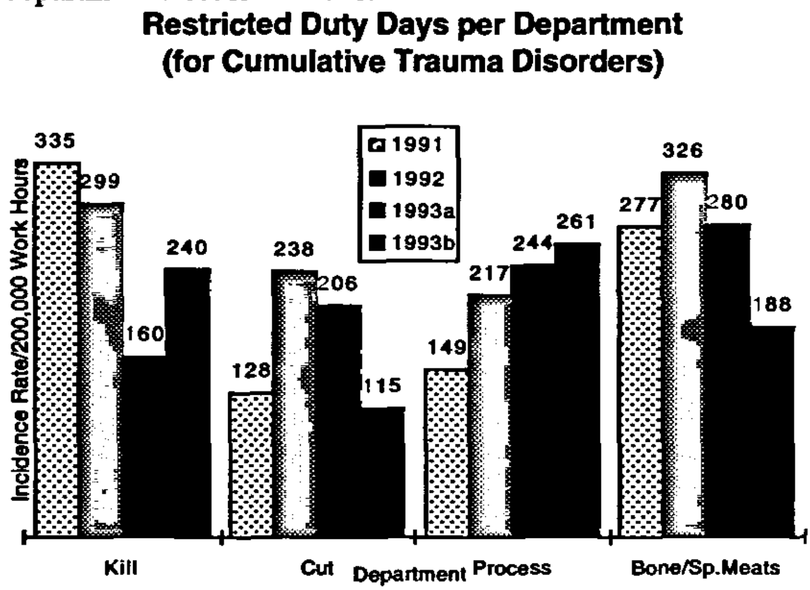

Figure 17. Restricted Duty Days Incidence Rates by Department

Employee Absenteeism: Analyses were also conducted to examine the level of absenteeism per person in each of the departments (see Figure 18). These findings revealed that the Kill and Cut

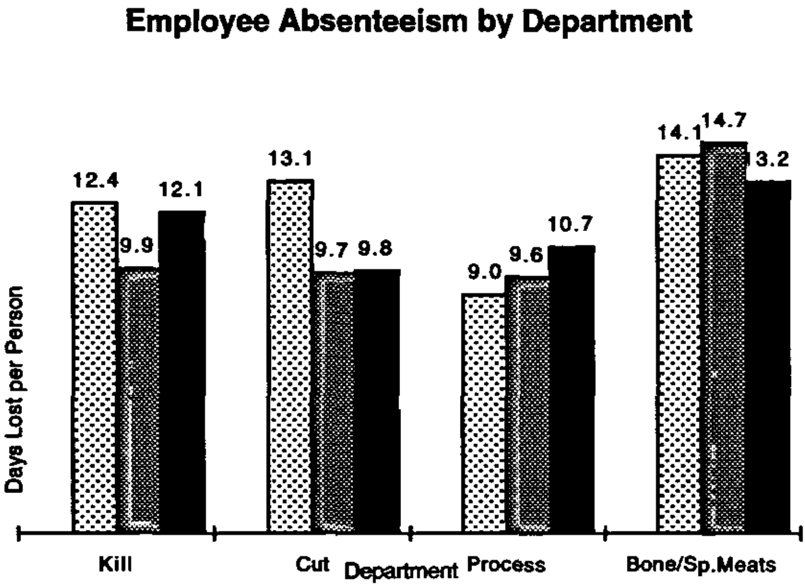

Figure 18. Employee Absenteeism by Department

departments appear responsible for the 8.4% plant-wide decrease from 1991 to 1992. However, in 1992-1993 the effect on the plant-wide absenteeism rate from the 10% reduction in the Bone/ Special Meats area was generally negated by increases in the Kill,

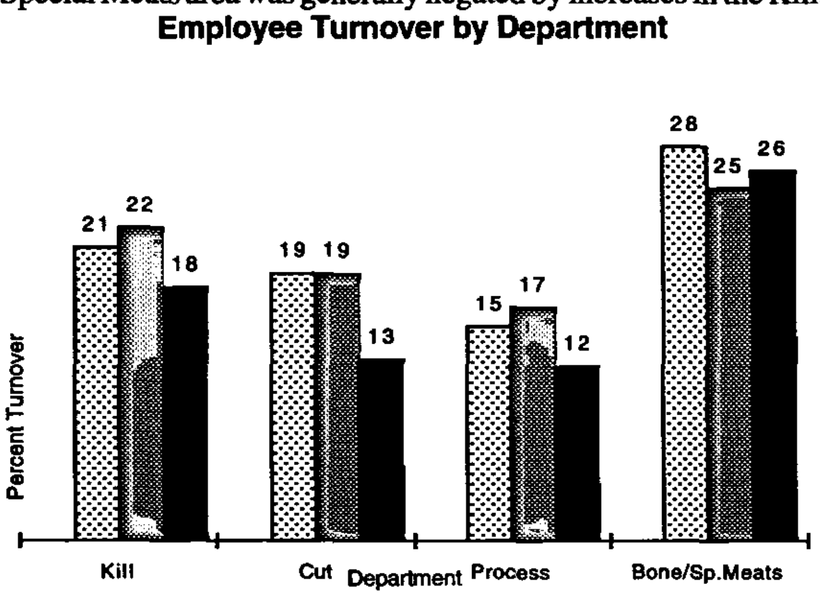

Figure 19. Employee Turnover Percentages by Department

Process, and Cut areas. Process was the only department with consistent growth in employee absenteeism for the study's time periods.

Employee Turnover: The most notable facts about the departmental turnover data shown in Figure 19 is that employee turnover decreased in three of the four departments from 1992 to 1993. Kill, Process, and Cut had reductions of 18.7%, 25.3%, and 32.2%, respectively. There was relatively little change in the turnover rate of the Bone/Special Meats area, which maintained a high turnover rate for all three years.

CONCLUSIONS AND RECOMMENDATIONS

Overall, the ergonomics program in this plant was successful in achieving a number of the objectives set forth at the beginning of the program. The participatory team approach to ergonomics, accenting worker involvement in team efforts to define and solve problems, was implemented. Team functions and effectiveness in carrying out these tasks were assessed and some groups were found to be more productive than others in completing ergonomic job changes having positive effects on CTD problem indicators, but all teams realized success in at least one of these measures. Quality of leadership, cohesiveness of the team, and more deliberate, systematic approaches to decision-making appeared to play key roles in effective team operations, as perceived by the team members and outside university observers.

In terms of beneficial impacts, the information presented here showed both the overall incidence rate and the severity of cumulative trauma disorders to have decreased in the plant as an outcome of the intervention program. Because of these reductions, the plant has also seen a decrease in the incidence of restricted duty days. Finally, turnover among plant employees has declined as well. Information gathered in the employee surveys seems to substantiate that employees are feeling less persistent pain and that the pain they do have is less severe. Analyses of the employee survey revealed that pain severity decreased, particularly among those who had some form of ergonomic job change. These individuals also expressed fewer intentions to leave the company than those who did not experience some form of ergonomic change. Employees with an ergonomic job change also maintained a more positive attitude toward the ergonomics program than those whose jobs were not changed. A number of specific recommendations emerged from this plant's experience with a participatory ergonomics approach that confirm and give concreteness to certain ideas found in the literature on team approaches in problem solving as well as suggest added thoughts for general consideration. The following elaborates:

- Team Composition, Reporting Structure, and Leadership: The ergonomics team composition and leadership are extremely important in establishing effective patterns of member interaction and task processes in the group. The operation of the teams in this research suggested that the inclusion of both top management and labor representatives may make interaction difficult. Teams composed of employees, medical staff and maintenance personnel, with management support, may be more effective than teams that actually include both upper management and employee representatives. Instead, teams could report through department supervisors or other intermediaries to the top plant management. Also, the employee representatives on the team should come from a diverse background of jobs in the department with different levels of experience. Experienced members can discuss what it is like to work in a given job, while relatively new personnel can add fresh insight to job analyses. Finally, teams should be allowed to choose their own leaders from among the employees on the team.
- Maintenance Staff Involvement: Having maintenance personnel on the teams should be stressed to any organization implementing the team approach since it is the maintenance personnel that implement almost all of the ergonomic changes. Optimally, maintenance staff should be

given blocks of time that they can dedicate to making ergonomics changes at times when the plant is not in full operation (e.g., weekends or evenings).

- Smaller Teams with More Ergonomics Expertise: Employee involvement efforts should consider narrowing the number of members on each team to approximately five so that members can develop greater expertise in the area of ergonomics and be able to discern differences between safety risks and ergonomics risk factors in the plant. Task and social interaction would also be more easily facilitated within these smaller teams. Needs for merging night shift team members with day shift teams should also be considered to facilitate communication and ideas between the two shifts.
- Continual Training: To facilitate effective team interaction and ergonomic expertise of team members, continual training should be stressed for team members. Observations here suggest that additional team-building processes and ergonomics training are likely to benefit team members after initial training in these areas.
- Broad-based Involvement of Plant Employees: Although the team approach provides representative input, participation should include a broader base of employees in order to identify problem areas and increase the likelihood of acceptance of solutions. Team members indicated informally that their success depended greatly on fellow employees. Indeed, Caplan (1990) has suggested that focus groups of employees be used to get feedback on ergonomic changes before implementation. Pre/post-survey differences revealing less favorable attitudes toward the ergonomics project by the plant population suggests that the initial employees' expectations for the program were not met. Greater levels of communication with employees should be undertaken to avoid unrealistic expectations at the beginning of a program, and then maintained consistently throughout, so that employees are informed of progress on different projects.

- Team Accountability/Communication with Plant Employees: Related to the above point, mechanisms should also be in place which allow other plant employees to review the teams' ergonomics projects and the current status on those projects. Thus, the teams become accountable to the employees in their department for making progress on specific ergonomics projects. As such, projects should be posted by priority with anticipated dates of completion.
- Team Autonomy: Given this increased accountability to employees, ergonomics teams should also be given greater authority to make ergonomic changes within specific budgetary constraints. Important resources and information should also be accessible to the team. Experienced team employees can particularly help with these issues.
- Team Functioning: Teams should be trained and monitored regarding the internal task-based processes discussed above: goal setting, prioritizing projects, and developing workable solutions to problems. Team meeting agendas should be distributed in advance of the meeting.
- Ergonomics Project Documentation: Plant management should ensure that ergonomics teams are continually documenting their ergonomics project activities through the following means: written documents, videotapes (before and after), slides, and employee testimonials. This documentation process should be systematic and have a uniform format so that projects and their outcomes can be compared objectively.
- Release Time and Overtime: Team members should be formally released at times from other duties to focus solely on ergonomics issues. Opportunities to do some work on overtime should be permitted to avoid resentments being built up among co-workers when members are released from their normal duties to work on "special" projects.
- More Systematic Job Analysis Needed as Teams Develop: While at first teams should focus on the identification and implementation of relatively easy ergonomic job changes in order to build team confidence and efficacy, this activ-

ity should not deter efforts at more deliberate, systematic analyses of work conditions or the need to undertake larger scale, more formidable projects as deemed warranted.

- Address Existing Problems, Then Preventive Measures for CTDs: Ergonomic interventions should follow the two-stage approach advocated by Adams (1993). The first priority should be to address existing problems with ergonomic solutions. This process should begin with a systematic job analysis process that reviews the stressors present and prioritizes the problems for implementation. Attempts should then be made to prevent CTDs by effectively designing future tools, equipment, and workstations. Employee-driven ergonomics provides a solid base for both stages of ergonomic improvement.
- Full-time Plant Ergonomist: The presence of a full-time plant ergonomist can greatly facilitate efforts of the ergonomics teams and assist in developing engineering solutions to designated problems. Without such an internal advocate, many important projects are either never pursued or are dropped due to lack of ergonomics expertise.
- Management Information System: Any effective employee involvement effort in ergonomics should provide ongoing feedback and information to the teams responsible for the ergonomics changes and to top plant management. Such information is vital to the detection of worksite hazards and the development of viable solutions to ergonomic-related problems. The teams in the current plant received much of this information from the medical management staff and university researchers regarding incidence of CTDs by type of job and tool used. Efforts must be made to establish an effective management information system that employees can easily learn to use and access when gathering data on ergonomic-related issues.

In summary, the ergonomics intervention project described in this case study was an extensive effort initiated by both plant management and university faculty. As evidenced here, the project was successful in demonstrating a team approach to addressing ergonomic problems in a meat-packing environment and in yielding many recommendations for enhancing the process of employee involvement in defining and solving ergonomic problems in this type of work and others as well. The case study also shows that the applications of such efforts carry the potential for significant reductions in workplace illness and injuries.

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CASE STUDY #2

Based on the Final Report of:

A Cooperative Agreement* with
Department of Preventive Medicine
Medical College of Wisconsin
Milwaukee, Wisconsin

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