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## An Examination of the Compressed Work Week in a Continuous Operation

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LOYOLA UNIVERSITY OF CHICAGO

AN EXAMINATION OF THE COMPRESSED WORK WEEK IN A CONTINUOUS  
OPERATION

A THESIS SUBMITTED TO THE INSTITUTE OF HUMAN RESOURCES AND  
INDUSTRIAL RELATIONS

BY

MARK TIPPINS

VALPARAISO, INDIANA

JANUARY 1992

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This is dedicated to my wife, Judy, whose input cannot be quantified by any meaningful scale.

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CHAPTER 1  
INTRODUCTION

This thesis investigates how an alternative work schedule may influence the quality of work and family life produced by shiftwork. By studying employee and supervisor attitudes a shiftwork schedule, this study can assist business and management in the scheduling a round-the-clock workforce.

The Bureau of Labor Statistics defines shiftwork as "any schedule in which more than half of the hours worked fall outside of the period between 8 am. and 4 pm."<sup>1</sup> Shiftwork involves a work force in essentially two ways: it can be a separate, independent form which excludes all other schedules (e.g. night watchmen or office cleaners), or a system of successive shifts. This succession may be fixed (workers stay on one shift), or rotational, oscillating or alternating (workers switch shifts according to some established cycle).<sup>2</sup>

Shiftwork may be more desirable because of increased wages provided by shift differential or a heightened ability

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<sup>1</sup> Lynn White and Bruce Keith, "The Effect of Shift Work on the Quality and Stability of Marital Relations," Journal of Marriage and the Family 52 (May 1990): 454.

<sup>2</sup> Ibid.



to improve child care arrangements when spouses work differing shifts. These advantages, however, are generally overlooked in terms of motivating a work force, since nearly three-quarters of workers on shifts would prefer to work a straight day schedule.<sup>3</sup>

There are three types of shift systems: continuous, where production of services continues 24 hours a day, seven days a week; semi-continuous, where work proceeds 24 hours a day, but shuts down at the end of the week; and discontinuous, where the total duration of work activity is less than 24 hours, and work stops every day and at the weeks end.<sup>4</sup>

Rotation refers to the pattern or flow of the shift schedule in which employees rotate from day to night (or afternoon) or night to day shifts. The frequency of rotation is a key decision that needs to be made in scheduling. Fast rotation occurs when an employee rotates to a different shift at the end of each work schedule cycle. Slow rotation extends the work shift to anything greater than one work cycle. The impact of shift rotation on a workforce may include:

- \* equal opportunity for all involved workers to participate in social and family activities

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<sup>3</sup> Karolynn Siegal, "Shift Work: The Wave Of The Future," S.A.M. Advanced Management Journal (Autumn 1982): 43.

<sup>4</sup> Ibid.

- \* fairness to all who don't want to be permanently assigned to the same shift (particularly the night shift)
- \* equalizes compensation due to shift pay differentials
- \* equal access for all workers to the day working management and administration
- \* equality of seniority and experience distributed around the clock.<sup>5</sup>

Research in shift rotation suggests that the direction of the rotation should be forward or clockwise (i.e. rotate to the next latest shift). Most rotation prior to this information followed a counterclockwise motion. Research on the rate of rotation (how long to stay on a shift) has not provided any clear answers. Typically, it is suggested that longer periods are physically healthier, but that workers prefer faster or shorter rotation.<sup>6</sup>

In 1981, Muhammad Jamal reported that one-fourth of the labor force in the U.S. and Canada had shiftwork schedules, and that the rate was growing about one percent a year.<sup>7</sup> Current estimates are that over 25% men and nearly 20% women

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<sup>5</sup> Edward F. Stafford, J. Daniel Sherman, and James K. McCollum, "Streamlining 12-Hour Work Shifts," Personnel Administrator (Dec. 1988): 53.

<sup>6</sup> Preston Richey, "How to design shift schedules," Chemical Engineering (May 11, 1987): 70.

<sup>7</sup> M. Jamal, "Shiftwork Related to Job Attitudes, Social Behavior: A Study of Nurses and Industrial Workers," Personnel Psychology 34 (May 1981): 535.

are involved in its growth.<sup>8</sup>

The demand for shiftwork ultimately stemmed from the factory system, where large capital investments in machinery and the development of certain continuous production processes for which the cost of daily shutdowns would be prohibitively high required extending the hours of labor. Unit cost were reduced by spreading out operations of machinery and creating more units of production. In the more recent technological growth phase, a quickening obsolescence of factory and office machinery has forced the employer to consider the feasibility of multiple shifts, which would permit a more rapid amortization of equipment.<sup>9</sup> As a result, shiftwork has infiltrated into work sectors that were traditionally 9 to 5.

Large industrial operations near population centers tend to foster peripheral support mechanisms (like restaurants, gas stations, and groceries). Consequently, more round-the-clock employment is generated if these industries involve 24-hour employment. Operating during peak off-hours provides yet another advantage because of the lower cost associated with computer time-sharing usage, electricity, and transportation services. Working in shifts can also enable companies to operate with a smaller sized

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<sup>8</sup> Michael A. Verespej, "A New Clock for Shiftworkers," Industry Week (April 2, 1990): 25.

<sup>9</sup> Siegel, 44.

plant and substantially reduce building or rental costs. Finally, population increases and the greater influx of women seeking full time employment are more or less demanding shiftwork situations to provide a relief valve.<sup>10</sup>

The complexion of work scheduling today is changing as more women are becoming shiftworkers for structural reasons. The fastest growing sector of the economy, the service sector, contains the highest proportion of shiftwork among dual earner couples. Cashiers, registered nurses, janitors and cleaners, truck drivers, and waiters and waitresses are the five occupations with the largest projected job growth (in absolute numbers) through 1995. These occupations show exceptionally high proportions of dual-earner spouses working non-days and this sector has subsequently absorbed a disproportional growth in female employment.<sup>11</sup>

Shiftwork as a condition of life is arguably oppressive. The general theme of research during the 80's portrayed the shiftworker as having worse mental and physical health, less sleep, fewer friends, more disrupted family relationships, and one who is in general, out of step with the rhythms of life.<sup>12</sup>

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<sup>10</sup> Ibid., 45.

<sup>11</sup> Harriet B. Presser, "Shift Work and Child Care among Young Dual-Earner American Parents," Journal of Marriage and the Family 50 (Feb. 1988): 147.

<sup>12</sup> "Rotational Shiftwork: CCOHS Report," Worklife Report (Canada) 5:6 (1988): 9-10.

By factoring in rotation, oppression is likely intensified. A report by the Canadian Centre for Occupational Health and Safety lists some of the problems encountered by rotational shiftworkers in contrast to non-shiftworkers.

1. There is disruption of circadian rhythms which regulate many functions, including digestion, sleep and wake cycles, secretion of adrenalin, blood pressure, body temperature, and pulse rate. This disruption of the body rhythms occurs as sleeping, eating, and working schedules change. "Frequent changes in schedule and disruption to circadian rhythms can lead to chronic fatigue and other health problems."

2. Gastro intestinal disorders are more frequent.

3. Heart attacks are more common because of the associated lifestyle. "In general, they smoke more heavily, are more obese, have poorer dietary habits, and participate in fewer leisure activities. It is more difficult for them to have a regular exercise program and this may contribute to a decreased level of fitness, and increased level of heart attack, and increased weight gain, and a decreased ability to cope with stress" (these symptoms are so commonplace among shiftworkers that Dr. Martin Moore-Ede of Harvard Medical School has dubbed it "Shift Maladaptation Syndrome").

4. More interference with family life, which is of

significance because "the amount and quality of social interaction is related to physical and mental health."

5. Workplace accidents and injuries are more likely under the influence of shiftwork since lack of sleep aggravates performance decline normally experienced at certain times of the day. "Research has shown that the optimum mental performance level for workers occurs between 2 and 4 pm. and maximum general awareness is between 1 and 7 pm. Performance levels are lowest between 3:30 and 5:30 am."<sup>13</sup>

A recent study by White and Keith found that shiftwork increased the probability of divorce from 7% to 11%, "an increase of 57%, when all the background variables are at their mean." They surmised that: a) shiftwork tends to reduce the barriers to divorce by perhaps encouraging more independent lifestyles through the reduction of the spouses' psychological dependence on one another; b) jealousy and concerns about faithfulness are more pronounced in marriages involving shiftwork; c) shiftworkers working the non-day shift are introduced to Melbin's (1978) "nighttime" community, which becomes or is less committed to conventional lifestyles.<sup>14</sup>

Harriet Presser suggests that structural changes in the

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<sup>13</sup> Ibid.

<sup>14</sup> White, 460.

American family may be due in part, to the impact of shiftwork. This structural change increases "male participation in child care more than ideological changes about children's need for more fathering or women's needs for more role sharing." The essence of Presser's report points to the uncertainty that such a change in parenting and family structure may create to our future generations.<sup>15</sup>

Productivity and safety under shiftwork are another concern. C.F. Ehret notes that the nuclear accidents at Chernobyl, Three Mile Island, and the chemical disaster at Bophal may have resulted in human error during a night shift. He found that the accidents at the latter two occurred on a night shift immediately following a shift rotation (the first day back).<sup>16</sup> Specifically concerning Three Mile Island he stated, "The crew at Three Mile Island had just passed the middle of its night shift when the accident occurred. The crew members had been on a cycle of slow rotation rounds repeating every sixth week...The seriousness of (the) accident, developing as it did from human error, was in a very real sense avoidable."<sup>17</sup> Lowered productivity, along with industrial accidents under

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<sup>15</sup> Presser, 147.

<sup>16</sup> Stafford, 53.

<sup>17</sup> Jon Van, "The Night Syndrome," The Chicago Tribune, (May 5, 1983), p 9.

shiftwork's confluence are costing businesses in excess of 70 billion dollars annually.<sup>18</sup>

In summary, shiftwork adds to and enhances the stress already abundantly supplied in modern life. Planning improvements for the workers' plight needs to be addressed at the organizational level during the next decade, particularly since global competition and the changing world marketplace a premium on efficient work flow. Human resource planners and management need to address these concerns since capitalistic venues engender a service type of economy with increased demand for goods and services on a 24 hour basis.<sup>19</sup>

Increasing the organizational effectiveness in the area of shiftwork would tend toward primarily optimizing the shift schedule. The principal factors to be considered are:

1. The length of the rotational period. Science has yet to articulate what that might be.
2. The starting and stopping times of a shift.
3. The direction of the rotation of the shifts.
4. The amount of rest allowed between shifts.
5. Alternative forms of organizing the work

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<sup>18</sup> Richard M. Coleman, "Shiftwork Scheduling for the 1990's," Personnel 66 (Jan. 1989): 10.

<sup>19</sup> Mark Tippins and Linda Stroh, "Shiftwork: Factors Impacting Workers' Biological and Family Well-Being," Journal of Applied Business Research, (Spring 1992).



schedule.<sup>20</sup>

In today's industrial complex, a jobs attractiveness is not determined solely by pay, but whether or not it involves shiftwork and in some environments, the implemented schedule of shiftwork. But the question remains, if a schedule compresses the workweek in a continuous operation, can some of the deleterious effects of shiftwork improve?

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<sup>20</sup> Rotational Shiftwork: CCOHS Report, 10.

## CHAPTER 2

### LITERATURE REVIEW

The compressed workweek is a type of alternative work schedule system that can provide the worker with greater flexibility and freedom in scheduling off-the-job activities. According to Tepas (1985), the compressed workweek is "any system of fixed working hours more than 8 hours in length which results in a workweek of less than 5 full days a week," the most common form being the 10-hour, 4 day workweek with three off-days. Table 1 notes the advantages and disadvantages of the compressed workweek that uses the 10-hour day as derived by Tepas.<sup>1</sup>

Ronen and Primps in examining 14 different studies in the 1970's on the compressed workweek, summarized that: employee attitudes and job attitudes were positive but that it appears that attitudes toward the schedule do not necessarily generalize to job attitudes. The compression of the workweek is a function of leisure desirability. They purport that positive outcomes associated with the compressed workweek (including attitudinal change) rely on

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<sup>1</sup> Donald Tepas, "Flexitime, Compressed Workweeks and Other Alternative Work Schedules." Hours of Work. Ed. Simon Folkard and Timothy H. Monk. Chichester: Wiley, 1985: 148.

Table 1

Tepas' Advantages and Disadvantages of the Compressed  
Workweek

POTENTIAL ADVANTAGES	POTENTIAL DISADVANTAGES
*reduction in commuting costs and related problems	*non-work time difficulty during the work week
*increase in multi-day off-the-job leisure	*more fatigued workers
*fewer work days with no loss of pay	*more pacing of work speed
*more time for scheduling training sessions or meetings	*increases in tardiness, absenteeism, turnover
*decreases in start-up and/or warm-up expense	*increases in on-the-job and off-the-job accidents
*fewer supervisors may be needed	*decreases in production rates
*increases in production rates	*scheduling problems on longer than standard work week operations
*better morale	*more overtime pay
*improvements in quality of services to the public	*contrary to traditional union objectives
*improves opportunity to hire skilled workers in a tight labor market	*decrements in job performance for those who "moonlight" on off days
*fewer personal business days taken	*increased physical maintenance and energy costs
*less sick days taken and overtime paid	

Source: "Flexitime, Compressed Workweeks and Other Alternative Work Schedules," 150.

antecedents like job level and the degree of job satisfaction. Employee's with lower initial levels of job satisfaction would tend to be more positive toward the change. They also reported strong evidence to support declining absentee rates.<sup>2</sup>

A more recent study of white collar engineers reported that personal business could be conducted more efficiently, and productivity improved under such a regime because of increased work continuity, while customer service improved by extending the hours. In contrast, they indicated a restricted ability to engage in weekday evening activities and a more difficult evening commute.<sup>3</sup>

The decision to use a compressed workweek is contingent upon the merging of a decision maker's common sense with a comprehensive evaluation of many relevant on-and off-the-job variables. Since continuous operations incorporate shiftwork into the work schedule in order to protect large capital investments in machinery, structure, and operation so that unit costs are reduced, compressing the workweek may become a viable option. Compressing the work schedule in these environments would use the 12-hour day which was first tried over twenty years ago, and throughout the years by a number

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<sup>2</sup> Simcha Ronen and Sophia B. Primp, "The Compressed Workweek as Organizational Change: Behavioral and Attitudinal Outcomes," Academy of Management Review 6:1 (1981): 71-73.

<sup>3</sup> Spyros Economides, D.N. Neck, and Allen J. Schub, "Longer Days and Shorter Weeks Improve Productivity," Personnel Administrator 34 (May 1989): 114.

of industries.<sup>4</sup>

An Exxon facility in Winnipeg Canada piloted the 12-hour shift in 1970 for a trial period of 9 months. At the conclusion of the trial period, the employees voted unanimously to continue the schedule. Eventually, Exxon permanently adopted the 12-hour shift to more than 20 other facilities.<sup>5</sup>

Monsanto, following Exxon's lead began pilot studies of 12-hour shifts at some of its plants in the mid 70's. Their test group showed greater productivity and morale, while absenteeism and turnover were reduced. Monsanto thus began the implementation of this schedule to other plants. Both the Exxon and Monsanto 12-hour schedules were conducted by having the employees design, implement, and evaluate the schedule. Much of the success attributed toward the schedules acceptance underscores this fact.<sup>6</sup>

Initial inroads toward a 12-hour compressed workweek in electric power companies began with South Carolina's Duke Power Company in 1983. After comparing absentee data from the last year of the old three shift rotational schedule to the first year of the new (4 12-hour days followed by 4 off days), it was determined that sickness allowance decreased and the percentage of overtime also decreased. Management

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<sup>4</sup> Stafford, 54.

<sup>5</sup> Ibid.

<sup>6</sup> Ibid.

evaluations found that morale was similar to those who worked a standard workweek; productivity either equaled or exceeded expectations "by preventing loss of load during abnormal situations, and/or reduced critical 'path' time when returning a unit to service." There was no problem in obtaining personnel for off-schedule overtime, and as far as quality of work in terms of alertness, "the majority of personnel who had previously worked the 8 hour rotation stated that it was no more difficult, and in fact less difficult to maintain their alertness on the night shift on the 12-hour rotation.<sup>7</sup>

Building from the Tepas 10-hour day compressed work-week, tables 2a and 2b (see next page) list the positive and negative aspects of the 12-hour day compressed work week used in continuous operations as derived by various authors.

Research in this area has been mixed. In a study by Breugh (1983), off-time can be so valued that workers develop a positive attitude toward the 12-hour day. As a result of the off-time, the workers indicated that the schedule was less fatiguing, that it allowed savings on commuter time, and provided both greater regularity of sleep patterns and usable time off.<sup>8</sup>

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<sup>7</sup> T.D. Patterson, Assistant Operating Engineer, Duke Power Company Study, 13 Feb. 1984.

<sup>8</sup> James A. Breugh, "The 12-Hour Work day: Differing Employee Reactions," Personnel Psychology 36 (Summer 1983): 284-287.

Table 2a

## Advantages of the Compressed Work Week in a Continuous Operation

*25% increase in off-time per year <sup>c</sup>	*reduce commute time and cost by 1/3 annually <sup>b</sup>
*increased job satisfaction <sup>a</sup>	*reduced unscheduled overtime <sup>b</sup>
*improved morale <sup>a</sup>	*improved operating continuity <sup>b</sup>
*decreased absenteeism <sup>a</sup>	*less request for transfer <sup>b</sup>
*easier to adjust sleep time to two shifts instead of three <sup>a</sup>	*improved maintenance efficiency <sup>b</sup>
*decreased training costs, more experienced job operators <sup>a</sup>	*closer working relationships between groups <sup>b</sup>
*more family and leisure involvement, and time to conduct personal business <sup>a</sup>	*relief improvements-because a middle shift is eliminated, tardiness would be less likely because direct revenge is easier. <sup>c</sup>
*reduced communication error during shift turnover <sup>a</sup>	*overtime acceptance increased while actual overtime need may decrease <sup>e</sup>
*more rest days dissipate fatigue <sup>a</sup>	*improved productivity-less time spent in shift turnover (33.3% less) <sup>b</sup>
*greater chance of seeing a job through to the end, which contributes to quality work and job satisfaction <sup>e</sup>	*improvement in sleep duration, quality, and cardio-vascular performance <sup>c</sup>

Sources: See next table.

Table 2b

Disadvantages of the Compressed Work Week in a  
Continuous Operation

*workers lose touch with operations <sup>a</sup>	*increased labor costs <sup>d</sup>
*lower efficiency ratio- total hours worked/hours of effective labor-82.5% for 12-hour vs. 87.5% 8-hour <sup>c</sup>	*workers might be tempted to travel too far on their off days, moonlight, or overextend themselves recreationally and return to work fatigued <sup>a</sup>
*alertness and safety may decline <sup>a</sup>	*prolonged exposure to industrial substances and conditions <sup>d</sup>
*work pace may slow to compensate for the long day <sup>a</sup>	*less time for rest between consecutive work days, so fatigue could be intensified <sup>a</sup>
*workers need more breaks <sup>a</sup>	*12-hour schedule creates ongoing communication problems because employees don't want to put in extra time to participate in problem solving, planning, or information sharing meetings <sup>d</sup>
*12-hour day more difficult for older worker <sup>a</sup>	*12 hours makes for a long work day <sup>e</sup>
*12-hour night shift more difficult than 8-hour night shift <sup>a</sup>	*limited free time for leisure and family on work days <sup>d</sup>

Sources: <sup>a</sup> "Recommendations for NRC Policy on Shift Scheduling and Overtime at Nuclear Power Plants," Lewis, P.M. (July, 1987) (NUREG/CR-4248, PNL 5435); <sup>b</sup> Duke Power Company Study; <sup>c</sup> Susan L. Koen, Critical Issues Impacting 12 Hour Shift Schedules. Paper presented as part of the American Power Conference 51st Annual Meeting, Chicago, 24 April, 1989, 1; <sup>d</sup> W. O'Flynn, Shiftwork, Its Effects on the Worker and Recommendations for Shift System Adaptation.



Paper presented at the XXI International Congress on Occupational Health, Dublin, September, 1984; <sup>e</sup> Bert Valenkamph, "12 Hour Evaluation," (Schahfer Generating Station, April 1989), Photocopied.

However, the duration one spends on a schedule may affect its desirability. Bulkeley found that even though initially workers liked the new schedule, over time they grew to dislike it, because absentee and turnover rates increased.<sup>9</sup>

According to Susan Koen of Matrices Consultants Inc., 12-hour shift employees work 182 days annually, while 8 hour workers work 273. This represents a 25% reduction in work days, or conversely, a 25% increase of off-time per year, but this increased quantity does not necessarily mean improved quality.<sup>10</sup> Koen indicates that some employees report that they use too much of their off-time recovering from the 12-hour shifts, while others indicate no ill effects. In her view, the variation in reported off-time quality seems to be linked to three components.

1. The type of 12-hour system--some research suggests that schedules of more than three consecutive work days often result in poorer quality off-time patterns.

2. Employee gender--female workers tend to view off-time patterns more negatively and critically than do male

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<sup>9</sup> W.M. Bulkeley, "Short Shift: For Some Companies, The Four-Day Week Is A Four-Day Headache," The Wall Street Journal, (30 April 1973), 1, 26.

<sup>10</sup> Koen, 2.

workers.

3. Perceptual differences--if one views the 12-hour day as shortening the work week rather than lengthening the work day, then their attitudes will be more positive.<sup>11</sup>

Age is another factor affecting off-time quality. According to Coleman and Associates, the 12-hour day is more desirable to the younger worker "because younger workers prefer to have lengthier time-off periods to accommodate strenuous leisure time activities. A longer day allows this. Older workers prefer a less strenuous schedule with shorter work periods and more frequent, but shorter off periods."<sup>12</sup>

Obviously, physical demands of the job would have an impact on the effectiveness of the 12-hour shift schedule. According to Stafford et.al.(1988), "When the work is physically demanding and fatiguing, with increased injury risks or productivity losses occurring in later hours of a shift, the eight hour shift is preferable. Likewise, if the work is mentally demanding on an ongoing basis..then the eight hour shift is probably the better choice again."<sup>13</sup> Just where a choice is made along the physical and mental spectrum is not obvious.

The Woodyard, a labor intensive department at a Temple-Eastex paper mill in Texas tried using a 12-hour shift.

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<sup>11</sup> Ibid.

<sup>12</sup> Richey, 70.

<sup>13</sup> Stafford, 51.

Management thought that the schedule created improvements in safety and productivity, as overtime hours were lowered. They suggested that overall, the conversion from rotational 8-hour shift to 12-hour was successful.<sup>14</sup> Having one less shift change caused one less lull in production created by the employees leaving and oncoming employees.<sup>15</sup>

At the Manville Building Insulation Plant in Willows, California, a 12-hour rapid rotation with three and four consecutive workdays began in late 1985. The work involved heavy machinery operations in a continuous operation setting. After a six month trial period, 83% of the employees opted to stay on the 12-hour schedule.<sup>16</sup>

A Southeastern U.S. high tech manufacturer of compact disks implemented a 12-hour schedule. The physical demands of the affected jobs were similar to those found in the chemical industry. A study was launched to assess employee attitudes by using surveys and follow up in-depth interviews with 30 randomly selected workers. "It was concluded that no strong differences in shift preferences existed based on age or gender of employees." It was also determined that job related attitudes have minimal impact on an employee's work

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<sup>14</sup> Robert D. Brinton, "Everyone at this unionized papermill seems pleased with the new work schedule," Personnel Journal (May 1983): 398.

<sup>15</sup> Ibid., 396.

<sup>16</sup> Marianne Krantz, "Management in Practice: Twelve Hours at Manville," Management Review 22, (Feb. 1991): 9.

schedule preference. They determined that 12-hour shifts are viable in staffing high volume, high tech production facilities where physical demands are low to moderate.<sup>17</sup>

Scrapyard, metallurgy, casting, finishing and shipping, and the rolling operations at Raritan River Steel Co., Perth Amboy, New Jersey have been on 12-hour shifts since 1988. John K. Browning Jr., vice president of human resources found that work quality improved, and after a period of time, it became easy to staff overtime needs. "At first, employees are jealous of the off-time because the old schedules by comparison, had none. But after six months, they are bored at home and ask to be on the sign up list for overtime and training." He concludes: "A lot of companies do a lot of talking about people being their strongest resource. If they really believe that, then they will look at redesigning shiftwork, because shiftwork is an unnatural function."<sup>18</sup>

In the health care industry, the feasibility of 12-hour shift was explored at a new telemetry unit at St. Josephs Hospital in Milwaukee, Wisconsin. After a six month trial period, questionnaires were distributed and verbal evaluations by the patients of the 12-hour staff were taken. Most favorable ratings were attributed to the areas of shift-to-shift communications, continuity of care, and

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<sup>17</sup> Verespej, 31.

<sup>18</sup> Ibid.

quality time away from work. A high level of satisfaction with the staff was revealed by patient interviews. Because of these favorable findings, the decision to continue the 12-hour shifts was made.<sup>19</sup>

The 12-hour shift schedule (also known as the Dupont schedule) incorporates three primary shift patterns (with many variations possible). These patterns are driven by the assumption that the nature of the 12-hour day makes it more likely that one would work when they may be tempted to otherwise take-off because of the greater loss of pay. The 3/3 shift pattern has employees working three consecutive days, followed by three consecutive days off. Little research exists on this form, but a salient disadvantage to the employee would be a reduction in pay. The 3/2/2 pattern has been used by the Monsanto plants and is more complex. "During a two week cycle, an employee works two days, is off two; works two days, is off three; works two days, is off two." This schedule is recommended by some consulting firms because of the advantages it holds for a business, but makes it more difficult for employees to project ahead when making plans around their work schedules, while also reducing their amount of possible pay.<sup>20</sup>

Finally, the shift system that appears advantageous to

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<sup>19</sup> Kathleen D. Gresk, "Twelve-Hour Shifts on a New Telemetry Unit," Nursing Management 22 (Feb. 1991): 42.

<sup>20</sup> Stafford, 52.

both the employer and employee, the 4/4, compresses the workweek to four days using 12-hour shifts. 4/4's may hold advantages because the workers receive four days off after four days work in a consistent fashion (these "mini-vacations" serve to make the job more palatable). This schedule also makes it less probable that one would get sick on a work day, simply because the odds are decreased by 30% from the likelihood of the traditional 6/2 schedule (work six 8-hour days, off two). Greater harmony between work crews is also possible since there is no middle shift for workers to push unfinished work on.<sup>21</sup>

The disadvantages may include a greater likelihood of fatigue, possible safety problems, and communication problems as it is more difficult for employees to be kept abreast of current work conditions because of the extra time off. Some may be distrustful of a company's intent in a union environment toward using a 12-hour day because it gives back something that unions fought so hard for--the eight hour day.

And as mentioned, shift scheduling, whether in continuous or non-continuous operations need to be accorded adequate attention organizationally. Preston Richey of Coleman and Associates adds, "Extensive effort goes into the process design and engineering of a ...plant. The design of

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<sup>21</sup> United Steelworkers Union, Schedule Comparison and Rules, (Hammond, In., 1983), 2, Photocopied.

scheduling for the workers who run the plant is also deserving of more effort." It should be clear that shiftwork is radically different from the regular workweek and should accordingly be treated "as a separate entity with work rules that make sense in the context of 24-hour a day operations."<sup>22</sup>

Worker input and compliance within the various work environments in terms of developing a schedule is therefore crucial. "Policies can be developed that will allow workers to customize their schedules, while still giving managers the dependability it needs." Any schedule being designed should take into account human physiology, psychology, and social effects by examining the ever growing body of literature on this subject.<sup>23</sup>

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<sup>22</sup> Richey, 73.

<sup>23</sup> Ibid.

## CHAPTER 3

### THE HYPOTHESES

This study will compare and contrast two work schedules: the 4/4 (four 12-hour work days followed by four off days) and the 6/2 (six 8-hour days followed by two off days). The 6/2 schedule has become the industrial standard (utilizing the day, afternoon, and midnight shifts). The sixth workday allows a crew to overlap a day forward each week, allowing for an operation to be continuously staffed on a twenty-four day cycle with four work crews. By rotating the schedule seniority bidding toward preferred shifts is disabled, since all workers work all shifts.<sup>1</sup> Typically, 6/2 workers receive approximately seven weekends off a year while 4/4's receive around twenty. 6/2 workers have about three holidays off a year while the 4/4's have six.<sup>2</sup>

The focus of this research are the workers and supervisors of inside-the-plant production departments at four Northwest Indiana "Lake Michigan installed," coal fueled power plants, where both of these schedules are deployed. Based on the related literature, the following

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<sup>1</sup> Breaugh, 278.

<sup>2</sup> United Steelworkers Union, 1.



hypotheses will be explored.

1. Those employees who work the 4/4 schedule take less personal business days than those who work the 6/2 schedule.

2. Those employees who work the 4/4 schedule have an absentee rate lower than those employees who work the 6/2 schedule.

3. The productivity of employees on the 4/4 schedule is better than the productivity of those employees on the 6/2 schedule.

4. The morale of employees on the 4/4 schedule is better than the morale of those employees on the 6/2 schedule.

5. Staffing problems are fewer for the supervisors of 4/4 workers than for the supervisors of 6/2 workers.

6. Because there are only 2 work crews on 4/4 as opposed to 3 on the 6/2, the work crews on the 4/4 will have better crew harmony.

7. Problems created by shiftwork are fewer on the 4/4 schedule than on the 6/2 schedule.

8. Those employees who work the 4/4 schedule will have a better attitude toward the 4/4 schedule and prefer it more than those who never worked it.

9. A faster rotation on the 4/4 schedule improves the employees' work attitudes.

10. A faster rotation on the 4/4 schedule improves the employees' quality of life.

11. Male workers will prefer the 4/4 schedule more than female workers.

12. Older workers will be less favorable toward the 4/4 schedule than younger workers.

CHAPTER 4  
RESEARCH DESIGN

Methodology

The general goal of this study is to determine the effect of workweek compression on individual and job outcomes, and assess whether or not the 4/4 schedule can be seen as an improvement over the 6/2 schedule. A mean comparison of the 6/2's workers' attitudes about the 4/4 when compared to the attitudes of those who actually work the 4/4 should provide an understanding as to whether or not the 4/4 schedule affects attitudes and if there are areas of work and non-work life that are impacted by a 4/4 work schedule.

In a similar study by the Duke Power Company, productivity and work team performance were measured by assessing the supervisors perspective. Absentee data was used to determine if personal business days and sick days declined. This study uses similar methods as the Duke Power Company study.

Procedure

Plant management at Bailly Generating Station was

approached about the plausibility of conducting a study on shift scheduling. The aspects discussed were logistic feasibility, compliance, sample size, and general interest in the study. It was determined that the administration of surveys to inside-the-plant production employees would be possible, compliance from all the plants' administration was assured, the sample size would be adequate, and the company would be very interested in the results.

Plant administrators at the other plants, D. H. Mitchell, Michigan City, and Schahfer were contacted to determine the number of employees and the best possible time for administration of the surveys. Local 12775 of the Steelworkers, the bargaining unit representative, was also contacted and agreed to comply. They too, expressed an interest in the outcome of the study.

Production and chem tech supervisors were contacted to determine the best way to survey the employees at the same time and under similar conditions. Essentially, there are four production crews at each plant and 2 chem tech crews (one crew is split to cover the day). Going in on the last work day of the first set of crews and the first day back for the next set, proved to have the most advantages. Prior to going in, union grievance men were contacted and the nature and intent of the study was explained. It was hoped that through the grievance men and through personal contacts at the plants, employees would be ensured that the study was

an independent unbiased study, solely intent on exploring work schedules as objectively as possible. This information was expressed in the opening paragraph of the various surveys as well (see appendices 2, 3, and 4). It seemed important to express that the acquired information would not be used against anyone and that the investigator was not being employed by Nipsco or the union.

Separate questionnaires were prepared for the workers of the 4/4 schedule and the 6/2 schedule with the primary difference being a more extensive coverage of schedule preference in the 4/4 survey<sup>1</sup> (see appendix 2 for 4/4 survey, and appendix 3 for the 6/2 survey). The questions were further strengthened by peer review (a research design class) and employee review (a small employee focus group). In the area of schedule preference, the 6/2 questionnaire contains 6 questions taken from the 4/4, with the directions to express an opinion (e.g. "I would feel more productive working the 4/4 than I do on the 6/2").<sup>2</sup>

It was determined that participation from line supervisors would be enhanced by supplying a stamped return envelope to Loyola University. Line supervisors had been experiencing some lay-offs over the past few years, so utmost concern was taken toward ensuring confidentiality.

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<sup>1</sup> 12 questions were derived from Breaugh, 284-285.

<sup>2</sup> Questions 1 through 12 are work schedule questions on the 4/4 survey. Questions 1 through 6 are the work schedule questions on the 6/2 survey.

The return envelopes were coded so that later matches to work crews could be made.

Personnel absentee data was acquired by contacting an industrial relations administrator, who in turn arranged for copies of the microfiche to be made available from human resources. This same administrator also supplied the job descriptions.

Data collection began on the last day of March 1991 and continued through the second week of May. In most cases, individual employees were approached at their work areas. In a few cases where this procedure was not able to be followed, all of the employees on the crew were called in to a central location, where the study could be explained, and the survey administered. A basic strategy was to keep the questionnaire to a length that would not take longer than fifteen minutes to fill out. Disruption to the work process would hopefully be minimized while a greater likelihood of compliance would be realized. Supervisors were told to fill out the survey at their convenience, but to return it within a week.

The major hindrance in acquiring data proved to be "start-up" periods where turbines were brought back on line after being shut down for some reason (i.e. maintenance or mechanical failure). During these times, employees would be too busy or too scattered to be approached. When operations are normal, employees can easily take a few minutes out in

between their "rounds," but start-up places the employees at a high level of monitoring, thus making their involvement to the production process more critical. Access, while not necessarily denied at these times, was definitely discouraged, so arrangements were made to come in during standard operating times (approximately 20 employees at Schahfer and 9 at Bailly).

Follow-up for absent or vacationing employees was conducted in the latter part of May. Fifteen previously unavailable employees were contacted and asked if they wished to participate. Surveys were then distributed through the company mail.

### Measurements

Table 3 provides a conceptual overview of the study design based on where the data came from, what type of data it was, and how it was analyzed. The absentee data would test for hypotheses one and two, the supervisory data would test for hypotheses two, three, four, five, and six. The employee surveys would test for hypotheses seven through twelve.

Table 3  
Conceptual Study Design

Absentee Data

Data Source	Data Obtained	Analysis
archival data from industrial relations and human resources	<ul style="list-style-type: none"> <li>-personal business days</li> <li>-sick days</li> </ul>	<ol style="list-style-type: none"> <li>1. Change-before and after implementation using equal time frames.</li> <li>2. Comparison-4/4 workers to 6/2 workers.</li> </ol>

Supervisor Survey

Data Source	Data Obtained	Analysis
surveys from 4/4 and 6/2 schedule supervisors	<ul style="list-style-type: none"> <li>-staffing problems</li> <li>-crew harmony</li> <li>-morale</li> <li>-productivity</li> </ul>	<ol style="list-style-type: none"> <li>1. Comparison of work groups based on work schedules</li> </ol>



## Employee Survey

Data Source	Data Obtained	Analysis
surveys of employees on the 4/4 schedule and employees on the 6/2 schedule	<ul style="list-style-type: none"> <li>-scheduling effects (preference)</li> <li>-demographic characteristics</li> <li>-attitude assessment of work and non-work life</li> <li>-job satisfaction</li> <li>-health (sleep, sickness, stress)</li> </ul>	<ol style="list-style-type: none"> <li>1. Comparison-of demographic characteristics of 4/4 employees</li> <li>2. Comparison-of the 4/4 employees attitudes to 6/2 employees attitudes</li> </ol>

## Independent Variables

The employees on the 4/4 and 6/2 work schedules, and the supervisors of the 4/4 and 6/2 work schedule represent the independent variables. The 4/4 workers were measured using a 33 question survey, while the 6/2 workers received a 26 question survey (some questions about schedule preference were omitted because they were not applicable to the 6/2 worker). Both the 4/4 and 6/2 supervisors received the same 38 question survey. To test for test/retest reliability (which was possible only for the 4/4 survey), the chemical department at Bailly generating station (N=8) was given the same survey 6 weeks after the first administration. Test/retest reliability of the 4/4 questionnaire was .84.

## Dependent Variables

Ten dependent variables were used from company

personnel data and various work/family constructs used in the surveys. Each dependent variable relates to a previously discussed hypothesis.

### Personnel data

Data on personal business days/hypothesis 1 and sick days/ hypothesis 2 was acquired by viewing the records on microfiche at the company's corporate headquarters. The data provided was expressed as a percent of scheduled hours absent. Personal business days for last year from Jan. 1990 to Jan. 1991 at the 4/4 Schahfer plant (N=61) were compared to the 6/2 Mitchell and Bailly plants (N=69). Sick days were compared between all four plants from April of 1990 to Jan. of 1991. April was chosen simply because for the first time in the company's history, two plants were on 4/4 and two were on 6/2. In both of the cases mentioned, a lower mean percentage would indicate improvement.

Principally, departments were compared to test hypothesis 2 in terms of sick days for equal time periods prior to and after the initiation of the new schedule. As an example, Bailly chem techs went on the 4/4 April 3, 1990. April would be a transition month (i.e. it contains work days from both shifts), so the data for that month is not counted. That leaves 9 months from June to January, so 9 months prior to April (excluding March, which was missing company wide) when the crew was on the 6/2 schedule is used

as a comparison.

### Supervisor Survey

This survey used six constructs to determine four hypotheses, which generated data that was a comparison of the attitudes of the 4/4 supervisor and the 6/2 supervisor. In the following, the abbreviation for the construct (or the way it will appear in the tables) is in parenthesis following the construct name. The question numbers on the survey that corresponds to the construct will also be in parenthesis. Reverse coding of a question is denoted by (RC). The responses (unless noted otherwise) were made on a 5 point Likert scale (1=strongly agree, 2=agree, 3=neutral, 4=disagree, 5=strongly disagree).

### Productivity/Hypothesis 3 (PRODUCT)

The intent of this construct was to determine how effective the supervisors thought that their workers used their work time and how much effort it required to get the workers to be productive. PRODUCT consisted of questions derived from the Morse Indexes of Employee Satisfaction (1),<sup>3</sup> Supervisory Behavior Description (15RC, 20RC, 30),<sup>4</sup>

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<sup>3</sup> Nancy Morse, Morse Indexes of Employee Satisfaction, Delbert C. Miller, ed. Handbook of Research Design and Social Measurement (New York: David McKay, 1977), 3rd. ed., 364-366.

<sup>4</sup> Miller, Supervisory Behavior Description, by Edwin A. Fleishman, 332-334.

and the Insel & Moos Work Environment Scale (10RC, 21RC, 22RC, 23RC, 24RC, 31).<sup>5</sup> The eleven item summated scale has a Cronbach alpha reliability of .90.

Examples: 1. "Most of my workers just seem to be putting in time."

2. "My employees often do exceptional work."

#### Morale/Hypothesis 4 (MORALE)

Social scientists often resort to defining the global nature of morale by breaking it down dimensionally. Dabas (1958) identified some fifteen different dimensions of morale, three of which are used by this study.<sup>6</sup> Since morale, in this case, was not assessed by employee self-report, but rather supervisor perception, the attitudes and demeanor of individual employees, the ability of the work crews to get along, and the relationship of the employees to their supervisors were used as the criteria for the construct of morale.<sup>7</sup> Each of these dimensions were used as individual constructs and then the three dimensions were summated to create the morale construct.

1. Employee Work Attitudes (EWA). EWA consist of a total of four questions, three derived from Brayfield and

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<sup>5</sup> Paul M. Insel and Rudolf H. Moos, Work Environment Scale (form R). California: Consulting Psychologist Press, 1974.

<sup>6</sup> Miller, 357.

<sup>7</sup> Miller, 338.

Rothe's Index of Job Satisfaction (3, 25, 26),<sup>8</sup> and one from the Work Environment Scale (12). The alpha reliability of the scale is .74.

Examples: 1. "My workers seem satisfied with their jobs."

2. "Most of my workers take pride in their jobs."

### 2. Labor-Management Relations (LABMAN). LABMAN

consisted of 6 questions derived from the Work Environment Scale (4, 7, 17, 18, 19, 29) and one by the researcher (2). The alpha reliability coefficient for this summated scale is .56.

Examples: 1. "The work atmosphere in our department is impersonal."

2. "Most of my employees would say that I stand up for them."

### 3. Conflict/Cohesion (CONCOH). CONCOH consisted of

three questions derived from Hemphill's Index of Group Dimensions (9, 11, 27),<sup>9</sup> and two from Seashore's Group Cohesiveness Index (5RC, 8).<sup>10</sup> Alpha reliability for this scale is .79.

Examples: 1. "My employees treat each other with respect."

2. "Work crews often "pawn" off work to the following crew."

Morale, as it pertains to the hypothesis is derived at

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<sup>8</sup> Miller, Brayfield and Rothes' Index of Job Satisfaction, by Arthur H. Brayfield and Harole F. Rothe, 370.

<sup>9</sup> Miller, Hemphill's Index of Group Dimensions, by John K. Hemphill, 246-252.

<sup>10</sup> Miller, Seashore's Group Cohesiveness Index, by Stanly E. Seashore, 257-258.

by adding up the scores on these three related constructs. The alpha reliability of the summated constructs has a coefficient of .83.

#### Staffing/Hypothesis 5 (STAFF)

The 5 questions on staffing were developed to create an index by interviewing three supervisors on what constituted appropriate information and the proper phrasing. A four point Likert scale was used (1-very easy to 4-very difficult) to determine staffing for vacations, overtime, job assignments, employee ability to trade shifts, and communication ability.

#### Crew Harmony/Hypothesis 6 (HARMONY)

Two questions were aimed at determining whether or not the supervisors have observed that a work crew that is leaving would stick the next crew with work, risking revenge. Question 32(RC) was developed by the researcher and summated with question 5(RC) from Seashore's Group Cohesiveness Index. Alpha reliability for this scale is .73.

Two other constructs are also presented in the result which are not part of the hypotheses, but are considered worth mention.

1. Safety--consisted of two questions (6, 16).<sup>11</sup>

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<sup>11</sup> Derived by the researcher.

Example: 1. "On-the-job injuries are commonplace in my department."

2. Overtime--consisted of questions 13 and 35b, both developed by the researcher.

### Employee Questionnaire

This survey used seven constructs to determine two hypotheses regarding dependent variables. In the following, the abbreviation for the construct will appear in parenthesis following the construct name. The question numbers on the survey that correspond to the construct will also be in parenthesis. Reverse coding of a question is denoted by (RC). The responses (unless noted otherwise) were made on a 5 point Likert scale (1=strongly agree, 2=agree, 3=neutral, 4=disagree, 5=strongly disagree).

#### Shiftwork Problems/Hypothesis 7 (PROFILE)

The problems associated with shiftwork are too broad to be covered in a single item measure. Literature suggests that shiftworkers have a harder time being positive about their relationships at home and work, their jobs, their quality of life, and suffer from more stress than the straight day worker.<sup>12</sup> A problem profile made up of five constructs was created and a comparison of both work groups was made. Each individual construct was first used to make

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<sup>12</sup> Tippins, 1-5, 12-13.

comparisons between the 4/4 and 6/2 workers. These five constructs were then added to create the shiftwork problem construct and similar comparisons were made.

1. Non-Work Attitudes (NWA). This three item scale takes a broad look at how well one perceives they get along outside of work. NWA consisted of questions derived from Brett's Interest/Conflict (14RC on 4/4, 8RC on 6/2),<sup>13</sup> and Yogev and Brett's Family Involvement (16 on 4/4 and 10 on 6/2).<sup>14</sup> Alpha reliability for this construct is .39. Example: "I am very much involved personally with my family member's lives."

2. Work Attitudes (WA). This four item scale looks at the perception of the job's worth and attitudes about the job. WA consisted of questions derived from the Intrinsic Motivation Scale of Hackman and Lawler (17 on 4/4 and 11 on 6/2)<sup>15</sup> and Quinn's et. al's Intrinsic Satisfaction Scale (18,19,20 on 4/4 and 12,13,14 on 6/2).<sup>16</sup> Alpha reliability for this construct is .74.

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<sup>13</sup> J. Brett, "Job Transfer and Well-Being," Journal of Applied Psychology 67 (1983): 450-463.

<sup>14</sup> S. Yogev and J.M.Brett, "Patterns of work and family involvement among single and dual-earner couples," Journal of Applied Psychology 70 (1985): 754-768.

<sup>15</sup> R. Hackman and E.E. Lawler, "Employee reactions to job characteristics," Journal of Applied Psychology 55 (1961): 259-286.

<sup>16</sup> R.P. Quinn and G.L. Staines, "The Quality of Employment Survey," Institute for Social Research (Ann Arbor, Mich. 1977).



Examples: 1. "My work is interesting."

2. "I feel badly when I do my job poorly."

3. Co-Worker Attitudes (CWA). This construct looks at the worth that the worker places on his or her co-worker. It essentially deals with the question of harmony and cohesion from the employee's perspective. CWA consisted of 2 questions (21 and 24 on the 4/4 and 15 and 18 on the 6/2) derived by the peer and employee groups indicated in the procedure section. Alpha reliability of this construct is .61.

Example: "The workers in my department do their fair share of work."

4. Stress (STRESS). Shiftworkers report health problems related to stress. To assess this, questions 25a-25h on the 4/4 (19a-19h on the 6/2) were taken from Patchen's Physical Symptoms of Stress.<sup>17</sup> Alpha reliability is .77.

Example: "All of us are occasionally bothered by minor health problems. In the past few weeks have you experienced...trouble sleeping?" Responses choices were 1 = a lot, 2 = some, 3 = a little, 4 = not at all.

5. Quality of Life (QOL). This measure looks at a broad overview of one's satisfaction or dissatisfaction with life conditions. QOL questions 26a-26h on the 4/4 (20a-20h on the

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<sup>17</sup> M. Patchen, "Some questionnaire measures of employee morale: A report on their reliability and validity," Institute for Social Research, (Ann Arbor, Mich. 1965). Monograph, 41. All questions on both surveys were reverse coded.

6/2) were taken from Campbell's et.al. Quality of Life.<sup>18</sup>

Alpha reliability for this construct was .85.

Example: "How satisfied or dissatisfied are you ...with your family life?" Responses are 1=very satisfied, 2=satisfied, 3=neutral, 4=dissatisfied, 5=very dissatisfied, 8=not applicable.

The summated profile attempts to uncover whether or not the problems are less intensive for the 4/4 shiftworker and sums into the measurement (PROFILE) used for assessing hypothesis 7. The summated construct has twenty-five questions with an alpha reliability of .56.

#### Schedule Preference/Hypothesis 8 (SP)

The focus of this construct is a comparison of an attitude about a work schedule not worked, to the reality of working it. Foster et. al. (1979) in a study of computer personnel found that this concept was crucial toward an accurate evaluation of a compressed work schedule.<sup>17</sup> If attitudes and preferences about a work schedule by the workers significantly exceed a base measurement of attitudes and preferences of that same schedule by workers not on the schedule (that being the attitudes and preferences about the 4/4 schedule by the 6/2 worker), then strength and direction

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<sup>18</sup> A. Campbell, P.E. Converse, and W.L. Rodgers, "The quality of American life," Russell Sage Foundation (New York 1976).

<sup>17</sup> Breaugh, 279.

of improvement that the schedule holds for the worker can be measured. This construct used 6 questions developed by Breagh<sup>18</sup> (2, 3RC, 4, 5, 7, and 12 on 4/4 and 1 through 6 on the 6/2) and compared the opinion of the 6/2 worker about 4/4, to the attitude about the 4/4 schedule by the workers on it on various dimensions. The alpha reliability for this construct is .94.

Example: "My job would be too strenuous and tiring for the 12-hour day."

#### Demographic Variables

This study assessed the impact of demographic characteristics of the 4/4 employees using shift rotation, sex, and age. These questions were at the end of the survey (see Appendix 3).

#### 4/4 Shift Rotation/Hypothesis 9 and 10

Chem techs were eliminated from this analysis because they are not required to have an equally distributed labor force over both the day and night schedules. Management typically "day loads" personnel and provides a "skeleton" crew for night time operations. Two types of shift rotations were used by the 4/4 production departments, weekly (one week days, one week nights) and more than weekly (typically

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<sup>18</sup> Breagh, 284-285.

two weeks of days, two weeks of nights). Coleman and Richey suggests that a medium rotation (week to week) is usually considered the best by workers.<sup>19</sup> The constructs of work attitudes (WA) and quality of life (QOL) were chosen for their reliability and because the two constructs adequately measure an overview of the workers' lives for a meaningful comparison.

#### Sexual Differences/Hypothesis 11

The literature suggests that males have a higher opinion about the 12-hour day than females. Question 12 of the survey was used because it asks for an opinion of the 4/4 schedule. Also, as the ratio of females to males is nearly 16 to 1, co-worker attitudes (CWA) are measured to see if differences exist between the sexes.

#### Age/Hypothesis 12

Questions from the survey pertaining to the difficulties or ease that this schedule places on ones life were used in determining whether or not older workers would be less favorable toward the 4/4 schedule. Questions 2 (preference), 3 (strain), 6 (routine), 7 (health), 9 (useable time off), 11 (family problems), and 12 (opinion) were used. This composite presents a number of dimensions for a meaningful comparison.

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<sup>19</sup> Coleman, 14; Richey, 70.

### Sample Description

Nipsco is the energy arm of the Nipsco Industries holding company and provides gas and electric to Northwest Indiana, which includes a sizeable industrial corridor containing Inland, USX, LTV, Bethlehem, and Midwest steel companies. Half of the industrial electrical revenues are generated by the steel producers<sup>20</sup> and in total, the company employs more than 4,500.<sup>21</sup>

Electricity is sold to an estimated population of 2,188,000 in 233 communities. "A substantial portion of the system's requirements is purchased from the non-affiliated under contract and in turn the company sells a large amount of power to other utilities."<sup>22</sup>

The 4/4 schedule actually began at the Schahfer plant with the coal handling supervisors and was subsequently tried by the production supervisors. The first implementation of the schedule by the union employees was in November of 1988. This method of scheduling was then used at other Nipsco plants. A chemical technician (chem tech) at Schahfer is credited with doing preliminary research and distributing information. The company agreed to allow the schedule to be implemented since total labor cost would only

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<sup>20</sup> John Reichanater, "NIPSCO and American Steel: Building our Futures Together," Monitor, March 1991, 18.

<sup>21</sup> Idem, *ibid.*, "Making an environmental difference," 8.

<sup>22</sup> Moody's Public Utility Manual, vol 2, 1985, "Northern Indiana Public Service Company," 2919.

increase by approximately three hours per employee, per year.<sup>23</sup> Questionnaires were administered to assess interest, and a vote was taken. While different departments may have employed different rules, a simple majority vote seems to be the norm in most departments.

The original concept in preparing this study was to look solely at unionized chem techs at all the generating stations. It was decided later to add production employees because they were on 6/2 at two plants (D.H. Mitchell and Bailly), while 4/4 was being worked by production at the other two (Schahfer and Michigan City). The 6/2 workforce represents a "pre-treatment" group who is not overwhelmingly negative toward the 4/4 schedule. The 4/4 schedule was voted out at Mitchell by one vote and voted in at Bailly by three votes on the second ballot (on the first ballot it lost by one vote so another election was held after 6 weeks). This survey indicates this closeness as 55.08% of the 6/2 workers would prefer the 4/4, and 44.92% would not prefer it. Historically, the elections that voted on the schedule have always been close in the larger production departments.

As none of the chem techs were working 6/2, this seemed to be the only way to provide an element of contrast. Further, production workers are teamed in such a way as to be staffed equally over a twenty-four hour period, while chem techs are primarily "day loaded" (e.g. a typical crew

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<sup>23</sup> United Steelworkers Union, 6.

of 5 division might be 3 on days with 2 on nights). Also, by merging the chem techs with the production workers, all inside-the-plant production people would be included, giving complete coverage to that classification.

Two other departments are considered a part of production, the coal handlers and F.G.D. (flue gas desulfurization). Both of these departments are located outside of the generating station proper, making them outside-the-plant production. Despite a small sample from Schahfer's coal handlers (N=7), these departments were excluded.<sup>24</sup>

The physical demands of the jobs in the two departments are not considered to be labor intensive, although occasional exertion may be used on all the jobs. Of the six different jobs under consideration, the ash and auxiliary (A&A) operator would probably be considered the most labor intensive.

Table 4 provides a brief glimpse at the difference between the positions of inside-the-plant production as determined by their job descriptions. Table 5 indicates the training stages and requirements for these job descriptions.

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<sup>24</sup> F.G.D. exists only at Schahfer and proved to be too logistically difficult in acquiring data. The coal handlers at Schahfer are the only ones of the four plants that work the 4/4 on a twenty four hour basis. After one attempt at acquiring data from them, they too were dropped from the study for logistic reasons.

Plant descriptions

Bailly (constructed in 1962) is located on Lake Michigan in Porter County and is flanked by Bethlehem Steel on one side and a national park on the other. It will become the second plant with an F.G.D. scrubber which allows a utility to burn cheaper, high sulfur coal, while meeting

Table 4

Job Descriptions of Inside-the-Plant Production

Job	Characteristics	
Relief operator	1. Relieve or assist in any operating classification.	2. Report irregularities and abnormal conditions.
Control Room Operator	1. Coordinate and direct the functions of employees in lower operating classifications.	2. Direct the regulation of unit output and voltages.
Station Operator	1. Operate, inspect, and service electrical switching isolating transformers and isolate breakers.	2. Operate, inspect, and service cooling water systems.
Unit Attendant	1. Assist in the starting, operating, and stopping of turbogenerator and auxiliaries.	2. Control temperature of turbine oil and hydrogen in generator.



Job	Characteristics	
Ash and Auxiliary Operator	1. Operate, inspect, and service bottom ash and fly ash disposal equipment, water treatment system and station heating, and service condensate system.	2. Operate, inspect, and service ash sluice pumps, vacuum pumps, bearing cooling water pumps, air compressors and rotating screens.
Chemical Technician	1. Investigate, report and take corrective action on abnormal conditions of systems such as: bearing cooling water and condenser fouling.	2. Sample and analyze special items such as turbine blade deposits and boiler drum deposits.

Table 5

## Training Stages and Requirements

Job	Training
Ash and Auxiliary	Stage 1, requires 4 months of training to qualify.
Unit Attendant	Stage 2, requires 3 months of training in addition to completing stage one.
Station Operator	Precursor to control room operator, requires 3 months of training in addition stages 1 & 2.
Control room operator	Requires 6 months of training to qualify in addition to stages 1, 2, and 3.
Relief Operator	Must complete all stages, no additional training required.

Job	Training
Chemical Technician	Must progress through 10 grades based on training requirements that culminate at the end of a 5 year apprenticeship program.

Source: Tables 4 and 5, Nipsco.

E.P.A. standards. Two turbines produce a gross capacity of 608 mega watts (mw).

D.H. Mitchell (constructed in 1955) is located on Lake Michigan in the Lake County industrial belt and like Bailly, uses lake water in the turbine and cooling process. It is the smallest plant with four turbines that are capable of producing 511 mw gross capacity.

Michigan City is the third plant located on the lake in LaPorte county. This plant is unique in that it has on old side (building constructed in 1929) as well as a newer side. The old side, with its 50's-style turbines produces 140 mw. The new side has a very large G.E. turbine capable of producing 512 mw.

Roland Schahfer (constructed in 1976), the largest plant is located in rural Jasper county and uses the Kankakee River for its water supply. Like Michigan City, it has two sides roughly separated by six years of construction. The 14-15 side contains two large turbines capable of producing 1,060 mw., while the newer 17-18 side

can produce 700 mw.<sup>25</sup>

### Sample Size and Response Rates

The total number of supervisors of the 6/2 schedule indicated by the company was 11, and 26 4/4 supervisors were reported for a total of 37. The number of reported 6/2 production workers at the Mitchell and Bailly plants was 72. The number of reported 4/4 production workers at 2 plants was 94. The number of reported 4/4 chem techs at 4 plants was 42. The total number of reported inside-the-plant production employees was 208.

Table 6 gives the final totals and response rates for the employee and supervisor surveys. Response rates were based on the total reported amount of workers in a department (provided by the contacted plant administrator) and were affected by non-compliance, sick leave, or positions yet unfilled due to attrition, restructuring, or job change.

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<sup>25</sup> Plant description information provided by Nipsco.

Table 6

Response Rates for all Surveyed Employees and Supervisors\*

Department/Job	Total Reported	Total Responding	Response Rate
Chem Techs	42	31	74%
Production	173	160	92%
Supervisor	37	33	89%

### Data Analysis

The entry, editing, manipulation, and storage of data was performed on SYSTAT (statistical software package). This package allows for easy data entry and provides for simple basic data programs. The basic manipulations that needed to be programmed were reverse codes and construct summation. Reverse coding was necessary on occasion to keep the direction of the data the same. The set up of the Likert responses dictated that the lower the mean score, the more favorable the response, or the stronger the advocacy toward the 4/4 schedule.

Initially, every question was run on a frequency table to be certain the data was clear. Each survey was given a case number and further received a location code (i.e. plant, department, and crew) in case future analysis becomes necessary.

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\* Numbers do not reflect coal handlers (N=7).

Absentee data was tabulated to produce a mean and standard deviation. An independent t test was used to determine the significance of the means on the discreet variables on the before 4/4, and after 4/4 comparison. The mean, standard deviation and one-tailed, independent t test were also used in both the employee and supervisor surveys (since the hypotheses are directional).<sup>26</sup> Question results that looked solely at one work group or attribute are presented as basic statistics, along with the percentage of responses.

The data in the surveys had to be structured so that the question numbers of the surveys corresponded to a variable. The 6/2 survey did not include as many schedule specific question as the 4/4, so these would be inserted as missing data into the structure. The data was carefully reviewed to ensure that all the blanks were properly placed down the 66 6/2 cases.

The continuous variable of age was analyzed by using Pearson's correlation coefficients to determine the direction and strength of the variables. Open ended responses, because of the variety were transcribed, and can be viewed in appendix 1.

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<sup>26</sup> A negative t score directionally favors the 4/4 schedule.

CHAPTER 5  
STUDY RESULTS

Personnel Data

To test hypothesis one, this study compared last years personal business days from the 4/4 Schahfer production department (N=61) with the 6/2 Bailly and D.H Mitchell production departments (N=69). The results are shown in table 7. A lower mean percentage represents fewer personal business days taken by the employee. The numbers reflect the percentage of total hours scheduled. N represents one month of accumulated personal business data for production departments only.

Table 7

Personal Business Days as a Percentage of Total Hours Scheduled for 1990-1991

Schedule	N	Mean	S.D.
4/4	13	.37%	.16
6/2	26	.55%	.47

The results indicate that the mean percentage does

decrease by .18%, giving support to the first hypothesis that personal business days decrease on the 4/4 schedule.

Both the NRC report and Tepas indicated a reduction in personal business days due to compressed 12-hour schedules (see Tables 1 and 2). The mean comparison in this study shows a non-significant reduction. The importance of this reduction to a firm depends on the size of the departments, the amount paid to restaff, and basic labor costs that would determine the relative worth of this finding to the companies. This research suggests that the hypothesis of reduction is supported but the finding is not significant.

To test hypothesis 2, first a comparison of sick days of all the plants was made to determine if the mean difference were lower. Table 8 is a comparison of 10 months, allowing for Michigan City station to be included as a 4/4 plant. N represents accumulated absentee data reflecting sick days for production departments only.

Some of the previously reviewed research on the 12-Hour day (NRC report, Duke Power, Tepas, Monsanto and Ronen and Primps) indicated a reduction in absentee rates due to sickness. The all-plant data reported in Table 8 compares the face value mean percentages and shows a decline of nearly 2% in the absentee rate.

Table 8

All Plant Sickness as a Percentage of Total Hours Scheduled  
for March 1990-January 1991

Schedule	N	Mean	S.D.
4/4	20	14.54%	4.51
6/2	20	16.31%	5.78

Again, the importance of this data depends on what "nearly 2%" would mean to these companies. In the case of Nipsco, it would provide a savings to terms of insurance rates and the 80% paid out for excused sick leave. One rough estimate would place this savings at nearly \$4,500 for a ten month period if all employees were on 4/4 using the mean differences indicated.<sup>1</sup>

The data in tables 7 and 8 do not take into account the characteristics or predispositions of the various departments, so the effect of alternative hypotheses could explain the differences (e.g. influenza outbreaks at one plant or absentee reporting errors). By looking at virtually the same workforce before the implementation of the 4/4 to actually being on the 4/4, the threat of alternative

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<sup>1</sup> This figure arrived at by taking the mean rate per hour for production of \$17.98, multiplying it by 80% (what is paid to the employee when he or she is sick), multiplying that by 170 (the number of reported production employees), and multiplying that by 1.77% (the percentage difference between the two schedules). This figure does not include the additional money needed to pay a replacement worker either time-and-a-half or double time to fill in.



hypotheses can be diminished.

While all of the production departments had lower mean absentee rates, none were statistically significant.

Comparisons of chem techs, however, proved to be significant. Table 9 looks at essentially the same employees' absentee rates before the 4/4 (when they were on 6/2) and after they went on the 4/4 schedule.

Table 9

Chem Techs, All Plant, Sickness as a Percentage of Total Hours Scheduled

Plant	Sched.	N	Mean	S.D.	t of means	p
Bailly	6/2	8	14.04	4.39	-2.51	.013*
Bailly	4/4	8	9.02	3.56		
Mitch.	6/2	7	14.26	4.22	-0.87	.20
Mitch.	4/4	7	11.82	6.06		
M.City	6/2	10	12.37	7.74	-1.40	.09
M.City	4/4	10	8.43	.18		
Schahf.	6/2	24	15.80	4.90	-3.01	.002**
Schahf.	4/4	24	11.87	4.04		

All chem tech departments had lower absentee rates on the 4/4 schedule than on the 6/2. The department that has been on the 4/4 schedule the longest, the Schahfer chem

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\* p < .05

\*\* p < .01

techs, significantly lowered their absentee rates after going on the 4/4, as did the Bailly chem techs. The Michigan City chem techs had a reduction of nearly 4% and the Mitchell chem techs approximately 2.5%.

The results from Table 8 suggest that the overall rates for sickness was lower by nearly 2% for the 4/4 plants, and the consistently lower mean of all the plants with the two significantly lower t scores for the Bailly and Schahfer plants support hypothesis 2, that absentee rates decline on the 4/4 schedule. This data shows a downward trend in absentee rates of all the company chem techs. That notion, coupled with the fact that the department with the longest "treatment" of 4/4 had significantly lower rates may suggest that measurements taken over longer periods of time could show a greater amount of departments with significantly lower absentee rates.

#### Supervisor Survey Data

The supervisor survey provided some useful insight into managements' perception of its employees. Table 10 presents the breakdown of the principal constructs as defined in Chapter 4. All four constructs that relate to the hypotheses found in this survey are in bold/underlined type. The lower the mean score, the more favorable the group is to that construct.

The results of this table show that productivity is

Table 10

## Construct Comparison of the Supervisors of Both Schedules

Construct	Schedule	Mean	S.D.	N	t
CONCOH	4/4	14.33	3.74	24	-1.67*
	6/2	16.78	3.77	9	
LABMAN	4/4	19.08	3.67	24	-1.62
	6/2	21.11	3.19	9	
EWA	4/4	10.87	2.76	24	-1.95*
	6/2	12.67	2.18	9	
<u>MORALE</u>	4/4	44.30	8.81	24	-2.03*
	6/2	50.56	7.56	9	
<u>PRODUCT</u>	4/4	25.54	6.98	24	-2.79**
	6/2	33.11	6.88	9	
<u>STAFFING</u>	4/4	9.88	1.95	24	1.35
	6/2	8.78	2.10	9	
OVERTIME	4/4	3.17	1.20	24	.35
	6/2	3.00	1.23	9	
SAFETY	4/4	3.33	1.13	24	-0.00
	6/2	3.33	1.00	9	
<u>HARMONY</u>	4/4	5.13	1.87	24	-2.98**
	6/2	7.00	1.50	9	

considered improved by the 4/4 supervisors at a high level of significance. Hypothesis 3, concerning greater

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\* p < .05

\*\* p < .01

productivity being attributed to the 4/4 workforce is supported. Like the NRC guidelines, Tepas, and Duke power, this study, concurs that productivity improves on a 12-Hour compressed workweek, but it singles out and specifies the four day on, four day off use of the 12-hour work day.

Two of the components comprising Morale (CONCOH and EWA) were significant, culminating in the morale construct being favorably significant toward the 4/4 worker. Hypothesis 4, concerning greater morale for the 4/4 work group is supported by the data.<sup>2</sup> The NRC, Tepas, and Duke power also indicate improvements in workforce morale on a compressed schedule.

These two hypotheses taken together would indicate that the workforce improves on this schedule and one could expect that if the supervisors truly thought this schedule was an improvement, that they themselves would try it. Recently (mid July), the supervisors at Bailly (who originally decided to stay on the 6/2) freely decided to go on the 4/4, working the same schedule as their employees. Based on this development, along with the data results, it seems reasonable to suggest that supervisors find 4/4's provide improvements as a work schedule.

Staffing, although not significant, was reported to be more problematic by the 4/4 supervisors. Hypothesis 5,

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<sup>2</sup> Even labor management relations came out nearly significant with a p value of .06.

concerning improvements in staffing on a 4/4 schedule is not supported by the data of this survey.

Crew harmony was perceived as significantly better by the 4/4 supervisors. Therefore, hypothesis 6, concerning an increase in the ability for different work crews to get along is also supported by the data. This indicates an efficiency in the design of the 12-hour day advanced by Brinton which suggest that since there are only two work crews (one following the other), greater concern is taken by each crew to get along with the crew that follows them to avoid revenge. This harmony, or between crew cohesion as it is referred to in the Duke power study is due to the removal of an in-between crew inherent in the 6/2 schedule.

Table 10 also indicates that safety and overtime were viewed almost identically by both types of schedule supervisors. No hypotheses sought to determine these particular variables, but it seems appropriate to note that no advantages in these areas were determined while the studies mentioned above indicated the 12-Hour schedule to be safer with less overtime needed.

#### Employee Survey Data

Table 11 presents a breakdown of the constructs used in support for hypotheses 7 and 8. The lower the mean score, the more favorable the group is to that construct.

Table 11

Mean Comparison of both Work Groups on the Survey Constructs

Construct	Schedule	Mean	S.D.	N	t
NWA	4/4	5.72	1.71	132	1.59
	6/2	5.32	1.71	66	
WA	4/4	8.72	2.35	132	-.34
	6/2	8.85	2.76	66	
STRESS	4/4	12.44	3.53	132	-.16
	6/2	12.53	3.94	66	
QOL	4/4	16.52	4.55	132	-.30
	6/2	16.74	5.30	66	
CWA	4/4	5.85	1.69	132	2.21*
	6/2	5.35	1.40	66	
PROFILE	4/4	49.23	9.05	132	.33
	6/2	48.79	10.04	66	
SP	4/4	13.07	6.49	132	-3.38**
	6/2	16.56	7.55	66	

Hypothesis 7, concerning shiftwork related problems being eased is not supported by the data. The determination of worker attitudes pertaining to the workers' work environment, the environment outside of work (non-work), the perceptions about co-workers, the level of stress, and the perceived quality of life were the components of the profile. Directionally, at least, 6/2 workers scored slightly lower on the problem profile, and in particular,

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\* p < .05

\*\* p < .01

significantly lower on co-worker attitudes.

Essentially, no pattern or trend is indicated showing the 4/4 worker to have less problems with shiftwork as defined by this study. The higher score on the CWA construct by the 6/2 workers is interesting, because it suggests that the 6/2 worker considers his crew members to be supportive and cohesive, while his supervisor does not.

Hypothesis 8 indicates that workers who have worked the 4/4 schedule will be more positive about it than those who have not. Following Foster (1979) and Breugh (1983), this study strongly supports the hypothesis. Foster and later Breugh's findings suggested that an evaluation of a compressed work week would not be accurate without reactions from people who have worked them.<sup>3</sup> All of the 4/4 workers except two had previously worked the 6/2, so the assumption by Foster and Breugh that the 4/4 schedule is preferred by those who have worked both schedules is supported by this data.

Table 12 presents the demographic data that relates to hypothesis 9 and 10, which suggests that a faster rotation improves the workers' attitudes about their jobs as well as their quality of life.

The data in Table 12 does not support hypothesis 9 suggesting that work attitudes are better on a faster rotation. Contrastingly, hypothesis 10, suggesting the

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<sup>3</sup> Breugh, 279-280.

quality of life is perceived better on a faster rotation is supported. The research by Coleman and Richey suggests that workers will prefer a faster rotation, but the research doesn't explain why. Since no questions on the survey pertained to preferred rotation length and why it was preferred, this research suggests that a faster rotation may enhance workers' quality of life, without affecting their work attitudes.

Table 12

Mean Comparison of Survey Constructs of 4/4 Worker by Rotation

Construct	Rotation	Mean	S.D.	N	t
WA	Weekly	8.08	2.70	39	-1.01
	2 or 3 Week	8.59	2.00	62	
QOL	Weekly	15.21	3.76	39	-2.06*
	2 or 3 Week	17.05	5.20	62	

Table 13 contains demographic data relating to hypothesis 11; in particular that males will prefer this schedule because it contains 12-hour days. Koen reported that males prefer the 12-hour day to females, but she did not make clear what type of work environment was measured.

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\*  $p < .05$



Table 13

## Mean Comparison of Survey Constructs of 4/4 Worker by Sex

Construct	Sex	Mean	S.D.	N	t
SCHEDULE OPINION	Male	2.12	1.31	124	2.13*
	Female	1.50	.76	8	
CWA	Male	5.77	1.70	124	-2.73*
	Female	7.00	1.20	8	

The data from this study indicates that females who have a trade, and work in a power plant prefer the 4/4 schedule more than do men. Hypothesis 10 which originated from Koen's notion is not supported by this sample. Females are also not as favoring of their co-workers as are males. The speculation here is that females believe their co-workers to be less reliable or dependable in terms of getting the job done.

Hypothesis 12 which indicates that the older worker will be less favorable to the schedule is derived from table 14. Age was split in eight groups on the questionnaire making it a categorical variable with linear qualities. Pearson correlation coefficients were used to compare age with the constructs and the questions concerning schedule attitudes and observations indicated in chapter 4. All of

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\* p < .05

these questions composed the SP construct. Negative correlations indicate that the older worker compared more favorably with the construct or question.

Table 14

Correlations of Constructs and Questions of the 4/4 Worker as Paired with Age<sup>2</sup>

Question/Construct	N	Correlation Coefficient
WA	132	-.22*
CWA	132	-.27**
Q2	132	.31**
Q3	132	.27**
Q4	132	.14
Q5	132	.30**
Q6	132	.32**
Q7	132	.25**
Q9	132	.21*
Q10	132	.14
Q11	132	-.22*
Q12	132	.24**
SP	132	.28**

The results of this table strongly support hypothesis

<sup>2</sup> See appendix 1 for questions.

\* p < .05

\*\* p < .01

12 that the older worker will not prefer the 4/4 schedule as much as the younger. Older workers have better attitudes concerning work and their co-workers. While they do disagree more than the younger worker that the 4/4 results in family problems (perhaps reflecting the more staid and stable ways of the older worker), the overall indication is that on eleven of the twelve dimensions measured, the older worker is less favorable to the schedule.

## Chapter 6

### CONCLUSIONS OF STUDY

#### Implications

Most of the study's hypotheses are strongly supported by the data, suggesting that a worker's life is effected by the 4/4 work schedule and that the impact is largely positive. This implication suggests a trade-off. Minimizing the physical trips into a plant is essentially what one trades when they opt to change to a 4/4 work schedule. This research indicates that other than that, the "problem" states are essentially the same. Workers on both schedules will have spousal, parental, physical, and mental problems induced either by shiftwork, or a plethora of other concerns beyond a work schedule. Ultimately, perhaps, assessing the value that a worker or workforce places on off-time (as was found by Breaugh), or the function of leisure desirability (as indicated by Ronen and Primps) is a critical step in the process toward the successful implementation of this schedule from an employee perspective.

This study indicates further that once workers who enjoy their off-time get a taste of increasing their off-

time, they tend to grow to prefer the 4/4 schedule. While preferring a schedule does not diminish the problems of shiftwork as defined by this research, it helps toward improving the productivity and morale of those that work the schedule, as was determined by the supervisors of the workers. Anything that can have this impact on a workforce involving continuous operation must be examined more fully by employers.

The cost of initiating such a schedule does not necessarily go up. In the case of Nipsco, the estimated labor cost increase, as proposed by the union was 2.85 hours annually, or a .002% increase. This is more than offset by the approximate reduction that a decline of 2% in absentee rates would have.<sup>1</sup>

In the implementation of such a schedule, it is important that the workers can decide for themselves if they want such a schedule, based on an awareness that the pain a change will make will be worth the benefits. The workers and management will need to commit themselves and be willing to compromise for any schedule to work, but unless they try something different, they will never be able to change, and for many shiftworkers, that is a miserable prospect indeed.<sup>2</sup> The workers involved in this study at Nipsco apparently believed that the "pain" of implementing such a

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<sup>1</sup> Steelworkers union, 6.

<sup>2</sup> Richey, 73.

schedule has been worth the benefits.

Despite showing support for most of the study hypotheses, this research is not without shortcomings. Two problems arise from the supervisor survey. First, it is a self-report inventory, and as such is not an objective analysis of productivity. However, it is difficult to measure productivity when a product is a function of a workforce's ability to ensure and maintain the continuous operation of machinery and a process. When these machines stop functioning, production is stopped, often beyond the control of the worker. Given that safety issues are a real concern in these environments (particularly in nuclear plants), and that unsafe practice or performance could endanger the worker and disrupt the production process, one could argue that safety is interwoven into the productivity scenario. If it were found that safety statistics significantly improved under the 4/4 schedule along with a subjective appraisal of productivity, then the picture would be stronger indeed. Although "safety" was subjectively sought by the questionnaire, no mention was made about how to acquire safety statistics by any company personnel in the planning stages. Subsequently it was not made a part of the design.<sup>3</sup> Archival safety data, in conjunction with the strong productivity data would have improved this study and should be a concern for future research.

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<sup>3</sup> It seemed that this data would be difficult to obtain.

Second, the sample size of the 6/2 (N=9) and the 4/4 (N=24) supervisors is very small. In addition, the supervisors on 6/2 were from the Bailly and Mitchell plants where the environments, the work crews, or the attitudes of the supervisors themselves could possibly be more negative than at the other two plants. While it is difficult to compare different environments, it is hoped that the sample homogeneity (similarities of work, job descriptions, training, and being from the same union and company) would diminish this effect and that despite the small number of reporting supervisors on a schedule, they would convey an accurate picture of their attitudes about their work crews.

A further point, the existing literature on compressed workweek does not deal with staffing issues (other than overtime) of a work force on 4/4's. A more detailed way of measuring staffing would have improved the research.

Obtaining information from the employees also contained problems. The data may have been affected by attempting to catch one crew before going on off-days and one crew coming off of off-days.<sup>4</sup> One crew being "fresher," while the other being more tired may have added systematic error to the data. Further, the nature of the study was not hidden from the participants and as such may have produced a response bias. Questions geared toward assessment of the life

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<sup>4</sup> This approach was used consistently at all plants to minimize the amount of time needed to collect data.

contentment profile may have been responded to more accurately if the conveyed intent of the study was to look at the problems inherent in shiftwork, devoid of scheduling. At least, this would minimize the halo effect that a work schedule could place on the way one would respond.

Because the surveys were distributed to work crews with potentially strong coalitions, the probability of an auspice bias could have been greater. Facial expressions or "clue" comments made by employees taking the survey may have tainted the responses.

And despite the precautions taken by ensuring anonymity and the assurance of independent affiliation of the research, fear of reprisal, or that the results of this study would somehow be used against the participants could have also contributed to a response bias by some of the sample respondents.

#### Suggestions for Future Research

In summary, this studies' findings suggest to utilities (and similar venues) that a 12-hour schedule producing more off-time will likely contribute to an employee's contentment with their schedule, which would contribute favorably to their morale and productivity while lowering their absentee rates. Other issues to be more adequately addressed by research in 12-hour compressed work week seems to be in the area of effective shift rotation (fast or slow), starting



times (early or later), communication errors during shift turnovers (and how this may relate to rotation and starting times), more critical analysis of what type of jobs and operations would benefit from such a schedule, and whether or not the training experience and costs are affected by the schedule. Issues that stem directly from the process of doing this research for future consideration include the following.

1. Does the 4/4 schedule take away the will power to do something on a regular basis (like exercise)?

2. Does the 4/4 schedule take away a sense of urgency in the completion of tasks at home?

3. Does the length of time on a 4/4 schedule affect the way a worker feels about the company?

Finally, a future research consideration is inherent to this study. A longitudinal look at the Bailly 6/2 workers' (who went on 4/4 April 3rd) attitudes after a year on the schedule could further strengthen the hypotheses of this study. Given the reaction of workers who have worked both schedules, it is probable that this recent converted 6/2 crew would show similar characteristics.

## Appendix 1

### Additional Comments Generated by the Surveys

Both the employee and supervisor surveys prompted for additional comments. The following is a summary of the comments made by the supervisors that responded (N=4). All were 4/4 supervisors.

1. Upper management is the basic problem, not the work schedule.

2. The 4/4 "tends to give a person more time with family, friends, and the ability to complete more projects of a personal nature."

3. On the 4/4:

- there is less sickness;

- "operators seem to have more energy for work, whether or not they work overtime;"

- there is "less hassle for supervisors when directing the workforce;"

- there is an "increase in productivity;"

- "supervisors call off sick less;"

- "supervisors attitudes (are) better when cooperating with other departments;"

- there is "more productivity from supervisors;"

- there is "more time off to get over stressful situations;"

- "the various health problems I experienced while on the 6/2 schedule, I no longer have."

Some comments were not so favorable.

4. "It does restrict the time to do much of anything during

the four working days."

5. "If you work diligently day after day, 12-hour shifts will be too long for you. You will suffer on your 4th workday and your 1st day off will be spent recuperating. Most workers will 'pace' themselves in order to get through the day and the workweek. Some of us can't and some won't pace themselves."

6. "The 4/4 work schedule primarily benefits the employee."

7. "On (the) 6/2 schedule, (the) maximum overtime allowed was 16 hours continuous. On 4/4, maximum OT is 24 hours. 24-hours of work make(s) people more prone to accidents and are (there are) greater supervisory problems because you find them 'at rest' more than 'at work.' I don't like working with dangerous people."

8. "Those employees that spend the greater share of their workday resting will love (the) 4/4 schedule. Those people that can't or won't do this will not like the 4/4."

9. It becomes commonplace for employees to not know equipment status after their days off.

Of the 66 6/2 surveys, 14 included additional comments. The following are pro 6/2 comments.

1. The 6/2 provides time off when kids are in school which leaves time to be alone with the wife.
2. I enjoy the 3 to 11 shift. On it I "feel most productive at work and at home."
3. "The only answer to (this) shiftwork is retirement."

The majority of the comments were not favorable to the shift schedule. Many of the comments concerned the reverse rotation (midnights to afternoons to days). The following typifies these comments.

4. Backward shift rotation affects your biological clock significantly. "Having the right mental attitude and being reasonably satisfied with your work, along with an understanding family is immeasurable."

5. "If I was an employee that sometimes called off work, or don't (sic) like my family, or (had) zero outside interest, I would prefer the 6/2 schedule."

6. "It would be difficult to devise a more asinine work schedule than the one I've worked for 35 years, rotating every week in reverse order...just about anything has got to be better."

7. Working the 4/4's would give me more weekends off for social events.

8. "I dislike this schedule intensely."

9. "Prior to working on the 6/2 shift (southern swing) I spent most of my working life on a two shift swing (days and afternoons) 5 days a week or a 5-day workweek straight days. I have never experienced such severe emotional swings as I now experience, nor the sleeping disorders I now experience working the 6/2 swing shift!"

Of the 132 4/4 surveys that were collected, 57 chose to include comments. Five surveys advocated the weekly

rotation, while four thought the slower rotation was better. Twenty four surveys had favorable comments while 16 were negative. Many of the responses with a single sentence like "I love the 4/4's," or "Go back to the 8-hour days," were typical responses. A summary of the negative comments follows.

1. The 12-hour day is too long. It's harder to trade shifts.
2. My physical condition has declined. It's difficult to adjust to daytime activities after working nights.
3. The 4/4 schedule does not foster alertness.
4. "The 4/4 has put more work on fewer people because we are (here) for a longer amount of time."
5. "If I had to stay on 4/4, I would like to have a different starting time, like 10:30, so a person could go to the bank or doctor, or even run uptown to some places (that) aren't open."
6. "The 4/4 puts one on the job too long causing mechanical like work habits. (The) 4/4 leaves one away from the job site too long causing (a) lack of job interest."
7. "I feel that the company has used the implementing of the 4/4 schedule as a way to cut benefits by only paying 8 hours for holidays, funeral leave, etc."
8. "The 4/4 schedule isn't fit for a dog--ask any doctor."
9. "Motivating other operators can be very stressful on 12-hour shifts. Workdays are lost days."
10. "I don't believe the 4/4 schedule has improved my

quality of life."

11. "Thus far, the 4/4 has been a pain in the ass in so far as dealing with family life in any way resembling normalcy."

12. "(The) 4/4 conflicts with (the) equal distribution of overtime."

13. "Accidents increase working (the) 4/4, from the 6/2."

Most of the comments made in the positive vein simply underscored that persons happiness or approval of that schedule. A summary of the positive comments follows.

1. Working the 4/4 has "given me a much better feeling of balance between work and home, if not more home time than work!"

2. "I always felt tired and half sick" from working the 6/2.

3. "I'm a part time farmer of 600 acres, (and that) is why I work 4/4's."

4. "I love the 4/4 even better than Monday through Friday days."

5. The 4/4 has positive mental and physical benefits.

6. "The 4/4 isn't perfect, but a great schedule compared to 6/2."

7. "The 4/4 is the best shift I've ever worked. If I had to work a 6/2, I'd probably bid to another job."

Five questionnaires contained comments that were critical of management and union in the way that the language of the agreement concerning the schedule was drawn up.

Appendix 2

Supervisor Survey



It is the interest of Loyola University to investigate the differing schedules of shiftworkers. To ensure maximum confidentiality and anonymity, addressed, stamped envelopes will be provided and the data will be presented in aggregate form. The information obtained will be made available to all interested parties. Your cooperation in taking the time to answer this survey is greatly appreciated. Please circle the response that best reflects your view on the following items.

	STRONGLY AGREE	AGREE	NEUTRAL	DISAGREE	STRONGLY DISAGREE
1. My department is one of the best in the company in terms of getting the job done.	1	2	3	4	5
2. In general, Union employees are easy to manage.	1	2	3	4	5
3. My employees seem enthusiastic about their work.	1	2	3	4	5
4. The work atmosphere in our department is impersonal.	1	2	3	4	5
5. Work crews often "pawn" off work to the following crew.	1	2	3	4	5
6. On-the-job injuries are commonplace in my department.	1	2	3	4	5
7. I socialize with my employees outside of work.	1	2	3	4	5
8. Employees under my supervision help each other out when someone falls behind or gets in a tight spot.	1	2	3	4	5
9. Most of my workers do small favors for one another.	1	2	3	4	5
10. Most of my workers just seem to be putting in time.	1	2	3	4	5
1. Most of my workers take a personal interest in each other.	1	2	3	4	5
2. Most of my workers take pride in their jobs.	1	2	3	4	5

13. I find that overtime is used more than it should be.	1	2	3	4	5
14. In terms of allowing for an adequate work force, my experience with my workers' schedule has been favorable.	1	2	3	4	5
15. I find that I have to rule with an "iron hand."	1	2	3	4	5
16. My workers usually get the job done as safely as possible.	1	2	3	4	5
17. Employees discuss their personal problems with me.	1	2	3	4	5
18. Most of my employees would say that I stand up for them.	1	2	3	4	5
19. I meet with employees regularly to discuss future work goals.	1	2	3	4	5
20. I have to "needle" my employees for greater effort.	1	2	3	4	5
21. There is a tendency for people to arrive at work late.	1	2	3	4	5
22. It's hard to get most of my workers to do any extra work.	1	2	3	4	5
23. There is a lot of time wasted because of inefficient employee work habits.	1	2	3	4	5
24. I constantly need to figure out ways to motivate my workers.	1	2	3	4	5
25. My workers seldom seem bored.	1	2	3	4	5
26. My workers seem satisfied with their jobs.	1	2	3	4	5
27. My employees treat each other with respect.	1	2	3	4	5
28. Most of my employees socialize with each other outside of work.	1	2	3	4	5
29. I never have to talk down to my employees.	1	2	3	4	5

	<i>Strongly Agree</i>	<i>Agree</i>	<i>Neutral</i>	<i>Disagree</i>	<i>Strongly Disagree</i>
30. My employees often do exceptional work.	1	2	3	4	5
31. All the crews seem to do their fair share.	1	2	3	4	5
32. It is common when some work goes undone by one shift because the workers don't care if it becomes the concern of the following shift.	1	2	3	4	5
33. Most of my employees find their jobs too strenuous and tiring for a 12-Hour work day.	1	2	3	4	5
34. The 4/4 schedule is harder on one's health than the 6/2.	1	2	3	4	5

35. Please indicate the relative ease or difficulty associated with the following union staffing situations.

	<i>VERY EASY</i>			<i>VERY DIFFICULT</i>
a) filling vacation vacancies	1	2	3	4
b) filling overtime	1	2	3	4
c) determining daily job assignments	1	2	3	4
d) employees ability to trade or "swap" shifts	1	2	3	4
e) ability to communicate information to all crews	1	2	3	4

Please circle the appropriate response.

34. I supervise employees on the following schedule.  
 1 . 4/4                      2. 6/2

35. I work a standard work schedule (5 days on, 2 off)    Yes or    No

36. My age falls in one of the following ranges:  
 21-30      31-40      41-50      51-60      60+

## Appendix 3

### Employee Survey for 4/4 Workers

It is the interest of Loyola University to investigate the differing schedules of shiftworkers. The data will be presented in aggregate form to ensure that maximum confidentiality and anonymity are upheld. The information will be made available to all interested parties. Your cooperation in taking the time to answer this survey is greatly appreciated. Please circle the response that best reflects your view on the following items.

STRONGLY  
AGREE

AGREE

NEUTRAL

DISAGREE

STRONGLY  
DISAGREE

	1	2	3	4	5
1. Working the 4/4 schedule day shift is preferable to working the 4/4 night schedule.					
2. Working both shifts of the 4/4 schedule is preferable to working the three shifts of the 6/2 schedule.					
3. My job is too strenuous and tiring for the 12 hour day.					
4. I feel more productive working the 4/4 schedule than I am on 6/2.					
5. My family (or significant people outside of work) prefers the 4/4 schedule to the 6/2 schedule.					
6. It easier to get into the routine of working and sleeping on the 4/4 schedule than on 6/2.					
7. The 4/4 schedule is harder on one's health than the 6/2.					
8. Working the 4/4 schedule has lowered my work commuting cost.					
9. Working the 4/4 schedule provides one with more useable time off.					
10. Going back to work after having four days off is more difficult than going back after two days off.					
11. Working the 4/4 schedule results in a lot of family problems.					
12. My opinion of the 4/4 schedule is very positive.					
13. My life outside of work is interesting.					

STRONGLY  
AGREE      2      AGREE      3      NEUTRAL      4      DISAGREE      5      STRONGLY  
DISAGREE

- 14. I get into many arguments with people who are close to me.      1      2      3      4      5
- 15. I believe the union is important.      1      2      3      4      5
- 16. I am very much involved personally with my family member's lives.      1      2      3      4      5
- 17. I feel badly when I do my job poorly.      1      2      3      4      5
- 18. The results of my work are valuable to the company.      1      2      3      4      5
- 19. My work is interesting.      1      2      3      4      5
- 20. I have the opportunity to develop my special abilities at work.      1      2      3      4      5
- 21. The workers in my department do their fair share of work.      1      2      3      4      5
- 22. I am offered enough overtime.      1      2      3      4      5
- 23. I feel rested after my days off.      1      2      3      4      5
- 24. I sometimes have to finish someone else's work.      1      2      3      4      5
- 25. All of us are occasionally bothered by minor health problems. In the past few weeks have you experienced.....?

a lot      some      a little      not at all

- a.trouble sleeping      1      2      3      4
- b.nervousness      1      2      3      4
- c.headaches      1      2      3      4
- d.upset stomach      1      2      3      4
- e.nightmares      1      2      3      4
- f.indigestion or heartburn      1      2      3      4
- g.constipation      1      2      3      4
- h.irritability      1      2      3      4

26. How satisfied or dissatisfied are you.....?

	VERY SATISFIED	SATISFIED	NEUTRAL	DISSATISFIED	VERY DISSATISFIED	NOT APPLICABLE
a.with your non-working activities?	1	2	3	4	5	6
b.with your marriage/relationship?	1	2	3	4	5	6
c.with your health?	1	2	3	4	5	6
d.with the type of work you are doing?	1	2	3	4	5	6
e.with your family life?	1	2	3	4	5	6
f.with your company as a place to work?	1	2	3	4	5	6
g.with your friendships?	1	2	3	4	5	6
h.with your standard of living?	1	2	3	4	5	6

Please circle the appropriate response

27. I am...Male or Female      28. I am...married or single

29. I am at this very time working... 4/4 Days      4/4 Nights

30. My age falls in one of the following ranges....

20-25    26-30    31-35    36-40    41-45    46-50    51-55    55+

31. My schedule rotates weekly.      1) Yes      2) No

32. I have previously worked the 6/2 schedule.      1) Yes      2) No

33. Approximately how long have you been working the 4/4 schedule in terms of months or years (whichever is appropriate).

If you would like to make any comments, suggestions, or observations regarding the work schedules, feel free. Your input could be invaluable.

Thank you for your time and effort, which are deeply appreciated. Please return uncollected surveys with return address to Schedules of Shiftwork Study, Institute of Industrial Relations, Loyola University of Chicago, 840 N. Wabash Ave., Chicago, Illinois 60611. You will be reimbursed for your postage.

Appendix 4

Employee Survey for 6/2 Workers



It is the interest of Loyola University to investigate the differing schedules of shiftworkers. The data will be presented in aggregate form to ensure that maximum confidentiality and anonymity are upheld. The information will be made available to all interested parties. Your cooperation in taking the time to answer this survey is greatly appreciated. Please circle the response that best reflects your view on the following items. On questions 1 through 5, please give an opinion even though you may not have worked a different schedule.

	<i>Strongly Agree</i>	<i>Agree</i>	<i>Neutral</i>	<i>Disagree</i>	<i>Strongly Disagree</i>
	1	2	3	4	5
1. Working both shifts of the 4/4 schedule would be preferable to working the three shifts of the 6/2 schedule.					
2. My job would be too strenuous and tiring for the 12 hour day.					
3. I would feel more productive working the 4/4 schedule than I do on the 6/2.					
4. My family (or significant people outside of work) would prefer the 4/4 schedule to the 6/2 schedule.					
5. The 4/4 schedule would be harder on one's health than the 6/2.					
6. My opinion of the 6/2 schedule is very positive.					
7. My life outside of work is interesting.					
8. I get into many arguments with people who are close to me.					
9. I believe the union is important.					
10. I am very much involved personally with my family member's lives.					
11. I feel badly when I do my job poorly.					
12. The results of my work are valuable to the company.					
13. My work is interesting.					
14. I have the opportunity to develop my special abilities at work.					

15. The workers in my department do their fair share of work.      1    2    3    4    5
16. I am offered enough overtime.      1    2    3    4    5
17. I feel rested after my days off.      1    2    3    4    5
18. I sometimes have to finish someone else's work.      1    2    3    4    5
19. All of us are occasionally bothered by minor health problems. In the past few weeks have you experienced....?

	a lot	some	a little	not at all
a.trouble sleeping	1	2	3	4
b.nervousness	1	2	3	4
c.headaches	1	2	3	4
d.upset stomach	1	2	3	4
e.nightmares	1	2	3	4
f.indigestion or heartburn	1	2	3	4
g.constipation	1	2	3	4
h.irritability	1	2	3	4

20. How satisfied or dissatisfied are you.....?

	VERY SATISFIED	Satisfied	NEUTRAL	DISSATISFIED	VERY DISSATISFIED	NOT APPLICABLE
a.with your non-working activities?	1	2	3	4	5	8
b.with your marriage/relationship?	1	2	3	4	5	8
c.with your health?	1	2	3	4	5	8
d.with the type of work you are doing?	1	2	3	4	5	8
e.with your family life?	1	2	3	4	5	8
f.with your company as a place to work?	1	2	3	4	5	8
g.with your friendships?	1	2	3	4	5	8
h.with your standard of living?	1	2	3	4	5	8

Please circle the appropriate response

21. I am...Male or Female      22. I am...married or single
23. The shift I am on at this particular time is...      6/2 Days  
6/2 Afternoons      6/2 Midnights
24. My age falls in one of the following ranges....  
20-25   26-30   31-35   36-40   41-45   46-50   51-55   55+
25. My schedule rotates every week.      1) Yes      2) No
26. I have been working a 6/2 schedule for.... 1) less than a year  
2) 1 to 5 years      3) 6 to 10 years      4) 11 to 20 years  
5) 21+ years

If you would like to make any comments, suggestions, or observations regarding the work schedules, feel free. Your input could be invaluable.

Thank you for your time and effort, which are deeply appreciated. Please return uncollected surveys with return address to Schedules of Shiftwork Study, Institute of Industrial Relations, Loyola University of Chicago, 840 N. Wabash Ave., Chicago, Illinois 60611. You will be reimbursed for your postage.

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The thesis, "An Examination of the Compressed Work Week in a Continuous Operation" submitted by Mark Tippins has been read and approved by the following committee:

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The thesis is, therefore, accepted in partial fulfillment of the requirements for the degree of Human Resources and Industrial Relations.

December 3, 1991

Linda K. Stroh

December 3, 1991

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