

Glossary of Terms

Downsizing Rate

The ratio of the number of employees laid-off divided by the number of employees at the site, averaged across all departments/work groups.

Downsizing Process

The procedures and policies used to carry out the downsizing; that is, the way the downsizing was handled, the fairness of the procedures, and the degree of open and honest communication with employees.

Downsizing Involvement

The extent to which employees had more direct experiences of downsizing, such as delivering layoff notices, being laid off and then rehired, and changing jobs/departments.

Survivor Syndrome

A cluster of symptoms which includes feelings of guilt, sadness, and worry seen in workers who retain their jobs after

The Impact of Downsizing and Reorganization on Employee Health and Well-being at the DOE Nevada Test Site

Investigator: Lewis D. Pepper, M.D., M.P.H., Associate Professor, Principal Investigator; Miriam Messinger, M.P.H., Project Manager, Department of Environmental Health, Boston University School of Public Health.

Study Sites: Nevada Test Site, Oak Ridge (Y-12), Pantex, Los Alamos National Laboratory, and Idaho National Engineering and Environmental Laboratory.

Study Focus: The negative effects of downsizing and reorganization on workers who lose their jobs is well known, but there is growing evidence that even workers who retain their jobs during downsizing also are affected in negative ways. It is common to find reports of reduced job commitment, low morale and low job satisfaction among "job survivors," as well as feelings of guilt, sadness and worry. The present study examined this "survivor syndrome" as well as other health and safety effects of downsizing at the DOE Nevada Test Site (NTS). The study measured how downsizing was done in each department, the adequacy of communication, perceived fairness, and characteristics of jobs (e.g., workload, decision-making, etc).

Methods: Data were collected using a questionnaire survey that was designed specifically for this study. The questionnaire asked workers and managers about how the downsizing was accomplished (e.g., perceived fairness, openness of communication) and the extent of their direct involvement in the downsizing. In addition, the survey measured job characteristics such as workload, decision-making authority, conflict resolution, and supervisor support. The survey was sent to a random selection of 1,034 workers at NTS. Responses were returned from 67% (N=699) respondents of those who received the survey. Additional data were obtained from archival records, including sick time data, overtime usage, and accidents/illnesses, and from focus groups and interviews with workers and managers at the site.

Study Findings:

1. Workers who felt that the downsizing process was fair, and that communication was open and honest, reported fewer medical symptoms (e.g., headaches, shortness of breath, backaches), fewer symptoms of survivor syndrome, better mental health, and less job insecurity.
2. Workers who were more directly involved with the downsizing process (i.e., delivered layoff notices, were laid off and then rehired, changed jobs/departments) reported more medical symptoms, and lower mental health.

Further NIOSH Information:

- For a copy of the final technical report or the executive summary for this study, call:

1-800-356-4674

- For a summary of NIOSH research involving Department of Energy workers, visit online at:

www.cdc.gov/niosh/oeindex.html

This study was supported by the National Institute for Occupational Safety and Health (NIOSH) Co-operative Agreement Program. The conclusions and recommendations expressed are those of the authors and not necessarily those of NIOSH.

Study Findings (Continued)

3. Workers in jobs with high workload demands but with low decision-making authority reported more symptoms of survivor syndrome, more stress, and more job insecurity.
4. Workers who reported having a supportive supervisor had fewer medical symptoms and higher morale.
5. Workers who experienced threats or acts of violence or harassment reported more medical symptoms, more stress, and more job insecurity.
6. Focus group and interview data yielded several common themes:
 - communication with management was improved and there was a greater sense of job stability than in previous years
 - the main effects of downsizing reported by workers were emotional and family problems
 - workload increased substantially after downsizing
 - job skills are very specialized so that alternative employment in the community is low

Interventions: The findings point to recommendations that may help mitigate some of the negative impacts of downsizing on employee health and well-being. For example, organizations should consider:

1. Implementing processes and policies that emphasize fair procedures, and open, timely, and honest communication to employees in all work units.
2. Assessing workload demands following significant changes to a work unit or department.
3. Implementing regular surveys of the organization, with particular attention to communication, workload, and management relations with the DOE.

Important Announcements

Study findings will be presented at NTS in October/November 2000. Details of the site visit will be provided later. For more information including developments regarding the scheduling of site visits, please contact DOE site representative, La Tomya Glass at (702) 295-3521. Copies of the complete report, [The Health Effects of Downsizing in the Nuclear Industry: Findings at NTS](#), can be found in the DOE Public Reading Facility, B-3 Building, 2621 Losee Road, North Las Vegas, NV, 89030. Contact: (702) 295-1628. Questions concerning this study should be directed to Dr. Pepper at (617) 638-4620.

NIOSH/HERB Contact Points for further information...

National Institute for Occupational Safety and Health (NIOSH)
Division of Surveillance, Hazard Evaluations and Field Studies (DSHEFS)
Health-Related Energy Research Branch (HERB)

NIOSH-HERB MS R-44
4676 Columbia Parkway
Cincinnati, OH 45226

Phone: (513) 841-4400
Fax: (513) 841-4470

The Health Effects of Downsizing in the Nuclear Industry

NEVADA TEST SITE

Executive Summary

August 2000

For additional information:

Principal Investigator: Lewis D. Pepper, MD, MPH

Boston University School of Public Health

lpepper@bu.edu

Department of Environmental Health

715 Albany Street, Talbot 2

Boston, MA 02118

617-638-4620

Funded by a grant from the National Institute of Occupational Safety and Health (NIOSH)

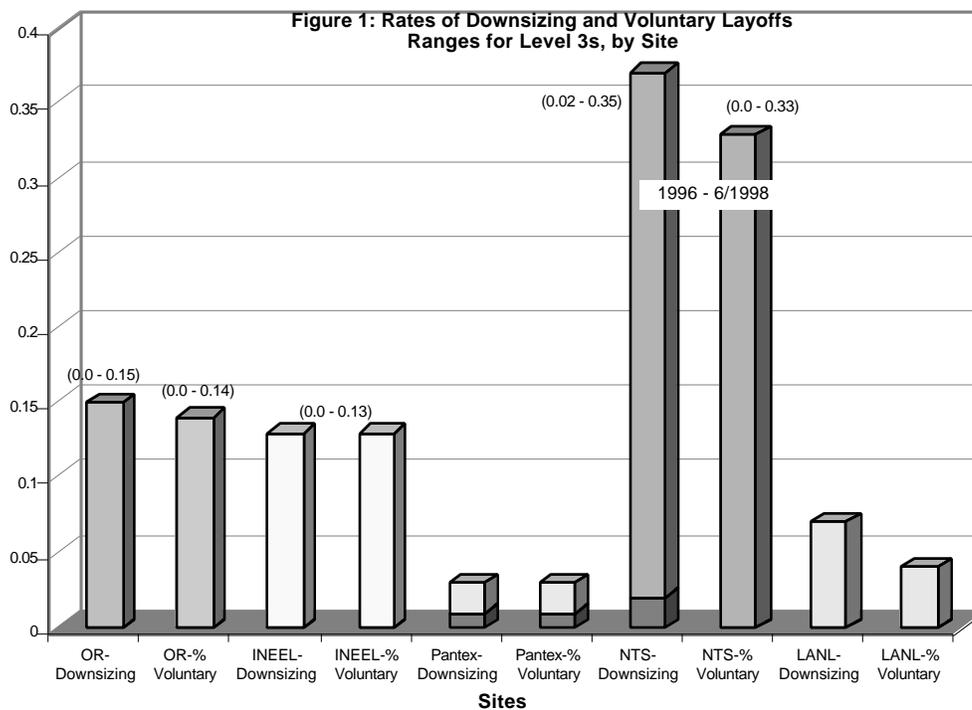
Copies of the complete report are available in the Nevada Department of Energy Reading Room or contact **Nevada Operations Office Public Affairs contact: Darwin Morgan, 702-295-1755** or **Bechtel Nevada Public Affairs contact: Cheryl Oar 702-295-2966**

The Health Effects of Downsizing in the Nuclear Industry NEVADA TEST SITE

Executive Summary

Organizational restructuring within the defense industry prompts research on health effects.

The dissolution of the Soviet Union and the ending of the Cold War in 1992 resulted in marked shifts in United States military strategy and budgets. Consequently, Congress passed Section 3161 of the National Defense Authorization Act for Fiscal Year 1993 outlining an approach to workforce layoffs in the nuclear weapons industry. Since then, there have been 46,000 layoffs of contractor employees at Department of Energy sites. More than 14,000 employees were downsized from the five study sites between September 1991 and September 1998 through voluntary and involuntary layoff events. In 1999, employment at the five sites was from nine to sixty nine percent lower than the highest employment level during the 1990's. The downsizing rates for each of the sites, including overall downsizing and the extent to which layoffs were of a voluntary nature, are presented below in Figure 1.



To better understand the impact of such downsizing and other organizational changes on both the remaining workforce and those who lost their jobs, the U.S. Department of Energy (DOE) and the Centers for Disease Control (CDC) solicited research proposals.

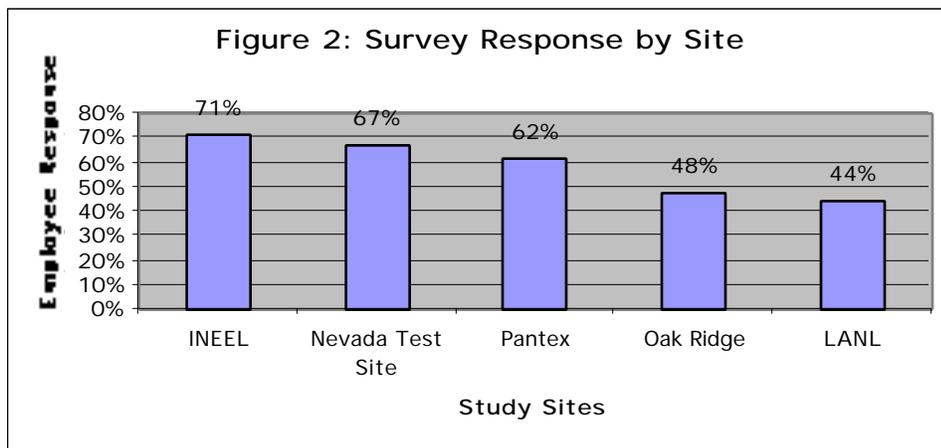
Boston University School of Public Health, with funding from the National Institute of Occupational Safety and Health (NIOSH), was selected to study and recommend ways to mitigate the impacts of workforce reductions on individual and organizational health.

This study required enormous cooperation. Our biggest thanks are to the nearly 6,000 employees who participated in focus groups or interviews and completed surveys, and to those supervisors who helped make that possible. This report was peer reviewed by two experts in the field of workplace stress and psychosocial research.

Boston University School of Public Health study is most far reaching of its kind.

Our research, covering the period from 1991 through June 1998, is the largest of its kind--in both scale and scope--to investigate the health and organizational effects of workplace restructuring. Marrying the disciplines of public health, organizational psychology and organizational management, we used several methodologies and designed a multi-level research model to best capture the complexity and variety of relevant data.

In our survey, which was only one piece of the data collection, we sampled 10,645 employees from our five study sites (or 43% of all eligible employees at those sites). We received an overall response of 55% and, at the Nevada Test Site 71% of the sample or 699 employees completed the survey (BN and WSI). Figure 2 compares response rates by site.



Globally, downsizing and organizational restructuring have become common management tools, used to improve operational and fiscal efficiency. However, little is known, about the effects of these tools on employee health or organizational effectiveness. Therefore, the knowledge sought through this research is important for employees, unions, and other employee organizations, contractors and federal entities managing organizational change in DOE facilities, as well as for those in other industries.

We identified and investigated four key issues in downsizing, reorganization and health.

1. Downsizing will have a negative effect on individual health and workplace functioning (i.e., employee morale, work performance and job security).
2. Employees are less likely to experience negative health effects and organizations are more apt to function normally the fairer the downsizing process and the fewer direct elements of downsizing the employee experiences.
3. During periods of organizational change, one's work and work environment, including job strain*, organizational style, co-worker and supervisor support, and workplace safety will affect both individual health and workplace functioning.
4. Workplace factors including job strain, organizational climate, and the employee's perception of the fairness of the downsizing process can moderate the impact of downsizing on health and organizational outcomes.

Findings at Nevada Test Site Demonstrate Need to Develop Interventions for Improved Employee Health.

NTS was chosen as a study site based on two primary demographic and downsizing characteristics. The site is located near a large urban area that is undergoing a multi-year economic boom. New and reasonably well paying jobs continue to be created in Las Vegas offering NTS workers continual employment opportunities. The

• Definitions of terms

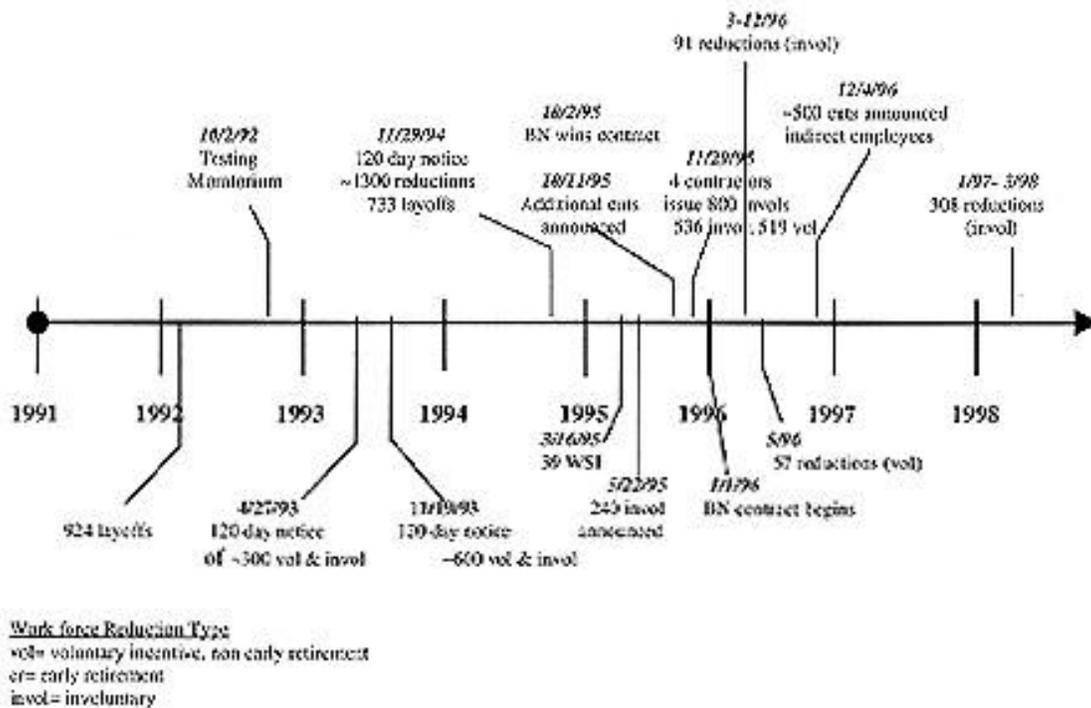
Job strain measures both the “demand” one experiences at work (physical and psychological) and the “control” an employee has over work tasks, where job control refers to the ability to structure your work, feel challenged and use your skills and training. Job strain is measured using three scales: the job demands scale, the decision authority scale and the skill discretion scale.

Organizational style refers to managerial and leadership approaches, with particular attention to how relationships and problems are handled. We looked at the company's organizational style using four scales on: 1) handling conflict, 2) the relationship with the DOE, 3) how management communicates with employees, and 4) workplace violence.

Organizational climate is used here as an umbrella term for work environment issues. We include the components of organizational style listed above (four scales) as well as co-worker and supervisor support and workplace health and safety (three scales measuring general safety, toxic exposure and exposure to noise).

downsizing story at NTS is dramatic. Downsizing followed shortly after the October 2, 1992, Testing Moratorium and continued throughout the study period. A large-scale reduction occurred midway through the study period within months of Bechtel Nevada winning the NTS contract. The downsizing coincided with profound organizational and mission changes along with the replacement of the site's longstanding contractor. The timeline below (Figure 3) diagrams the downsizing events and other major organizational changes experienced at the NTS from January 1991 through June 1998.

FIGURE 1: Timeline of Downsizing and Restructuring Events at NTS



Our research yielded the following five site-specific findings at Nevada Test Site.

1. Employees who perceived that downsizing was implemented with clearly explained reasons, worker input, open respectful, truthful and unbiased communication with employees, and consistent and fair rules experienced fewer negative health effects.
 - A process perceived as just and fair was associated with fewer reported medical symptoms.
 - Greater fairness was associated with fewer survivor syndrome symptoms.

- The more fair the downsizing, the less job insecurity was expressed and the higher the reported morale.
2. Employees who reported more direct experiences of the downsizing, had poorer mental and physical health status and a greater sense of job security.
 - A higher score on the downsizing experiences index was associated with a greater number of medical symptoms and conditions.
 - These employees had lower mental health scores (MCS).
 - The more downsizing elements experienced, the lower the job security expressed.
 3. Employees who experienced greater job strain reported an increase in adverse individual and organizational functioning outcomes.
 - Higher job strain was associated with poorer reported mental health status, increased symptoms of survivor syndrome and increased stress.
 - Workers with high strain jobs experienced greater job insecurity.
 4. A supportive supervisor and co-workers, good organizational relations and a safe workplace are associated with better employee health and organizational functioning.
 - Employees who reported receiving greater support from their manager and co-workers saw higher morale amongst their co-workers.
 - Employees who perceive that their managers have good relations with DOE or feel that there is healthy resolution of conflict at the site reported fewer instances of poor work performance.
 - The perception of a less safe workplace was associated with lower morale, while a belief that one is exposed to toxicants was predictive of more medical symptoms.
 - Qualitative data reports to a perceived association between poor management (unfair practices, poor communication, etc.) and low morale and motivation.
 5. Employees who experience threats or acts of violence, harassment or discriminatory treatment have worse health outcomes.
 - Employees who reported more experiences of violence, harassment or discriminatory treatment reported worse physical health (on all three measures).
 - These employees were also more likely to report lower overall mental health and more perceived stress (although lower survivor syndrome) at NTS.
 - An increased experience with violence or harassment was predictive of greater job insecurity and greater frequency of poor work performance.

6. Employees expressed some consistent concerns in employee discussion groups, interviews and comments written on the surveys. We heard that:
- although new missions have curbed some fears about job security, continued downsizing has led to a mindset that jobs will never be secure;
 - personnel were feeling more a part of BN, rather than relics from the old contractors, although some expressed the “us” versus “them” tension;
 - while new missions for the site have improved employee trust in BN, the technical trades still do not feel that BN understands and supports their needs and expertise;
 - contrary to our expectation, the growth of the local economy was not reassuring to many NTS employees since they believed that job skills at NTS are very specialized and are not seen as transferable to jobs available in the Las Vegas area.

NTS findings are similar to findings at four other study sites.

At all five sites, our survey, focus group and interview data show the importance of a fair and just downsizing process on employee health. The more elements of downsizing that individual employees experience, the more likely they are to suffer negative effects, particularly related to medical symptoms, overall mental health and job security. High job strain had negative effects on employee mental health and job security that is similar to the other sites.

The experience of violence or harassment predicted negative outcomes at three sites but it did not emerge as important at two others. At NTS, the violence/harassment index was significantly associated with all outcomes except morale, more than at any other site. Support from one’s supervisors and co-workers was not as important at NTS as at the other sites.

Study employs various methods to understand the complexity of downsizing and organizational change.

We used multiple approaches to collect and compare information about the extent of downsizing, employees’ perceptions of the downsizing, workplace safety and other organizational issues. Through our interviews with key individuals, focus group discussions and work-site observations, we were able to glean characteristics and themes within the workplace as perceived by the employees themselves. This qualitative data revealed aspects of employee culture and organizational climate that could not be obtained with other research techniques.

A central source of data was the responses to the *Boston University Workplace Survey*. The survey was sent to a random selection of 921 Bechtel Nevada (BN) employees and 113 Wackenhut Security (WSI) employees. We received a response of 699 (68%) from BN and WSI employees. This survey, based on our review of

relevant literature and knowledge gained from interviews and focus group discussion, was pilot tested at four sites, reviewed by NIOSH institutional boards and then revised.

We also reviewed archival records (including sick time data, overtime usage, downsizing data and accident and illness data, medical services utilization, etc.) for their potential use in this research.

Researchers maintained a high level of communication with employees and their communities throughout the study.

Throughout our research, we maintained the highest levels of communication with employees and members of their communities. We sponsored town and community meetings to relay information about and receive feedback on our study. We obtained informed consent from employees involved in any interview, focus group or who completed the employee survey. At various stages of the research we made available information about the study and research updates for publication in site and local media. Additionally, we established a study e-mail account and posted information on the World Wide Web. We will be presenting our results at each site and will make available written materials at all sites and by request from researchers and on the Web.

Researchers recommend interventions that target many levels of the organization and include further research.

Our findings point to many ways to mitigate negative impacts on employee health and workplace functioning. In order to be most effective, an intervention design should address the following three organizational levels and should feature a variety of approaches. We provide here only a few examples within each category. Our complete list of recommendations can be found in the final report for Nevada Test Site: [The Health Effects of Downsizing in the Nuclear Industry: Findings at the Nevada Test Site.](#)

At the policy and structural level, interventions should include, for example, programs and policies to address: any incidence of workplace harassment and violence; flexible work schedules that respond to employee concerns about workload, work demand and poor work-home balance; and preparation and training of managers who must plan or implement a downsizing or restructuring event.

Interventions that address procedures and group functioning should include, for instance: training for managers on effective supervision and communication; employee training on workplace diversity; and programs that encourage employees to respond to workplace change openly.

Individual level interventions should include, for example: sessions on exercise and stress reduction; collaboration with employees to redesign jobs or work stations; and information that use of the Employee Assistance Program will not detrimentally affect one's career.

The Health Effects of Downsizing
in the Nuclear Industry:
Findings at the Nevada Test Site

Final Report

October 2000

Conducted by: the Boston University School of Public Health (BUSPH)
Funded by: the National Institute of Occupational Safety and Health (NIOSH)

For additional information:

Principal Investigator: Lewis D. Pepper, MD, MPH
Boston University School of Public Health
lpepper@bu.edu
Department of Environmental Health
715 Albany Street, Talbot 2
Boston, MA 02118
617-638-4620

Copies of the complete report are available in the Department of Energy Reading Room or contact Toby Bickmore with DOE Nevada.

TABLE OF CONTENTS

<i>I. INTRODUCTION</i> _____	<i>1</i>
<i>II. CONTEXT and HISTORY</i> _____	<i>4</i>
IIA. Department of Energy Overview _____	4
IIIB. DOE Downsizing History _____	4
IIIC. Study Background _____	6
<i>III. HYPOTHESES and BACKGROUND LITERATURE</i> _____	<i>8</i>
IIIA. Description of the Problem and the Model _____	8
IIIB. Relevant Theories and Areas of Study _____	9
B1. Stress models _____	9
B2. Downsizing literature _____	9
B3. Justice and fairness _____	10
IIIC. Importance of this Research _____	11
<i>IV. RESEARCH METHODOLOGY</i> _____	<i>12</i>
IVA. Multiple Study Methods _____	12
IVB. Qualitative Data Collection and Analysis _____	13
IVC. Quantitative Data Collection _____	15
C1. The <i>Boston University Workplace Survey</i> _____	15
C2. Collection of archival data _____	16
<i>V. SITE DESCRIPTION</i> _____	<i>18</i>
VA. Site Characterization _____	18
A1. Site history _____	18
A2. Site selection characteristics _____	19
A3. Downsizing and restructuring history _____	20
VB. Site Visit and Focus Group Themes _____	22
B1. Site specific findings from interviews and observations _____	22
VC. Employee Assistance Program _____	24
C1. Workshops and services _____	24
C2. Consistencies across sites _____	25
<i>VI. DATA ANALYSIS PROCESS</i> _____	<i>25</i>
VIA. Employee Level Outcomes _____	25
VIB. Hierarchical Linear Models _____	29
<i>VII. SUMMARY STATISTICS</i> _____	<i>30</i>
VIIA. Archival Data _____	31
A1. Downsizing _____	31
A2. Sick time and accident data _____	33
VIIIB. Survey Data: Descriptive Tables _____	34

B1. Survey responders _____	34
B2. Summary statistics on survey scales _____	37
B3. Summary statistics compared to national norms _____	38
B4. Review of the <i>Boston University Workplace Survey</i> comments _____	40
VIII. MULTI-LEVEL MODEL RESULTS _____	41
VIIIA. Individual Level Controls _____	42
VIIIB. Downsizing _____	43
VIIIC. Downsizing Process _____	44
C1. Fairness _____	45
C2. Voluntary layoffs _____	46
C3. Individual experiences of downsizing _____	46
VIIID. Strain _____	46
VIIIE. Organizational Climate _____	48
E1. Organizational style _____	48
E2. Social support _____	50
E3. Safety and health _____	51
VIIIF. Interaction Effects _____	52
IX. DISCUSSION _____	52
IXA. Does Downsizing Negatively Affect Health? _____	53
IXB. Does a Fair Downsizing Process Result in Fewer Negative Impacts? _____	55
IXC. Do Work Environment and Job Strain Affect Health During Times of Change? _____	57
IXD. Does Downsizing Interact with Other Variables to Impact Employee Health and Well-Being? _____	61
X. SITE-SPECIFIC FINDINGS, RECOMMENDATIONS and NEXT STEPS _____	61
XA. Findings at the Nevada Test Site _____	62
XB. Recommendations for Intervention _____	63
XC. Next Steps _____	65
XD. Topics for Further Inquiry _____	66
ACKNOWLEDGEMENTS _____	68
REFERENCES _____	69
(See List of Appendices on next page)	

LIST OF APPENDICES

Appendix

A. Section 3161 of the National Defense Authorization Act for Fiscal Year 1993	73
B. Background Literature	75
C. Qualitative Data: Importance and Use	81
D. Data Collection: Methods and Evaluation	83
E. The Boston University Workplace Survey	87
F. Survey Sampling and Administration Protocols	88
G. Archival Data Collection, Rate Calculation and Evaluation	93
H. Exposure and Outcome Data Fields and Data Mapping	98
I. Site Visits to the Nevada Test Site	100
J. Overview of Employee Assistance Program Data	101
K. Description of Survey Scales and Alpha Coefficients	103
L. Variables Collected: Description, Scale Scores and Use in Models	107
M. Outcome Measures Compared to National Data Sets	111
N. Survey Comment Analysis Categories	112
O. Hierarchical Linear Modeling (HLM) Results	114
P. HLM 7 Step Summary for Selected Variables	123

LIST OF TABLES AND FIGURES

Tables

Table 1: Annual Downsizing at NTS (numbers and rates)

Table 2a: Annual Downsizing at NTS/WSI by Level 3 (ranges)

Table 2b: Annual Downsizing at NTS/BN by Level 3 (ranges)

Table 3: Sick Time Rates and Total Recordable Cases for NTS and All Sites

Table 4: Survey Response Rate by Site

Table 5: Survey Responder Demographics, BN and WSI Employees

Table 6: Survey Responders Compared to NTS Population (BN and WSI)

Table 7: Descriptive Statistics for all Survey Variables

Table 8: Hierarchical Linear Modeling Results for Downsizing Rate and Process Measures

Table 9: Hierarchical Linear Modeling Results for Job Strain Variable

Table 10: Hierarchical Linear Modeling Results for Organizational Style Measures

Table 11: Hierarchical Linear Model Results for Supervisor and Co-Worker Support

Table 12: Hierarchical Linear Model Results for Safety Measures

Figures

Figure 1: Timeline of Downsizing and Restructuring Events at NTS

Figure 2: The Statistical Model (7 steps, all variables)

Figure 3: Rates of Downsizing and Voluntary Layoffs, Ranges for Level 3s, by Site

Figure 4: Job Categories of NTS Responders

I. INTRODUCTION

- **Changing global economies require research on effects.**

In 1992 the Soviet Union dissolved and the Cold War ended. Consequently, the United States' military strategy and budget shifted. The Department of Energy (DOE) and the nuclear defense industry in the United States embarked on a process of changing its mission and determining revised, necessary staffing levels. In October 1992, Section 3161 of the National Defense Authorization Act for Fiscal Year 1993 was passed and outlined an approach to workforce layoffs in the nuclear weapons industry.

Anticipating major layoffs, the DOE and Centers for Disease Control (CDC) identified a key research priority: to study the impact of the expected downsizing and other organizational changes on both the remaining workforce and on those who lost their jobs. Boston University School of Public Health, with funding from The National Institute of Occupational Safety and Health (NIOSH), was selected to study the health and organizational impacts of workforce reductions. The goals were to: 1) understand those factors that mitigate or exacerbate the consequences of restructuring and downsizing and 2) propose measures to prevent adverse consequences of downsizing.

This report explains our research methodologies as well as the findings at the Nevada Test Site (NTS) in Las Vegas, Nevada, one of the five study sites. We discuss the significance of the findings and recommend ways to make all of the sites safer and healthier workplaces.

Downsizing and restructuring are two prominent manifestations of the continually changing global economic landscape. Business and government lack complete information about the economic, health and organizational impacts of downsizing. Our study contributes important data that can help ensure that decisions are made with more complete knowledge of how organizational restructuring will affect individuals and the workplace.

- **Study investigates impact of layoffs on health factors.**

Five study sites that best represented a variety of downsizing experiences were selected from a pool of 18 DOE defense sites: the Nevada Test Site (NTS), the Idaho National Engineering and Environmental Laboratory (INEEL), the Los Alamos National Laboratory (LANL), the Pantex Plant, and the Y-12 Plant at Oak Ridge. These sites also featured variation on other characteristics including size, location, the state of the regional economy, and percent of employees unionized. The Nevada Test Site has lost more employees than the other study sites. Data gathering included: interviews, workplace observations, employee discussion groups, an employee survey distributed to more than 40% of the site employees (over 10,500 people), and historical record review.

The study hypotheses are:

1. Downsizing will have a negative effect on individual health and workplace functioning (i.e., employee morale, work performance and job security).
2. Employees are less likely to experience negative health effects and organizations are more apt to function normally the fairer the downsizing process and the fewer direct elements of downsizing the employee experiences.
3. During periods of organizational change, one's work and work environment, including job strain¹, organizational style², co-worker and supervisor support, and workplace safety will affect both individual health and workplace functioning.
4. Workplace factors including job strain, organizational climate³, and the employee's perception of the fairness of the downsizing process can moderate the impact of downsizing on health and organizational outcomes.

We analyze data for each site, focusing on the impact of downsizing, job strain and organizational climate measures on physical health, mental health and organizational functioning. We examine downsizing as a work stressor and analyze how individual, organizational and systemic factors influence health.

- **Our study finds association between downsizing process, workplace factors and health.**

The principal statistical findings for the surviving employees at the Nevada Test Site follow.

1. The rate of downsizing and the level of voluntary layoffs were not predictive of worse health for employees.
2. The more fair employees rated the downsizing process, the fewer negative health and work functioning impacts they experienced including fewer medical symptoms or conditions, less survivor syndrome symptoms, greater job security and higher morale.
3. The more direct elements of the downsizing an employee experienced (from being laid off and rehired to distributing layoff notices to having one's job restructured), the more negative health and work functioning impacts were

¹ Job strain is a concept that encompasses the physical and psychological demands a worker experiences and the control that employee has over work tasks. Control at work is defined as the ability to structure work as well as the extent to which a job is challenging and one's skills are used. Job strain is measured using three scales: the job demands scale, the decision authority scale and the skill discretion scale. See items B1 and B6 in the attached survey (Appendix E).

² Organizational style refers to several aspects of managerial and leadership approaches, with particular attention to how relationships and problems are handled. We chose four scales related to organizational style to assess how the company/organization handles or experiences conflict resolution, the relationship with the DOE, communication, and workplace violence.

³ We use organizational climate as an umbrella term covering elements of the work environment. We include the components of organizational style listed above (four scales) as well as co-worker and supervisor support, and workplace health and safety (three scales measuring general safety, toxic exposure and exposure to noise).

- seen, including lower overall mental health scores, more medical symptoms and conditions, and more job insecurity.
4. Higher job strain was predictive of worse mental health, greater stress and job insecurity, more survivor syndrome symptoms and lower employee morale.
 5. Those who experienced more incidents of violence or harassment at work performed worse than their colleagues on seven of the nine outcome measures: they reported worse physical health (on all three measures), lower overall mental health, more perceived stress, greater job insecurity, greater frequency of poor work performance. Surprisingly more experiences of violence were associated with fewer survivor syndrome symptoms.
 6. Support from supervisors was associated with better employee morale and, oddly, with worse physical health (all three measures).

From our qualitative analyses we learned that employees experienced significant effects from the organizational restructuring and downsizing, including working in a site that feels partially abandoned with many vacant work areas. We heard employees discuss the perceived link between downsizing and stress and the influence on home life as well. Bargaining unit representatives felt relations with Bechtel Nevada management were fairly good while some employees see this contractor as top-heavy with management, uninterested in employee input and, as a construction contractor, unfamiliar with the type of structure that works best at this site. Many employees reported excessive workload, potentially threatening employee safety, while others felt that expectations had been raised but were manageable. Workers could feel the result of lower budgets and saw this manifested in inadequate training opportunities and equipment. There was a general consensus that job opportunities in Las Vegas did not alleviate the concern about future downsizing as available jobs were not comparable in terms of responsibility, pay or benefits.

Our findings are discussed in detail in this report with references to findings at the other four study sites. This report also includes details about study methodology and site history. The *Five-Site Final Report* contains an overview of all findings from this study and examines both individual level health and functioning outcomes and workgroup level outcomes (i.e., sick time usage and accident rates). It also contains important policy implications for the DOE complex.

- **Many people helped to make this study possible.**

This study required enormous cooperation. Our biggest thanks are to the nearly 6,000 employees who participated in focus groups or interviews and completed surveys, and to those supervisors who helped make that possible. At NTS, special appreciation is due to our primary contacts, Toby Bickmore, Patti Goin and Anne Gustavson. We also thank others who took over the contact roles or made access and data collection possible including Bob Gills, Bob Agonia, Nanette Saenz and Mary Murphy. We received cooperation from The Southern Nevada Building and Construction Trades Council as well as union stewards in Mercury and from the Independent Guards Union of Nevada. Additionally, many researchers and agencies contributed to this study; they are acknowledged by name at the end of this report.

This report received two levels of external review, including a peer review by two experts in the field of workplace stress and psychosocial research. We accounted for and incorporated comments in this final report.

II. CONTEXT AND HISTORY

IIA. Department of Energy Overview

- **Agency's missions change in response to ending of cold war.**

The Department of Energy (DOE), established as a cabinet-level agency in 1977, combined the functions of its predecessors: the Atomic Energy Commission (AEC), responsible for nuclear weapons development, and the Federal Energy Administration (FEA), created in response to the 1973 oil embargo to guard against energy supply disruptions. The DOE assumed the missions to protect the national security and reduce nuclear danger, enhance long-term energy security by advancing scientific understanding of conventional fuels and alternative energy sources, and develop technologies that contribute to US economic productivity.

With the end of the nuclear arms race and bans on weapons testing, the DOE weapons production mission shifted to one of weapons maintenance and research into longevity of weapons systems. Additionally, the DOE assumed responsibility for environmental stewardship to clean up radioactive and hazardous waste at 15 major locations in 13 states.

The DOE contracts with private corporations to run federally owned defense facilities. At most sites, these contracts lasted for long periods of time (up to 50 years) and were run on a dollar-plus basis. Since 1990, however, more contracts have been competitively bid, and contractors have been under tighter financial limits. Most contracts are now performance-based with no to limited capacity to expand funding in a given year.

The defense industry has always worked under the imperatives of secrecy. Though the ending of the Cold War prompted shifts toward a more open work environment, national security and secrecy continue to be paramount, particularly at the national laboratories and weapons facilities.

IIB. DOE Downsizing History

In 1992 the Soviet Union dissolved and the Cold War came to an end resulting in dramatic shifts in the United States' military strategy and budget. The DOE and the nuclear defense industry in the United States embarked on a process of changing its mission and determining necessary staffing levels. While layoffs (referred to as reductions in force or RIFs) had been implemented prior to 1992, the defense industry

had generally been one of growth. In October 1992, Section 3161 of the National Defense Authorization Act for Fiscal Year 1993 (attached as Appendix A) was passed and outlined an approach to planning and implementing workforce layoffs consistently across the nuclear weapons complex.

Section 3161 also identifies objectives that each plan should address, including: minimizing social and economic impacts; giving workers adequate notice of impending changes; minimizing involuntary separations; offering preference-in-hiring to the extent practicable to those employees involuntarily separated; providing relocation assistance under certain conditions; providing retraining, educational and outplacement assistance; and providing local impact assistance to affected communities (OWCT, 1998).

- **Task Force established to plan approach to downsizing and to anticipate impacts.**

DOE management and union leaders anticipated that these employment and organizational changes would affect not only employees, but also the communities in which these facilities have been located for decades. In 1993, the DOE established a task force to assess the impacts of these transitions. In September 1994, this task force became the Office of Worker and Community Transition (OWCT). Reporting to the Secretary of Energy, its charge was to plan, implement, and evaluate programs that supported workers and their communities through the downsizing process (which included retraining, placement programs, resale of DOE assets, and programs for survivors).

- **Strategic Alignment Initiative changed missions, budget and workforce size.**

In the fall of 1994 the DOE unveiled the Strategic Alignment Initiative, a planning process that shifted core DOE missions from defense production to environmental management and clean-up of production sites. In addition to the structural and mission changes, the DOE announced budget cuts in December 1994 to reduce operating expenses by \$14.1 billion over five years. These announced changes resulted in reductions to the workforce, restructuring of contractor organizations, and the planned closure of certain facilities. Even though the shift from production to environmental management was expected to produce a one-time, major reduction in the workforce, other events and continued budget reductions led to ongoing downsizing in the DOE complex and affected sites differently.

Layoffs continued in 1995 and beyond, driven by budget reductions and the realization that the number of production workers who were retained for environmental remediation exceeded the demand.

DOE prime contractor employment fell 25% over five years (from 140,589 in September 1991 to just over 105,000 in September 1998) and is expected to decrease further.⁴ The DOE had the greatest number of employees (148,686) at the end of fiscal Year 1992 (September 1993). Peak employment for the managing and operating (M&O) contractor at each study site was at the end of the following fiscal years: 1988 at NTS, 1989 at LANL, 1991 at INEEL, 1993 for Oak Ridge (Y-12 and other Lockheed Martin employees), and 1995 at Pantex. September 1999 employment levels at the five study sites range from 31% to 91% of their highest employment levels (figures from OWCT annual report, Fiscal Year 1998).

Throughout the DOE complex (contractor, not federal employees) there have been approximately 46,000 official Section 3161 layoffs since 1992. Seventy-one percent of these were voluntary separations.⁵ The percent of involuntary Section 3161 separations increased from 19% of the total in Fiscal Years 1993-95 to 55% in FY 1998.⁶ The five sites in this study downsized 14,018 employees between September 1991 and September 1998⁷ (OWCT, 1999). At several sites, including the Y-12 Plant and the Pantex Plant, downsizing has occurred since June 1998.

II.C. Study Background

- **NIOSH requests research to study impact of downsizing on survivors.**

Little is known about the health effects of downsizing on remaining workers even though some studies, including preliminary research sponsored by the OWCT, have focused on the health, economic, or social consequences on those who are laid off.⁸ In 1994, at the time of the Strategic Alignment Initiative, a joint committee of the DOE and CDC determined that it was a research priority to study the impact of the expected downsizing and other organizational changes on the remaining workforce as well as on those who lost their jobs.

⁴ Note: These overall employment levels and downsizing numbers are from the Office of Worker and Community Transition (OWCT). Later in this report, when we analyze downsizing rates by site or organizational unit, we rely on data received from the contractors, broken down by department (numbers downsized and type of event). For the Nevada Test Site, the raw numbers may appear distinct given different methods of and parameters for obtaining data (for example, we did not include Bechtel Nevada employees working at the Remote Sensing Lab in our sample).

⁵ Voluntary separations include offers for early retirement as well as requests for volunteers (with either an enhanced package or a severance package similar to that given to employees who are laid off involuntarily). In most instances, certain job categories or positions were eligible to take advantage of these voluntary offers and others were not. Not all requests for voluntary layoffs are accepted.

⁶ The totals here include voluntary layoffs, early retirements, attrition, and involuntary layoffs.

⁷ This figure includes 1,294 employees downsized prior to the start of the 3161 program in Fiscal Year 1993 (October 1992).

⁸ In 1995, the OWCT conducted a pilot study and then a broader study of the effectiveness of worker support and training programs and of an individual's success in achieving post-DOE employment plans (retirement, education, part or full-time employment) (Balcombe, 1995).

To that end, the National Institute of Occupational Safety and Health (NIOSH) released a request for proposals to examine the impacts of workforce reductions on the health of employees who retain their jobs and on their organizations. Boston University School of Public Health was selected to conduct the research. Our study is the first large-scale project measuring the health impact of organizational change on survivors of a downsizing event(s).⁹

The on-going globalization of today's economy has been associated with numerous organizational changes. Business and government tend to champion downsizing as a positive response to global competitiveness. Yet, how well it has transformed companies from less to more competitive is open to discussion with some studies showing that companies that downsize do not subsequently perform above industry averages (Cascio, 1998). Some attention has been directed toward the impact of downsizing on organizational productivity. Only recently have researchers begun to ask specific questions about how organizational change affects employee health (Hurrell, 1998).

- **Boston University School of Public Health investigates results of organizational change.**

Worker insecurity, employee distrust, and decreasing organizational commitment are likely results of this era of constant organizational change. Focus groups and employee interviews conducted by our group at the DOE facilities have recorded such concerns at each of the study sites. Indeed, these symptoms of organizational change appear to significantly affect employee health and performance. Our study highlights those effects and recommends interventions to modify the way organizations implement change so as to positively impact employee health and organizational functioning.

This study covers the period from 1991 through June 1998. We chose January 1991 as a starting point for data collection as it preceded the post-Cold War downsizing whose parameters were stipulated by Section 3161.

We employed a collaborative approach at these federally connected work sites. It is believed that an outside entity having no official attachment to the downsizing process might have easier access to study participants. At the same time, given the high security environment, it appeared useful and necessary to have government employees assist with negotiating site access and attend some site visits to lend their credentials and affiliation.

⁹ The study agreement originally included a component to look at displaced workers. The task was revised: explore with contractors the possibility of accessing rosters of former employees for future potential research. It appears Human Resources departments can create such rosters of displaced employees but there are data challenges including accessing information about employees of prior contractors and access to home addresses.

III. HYPOTHESES AND BACKGROUND LITERATURE

IIIA. Description of the Problem and the Model

Some of the impacts on workers who lose their jobs seem obvious: income loss, potential loss of identity, and uncertainty about their future. The purpose of this research, however, is to provide knowledge about the impacts of downsizing and other organizational change on the health of employees who retain their jobs and on organizational functioning. It is imperative that we understand the health effects for workers who remain given the likelihood that employees may be working more, yet will be facing fewer resources, job uncertainty, and changes in roles, required skills and site mission.

- **Research model considers downsizing as key stressor event.**

Few large-scale, epidemiological studies have been carried out to assess health outcomes. However, relevant literature exists on the impacts of work stress on health, job insecurity and health; the organizational consequences of downsizing; and perceptions of justice and fairness in the workplace. Findings from these areas are briefly summarized below with greater detail provided in Appendix B.

The model we tested uses downsizing as the stressor event. Downsizing is measured in four ways including a rate of downsizing, the extent to which it is voluntary, personal experiences of the downsizing, and perceptions of the downsizing process. We examine the links between the stressor event, other contributors to or buffers of stress (including organizational functioning, job characteristics, sociodemographic factors, and individual behaviors and experiences), and stress outcomes for the individual and the organization. Job strain, as defined by Karasek and colleagues (a construct summarizing job demand and job control), is included as a central concept in the field of work organization, stress and health (Karasek, 1979). Both the context and the outcomes in this model are viewed on individual, group, and system levels.

- **Hypotheses guide investigation at five DOE sites.**

We generated four study hypotheses to test at five Department of Energy work sites that had experienced downsizing. The hypotheses are:

1. Downsizing will have a negative effect on individual health and workplace functioning (i.e., employee morale, work performance and job security).
2. Employees are less likely to experience negative health effects and organizations are more apt to function normally the fairer the downsizing process and the fewer direct elements of downsizing the employee experiences.
3. During periods of organizational change, one's work and work environment, including job strain, organizational style, co-worker and supervisor support, and workplace safety will affect both individual health and workplace functioning.

4. Workplace factors including job strain, organizational climate, and the employee's perception of the fairness of the downsizing process can moderate the impact of downsizing on health and organizational outcomes.

IIIB. Relevant Theories and Areas of Study

B1. Stress models

This study is grounded in a work stress model. We ask what happens when a stressful event such as downsizing occurs. Although it is popularly recognized and accepted that work stress adversely impacts a workforce, there is much less agreement about what stress is, how to measure it, how it impacts health and what aspects of health are actually affected by it.

Our research examines the environmental causes of stress. Unlike other theorists who studied stress focusing on the individual and the way an individual interacts with the workplace, we examine work processes and climate as well as job characteristics (job strain and others). We study to what extent these influence the health and productivity of individuals in a changing work environment.

B2. Downsizing literature

Downsizing, or large-scale layoffs, has been adopted over the last decade as a management tool with the purported aim of strengthening a company or agency by reducing budgets and personnel. Sometimes downsizing is associated with a partial or complete restructuring while at other times it is simply a reduction in the number of employees. There is literature on downsizing in varied disciplines, with the vast majority coming from the fields of business (e.g., organizational management and human resources) and psychology (e.g., organizational development).

- **Previous research also examined effects of downsizing, but with a more limited scope.**

A 1995 study in six industrialized nations found that downsizing had been carried out at more than 90% of the firms studied (Wyatt 1993). This downsizing had been implemented without information about the health impacts on remaining employees and the organizational and productivity costs. Often, corporate executives are rewarded financially after a downsizing event, and stock prices increase. But, these stock increases are often temporary. For instance, stock prices of firms that downsized during the 1980s fell short of industry averages in the 1990s (Pearlstein, 1993). Data indicates that two thirds of companies that downsize will downsize again within a year (Cascio, 1996). These findings about the impact of downsizing bring into question whether downsizing is an effective tool for reducing budgets or for creating a more efficient and competitive organization.

From the field of organizational management, literature has emerged documenting impacts on productivity, quality, morale and turnover. Within the field of psychology,

David Noer has looked at individual responses to downsizing, and documented what he calls “survivor syndrome” which includes symptoms such as fear, insecurity, frustration and anger, sadness and depression, and sense of unfairness as well as reduced risk-taking and lowered productivity (Noer, 1993).

Researchers have also documented additional organizational effects seen in tandem with survivor syndrome, including decreased job security, organizational commitment, trust among co-workers, and job satisfaction, and increased workplace conflict (Henkoff, 1994; Sommer and Luthans, 1999). Other studies found that the threat of or actual downsizing can lead to deteriorated health, increased work demands and tensions in the workplace (Woodward, et. al., 1999). Writing extensively about fairness, Joel Brockner reports that how employees react to a downsizing event is related to their perceptions of how fair and justified the action was (Brockner, et. al., 1995).

Research has focused either on the impact of downsizing on work factors such as security, productivity and satisfaction, or on the relationship between these work factors and health outcomes. A recently published longitudinal study is one of the first to look at causal pathways and to ask not only how downsizing affects work and home factors and health behaviors, but also how that affects health outcomes (Kivimaki, et. al., 2000). Kivimaki and colleagues demonstrate that downsizing "results in changes in work, social relationships, and health related behaviours" (smoking), and that these changes combined with downsizing contribute to increased rates of long term sickness absence. Sickness absence was two times more likely in job groups that had experienced major (>18%) as compared to minor (<8%) downsizing (Kivimaki, et. al., 2000). The significant changes in work characteristics comparing groups that experienced low, medium and high rates of downsizing are: an increase in physical demands, a decrease in autonomy and skill discretion, lowered participation, and more job insecurity.

- **Boston University study adds to body of research.**

In our study, we used downsizing rate and the rate of voluntary layoffs as independent predictors. Two additional independent variables related to downsizing focus on the process: an index of the ways in which each person experienced the downsizing and perceptions of how fair the downsizing process was. We also used a six-item survivor syndrome scale (developed at NIOSH by Soo Yee Lim) as an outcome variable. The survivor syndrome scale covers many factors that relate to mental health and overall functioning concepts including guilt, sadness, and reduced motivation.

B3. Justice and fairness

- **Researchers hypothesize that perceptions of fairness can influence health outcomes.**

We posit that perceptions of fairness and justice directly affect health. We also posit that if an employee believes that workplace policies in general or a downsizing event are implemented fairly, then stressful events are less likely to have a negative impact on health. We are particularly interested in investigating two concepts: procedural justice

or whether employees believe that policies and procedures are determined and implemented in a fair and consistent manner; and interactional justice or how employees are treated by supervisors and upper management (Niehoff and Moorman, 1993).

In addition to the work of Brockner and others who have written specifically about the concept of justice and fairness in the context of a downsizing event, a literature is emerging about workers' perceptions of justice and fairness in how decisions are made and implemented. Research to date shows that perceptions of fairness are important in the workplace and should be considered as an independent variable when analyzing organizational functioning and health (Alexander and Ruderman, 1987; Folger, 1987; Fryxell, 1992; and Greenberg, 1990).

In our employee survey we used two scales to measure fairness/justice. The first was about the organization in general and the second (used in the statistical model) focused on the downsizing event. The scale asks for perceptions about the extent to which employees perceived that procedures were fairly implemented, people were treated with respect, communication was clear and timely, and the downsizing process was effective.

IIIC. Importance of this Research

- **Study findings and recommendations can be used to positively affect health outcomes.**

It is clear that downsizing and organizational changes will have critical and varying impacts on employees and organizations. A change process, for example, can produce an excess demand on employees or, on the other hand, a greater sense of control and satisfaction at work. Workforce reductions can either be voluntary (i.e., early retirement, voluntary incentive packages, normal attrition) or involuntary and can be well planned and well communicated or not. Downsizing can be part of a process of organizational restructuring or it can be implemented as a reaction to perceived problems, independent of other organizational assessments. These scenarios are likely to lead to different health and organizational functioning outcomes.

The knowledge sought through this research is important for employees, unions, and other employee organizations, contractors and federal entities managing organizational change in DOE facilities, as well as for those in other industries. Globally, downsizing has become a common management tool and more research is needed to understand the long- and short-term impacts and implications for individuals and companies.

IV. RESEARCH METHODOLOGY

IVA. Multiple Study Methods

- **Variety of methods leads to rich understanding.**

We used qualitative and quantitative approaches to collect data to fully understand the experience of downsizing. Quantitative data collection includes structured surveys and archival data. Qualitative methods were particularly important given the exploratory nature of this project and the importance of understanding employee perceptions and the context for recommendations. Qualitative, or ethnographic, data was drawn from the open-ended interviews, focus group discussions, and open-ended survey questions.

Ethnographic data, or descriptive information, which uncovers the patterns of the employee culture, is part of an important research strategy to study questions and populations that may be inaccessible with other research techniques. Ethnographic methods produce data that provides both depth and detail through direct quotation and meticulous description of situations, events, people, interactions, and observed behaviors (Agar, 1980; Spradley, 1979). Interviews with key individuals, work-site observations, and focus group discussions permit the researcher to understand the world as seen by the respondent within their everyday setting. Additional information on the importance of using qualitative data is presented in Appendix C.

Quantitative analysis on the other hand, involves the collection, organization, and interpretation of data according to well-defined procedures. Data gathered in this study are used to address questions such as how much, how often, where, and what kind. The data used in quantitative analysis include self-reported data (e.g., survey) as well as 'objective' or archival data (including sick time and accident rates).

Quantitative or statistical methods have at least three goals: 1) data reduction, 2) data inference, and 3) relationship identification. We have used well-recognized and tested scales as part of our analysis, an important feature particularly given that some of the research questions are new. The analytic results, which have a numerical value attached, have a shared meaning and understanding which extends beyond the study's scope. Quantitative methods allowed us to document the experience of many employees across the five study sites in a time-efficient manner, to draw inferences and to use statistical techniques to test our hypotheses.

This multi-method study approach is well suited to the concepts under study as a way to more fully describe the experience of stress and the research setting. Pearlin suggests that to understand and reflect an individual's experience of stress, a study should measure various levels of social functioning including sick-day usage, filing of grievances, accidents, and injuries (Pearlin, 1989).

Additionally, multiple methods are useful to confirm validity and reliability. Triangulation is a process to compare and contrast different sets of data and offers the opportunity to run convergent validity and reliability checks of the data. Denzin defines the process as "the combination of methodologies in the study of the same

phenomenon” (Denzin, 1978). The assumption is that “multiple and independent measures, if they reach the same conclusions, provide a more complete portrayal of the particular stress responses being studied” (Ivancevic and Matteson, 1988). In the discussion section of this report (Section IX) we identify where qualitative and quantitative results converge and where they provide distinct information.

IVB. Qualitative Data Collection and Analysis

- **Boston University School of Public Health study begins with carefully planned study methods.**

An overview of our initial data collection is presented in this section. Additional details and an evaluation of the process can be found in Appendix D. The first step in the study was to select Department of Energy sites to include in the study. Downsizing characteristics used to select sites included: the rate of downsizing, the number and content of support programs for surviving and displaced employees, and the level of worker participation in the process. Important organizational considerations included:

- a willingness to allow salaried and non-salaried employees to participate;
- availability of data; and
- management representatives open to an extensive research protocol including surveys and focus groups.

Sites were chosen where there was significant inter-site variability for the selection characteristics. Initial data collection and site selection was completed by June 1996.¹⁰

Site visits were made to collect the preliminary qualitative data. Generally, two to three research personnel attended each site visit and were often accompanied by personnel from NIOSH and/or DOE headquarters. The goals of the visits were to: 1) develop on-site relationships; 2) observe the conditions in the environment that people connect with stress; 3) collect current accounts of stress and downsizing via individual and group interviews; and 4) identify ways of measuring health and performance effects in the historical record. We developed instruments to carry out this research including an interview instrument, record review forms and focus group guidelines.

We used interviews to gather information about the structure of the site; processes and policies related to downsizing, personnel or other issues; data availability; and individual perceptions of downsizing. Some of the interviews were with individuals responsible for data management in offices housing records integral to our study.

We collected sample records to determine the format and availability of records from 1991 through June 1998 as well as policy statements and reports on relevant issues.

¹⁰ The initial five sites were Pantex, Idaho, Nevada, LANL, and Rocky Flats. Subsequently, Rocky Flats was dropped from the study sample (issues of access and site cooperation) and the Y-12 Plant on the Oak Ridge Reservation was added, offering an example of a site with significant downsizing and other organizational changes (split contracts, new contractors, and outsourcing).

We chose focus group research to provide key data for this study. The focus groups provided rich and complex information from a wide variety of employees at each site. The data was used to:

- gain an understanding of each site: history, important issues, and site functioning;
- determine the themes important to include in the employee survey;
- cross check quantitative data and the information that emerged from other data sources; and
- explain or better understand some of the quantitative results.

We conducted focus groups at four of our five sites: Y-12, INEEL, Pantex, and LANL. A complete round of focus groups was not planned at the Nevada Test Site as there was only one site visit and that visit took place after the employee survey was developed and at the very end of phase I (March 1998). At NTS, the site visit team held a discussion group with representatives of the Southern Nevada Building Construction and Trades Council (SNBCTC) on the site. Researchers felt that it was important to hear directly from craft employees who represent a majority of the workforce.

The group discussion with nine union stewards (not randomly selected), facilitated by a research team member, lasted one and one half hours. This discussion group and the focus groups at the other sites helped the researchers to learn about common concerns and to understand labor and management perceptions about the changing nature of work. The facilitator posed open-ended questions about job demands, control over work, job security, social support, workplace safety and accidents, performance, physical and mental health issues, and downsizing. The discussion was summarized and we analyzed the comments for themes.

- **Communication with employees and communities is a priority.**

Because downsizing affects not only employees at a facility but their families and the communities in which they live, we sponsored meetings to offer information about the study to former workers and others in the community. These meetings allowed interested and involved individuals to comment on our study and the research issues. In Las Vegas, we met with former NTS workers. At the other four study sites we publicized community meetings; 15 to 30 people attended each.

The research team established communication as a key priority to maintain throughout the study. The study population is large, consisting of approximately 24,000 potential participants at five study sites. More than 6,000 employees have directly participated in this study. In addition, employees throughout the DOE complex have been affected by downsizing and are interested in study results.

We obtained informed consent from employees involved in an interview, focus group, or who completed the employee survey. In the consent forms, we offered information clearly and succinctly. We made available at each stage of the research a summary of the purpose of site visits, and research updates to be printed in site and local media. We established a study e-mail account and posted information on the World Wide Web. We will present our results at each site and will make available written materials at sites, by request from researchers, and on the Web.

IVC. Quantitative Data Collection

C1. The *Boston University Workplace Survey*

- **Survey developed to measure key hypotheses.**

With colleagues at NIOSH, we developed a preliminary model of analysis. We used interviews and focus group discussions and reviews of relevant literature and site documents to identify important themes to include in the employee survey. For each construct that appeared important, we identified scales or individual items that would best measure it, prioritizing those scales that have been used extensively and for which there are population norms. We created a number of questions and scales about downsizing, including a scale to measure the opportunities that might arise during a restructuring process.

We completed our draft survey--the *Boston University Workplace Survey (BUWS)*--in July 1997, pilot-tested the instrument at four sites including NTS¹¹ and revised it based on comments solicited during debriefing sessions. We also solicited comments from site and NIOSH institutional review boards.

The final *Boston University Workplace Survey* is intended to take thirty minutes to complete. The survey is divided into seven sections covering demographic information, job characteristics, health and health behavior information, assessment of organizational change, and organizational climate. A summary of the sections and scales as well as a copy of the survey is contained in Appendix E.

- **Survey protocols ensure confidentiality and random selection.**

While developing the survey instrument, we designed protocols for survey sampling, administration, and data entry and analysis (see Appendix F for more detailed information). Since confidentiality was a primary concern to all we spoke with, researchers developed a system where study numbers were not connected to the names database. Surveys were coded with an anonymous study number as well as for site, contractor, department (or section) and sometimes work group. This allowed us to account for a person's work unit as one important element in the analysis.

At NTS our study focused on the employees of the two direct contractors, Bechtel Nevada (BN) and Wackenhut Security, Incorporated (WSI). We randomly chose 1,034 employees, including 921 from BN and 113 from WSI (45% and 55% of the total respective workforces

¹¹ We pilot-tested the survey instrument at INEEL (7/97), Los Alamos (10/97), NTS (3/98), and Oak Ridge (4/98) with one to two groups of 4-15 employees at each site. Participants were allotted one half-hour to answer questions and then a project staff person solicited feedback, probing on items that might be unclear and asking for opinions about the overall survey and the likelihood that their colleagues would complete it.

in June 1998) from a database of all employees (except those exempted)¹² and invited them to complete the survey.

Bechtel Nevada has 25 departments ranging in size from four to 776 employees and only seven have 60 or more employees. Thirteen departments had fewer than 20 employees and researchers combined them based on functional and hierarchical similarity into three groups for the purpose of sampling resulting in a total of 15 sampling units. Wackenhut has 11 sections with two to 132 people that were combined into four sampling units to ensure adequate cell size and confidentiality.

Approximately 40% of employees in each sampling unit (department at BN, section at WSI, or a combined group) were randomly included in the survey sample. Because each contractor uses different organizational nomenclature, we employed the term “level 3” for this sampling unit where level 1 is the individual, level 2 a small work group, and level 3 a larger work group (department or section).

Surveys were first mailed to sampled employees in August 1998. One researcher visited the site to encourage participation and was available for questions and to collect completed surveys. A thank you was sent two weeks after the survey to all sampled employees. Employees were asked to return the anonymous survey and a separate postcard with their name to indicate completion of the survey. Two additional reminder mailings were sent to all those who did not return a postcard.

C2. Collection of archival data

The grant proposal identified the need to collect and analyze organizational data to describe exposure, climate, and outcomes. In addition to downsizing rates, other data sets were used as objective outcome data. Certain information was central to the study hypotheses and was important to understand the quantitative results, such as information on employee assistance programs.

- **Data analysis includes extensive review of records.**

During the first few site visits to Pantex and INEEL, we reviewed many archival records to determine those organizational data sets that would be useful for the study. Unfortunately, records we reviewed¹³ had numerous limitations. We established guidelines for final selection of archival data sets, including the availability of summary data by level 3 (to match survey data), records relatively complete in paper or electronic

¹² Exempt employees were those who: a) pilot tested the survey, b) reviewed the survey for approval or who signed the cover letter, and/or c) served as contractor points of contact.

¹³ Records reviewed during initial visits included medical records, health claims data, worker compensation claims, sick leave data, safety and regulatory affairs data, employee assistance program data, employee grievances, EEO records, outplacement data, procurement records, human resources data including employment levels and attrition, and downsizing data (reports, numbers, support program information, outplacement program data).

form (1991-98), and consistent data across sites. In total, four data sets were requested of the contractors:

- sick time/paid time off data;¹⁴
- overtime usage;
- downsizing data; and
- accident and illness data.

We also obtained information on policies, policy changes, and organizational restructuring changes during the study period, to assist us in interpreting the data. In addition to the four data sets, we collected data from Employee Assistance Programs at each site to understand services available to surviving employees. We gathered regional economic indicator data from publicly available sources to understand the regional context but did not use these data in the statistical models. The specific data elements, reason for inclusion, intended use of each data type, formulas for calculating rates, and an evaluation of quantitative data collection are described in Appendix G.

These four data sets were collected by level 3 and the data was stored in a separate database for each contractor by month (or quarter) and year for each level 3. This required extensive organizational research to determine, when possible, how now-defunct organizational units were related to the present day units (level 3).¹⁵ This approach allowed us to relate the organizational outcome data (as the experience of defined groups of individuals within the organization) to the survey (as the experience of the individual as well as groups of individuals within the organization) in order to better understand the impacts of organizational change.

It was not possible to collect all the desired data points at each site for the entire study period and/or by the survey level 3s. At two of the study sites, a new, main contractor assumed site management over halfway through the study period (in 1996 at NTS and in 1995 at INEEL). This meant that prior data, when available, was not analyzable by level 3 given the enormous organizational changes that took place during these management transitions. See Appendix H for details regarding data collected and not collected for the Nevada Test Site, any limitations or special data parameters at this site, and for information on the percent of study period data that researchers were able to associate with the level 3s as they existed in 1998.

We measured the independent variables of downsizing rate and rate of voluntary layoffs for the entire study period (or all years for which data was available). We restricted analysis of organizational outcome data (sick time rates and TRC rates) to data from the

¹⁴ At two sites, sick time is part of a paid leave or paid time off policy. We collected paid time off data when no sick leave information was available. While these raw numbers measure different phenomena, we felt we would be able to utilize the data for within site analyses although not for comparison with other sites.

¹⁵ We started with the level 3s sampled for the survey and worked backwards to track work units that were merged, renamed, or had been discontinued at some point between January 1991 and June 1998. Given that we are studying restructuring, these changes were both ample and anticipated. For work units not currently in existence, we attempted to determine if the unit's function ended or if the unit was moved into another group. If units were merged or renamed, the data was labeled with the code for the current level 3. We used site experts and documentation of organizational restructuring to carry out this task. For level 2s and 3s that we could not trace, the data was retained but coded to level 3 = unknown.

last 12 study months (July 1997 through June 1998). EAP data were used to describe the mental health programs they offer, with special attention to services offered during times of major workforce change. No objective data regarding health care usage or medical symptoms were collected.

V. SITE DESCRIPTION

VA. Site Characterization

A1. Site history

In December 1950, the Atomic Energy Commission designated the Nevada Test Site as the on-continent testing area for nuclear weapons. Testing activities began in January 1951 and ceased with the signing of the Hatfield Amendment by President Bush in 1992, instituting the nuclear weapons testing moratorium. Similarly to INEEL, NTS is comprised of two distant facilities: The Losee Road Facility in Northern Las Vegas and the test site, located roughly 65 miles northwest of Las Vegas and spread across 1,350 square miles. Bechtel Nevada (BN) and Wackenhut Security Incorporated (WSI) manage NTS for the Department of Energy.

Since 1992, NTS's principal mission has changed from testing to maintaining testing capabilities and stockpile stewardship and management. In recent years, the site has diversified into other programs including hazardous chemical spill tests, emergency response training, conventional weapons testing, waste management and environmental technology studies.

- **Study focuses on Bechtel Nevada and Wackenhut Security Incorporated employees at the Nevada Test Site.**

This study focuses on employees working for the two prime contractors at the site, Bechtel Nevada (BN) and Wackenhut Security, Incorporated (WSI). Prior to 1996, the BN contract was held by three Managing and Operating (M&O) contractors: Reynolds Electrical and Engineering Co., Incorporated (REECo), EG&G Energy Measurements, Incorporated (EG&G) and Raytheon Services Nevada (RSN).¹⁶ Today, Bechtel Nevada manages the NTS operations while Wackenhut's contract is limited to providing security services for the site. Bechtel Nevada is a consortium of three teaming partners: the Bechtel Corporation, Lockheed Martin and Johnson Controls.

In June 1998, there were roughly 2,092 Bechtel Nevada employees and 197 Wackenhut Security, Incorporated employees. The site is highly unionized, with most of the union employees represented by the Southern Nevada Building Construction Trades Council

¹⁶ REECo was the prime support M&O contractor. The company was responsible for construction, food services, housing, industrial safety, medical services, purchasing, warehousing, transportation, radiation monitoring services and engineering. EG&G provided the electronic and instrumentation support. RSN was responsible for the architectural/engineering work at the site.

(SNBCTC). Guards or protective force employees are represented by the Independent Guard Association of Nevada (IGAN).

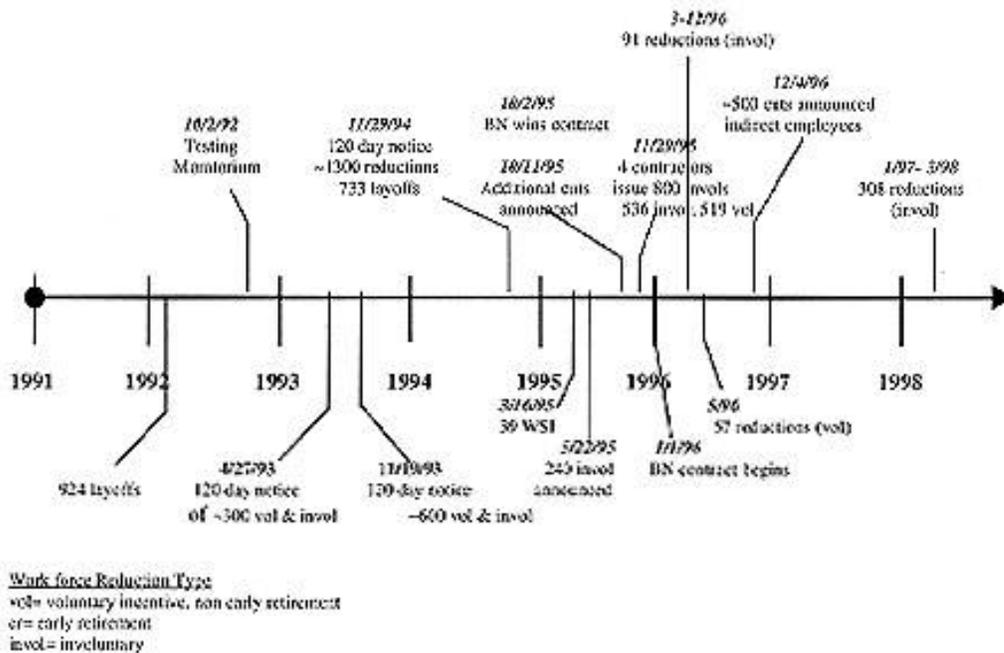
A2. Site selection characteristics

- **A growing Las Vegas is the backdrop for dramatic reorganization and downsizing at NTS.**

NTS was chosen as a study site based on two primary demographic and downsizing characteristics. The site is located near a large urban area that is undergoing a multi-year economic boom. New and reasonably well paying jobs continue to be created in Las Vegas offering NTS workers continual employment opportunities. The downsizing story at NTS is dramatic with a large-scale reduction occurring midway through the study period. The downsizing coincided with profound organizational and mission changes along with the replacement of the site's longstanding contractor.

Downsizing followed shortly after the October 2, 1992, Testing Moratorium and continued throughout the study period. A large-scale reduction occurred within months of Bechtel Nevada winning the NTS contract. The timeline below (Figure 1) diagrams the downsizing events and other major organizational changes experienced at the NTS from January 1991 through June 1998.

FIGURE 1: Timeline of Downsizing and Restructuring Events at NTS



A3. Downsizing and restructuring history

- **Downsizing at NTS began after the 1992 Moratorium and continued throughout the study.**

The moratorium in 1992 led to budget cuts in several NTS programs and initiated a wave of downsizing that continued through 1998. From 1992 through Fiscal Year 1998, nearly 5,000 employees were downsized from the site. Another 1,300 or more employees left of their own accord (attrition). For many, their decision to leave the organization was also due to the mission changes, uncertainties in the resumption of weapons testing and job insecurity (WFRP, 1995). WSI experienced a total loss of 125 employees between 1992 and 1996, approximately 80% from the Protective Force Operations section. Downsizing events dramatically slowed after FY 1997 and NTS began to experience some growth during FY 1998.

During calendar year 1992, 924 people were laid off from all four M&O contractors: REECo, 650 positions including 620 at a program transferred to New Mexico; EG&G, 175 employees; RSN, 80 employees; WSI, 19 positions (all voluntary layoffs). Separations included some special incentive packages, both enhanced severance pay and early retirement (WFRP, 1993).

In April 1993 employees of the three major contractors were notified of continued workforce reductions. DOE Nevada announced that there would be approximately 300 reductions of which half were anticipated to be bargaining unit workers. DOE Nevada asked each contractor to examine budgets and identify further ways to cut costs so as to minimize the total number of involuntary separations. Some cost-cutting measures included the elimination of nonessential travel and training costs and a consolidation of services: EG&G and RSN consolidated some management and overhead functions. A limited number of voluntary separations were offered early in 1993. At the close of FY 1993, 330 employees were laid off, 28% through non-early retirement voluntary incentives (WFRP, 1994 and 1995).

All four NTS M&O contractors experienced significant workforce reductions in FY 1994. DOE Nevada notified employees of upcoming reductions on November 17-19, 1994. Budget cuts resulted in fewer employees being offered voluntary incentives (as the incentive packages are more costly to the contractors). A total of 733 employees were laid off, among the four contractors. Overall, 26% of the layoffs were voluntary (WFRP 1995) although WSI was able to make half their 58 layoffs voluntary.

- **Contract consolidations and changes drive downsizing from 1995 onward.**

RIF events in FY1995 continued to be shaped by budget reductions and shifting missions. However, reductions during 1995 were also in preparation for the M&O consolidation. In total, 1,055 employees from all four M&Os were effected. Early retirement incentives were first offered to REECo and EG&G employees with 204 participants. Voluntary separation incentives were subsequently offered to all four M&O contract employees and 315 employees were accepted including 39 WSI employees. The remaining 536 individuals were laid off involuntarily (OWCT Annual Report, 1997).

Organizational change at NTS was compounded at the beginning of FY1996 when the three prime contracts with REECo, RSN and EG&G were consolidated into a single performance-based management contract under the auspices of Bechtel Nevada. Continued budget reductions coupled with the contractor consolidation by Bechtel Nevada resulted in heavy layoffs. Bechtel Nevada was awarded the NTS contract on October 1, 1995 and began as contractor on January 1, 1996. During the interim, BN interviewed all employees working for the three previous contractors and in November 1995 and offered jobs to those employees they wished to hire. Each company laid off their employees who had not received job offer letters prior to December 31, 1995.

On January 6-8, 1996, sixty-day notices of involuntary termination were issued to 91 BN employees. Upper management at BN told managers in each department the percentage budget reduction they faced. Managers then decided whom to lay off. A separate RIF in late January affected nine WSI employees. In May 1996, a voluntary reduction was announced which was based partly on funding and budget and partly a "learning curve" around issues of ideal employment level and productive employees (Human Resources interview). A total of 57 employees were voluntarily reduced. Involuntary layoffs continued into 1998 as part of FY 1997 budget cuts and affected 308 BN employees.

- **Planning for RIFs included clear steps to identify positions and review for fairness.**

Each contractor identified criteria for involuntary separation, although the procedures varied somewhat. Relevant considerations included appropriate skill mix, individual job performance and site mission (DOE Human Resources interview). The Human Resources Directorate reviewed those slated to be laid off to ensure that the company's downsizing procedures were followed. The office of Equal Employment Opportunity reviewed the layoffs to ensure no improper impacts on minorities, women and employees over age 40. Nonexempt/ nonbargaining employees were generally separated based on seniority. Bargaining unit employees were reduced on the basis of their specific labor unit agreements. Voluntary reductions were approved on a case-by-case basis but included the following considerations: a company's need to retain qualified employees, skill mix, work demands and timelines, whether the position will require replacement, and whether acceptance of the voluntary will reduce the need for an involuntary (WFRPs, 1993-1995).

Similar to other DOE sites, monetary incentives for the voluntary and involuntary layoffs included severance pay (usually one week of salary per year of service), educational assistance, extended medical insurance, and relocation assistance.

- **Several forums provided communication and union involvement.**

DOE and NTS contractors developed a list of stakeholders in the workforce reduction process. Stakeholders received announcements about reduction plans and were sent draft versions of the Workforce Reduction Plans (WFRP) for comment. Unless requested, no meetings were held with stakeholders. However, several town hall meetings were scheduled with contractor employees, both at the NTS and Las Vegas

facilities. The meetings provided employees with information about future NTS missions and answered questions regarding pending workforce reductions.

- **Placement center provides testing and training to displaced workers and survivors.**

NTS employees targeted for involuntary RIFs were offered outplacement services including the use of computers and telephones. Job search training manuals were provided through the Human Resources Directorate (HR) and resume help was available (HR interview). According to HR staff, only about 50% of those eligible for outplacement services used the programs. Managers received training in stress management techniques, identifying future job skills needed and retraining opportunities and identifying retraining possibilities for future employment. Retraining and cross-training of survivors was seen as critical to maintaining capabilities at the site (all WFRPs). We were not, however, provided information about specific retraining programs.

- **Agencies collaborate to provide economic development programs.**

The Community Reuse Organization (CRO) for Nevada was incorporated in 1995. The organization's goal is to integrate NTS into the local economy by re-utilizing Test Site resources such as land, equipment and personnel and to diversify the southern Nevada economy (interview with CRO staff). The CRO cites a few success stories including: 1) the redevelopment of Area 18 by Kislner Aerospace, who has developed a reusable launch for communication satellites; and, 2) the launch of Digital Ink, a private graphics company made up of former (outsourced) BN employees, started with seed money and training from a CRO privatization initiative.

- **Contract changes and BN restructuring is reconfigured.**

As described above, contractor change has been a major component of change at NTS and internal restructuring accompanied some of the Workforce Restructuring Plans beginning in FY1996. Restructuring activities included: new contracting arrangements, realigning management structures, eliminating duplication in positions or departments, new business practices and outsourcing.

VB. Site Visit and Focus Group Themes

B1. Site specific findings from interviews and observations

- **Site visits include several methods to collect data.**

The study team conducted two site visits (3/98 and 8/98) at the Nevada Test Site. These visits included interviews with union and management, meetings with employees in charge of data of interest, a group discussion with union stewards, pilot-testing of the employee survey, workplace observations, and a tour of the test site. During the first site visit to NTS, we conducted interviews with 28 people, from a variety of departments (health and safety, human resources, employee grievances,

medical services, EAP) and unions at the site. We toured the facilities that did not require special clearance. See Appendix I for details about the site visits.

- **Findings reveal variety of employee concerns.**

Downsizing and contractor and mission changes have significantly altered the work environment. Visiting the empty work stations that once housed roughly 70% more employees provided us with a physical representation of the magnitude of change and loss experienced at NTS. After six years of constant and dramatic workforce and work environment changes, NTS appeared to be functioning with a recently acquired sense of stability and optimism at the time of our site visit. During our interviews, we heard employees' thoughts about their work life under a new contractor, continued issues of job security and workload, as well as issues specific to unions and subcontractor employees.

NTS employees perceived BN as a construction company solely experienced at managing temporary labor forces and short-term projects when they took over from the three prior M&O contractors in 1996. BN transitioned into an environment where life-time employment was the norm and some employees felt they were nonchalant about instituting significant changes regardless of the impact on employees.

At the time of our site visit two years later, the organization appeared to be functioning more smoothly. Personnel were beginning to feel more a part of BN, rather than relics from the old contractors, although some expressed the "us" versus "them" tension. Employees expressed that management was making an effort in communication, employee recognition and seeking out new business for the site. New missions for the site have improved employee trust in BN, though the technical trades still do not feel that BN understands and supports their needs and expertise. Union leaders reported stronger relations with BN than with old contractors: communication was felt to be more open and fluid and fewer grievances are filed, a product of both a lower employee census and improved labor contracts.

New missions have curbed some fears about job security. However, continued downsizing has led to a mindset that jobs will never be secure. We heard from several interviewees that attrition was very high at NTS both because people chose to leave for more stable work environments and because young skilled employees left for more challenging work at times when NTS was struggling to define its mission. Employees whose positions were supported by indirect funds were reported to feel targeted during layoffs. Stress, depression and family problems were said to have increased during times of past downsizing events.

The reduced staff size appeared to have affected the functioning of most departments interviewed. We heard repeatedly that employees were overworked: "everyone is doing one and a half jobs with less support." Employees had to become "generalists" not "specialists". We heard from a few employees the flip side: workloads are not overwhelming; people just had to start working when BN came to town.

Some people discussed how safety has been affected by reduced budgets and staffing. Though the hazard level at the site has significantly declined, there is less money for

maintenance and for health and safety personnel. Only organizations with budgets for health and safety consultation will get the support from a matrixed health and safety personnel.

Interviewees generally stated that the growth of the local economy was not reassuring to NTS employees. This belied our hypothesis that the booming economy of Las Vegas provided for an open job market that might reduce employees' concerns surrounding potential job loss. Job skills at NTS are very specialized and are not seen as transferable to any job available in the Las Vegas area. When comparable jobs do exist, the salaries or benefits are less generous. Some respondents felt that older trade workers would struggle in the construction environment of Las Vegas that is said to be more fast paced than work at the site.

VC. Employee Assistance Program

Below is a brief overview of what EAPs offer to survivors as well as common themes expressed at all sites. A summary of the information collected via interview and record review of the NTS Employee Assistance Program (EAP) is attached as Appendix J. No utilization data was collected from NTS as the EAP Director explained that the database was temporarily inaccessible because of information system changes.

C1. Workshops and services

- **Few sites offer targeted training for survivor syndrome.**

Brief therapy and group workshops offered by EAPs at the sites are a valuable resource for employees to help mitigate psychological stresses of work and home life. Based on our interviews, however, we are aware of only a few sites that offered workshops directly addressing themes identified in the literature on "survivor syndrome." Workshops were voluntary and often were not evaluated by participants. In addition, we did not determine whether a sufficient number of workshops was offered. Employees were not as receptive to mandated workshops on change because these were seen as propaganda tools and not helpful.

NTS uses an on-site EAP within the Occupational Medicine Department (within the Human Resources Directorate prior to Spring, 1999). It is available to all employees working at the test site. At the time of our first visit, the EAP had one counselor and one part-time support staff who had approximately 140 employee contacts per month. Employees who use the EAP go on their own or at the suggestion of a supervisor.

The EAP coordinator characterized the nature and extent of employee complaints and concerns around the downsizings. Two chief complaints consistent throughout all years of downsizing and during the consolidation under Bechtel Nevada were emotional problems and family problems which employees attributed to the organizational changes. The EAP saw a few cases of stress that they attribute at least partially to potential job loss. Employees presented to the EAP with physical

complaints that were perplexing to their physicians. These complaints were often attributed to depression.

Family problems emerged as a focus during the period of major transition. For the most part, these were believed to result from pre-existing problems that had not been recognized and addressed when the work environment was more stable. The EAP staff hypothesize that these home issues came to the forefront when there was no longer a safe-haven for the employee at work. When their work life was dissolving, individuals needed to rely on their family but realized that the family situation was not stable. Employees sought out the EAP to aid in their family crises because that was the element they felt had hope for change. Stress from work and reduced patience also led to concerns about parenting.

C2. Consistencies across sites

- **Employees express tension about layoff notices and reluctance to visit EAP.**

The interviews and questionnaires used to understand the Employee Assistance Programs yielded interesting information. This section reports on themes that emerged as consistent across study sites. A central issue mentioned by staff of these programs (and sometimes in employee focus groups as well) was a reluctance by employees to visit the EAP for fear of losing their security clearance. DOE requires many employees to report whether they have consulted a mental health provider or physician about a mental health issue in the last seven years and this can result in certain levels of security clearance being denied.

An interviewee at the Y-12 Plant in Oak Ridge, Tennessee explained: "It's part of a site's legacy. Any veteran employee you talk with knows of someone who was fired after speaking with the company psychologist." No data is available to validate these claims. It appears as though employees are not sure what needs to be reported, so they avoid the risk by not seeking mental health services. That said, respondents did report that these concerns have diminished in the past few years. A staff person at INEEL felt the issue was no longer central except among some union employees. LANL staff expressed concern that recent espionage charges at the Laboratory might exacerbate these employee concerns.

VI. DATA ANALYSIS PROCESS

VIA. Employee Level Outcomes

The primary goal of our analysis is to assess the extent to which downsizing affects employee health. Using hierarchical linear modeling techniques, we account for variation in employee health related to employee and job characteristics (e.g., sociodemographic characteristics, psychological job demand) and workgroup characteristics (e.g., leadership, communication, job category). Variables in the

statistical analyses are classified as dependent (outcome) variables, independent (predictor) variables, or as co-variates.

Co-variates are assessed for their potential confounding effects as well as main effects on the outcomes. The potential effect-modifying role of some variables is assessed in an analysis of interactive effect as delineated in Hypothesis 4 of the study.

- **Statistical analysis occurs in three phases.**

In the first phase we generated descriptive statistics for all study variables. These include means and standard deviations for continuous variables and relative frequencies for discrete variables. In the second phase we constructed multi-item or derived variables. This process involved assessing scale items using principal components analysis and evaluating internal consistency and reliability of established and newly developed scales using Cronbach's alpha coefficients (a description of each scale and alpha coefficients can be found in Appendix K). The scores for all composite scales were standardized, on a range of zero to 100, for ease of comparability.¹⁷ In the third phase we developed and evaluated statistical models to address the study objectives.

- **Researchers pare down the variables and consider them as three conceptual types.**

Prior to determining the final variables in the model, we examined correlations between variables within blocks. If two or more variables were highly correlated (0.4 or greater), we considered only one to include in the multivariable models to minimize collinearity. We also eliminated variables from the model if the alpha coefficient was below 0.6 or if missing data was considered problematic (8% or more of sample not responding). Throughout, we prioritized the co-variates included to avoid overburdening the model with either too many variables or variables for which it was unclear if they functioned as moderators or outcomes. Once we determined a final list of variables, we ran correlations again. Appendix L contains a list of each variable collected, with information about scale scoring and construction, how to interpret a high score and the model(s) in which each was used or why it was excluded from the final models.

The independent variables we used in all final statistical models were downsizing rate and downsizing process. Downsizing process is actually comprised of three scales/indices including an individual's experiences of downsizing, fairness, and the rate of voluntary downsizing.

Co-variates in this model were organized into blocks focusing on the individual, the job and the environment/organization.

¹⁷ Each scale in the analysis has its own scoring calculation and the scales have varying number of items (anywhere from one to fourteen) and response categories (usually four or five). To allow for easier comparison, where appropriate, we standardized scale scores on a range of zero to 100. We used the following calculation to transform an individual's score for each scale into a standardized score:

$$\text{standardized score} = \frac{[\text{individual's score} - (\text{minimum possible score})]}{\text{Score range}} \times 100$$

where the range = maximum possible score - minimum possible score

1. **Individual level co-variate blocks:** *sociodemographics/SES, alcohol/tobacco use.*
2. **Job level co-variate blocks:** *job strain, job characteristics.*
3. **Organizational level co-variate blocks:** *social support, organizational and management style, safety and health.*

We ran the model separately for each of the nine dependent variables. The dependent or outcome variables are grouped into:

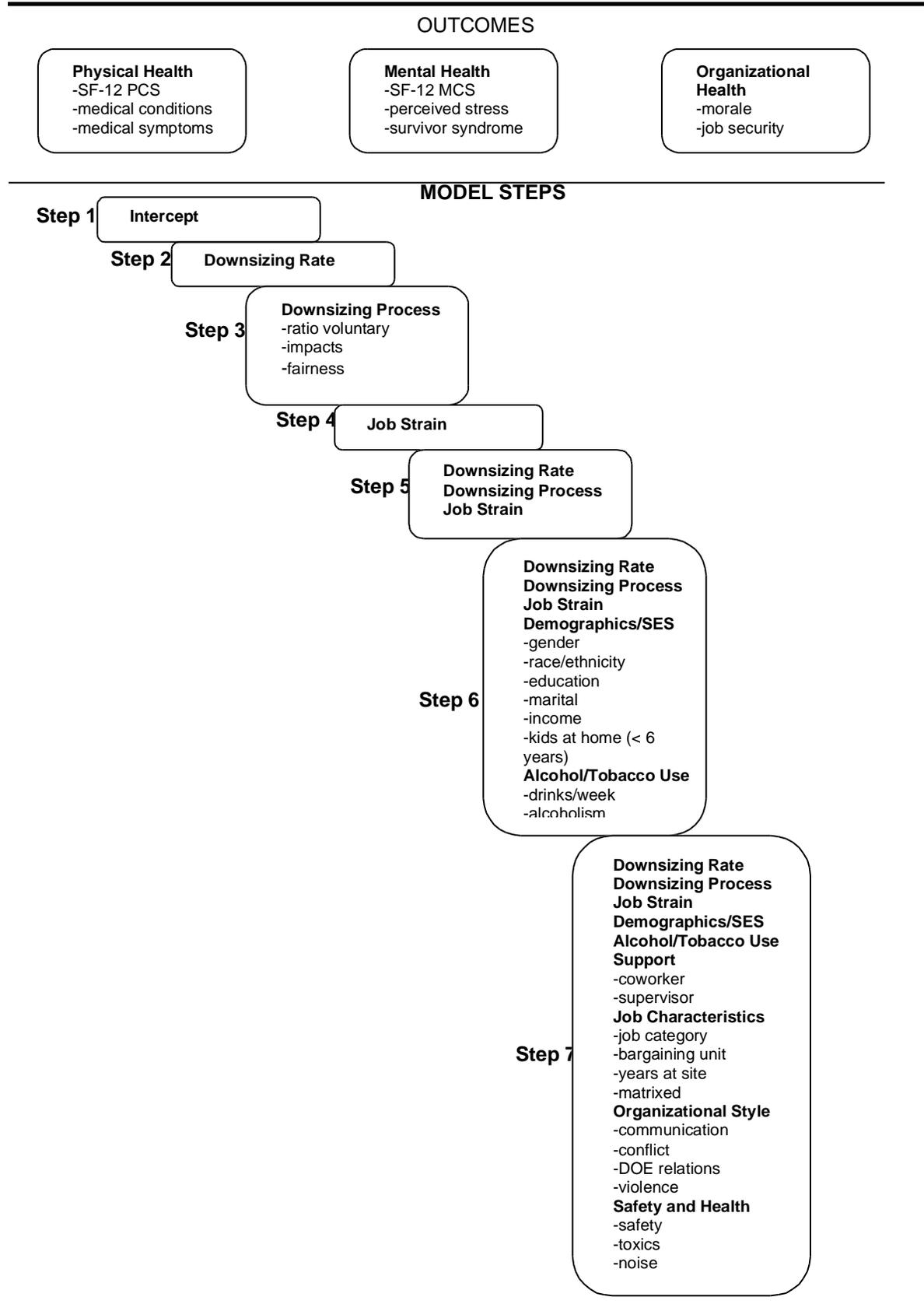
1. **physical health outcomes:** *physical component scale of the SF-12, medical symptoms and medical conditions;*
2. **mental health outcomes:** *mental component scale of the SF-12, survivor syndrome and perceived stress; and*
3. **outcomes directly related to organizational functioning¹⁸:** *work performance, job security and employee morale.*

- **Statistical model offers a view of how variables function individually and in combination.**

To determine the effect of potential confounders, we used seven steps to analyze data for each outcome. First, we looked at the outcome with no predictors (unconditional means model) which allowed us to examine variability in the mean for each outcome across level 3 organizational units. Then, in steps two and three, we examined each (set of) independent variables alone against the outcome of interest. We looked at job strain alone in step four as it has been extensively studied in this context and, in step five, we combined the variables from steps two through four. All other co-variates (individual, job and environment level variables) were added in steps six and seven. The final hierarchical model is presented in Figure 2, with the variables for each step and the variable block names in bold print.

¹⁸ Two additional organizational outcomes, sick time rate and the rate of total recordable cases (accidents and incidents), are used in the level 3, five-site model and presented in the *Five Site Final Report*.

FIGURE 2: Hierarchical Linear Model Steps



After the seven step models were run for each outcome variable, we tested the interrelationship of variables. Using Oak Ridge data, we examined specific interactions by including a cross product term of the factor with downsizing in the model to determine if certain factors acted as moderators for the effect of downsizing on each outcome.¹⁹ These factors included strain, fairness, race, violence, conflict resolution, supervisor support and co-worker social support.

- **Workgroup level outcomes used in separate model.**

We measured two outcomes of interest--sick time usage and accident rates (known as total recordable cases or TRC)--at the department level (level 3) rather than the employee level.²⁰ The number of observations available for the analysis of these outcomes (i.e., the number of organizational units) is then relatively small compared to the analyses of the employee level outcomes. Data for all five sites were combined for these analyses to increase our ability to determine the true relationship between model predictors and outcomes. Even though this approach increases the sample size, it does not provide a sufficient number of observations to use the modeling strategy described for the individual level outcomes. These analyses are not included in this site report but instead are included in the *Five Site Final Report*.

VIB. Hierarchical Linear Models

Hierarchical linear models, also known as multilevel models, can incorporate variation in employee health related to characteristics of the employee, the job and the workgroup. Individuals are affected not only by their personal and job characteristics, but also by characteristics of the social groups to which they belong. In this study, the social unit is the work group. Group characteristics, captured in downsizing, injury, and sick time rates, are distinct from those of individual group members. These group-level variables may affect outcomes independently of individual characteristics or modify how individual characteristics are related to outcomes.

- **Multi-level models assess complex environments.**

The study hypotheses are grounded in a belief that the climate of the workplace as well as of one's immediate workgroup will affect how health outcomes manifest in relation to stressful events. An HLM model allows us to account for similarities between members of the same work group that we may not have measured directly. A recent study testing the Job Strain Model (Van Yperen and Snijders, 2000) found that differences both between work groups and within work groups (between individuals) were related to health outcomes, with a finding that lower job control contributed to absence rates.

¹⁹ We used Oak Ridge data to help construct and test models to be applied to the other four sites.

²⁰ We are not using overtime usage rate as an outcome because it is not recorded consistently for all employees (differences between bargaining unit and exempt employees).

The individual (level 1) is the unit of observation for this first set of models. We account for similarities within divisions (level 3) in this hierarchical model.²¹ Level 2 is a workgroup; however, we could not sample at that level because the groups were often too small to offer anonymity and/or to have enough employees to achieve statistical significance. Two of the independent variables (downsizing rate and rate of voluntary layoffs) in this model are measured for level 3 and then assigned to each individual in that group.

As a simple case, consider a two-level model where the employee is level 1 and the workgroup is Level 2. At level 1, the outcome for employee i in the j th working group is the sum of an “intercept” (mean) for the employees’ working group and random error:

$$X_{ij} = \mu_{0j} + e_{ij}$$

where $e_{ij} \sim N(0, \sigma^2)$, that is, e_{ij} is distributed as a normal random variable with zero mean and fixed variance. At level 2, the intercept (mean) for the j th working group is the sum of an overall mean and a series of random deviations from that mean:

$$\mu_{0j} = \mu_0 + b_{0j}$$

where $b_{0j} \sim N(0, d_0)$. Using substitution we obtain the multilevel model:

$$X_{ij} = \mu_0 + b_{0j} + e_{ij}$$

where μ_0 is a fixed effect which represents the average outcome in the population, b_{0j} is a random effect which represents variability between working groups and e_{ij} is a random effect which represents variability within working groups.

VII. SUMMARY STATISTICS

We present here our findings regarding the rates of downsizing, sick time and accidents at the site. We then present information about the survey responders and descriptive statistics (i.e., means, standard deviation, range) for important scales included as co-variables or outcomes in our model. For those scales that have been used extensively in other studies, we compare our data to national norms. We also offer a summary of the major concerns employees described in their written comments.

²¹ Hierarchical models are commonly used in educational studies looking at students within classrooms within schools. Another example is a study of doctors grouped into practice groups within hospitals.

VIIA. Archival Data

A1. Downsizing

The net change in employment from Fiscal year 1991 (7,390) through June 1998 (2,297) was a loss of 5,098 employees through both attrition and downsizing events according to data published by OWCT. At NTS, 60% (4,458 employees) of the 1991 base population was laid off through downsizing events between January 1991 and June 1998 (see Table 1).²² The annual downsizing rate, calculated as the number of people downsized divided by the population at the start of the calendar year, ranged from less than 1% in 1998 to 49% in 1995, with a study average of 16.45%. Of the employees laid off, 970 or 22% received voluntary layoffs.

TABLE 1: Annual Downsizing at NTS (numbers and rates)

Year (fiscal)	Population (in January)	Voluntary		Involuntary IRIF	Total Downsize	Downsize Rate (%)	Voluntary Rate (%)
		VRIF	early retire (ER)				
1991	7390				0		
1992	6670	19+	unknown	unknown	924*	13.85	
1993	5548	95	0	235	330*	5.94	28.79
1994	5068	191	0	542	733*	14.46	26.06
1995	3940	315	204	536	1055**	26.78	49.19
1996	2765	94	71	799	964**	34.86	17.11
1997	2345	0	0	432	432	18.42	0.00
Jun-98	2297			20	20***	0.87	0.00
Study Period	(1991-1998)	695	275	2564	4458	16.45	21.76

Data Sources:

All site population data from OWCT with the exception of June 1998 provided by site contractors

*Downsizing numbers published in OWCT FY1993 - FY1995 Workforce Restructuring Plans (previous year totals); 1992 downsizing total reflects calendar year and source did not delineate type of downsizing event

**Downsizing numbers published in OWCT Annual Reports for respective fiscal year.

*** Downsizing numbers from BN and WSI (because OWCT data is by fiscal year).

- **Downsizing rate varies by study year.**

We collected downsizing data by level 3 including voluntary and involuntary layoffs from the current contractors, Bechtel Nevada (BN) and Wackenhut Security, Incorporated (WSI). This data was collected for each study year, 1991 through 1998, for which there were layoffs and available data at this level. We have data from WSI for the entire study period, with events in 1992 and 1994-6, for which we can assign a level 3. Data by level 3 for the main contractor was only available from 1996 (with events in 1996 and 1997) as that was the year Bechtel Nevada took over the contract and reorganized the work units. As noted above and in Table 1, we see that a majority of the

²² Please note that all figures regarding net employment change and downsizing in this section come from both contractor data and OWCT data as the current contractor, Bechtel Nevada, began as the M&I contractor in January 1996 and could not provide us with data for previous contractors. OWCT numbers will differ from data used in our analysis because OWCT includes some off-site employees not counted in our sample and because distinct criteria were used to gather the data.

downsizing and attrition took place between September 1990 and January 1996. If we look at the downsizing rate at NTS by year and by level 3 (Table 2a and 2b) we see noticeable differences, across years (from 0% to 15% at WSI and from 0% to 25% at BN) and across level 3s (the 1996 level 3 downsizing rate at BN ranged from 0% to 100%).

TABLE 2a: Annual Downsizing at NTS/Wackenhut by Level 3 (ranges) (N=4)

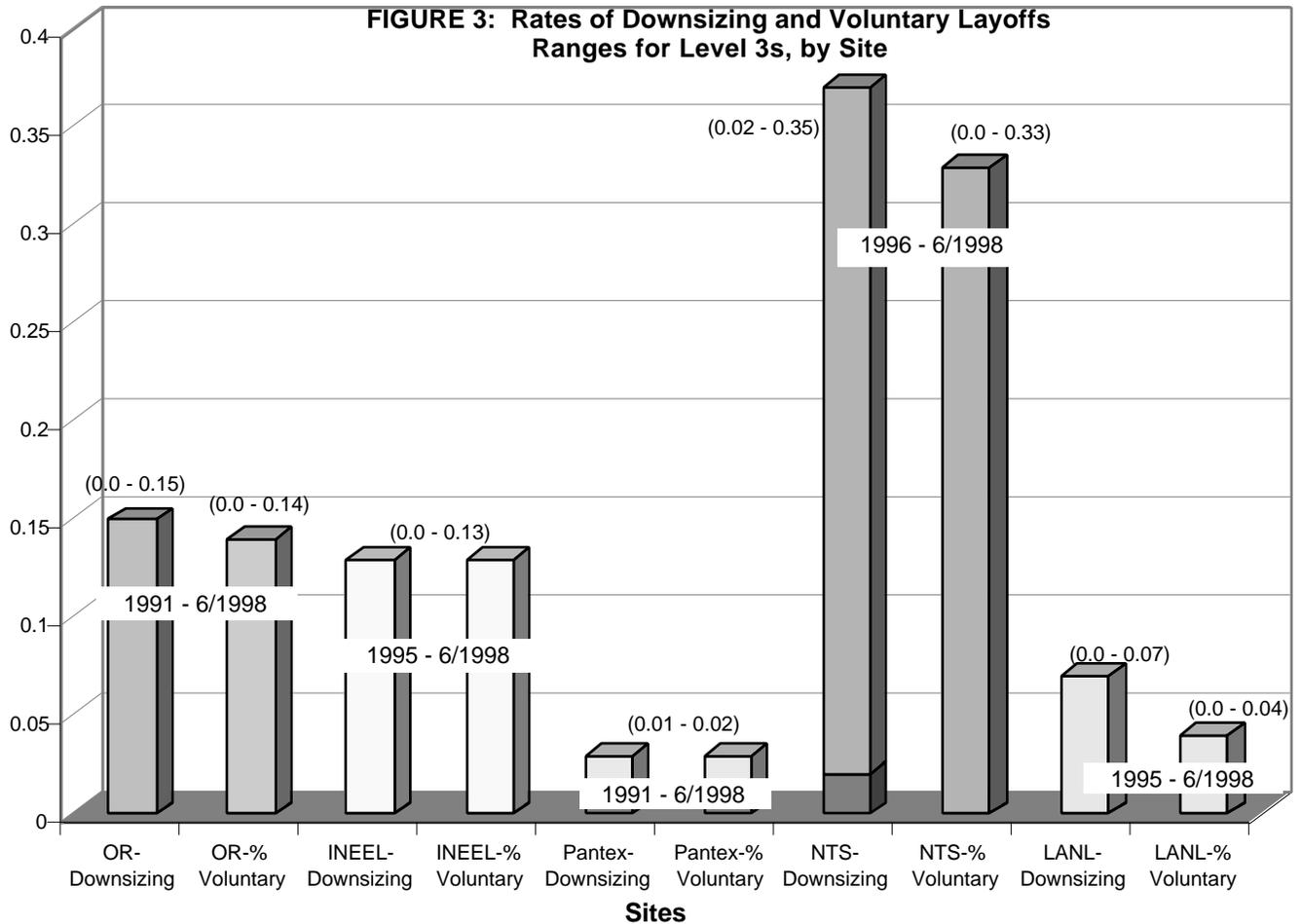
Year	Downsizing Rate		Voluntary Rate	
	Range (min - max)	Mean	Range (min - max)	Mean
1991	0.00-0.000	0.000	0.00-0.00	0.000
1992	0.00-0.070	0.017	0.00-0.07	0.017
1993	0.00-0.000	0.000	0.00-0.00	0.000
1994	0.075-0.216	0.118	0.075-0.09	0.080
1995	0.069-0.194	0.147	0.069-0.19	0.147
1996	0.00-0.061	0.026	0.00-0.00	0.000
1997	0.00-0.000	0.000	0.00-0.00	0.000
1998	0.00-0.000	0.000	0.00-0.00	0.000

TABLE 2b: Annual Downsizing at NTS/Bechtel Nevada by Level 3 (ranges) (N=15)

Year	Downsizing Rate		Voluntary Rate	
	Range (min - max)	Mean	Range (min - max)	Mean
1991	N/A	N/A	N/A	N/A
1992	N/A	N/A	N/A	N/A
1993	N/A	N/A	N/A	N/A
1994	N/A	N/A	N/A	N/A
1995	N/A	N/A	N/A	N/A
1996	0.000 - 1.0	0.12	0.103 - 1.0	0.10
1997	0.034 - 1.0	0.25	0.000 - 0.0	0.00
1998	0.000 - 0.0	0.00	0.000 - 0.0	0.00

We averaged the annual rates for each level 3 to derive a downsizing rate and voluntary rate for the level 3 for the entire study (data from 1991 through 1998).

The bar graph below (Figure 3) shows the range of study period downsizing and voluntary rates across level 3 for each of the five sites. Study period downsizing by level 3 at NTS (two contractors combined) ranges from 1.5% to 34.9%, with a mean of 10% and 90% of the level 3s with a downsizing rate of 17% or less. The voluntary rate is similar, with a range from 0% to 33% with a much lower mean of 3%. The rates at NTS are higher than the four other study sites, with Pantex and LANL having the lowest rates (approximately 0%-6% and mean of 1%) and Oak Ridge and INEEL with a middle range (approximately 0%-4% and mean of 5%). There were three downsizing events after Bechtel Nevada took over with some involuntary layoffs stretching over the course of several months. The last event occurred four months prior to survey administration.



A2. Sick time and accident data

We summarized two of the organizational outcomes of interest by level 3. Rates of sick time usage and total recordable cases (TRC or accidents) were calculated for the period July 1997 through June 1998 (the last 12 months of the study prior to survey administration). Table 3 shows the descriptive statistics for this data across level 3. The study-wide analysis of this data, using these two workgroup measures as outcome variables, will be presented in the *Five-Site Final Report*.

TABLE 3: Sick Time Rates and Total Recordable Cases for NTS and All Sites

	Facility	Mean	Standard Deviation	N (# of level 3s)	Range for Level 3s (min - max)
NTS	WSI Sick time rate*	64.65	10.12	4	51-72 - 75.62
	WSI TRC rate	0.01	0.02	4	0 - 0.04
	BN TRC Rate	0.01	0.02	15	0 - 0.07
All Sites Combined	Sick time rate**	64.79	26.48	78	18.35 - 149.78
	TRC rate	0.03	0.03	126	0 - 0.15

where: sick time rates= sum level 3 sicktime hours from July 1997-June 1888/ level 3 population
trc rates= sum level 3 trc 7/97 -6/98/ level 3 population

* For sick time, only data for Wackenhut (WSI) was included as Bechtel Nevada does not record sicktime

** Data from three sites where sick time is recorded separately: LANL, Oak Ridge and Pantex

VII B. Survey Data: Descriptive Tables

B1. Survey responders

- **High response rate is obtained.**

We sampled 10,645 employees from our five study sites (or 43% of all eligible employees at those sites) to receive the *Boston University Workplace Survey*. Overall, 55% of those sampled (5,897) completed and returned their surveys between July and November 1998 while at the Nevada Test Site 71% of the sample or 699 employees²³ completed the survey. Response rates at the five sites are shown in Table 4.

TABLE 4: Survey Response Rate by Site

Site	Percent of employees who returned survey
INEEL	71%
Nevada	68% (includes 2 contractors)
Pantex	62%
Oak Ridge	48%
LANL	44% (includes prime + 2 subcontractors, UC alone: 50%)

The majority of the NTS sample are male (72.9%), Caucasian (79.4%), and younger than fifty years old (52.3%). Responders are well educated: nearly 38% have completed college or attained a degree beyond college. The largest segment of responders is exempt, salaried employees (58%) and approximately 19% are members of a bargaining unit. Demographic information on NTS responders is summarized in Table 5.

²³ While there were 699 responders from NTS, some of the totals in the Tables are lower as they refer to the number of employees responding to particular demographic or other questions.

TABLE 5: Survey Responder Demographics, BN and WSI Employees

	N*	% of responders
<i>Gender</i>		
Female	187	27.1
Male	503	72.9
<i>Race/Ethnicity</i>		
White/Caucasian	546	79.4
Native American/Alaskan	12	1.7
Asian/Pacific Islander	12	1.7
Black/African American	56	8.1
Hispanic	47	6.8
Multiracial	15	2.2
<i>Education Level</i>		
Grades 7-11	8	1.2
Grade 12/GED	82	11.9
High School Plus Other Training	133	19.2
Associates Degree/2 Year College	73	10.6
Some College	134	19.4
Bachelors Degree	167	24.2
Advanced/Professional Degree	94	13.6
<i>Age</i>		
20-29	15	2.2
30-39	124	18.0
40-49	223	32.3
50-59	271	39.3
60+	57	8.3
<i>Marital Status</i>		
Married/Significant Other	523	75.6
Single, Never Married	50	7.2
Separated	8	1.2
Divorced	97	14.0
Widowed	14	2.0
<i>Spouse Job Status</i>		
Works Outside Home	350	50.8
Does Not Work Outside Home	339	49.2
<i>Children</i>		
Yes	533	77.2
No	157	22.8
<i>Household Income</i>		
< \$15,000	0	0.0
\$15,000 - \$30,000	23	3.4
\$30,001 - \$60,000	271	39.8
\$60,001 - \$90,000	234	34.4
\$90,001 +	153	22.5
<i>Pay Status</i>		
Exempt (not eligible for overtime)	130	19.0
Exempt (eligible for overtime)	256	37.4
Nonexempt	165	24.1
Bargaining Unit	133	19.4
<i>Tenure</i>		
	mean=13.3 years	
1 - 7 years		25.0
8 - 13 years		25.0
14 - 18 years		25.0
19 - 32 years		20.0
33 or more years		5.0

* There were 699 responders at NTS. The numbers in Table 5 are those answering the specific survey item. The percent is determined by the number of people responding to the specific item, not total responders.

- **Site has tradition of long tenure.**

As with most DOE sites, employees of the NTS have long job and site tenure. Of those responding to the survey, the average site tenure is 13.3 years with 75% of employees at the site for at least seven years (see Table 5). The average site tenure for the all sites sample was 14.5 years.

- **Responders were representative of the site but differ in some key respects.**

In Table 6, we compare responders with all site employees (BN and WSI employees combined) on demographic variables including gender, race, age, and union status. The group of responders was fairly comparable to the site overall in terms of gender and race/ethnicity. However, the group of responders had far less union representation and higher than representative responses from older employees. The data on bargaining unit employees is affected by the larger number of employees and responders from Bechtel, a company that has a lower rate of bargaining unit employees than does WSI. We were not able to conduct a statistical comparison of responders and non-responders to determine if there was a non-response bias because of the method used to maintain responder confidentiality.²⁴

TABLE 6: Survey Responders Compared to NTS Population, BN and WSI Employees

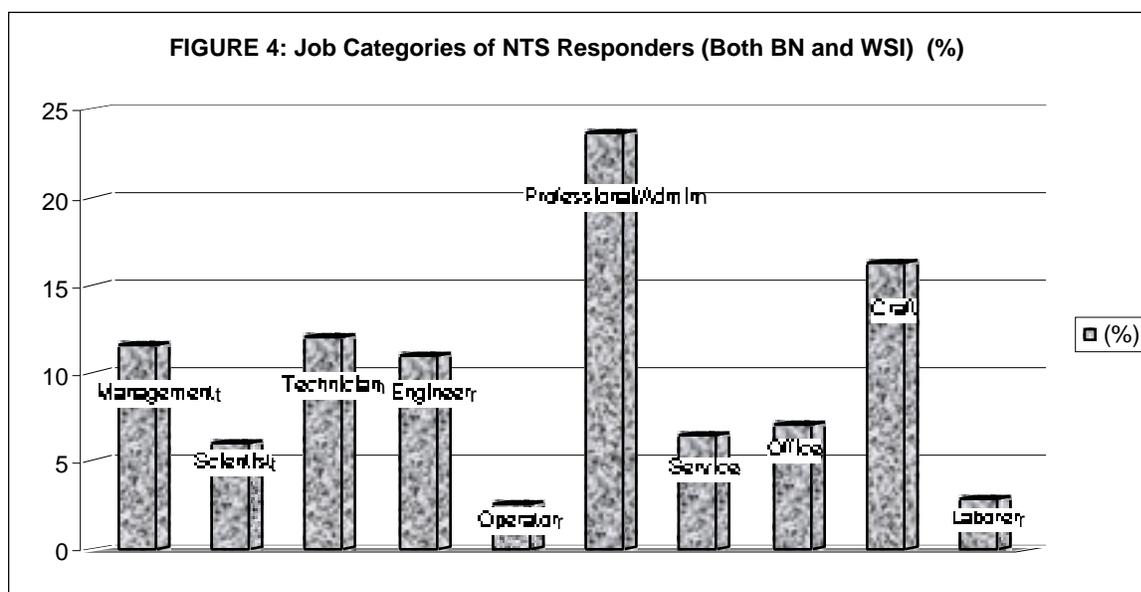
Variable	Responders		#	All employees % of total
	#	% of responders*		
N	699	67.6	2289	45% sampled
Female	187	27.1	566	24.7
Non-white	144	20.96	494	21.6
<i>African American</i>	12	1.7	238	10.4
<i>Latino</i>	47	6.8	171	7.5
<i>Asian/Pacific Islander</i>	12	1.7	85	3.7
<i>Native American/ Alaskan/ Multiracial</i>	27	3.9		
50 years or above	328	47.5	599 (for BN 55+)	26.2
Union member	133	19.3	681	29.8

*Note: percentages were calculated using all responding to that question and not total responders as the denominator.

The Nevada Test Site has testing as its primary mission. This mission is reflected in the distribution of employees across job categories with one quarter of the site employees in

²⁴ We could not create two groups to compare statistically (responders and non-responders) as we only knew who had sent back a postcard but not who had returned a survey. The best comparison then was to the site demographics overall.

craft, labor or service positions. They are supported by a large number of engineers (11%), technicians (12%) and professionals (24%). The ten job categories below (Figure 4) are taken from the Department of Energy's Common Classification System (COCS).



B2. Summary statistics on survey scales

Table 7 lists the summary statistics (i.e., mean, standard deviation, and range) for the nine outcome scales in the survey instrument and the other scales and indices included in this model. The scale scores have been standardized (zero to 100 points) for easier comparison.²⁵

It is interesting to note that Bechtel Nevada and Wackenhut employees differed on some measures. For example, Bechtel employees reported higher scores on the downsizing experiences index (37.2 compared to 28.9 with $p \leq 0.0001$) and felt the downsizing process was less just (53.7 compared to 60.8 with $p \leq 0.0001$). However, employees of both organizations reported similar levels of job strain.

²⁵ Information of interest referenced earlier includes the tables describing the conceptual basis and the statistical basis for each scale. They can be found in Appendices K and L.

TABLE 7: Descriptive Statistics for all Survey Variables

Variable (Standardized)	NTS				All Sites Sample	
	N	Mean	SD*	Score Range (Min-Max)	N	Mean (SD*)
<i>Outcome scales and indices</i>						
SF-12 Physical Component Summary (PCS)	665	75.53	8.31	39.16 - 91.42	5608	74.55 (10.25)
Medical Conditions	685	10.91	11.86	0 - 50	5808	11.72 (12.89)
Medical Symptoms	692	22.96	22.53	0 - 100	5831	24.57 (22.83)
SF-12 Mental Component Summary (MCS)	665	67.07	13.73	15.37 - 90.25	5608	65.91 (14.36)
Survivor Syndrome	620	56.97	14.70	20 - 100	5340	59.98 (11.77)
Perceived Stress	687	43.49	14.52	20 - 90	5836	45.42 (14.29)
Job Security	641	51.05	13.60	25 - 91.67	5523	52.84 (13.82)
Work Performance	699	10.98	11.00	0 - 94.44	5897	13.04 (12.37)
Morale	696	59.18	18.15	20 - 100	5856	55.69 (17.96)
<i>Independent or co-variate scales and indices:</i>						
Downsizing experiences	667	35.93	23.03	20 - 100	5670	25.21 (21.86)
Fairness/Downsizing process	645	54.43	12.00	20 - 94.29	5505	54.43 (11.73)
Strain	659	23.28	5.41	10.32 - 50.88	5550	23.88 (5.85)
Matrixing	683	13.18	23.51	0 - 93.75	5744	11.75 (23.39)
Alcoholism	675	5.74	16.77	0 - 100	5697	4.37 (14.18)
Violence	686	12.39	23.00	0 - 100	5805	14.76 (24.91)
DOE	688	58.41	15.43	20 - 100	5817	52.25 (16.29)
Communication	692	54.74	20.26	20 - 100	5840	54.22 (18.98)
Conflict	687	61.28	13.68	20 - 100	5761	57.79 (12.84)
Supervisor Support	682	75.50	15.60	25 - 100	5785	74.41 (15.32)
Coworker Support	683	77.23	11.05	37.5 - 100	5772	75.88 (11.43)
Safety and Health	687	79.59	11.75	20 - 100	5830	77.29 (12.62)
Toxic Exposure	685	47.10	15.31	33.33 - 100	5798	47.30 (15.31)
Noise	687	49.27	14.27	25 - 100	5824	47.30 (13.62)

*standard deviation

It is interesting to note that Bechtel Nevada and Wackenhut employees differed on some measures. For example, Bechtel employees reported higher scores on the downsizing experiences index (37.2 compared to 28.9 with $p \leq 0.0001$) and felt the downsizing process was less just (53.7 compared to 60.8 with $p \leq 0.0001$). However, employees of both organizations reported similar levels of job strain.

B3. Summary statistics compared to national norms

Three of the outcome scales are nationally used and validated measures. We were able to compare data from NTS employees and our entire sample (All Sites) to those national norms; that information is presented in this section with a table in Appendix M. We also incorporated other widely used measures into our survey, in particular, several

scales from the Job Content Questionnaire (JCQ).²⁶ We do not present comparative norms here because the international JCQ norms are reported by job category and those differ from those that we collected in this study (comparisons are pending).

We compared summary statistics from our sample with general population norms for the two SF-12 scales and for perceived stress.²⁷ Because our demographic categories differed from the way the normative data was grouped, we were limited in our ability to test comparisons. Reported here are results from a one-sample t-test to determine whether scores on PCS, MCS and perceived stress were different among NTS and the sample of all five sites combined (All Sites) compared to published, general population norms.²⁸ We compared our data (both NTS-specific and All Sites) with national norms for the total samples and by gender.

- **Comparisons to national norms reveal expected as well as unanticipated results.**

In summary, NTS data showed significant differences from the national population on the physical health scale (PCS) when compared overall and by gender to the national sample. The total NTS sample scored 2.9 points higher and 1.7 and 4.2 points higher for males and females respectively, indicating better measures of physical health among the NTS employee sample when compared to the general population. A similar trend was demonstrated for the All Sites sample as well. Both the NTS population and the All Sites sample when compared overall and by gender to the national data demonstrated poorer mental health on the MCS measures (lower scores). Results for the perceived stress scale indicate a similar pattern of poor mental health among the NTS males and females compared to the normative sample (higher scores), although the total NTS sample reported less perceived stress than the comparison population.

All comparisons with the exception of differences on the perceived stress scale among the total NTS sample and among females were statistically significant. However, it is not clear how the score differences from the national samples translate into actual health differences. In general, we might expect that a working population would be healthier than a general sample of US adults. For physical health as measured by the PCS scale, this expectation holds. One might also expect workers to have better mental health scores than the general population. However, our hypothesis that downsizing has an overall stress effect on employees is borne out by these results which show NTS and the All Sites populations with slightly lower mental health on the MCS and higher perceived stress than the normative data.

²⁶ Scales from the JCQ include psychological job demand, skill discretion, decision authority, supervisor social support, co-worker social support, toxic exposure, noise exposure, macro decision authority and job insecurity.

²⁷ Comparative national data for the SF-12 is described in the SF-12 Manual: "How to Score the SF-12 Physical and Mental Summary Scales," Third Edition, Quality Metric Inc. Comparative national data for the perceived stress scale is described in: Cohen, S., and Williamson, G. (1998). Perceived Stress in a probability sample of the United States. In S. Spacapan, and S. Oskamp (Eds.), The Social Psychology of Health: Claremont Symposium on Applied Social Psychology. Newbury Park, CA: Sage.

²⁸ Higher scores on PCS and MCS mean healthier physical and mental status and a higher score on perceived stress indicates higher stress levels or a less healthy status.

B4. Review of the *Boston University Workplace Survey* comments

Our survey included two open-ended questions encouraging respondents' comments on the following: 1) important job issues not addressed in the survey and 2) ideas for improving the quality of one's work life. All comments were entered into a database. A list of categories and subcategories was created and used to code comments (see Appendix N for coding themes). Frequencies were run on the categories for both open-ended questions to identify areas about which respondents most frequently commented (407 employees or 58% of respondents offered one or more comments).

- **Employees report a variety of concerns.**

The majority of the comments from NTS employees fell into three general categories: evaluation of management and employee-management relations, job demands, and organizational factors. Within these categories, employees documented a wide variety of concerns and, at times, expressed conflicting opinions. A summary of the major points is presented here.

Most comments about management addressed employee discontent with communication between employees and management. One person summed it up as follows: "When goals are not clearly defined or communicated...rumors fly." Management does not share information with everyone in a timely manner, and this has led employees to feel far out of the loop. Workers are frustrated further by a seemingly insensitive management that has no regard for employee opinion. For some, it is incomprehensible how feedback is not elicited from the very group that will be affected by a particular change or decision by management.

Additional comments in this category focused on the ratio of management to workers at NTS. As several employees described the situation, there are "too many chiefs and not enough Indians." The perception that management has become top-heavy during a period of layoffs is also demoralizing, as it appears "the worker bees always lose their jobs first."

Comments about job demands most frequently focused on workload and work schedule at NTS. The prevailing sentiment is that the site is severely understaffed. Mounting expectations from management apparently were not accompanied by a corresponding increase in personnel. The result has been what some employees label a dangerous or desperate situation, in which safety risks increase and customer satisfaction is threatened by the poor quality and delayed arrival of a product.

Employees also commented about the work schedule at NTS and the commute to the site. Many employees felt that they deserve to be compensated for their three to four hours of travel time. The long drive may affect job performance, and is an inconvenience that takes time away from family and other personal obligations.

The dominant organizational factor of concern to these employees was the desire for more job-related technical and computer training in their field, as well as in other areas.

These skills are vital to a worker's performance, as job requirements become increasingly complex and technology continues to change. One employee proposed the creation of a learning center where workers could enhance current skills and acquire new ones that would allow them to better meet the future needs of the industry. Unfortunately, many employees felt that none of this was possible with the current, limited funding.

In addition to training, many employees cite the lack of proper resources as a source of frustration. Among requests in this area are a major update of computer hardware and software, better transportation on site, and instruments that do not frequently malfunction. Employees pointed out that older or inadequate equipment causes delays and affects the quality of worker output.

A third area of concern within the organizational factor category is what one employee termed "senseless paperwork." The excessive amounts of red tape and bureaucratic requirements, such as the multiple reviews and approvals necessary for many activities, slow productivity without adding clear benefits.

VIII. MULTI-LEVEL MODEL RESULTS

We used multilevel modeling (HLM) to incorporate group-level variables into a contextual analysis. This allows us to capture information not provided by individual-level data. HLM also helps us understand the outcomes for individuals while accounting for similarities within work units. By constructing the model in steps, we see how each set of independent variable(s)--downsizing rate, downsizing process--is associated with the physical health, mental health, and organizational outcomes and how each operate when job strain and other individual and work focused co-variables are added. As mentioned in Section VI, outcomes are grouped into physical health outcomes, mental health outcomes and outcomes related to organizational functioning and each group contains three scales or indices.

In this section we briefly discuss individual characteristics (demographics and job characteristics) included in the model as potential confounders. We present the results for each of the independent and other key variables. We then provide findings about conceptually interesting co-variables, specifically those related to organizational climate and job characteristics. This overview focuses on the full model (step 7 of the hierarchical linear model) and comments on how key variables function differently in earlier steps of the model. At the end of this section we discuss results related to the fourth hypothesis regarding the way in which seven variables modify the impact of downsizing on health and functioning. We summarize the overall findings and interesting issues in the discussion (Section IX) and conclude with recommendations based on these findings.

Scores for all continuous scales were standardized and have a possible range of zero to 100. We report mean and standard deviation for variables and, in the tables, present the effect size (beta coefficient) and p value when a variable is significantly associated with

an outcome. Complete results for each of the nine outcomes are attached as Appendix O and a summary of how core variables perform throughout the seven steps of the model, for each of the nine outcomes, is presented in Appendix P.²⁹

VIIIA. Individual Level Controls

- **Associating demographic variables with outcomes provides important data.**

Five of the demographic variables measured in the survey³⁰ were characteristics possibly associated with some of the nine outcomes and were therefore controlled for in the model: age, race/ethnicity, gender, marital status, and having a child(ren) under six years of age at home. Contrary to expectations, increasing age was only significantly associated with poor work performance. Those who were married reported greater job insecurity and non-whites reported more medical conditions.

Job characteristics including pay status (bargaining unit/non-bargaining unit), tenure at site, matrixing, and job category,³¹ emerged from interviews and focus groups across sites as being differentially impacted by workplace changes. These job characteristics were seen as important co-variates and therefore entered in the final model.

It is interesting to note that pay status remained significant when all variables were included in the final model for the three physical health outcomes and two mental health outcomes. Bargaining unit employees were in better physical health, reported fewer medical symptoms and conditions and fewer symptoms indicative of survivor syndrome, and had lower perceived stress than non-bargaining unit employees.

The scale on matrixing focuses on the individual experience of the employee, assessing the experience with this job format (e.g., adequacy of supervision, connection to group, etc.) but it is also clearly tied to work structure, with a higher score meaning a more negative experience. The more negative experience as a matrixed employee (e.g., inadequate supervision, low connection to group, etc.) was not associated with any outcome for employees at NTS, although it was statistically associated with ten outcomes at the other four sites (6 of them at LANL).

We also controlled for tobacco and alcohol use. Surprisingly, tobacco use was not significant for any of the health outcomes.³² Consuming more drinks per week was not

²⁹ For additional information, see Table 7 above for descriptive statistics for all scales and Appendix L to understand how to interpret scale scores.

³⁰ Other individual level variables measured but not included in this model were: income, second job, and health insurance. These variables were cut as we attempted to create a leaner model.

³¹ Some of the job characteristics in the survey were excluded from this model because of lack of variability in responses. The variables excluded were: shift, number of overtime hours worked, management level and the number of days per week worked outside of one's main work group.

³² The variable may not have been sensitive as finally measured. While we included information about start and quit years in the survey, for this analysis people are divided into those who have never used tobacco and those who have ever or currently use tobacco. If we had limited this variable to cigarette smoking, it may have been statistically significant.

associated with any outcome but a higher score on the alcoholism index was significantly related to poorer physical and mental health for all six outcomes.

VIII.B. Downsizing

Our study hypothesis assumes that downsizing and health outcomes are associated. Individuals in work groups with higher downsizing will have more adverse health outcomes than individuals in groups with lower downsizing. In addition, higher downsizing rates will be associated with poor organizational functioning as measured by scales on work performance, job security, and morale, and by sick leave and accident rates.

Again, the downsizing variable is calculated for each organizational unit or level 3 at the site as the average of the annual rate for each study year (from 1991 through 1998 for WSI employees and 1996 through 1998 for BN employees).³³ NTS is the site with the greatest number of layoffs during the study period but most are not included in rate calculation for this analysis because of the change of the main contractor. There were five downsizing events between 1991 and 1998 at Wackenhut Services, Incorporated and three events at Bechtel Nevada from 1996 through 1998. The downsizing rate is applied to each individual in the level 3.

At NTS the downsizing rate variable ranged from 1.5% to 34.9% across the 19 level 3s in the model, with a mean of 10% and 90% of the observations with a rate below 17%.

- **Downsizing is statistically significantly related to only one outcome variable.**

As Table 8 demonstrates, downsizing rate was significantly related to only one of the nine outcomes at NTS. Overall, employees had a paradoxical response, with higher levels of downsizing associated with better health (higher score on PCS: $\beta=16.32$, $p \leq 0.05$). When downsizing rate was looked at alone against each of the outcomes (step 1), a higher rate of downsizing was predictive of several outcomes in both positive and negative directions: better physical and mental health (PCS and MCS) and higher morale, on the one hand, and more perceived stress and greater frequency of poor work performance on the other.³⁴ A summary of the seven steps, looking at a set of core variables for each of the outcomes is presented in Appendix P.

³³ At each site, we averaged annual rates for the number of years that data were available: Oak Ridge since 1991 with six downsizing events between 1991 and 1995 and several events each year from 1996 through 1998; Pantex, since 1991 with one downsizing event; LANL and INEEL since 1995 both experiencing three downsizing events; and NTS since 1996 with three downsizing events at Bechtel and five events at WSI (with data from 1996-98 for Bechtel groups and 1991-98 for WSI groups). Details regarding rate calculation are in Appendix G. At INEEL and NTS there was a change of prime contractor that meant the previous records of downsizing were at a site-wide level (not by level 3). At LANL, the University of California restructured extensively in 1995 and previous records were not traceable to a level 3.

³⁴ Higher scores on the outcomes scales can mean better or worse outcomes as follows. A higher score on these outcomes mean better health and functioning: PCS, MCS, morale. A higher score on these outcomes means worse health and functioning: medical conditions, medical symptoms, survivor syndrome, perceived

TABLE 8: Hierarchical Linear Modeling Results for Downsizing Rate and Process Measures

Outcome (N)	Downsizing Rate	Fairness	Voluntary Rate	Downsizing Experiences
	B estimate	B estimate	B estimate	B estimate
Physical Health				
SF-12 Physical Component Summary (PCS) (517)	16.32*	0.00	-3.36	-0.01
Medical Conditions (519)	-19.76	0.01	13.00	0.06*
Medical Symptoms (523)	-6.20	-0.30**	16.81	0.09*
Mental Health				
SF-12 Mental Component Summary (MCS) (517)	5.31	0.19**	-29.17*	-0.06*
Survivor Syndrome (506)	12.40	-0.23**	-4.30	0.01
Perceived Stress (523)	13.78	-0.14	9.75	0.02
Organizational Health				
Job Security (501)	-3.26	-0.19**	-10.13	0.07**
Work Performance (573)	16.08	-0.07	-9.05	-0.01
Morale (526)	-0.53	0.05	-21.07	-0.04

where: * $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$

We examined the possibility of a non-linear effect of downsizing using the Oak Ridge data as a test case. We included a quadratic term in each model testing for its impact on each outcome. This term was only significant for PCS indicating that as downsizing increases, PCS also increases but this effect diminishes for the highest levels of downsizing. This result--the same association found for downsizing rate--suggested that it was not critical to test this alternate version of downsizing at the other four sites.

Surprisingly, downsizing was only significantly associated in five other cases at the five sites, with three of the significant outcomes at Pantex. Downsizing was similarly associated with the PCS at one other site (Y-12 and associated with medical conditions and the MCS in the expected direction at Pantex (higher downsizing leading to more medical conditions and lower mental health scores). At two sites the downsizing rate was associated with job security, but in opposite directions.

VIIIC. Downsizing Process

Study Hypothesis 2 states that in a context where downsizing was a given, how the downsizing was carried out would influence the health and organizational outcomes. Specifically, greater worker involvement, more extensive communication about plans, timing and implementation, a higher rate of voluntary layoffs, and a downsizing process that employees perceived as fair would all result in a more cohesive workforce with fewer negative health, safety, and organizational functioning outcomes. We thought that some of these factors might vary within site (between work groups) as well

stress, job security (higher=greater insecurity), work performance (higher=more instances of poor work performance). Review Appendix L for more information on interpretation of scales.

as between sites. Hypothesis 2 also posits that the extent to which an individual personally experienced downsizing would influence health outcomes.

Downsizing process was discussed extensively in interviews and focus groups. We included three measures of downsizing process in the final hierarchical model: fairness or justice of the downsizing, individual experiences of the downsizing, and the rate of voluntary layoffs in a given organizational unit (voluntary departure or early retirement programs). We did not include another measure of process, the goals of the downsizing events and whether they were achieved as too many responses missing.³⁵

C1. Fairness

The fairness scale (E6 in the survey, Appendix E) asks employees to respond to 14 questions regarding the most recent downsizing event at their site. The scale includes items about interactional justice and formal procedures,³⁶ communication, timing, and worker involvement. Higher scores on the fairness scale correspond to perceptions of a more fair and open downsizing process. At NTS, scores on the fairness scale ranged from 20 to 94.3 with a site mean of 54.4 and standard deviation of 12.

- **Perceived fairness is statistically significantly related to health.**

Fairness was significantly related to five of the nine outcomes (see Table 8, above). The higher the perceived fairness, the healthier the person as measured by indices of medical symptoms ($p \leq 0.009$). Greater fairness was predictive of all three mental health outcomes: higher MCS ($p \leq 0.006$), fewer survivor syndrome symptoms ($p \leq 0.002$), and less perceived stress (borderline at $p \leq 0.055$). The more fair the downsizing, the less job insecurity expressed ($p \leq 0.007$).

For the four outcomes where fairness was not significant in the final step of the model, it was significantly related to the outcome in step 3 (PCS, medical conditions) or through step 6 in the model (poor work performance and morale). This suggests that the organizational climate and job characteristic elements added in step 7 are acting as confounders for these outcomes, that is it is related to both exposure and outcome (Rothman and Greenland, 1998).

Fairness was associated with less job insecurity at all five sites, and with lower survivor syndrome scores at four of the five study sites. It appears that, across site, people report fewer health problems (symptoms and/or conditions) the more fair they perceive the downsizing process.

³⁵ Either people did not understand the question (E1) or they did not feel qualified to comment on the goals of the downsizing.

³⁶ The justice questions were adapted from a procedural justice scale developed by Niehoff and Moorman, 1993. Some of the language was changed in this section to refer directly to a downsizing event rather than to general perceptions of procedural justice at a workplace. A general justice scale is included in the survey (C7) but was not included in the final model as it was highly correlated (.44) to this scale.

C2. Voluntary layoffs

- **Rate of voluntary layoff is statistically significantly related to mental health.**

We hypothesized that voluntary and involuntary downsizing processes reflect distinct levels of worker involvement and worker control over the outcome and therefore would have different impacts on employee health. The rate of voluntary layoffs ranged from 0% to 33% with a mean of 3%. At NTS, the rate of voluntary layoffs was significantly related to MCS but, unexpectedly, the higher the rate of voluntary layoffs in a group, the worse one's mental health score. The variable was only significant for one other outcome at the two other sites where it was included in the models,³⁷ again in an unexpected direction (greater voluntary rate associated with more job insecurity at Los Alamos).

C3. Individual experiences of downsizing

We created an index to count the ways in which someone had experienced the event(s), with a range from no effects to seven possible impacts, such as being laid off and later rehired, participating in RIF planning, handing out layoff notices or having a friend laid off. Scores on the downsizing experiences index at NTS ranged from zero to 100 with a mean of 35.9 (higher than the all site mean of 25.2) and standard deviation of 23, meaning that employees at NTS were more likely to have experienced several aspects of downsizing personally.

- **Findings suggest that downsizing negatively impacts mental health.**

The downsizing experiences index was significantly related to four outcomes at NTS. We found that more personal experiences of downsizing was correlated with a worse mental health status (MCS) at all five sites. At four sites (all except Pantex) the more aspects of downsizing an individual experienced directly, the more insecure about job future he or she felt and the more medical symptoms were reported. Interestingly, the index was not significantly correlated with morale at any site. Also surprising was that the individual experiences of downsizing index was rarely associated with survivor syndrome (only at LANL). This suggests that research into survivors needs to delve deeper and look at differences within the group of remaining employees.

VIIID. Strain

We assume that job strain is associated independently with the outcomes. We also believe that there may be a moderating effect between job strain and downsizing, a hypothesis we discuss below in the section on interactions (see Section VIIF).

³⁷ For two sites, Pantex and INEEL, all layoffs included in the model were voluntary so this variable was not included to avoid co-linearity with downsizing ratio.

Strain consists of a job demands dimension (defined by how fast and hard one works and whether one has sufficient time to get the job done) and a control dimension (defined by the ability to use skills on the job as well as the decision-making authority available to the worker). The job strain model emphasizes the relationship between job demands and control in causing stress: the greatest risk to physical and mental health from stress occurs to workers facing high psychological workload demands or pressures combined with low control or decision latitude in meeting those demands. In this study, we use the “quotient” model of job strain to create a continuous independent variable--demands divided by latitude.³⁸

- **Qualitative data indicates that downsizing worsens job strain.**

It is clear that downsizing may worsen job strain--either or both as an increase in job demand and a decrease in job control—although we could not test this relationship in this cross-sectional model. A recent study found that physical demands increased and autonomy and skill discretion (control) decreased in major as compared to minor downsizing (Kivimaki, et. al., 2000). Study respondents, in written and verbal comments, spoke extensively about work demands as well as the inability to structure their work. One employee at NTS wrote: “the job will not get done, not get done right, or not get done safely.” Others mentioned the impact of having too much work including stress caused by unrealistic time pressures, job burnout, and a “hostile” work environment. This was accompanied by a belief among some that their work is under-appreciated. This is consistent with the findings of Vahtera and colleagues (Vahtera and Pentti, 1999) who reported that worse health outcomes after downsizing were seen for those in job categories that had been significantly reduced (perhaps leading to work overload).

TABLE 9: Hierarchical Linear Modeling Results for Job Strain Variable

Outcome (N)	Job Strain <i>B</i> estimate
Physical Health	
SF-12 Physical Component Summary (PCS) (517)	-0.06
Medical Conditions (519)	0.19
Medical Symptoms (523)	0.38
Mental Health	
SF-12 Mental Component Summary (MCS) (517)	-0.49***
Survivor Syndrome (506)	0.39**
Perceived Stress (523)	0.06***
Organizational Health	
Job Security (501)	0.29*
Work Performance (573)	0.04
Morale (526)	-0.24

where: * $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$

³⁸ The quotient term is nonlinear and tends to give more weight to control (the denominator which includes skill discretion and decision authority) than demands. There are other formulations of job strain including one that dichotomizes strain at an arbitrary cut-point.

- **Greater job strain is predictive of negative outcomes.**

At NTS, scores on the job strain scale ranged from ten to 51 with a mean of 23.3 and a standard deviation of 5.4. A higher score is indicative of more strain. The five site mean on job strain was 23.9 (standard deviation=5.9).

Greater strain at NTS was statistically significantly associated with four out of nine outcomes at NTS, including all three mental health outcomes. Higher strain scores are predictive of lower general mental health functioning (see Table 9, $\beta=-0.49$, $p\leq 0.0001$), higher survivor syndrome scores ($\beta=0.39$, $p\leq 0.003$) and greater perceived stress ($\beta=0.16$, $p\leq 0.00301$).

Strain at NTS is also associated with one of three organizational/workplace outcomes. Higher strain scores are also related to greater job insecurity ($\beta=0.29$, $p\leq 0.02$). Having less control over work (or greater demand) affects how secure one feels in one's current job as well as perceptions regarding new job opportunities.

Consistent with the study Hypothesis 3, job strain was a strong and consistent predictor of negative health and performance outcomes. Strain was significantly associated with 30 out of 45 outcomes across all sites. It is clear that high job strain is an important predictor of negative outcomes in sites that are experiencing downsizing events over time.

VIII.E. Organizational Climate

We hypothesize (Hypothesis 3) that one's immediate environment, as measured by management and operating style and group functioning, can affect health and functioning in the workplace and may also influence how stressful events are experienced. HLM allows us to account for similarities within groups on these climate measures. In this section we discuss three groups of climate and operating variables. In Section VIII.F, we review how four of these factors interact with downsizing in the model.

E1. Organizational style

Four organizational style variables are included in the HLM model: violence, conflict resolution, DOE relations, and communication.³⁹ The violence and harassment variable is a three-item index (yes or no) that measures whether in the past 12 months the employee has been threatened, attacked, treated unfairly, or made uncomfortable by

³⁹ Other measures of organizational climate were considered conceptually important and were included in the survey but not in this model for one of three reasons: 1) they were highly correlated with another scale already in the model; 2) they had a low alpha coefficient; or 3) conceptually they can serve as a co-variate, an outcome or both. Variables that were dropped for these reasons are: role ambiguity, organizational commitment, skill loss, supervisor style, feedback quality, opportunity, procedural justice (general scale, not downsizing specific) and innovation. The survey question regarding site mission was not included because more than 8% of the sample did not complete it.

words or actions while on the job. A higher score indicates more experiences of threats or harassment. For the other three scales, a higher score indicates a more positive outcome, that is, better communication, more effective resolution of conflicts, and better working relations with the local DOE office.

TABLE 10: Hierarchical Linear Modeling Results for Organizational Style Measures

Outcome (N)	Conflict Resolution	DOE	Violence	Communication
	B estimate	B estimate	B estimate	B estimate
Physical Health				
SF-12 Physical Component Summary (PCS) (517)	0.01	0.01	-0.05**	0.01
Medical Conditions (519)	-0.02	-0.02	0.07**	-0.05
Medical Symptoms (523)	-0.02	-0.04	0.10*	-0.08
Mental Health				
SF-12 Mental Component Summary (MCS) (517)	0.07	0	-0.05*	0.06
Survivor Syndrome (506)	-0.1	-0.03	-0.07*	-0.06
Perceived Stress (523)	-0.04	-0.02	0.06*	-0.05
Organizational Health				
Job Security (501)	-0.02	-0.04	0.06*	-0.10**
Work Performance (573)	-0.10*	-0.09*	0.05*	-0.04
Morale (526)	0.18**	0.01	-0.03	0.20***

where: * $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$

- **Of the four organizational measures studied, the experience of violence or harassment is most frequently associated with negative health and functioning outcomes.**

Of the four organizational style variables, violence is statistically significantly related to the outcomes twice as often at the five sites overall and more frequently than that at NTS.⁴⁰ When examined as a group, one or more of these four organizational climate variables is significantly related to all nine outcomes at NTS and 40 of the 45 outcomes across site.

At NTS, the violence/harassment index is significantly associated with all outcomes except morale, more than at any other site. In seven of the instances, greater experience of violence or harassment is associated with worse outcomes (the exception is survivor syndrome scores). At the four other sites, violence is related most often to worse physical health outcomes.

The DOE relations scale was associated with only one of the study outcomes at NTS. The better the reported relations with DOE, the lower the reported absences ($p \leq 0.03$). Overall, good relations with DOE were most often significantly related to the mental health outcomes (lower survivor syndrome scores at three sites and lower MCS at two sites), to lower medical symptom (two sites) and to better morale (two sites). This scale

⁴⁰ Violence is significantly related to 22 outcomes across the five sites (of a possible 45) with each of the other variables related to 13 or fewer: conflict resolution (13), DOE relations (11), and communication (9).

did not emerge as important at either INEEL or Nevada Test Site (significant for none and one outcome respectively) although employees at both those sites did discuss these issues in the focus groups and interviews. At NTS, fewer of the written comments offered on the surveys were related to DOE issues (10.3% of all comments compared to an average of 17% at the four other sites).

The communication scale was associated with less job insecurity ($p \leq 0.009$) and better morale ($p \leq 0.001$) at NTS. At the other four sites better communication was also significantly related to higher morale ($p \leq 0.001$). Better communication was associated with less job insecurity at two other sites (LANL and INEEL) and with fewer medical conditions at one site (Pantex).

We included six items to measure conflict resolution within work groups and between contractors (C8, page 9 of survey). The variable was associated with less absenteeism ($p \leq 0.003$) and better morale ($p \leq 0.001$) at NTS. Across sites, it was significantly related to study outcomes 13 times, most often the three organizational outcomes and most frequently at INEEL (significant for seven of the nine outcomes).

E2. Social support

Social support is a measure of work climate and has been examined as a modifier of job strain (Johnson and Hall, 1988). In our model, we hypothesize that strong support from one's supervisor or co-workers will be associated with better health outcomes and might serve to mitigate potential negative stress and health outcomes caused by downsizing. The mean scores (and standard deviations) for supervisor support and co-worker support are 75.5 (15.6) and 77.2 (11) respectively with higher scores indicating more support.

TABLE 11: Hierarchical Linear Model Results for Supervisor and Co-Worker Support Measures

Outcome (N)	Supervisor Support	Coworker Support
	B estimate	B estimate
Physical Health		
SF-12 Physical Component Summary (PCS) (517)	-0.09**	0.02
Medical Conditions (519)	0.09*	0.02
Medical Symptoms (523)	0.24**	-0.15
Mental Health		
SF-12 Mental Component Summary (MCS) (517)	0.03	0.06
Survivor Syndrome (506)	-0.05	-0.05
Perceived Stress (523)	0.03	0.03
Organizational Health		
Job Security (501)	-0.04	0.01
Work Performance (573)	0.01	-0.06
Morale (526)	0.26***	0.27***

where: * $p \leq 0.05$, ** $p \leq 0.001$, *** $p \leq 0.001$

- **Social support is associated with higher morale.**

At NTS, supervisor support was significantly related to the three physical health outcomes and to morale. Ironically, greater supervisor support was a marker for poorer health outcomes in all three instances but was associated with higher employee morale in the workplace ($p \leq 0.0001$) (see Table 11). More support from co-workers is also associated with higher morale ($p \leq 0.0001$). At the other sites, it appears that support is more important when looking at mental health outcomes and organizational functioning outcomes than at physical health.

E3. Safety and health

We measured three health and safety factors in the workplace: general perceptions of the health and safety climate, perceived exposure to noise, and perceptions of exposure to toxic materials or environments. We hypothesized (Hypothesis 3) that feeling unsafe at work might be associated with negative health outcomes and poorer workplace functioning, as well as making one more vulnerable to stress effects. The health and safety scale is an eight-item scale; the mean score at NTS was 79.6 with a standard deviation of 11.8 with higher scores representing a more health and safety conscious work environment. The single item question on noise asks how loud one would have to talk to be heard by someone standing next to him or her from whisper (low score) to shout (high score). The mean score was 49.3 (standard deviation=14.3) and the mean score on the three-item toxic exposure scale was 47.1 (standard deviation=15.3) with a higher score indicating that one is exposed and that it is a "sizable or great problem."

TABLE 12: Hierarchical Linear Model Results for Safety Measures

Outcome (N)	Safety	Toxics	Noise
	B estimate	B estimate	B estimate
Physical Health			
SF-12 Physical Component Summary (PCS) (517)	0.01	-0.02	0.04
Medical Conditions (519)	-0.09	0.04	-0.03
Medical Symptoms (523)	-0.15	0.16*	-0.1
Mental Health			
SF-12 Mental Component Summary (MCS) (517)	-0.03	-0.02	0.01
Survivor Syndrome (506)	0.03	-0.03	-0.01
Perceived Stress (523)	-0.04	-0.01	0.06
Organizational Health			
Job Security (501)	0.03	0.06	0.07
Work Performance (573)	0.08	0.05	-0.07
Morale (526)	0.18**	0.02	0.09

where: * $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$

- **Each safety measure relates statistically to only one outcome.**

Each of the safety measures was significantly related to zero or one outcome (see Table 12). An environment considered to be safe and healthy for employees was associated

with higher morale ($p \leq 0.008$). Greater perception of toxic exposure is correlated with more medical symptoms ($p \leq 0.04$).

At the five sites overall, one of the three safety variables was significantly associated with one third of the outcomes, most frequently at LANL (six of the 15 associations). When one of the variables was significant, it was most often an association with a physical health or organizational functioning outcome, particularly medical symptoms, job security and morale (each associated with one of the safety variables at three sites and always in the expected direction).

VIIIF. Interaction Effects

Hypothesis 4 states that the effect of downsizing may depend on the presence of moderating variables. For example, employees with high strain and in work groups with high downsizing might be more likely to have poorer health outcomes than individuals with low strain in the same group. Or, as another example, employees in two groups exposed to the same level of downsizing may demonstrate different outcomes depending on the style and practices of their supervisors, the perceived fairness of the downsizing, or the level of social support they receive from co-workers and supervisors.

- **Interactions of downsizing with seven variables are not predictive of outcomes.**

We examined specific interactions of downsizing with strain, fairness, race, violence, conflict resolution, supervisor support and co-worker social support, using the Oak Ridge data. Of the 63 interaction terms tested (nine outcomes by seven potential moderators) only the interaction of downsizing with conflict was significant at the .05 level ($p = 0.0267$). Considering the number of interactions tested and the magnitude of this effect, this result is likely due to chance alone. We therefore decided not to insert interaction terms into the models for NTS or the other three sites.

IX. DISCUSSION

Our study--one of the few to examine survivor health and reactions in a post-downsizing work environment--has provided a tremendous opportunity to explore a newly emerging research area. Downsizing is an epi-phenomenon representing change in organizational structures, economic relationships, employee-employer expectations, generational characteristics and bargaining styles. However, this opportunity is also associated with significant, potential pitfalls. The theoretical and conceptual nature of downsizing, stress, and health has not yet been charted. Thus, researchers coming to this topic map out their models with a sense of trepidation as well as excitement.

Our research is the largest of its kind—in both scale and scope—to investigate the health and organizational effects of workplace restructuring. We have approached this

study with great care. Ensuring that we have applied the most rigorous methods, we brought together the knowledge of various disciplines including public health, occupational health, organizational management and organizational psychology. In this section we discuss our findings in light of the four main study hypotheses:

1. Downsizing will have a negative effect on individual health and workplace functioning (i.e., employee morale, work performance and job security).
2. Employees are less likely to experience negative health effects and organizations are more apt to function normally the fairer the downsizing process and the fewer direct elements of downsizing the employee experiences.
3. During periods of organizational change, one's work and work environment, including job strain, organizational style, co-worker and supervisor support, and workplace safety will affect both individual health and workplace functioning.
4. Workplace factors including job strain, organizational climate, and the employee's perception of the fairness of the downsizing process can moderate the impact of downsizing on health and organizational outcomes.

IXA. Does Downsizing Negatively Affect Health?

The finding that the level of downsizing is only associated with one outcome at NTS and with five others at the remaining study sites is at odds with our expectations and with the observations of other researchers of this topic. Similarly, the lack of findings of any significant interaction effects between downsizing and seven key variables on our outcomes was surprising. Even in the absence of a statistical association, qualitative data emphasized the strong impact of both downsizing and the fear of downsizing on employees. Many factors may account for these findings.

- **Methodological and data constraints must be considered to interpret statistical significance.**

Researchers explored methodological explanations for why downsizing rate did not emerge as a predictor of negative health outcomes while downsizing process and other work and organizational factors were clearly associated with the outcomes in our study. Limitations to the data that may have obscured the ability to observe a potential effect fell into three categories.

Researchers collected downsizing data and calculated downsizing rates. There are possible limitations in the exposure term that we created and in our ability to compare level 3s.

- Downsizing exposure was not highly variable within each site (across level 3s).
- The range of downsizing rate was smaller than for other key variables and may have been too small to demonstrate an effect (e.g., downsizing rate 0-15, fairness 21-93, downsizing experiences 0-100, and job strain 11-76).

- Downsizing data from early study years were attributed to current day level 3s and, given the extent of organizational changes, may have been incorrectly assigned, resulting in non-differential misclassification of exposure data. In essence, this reduced the ability to demonstrate a relationship between exposure and outcome.

Downsizing happened at these sites at the same time that other organizational changes were being implemented. It is possible that we did not capture the best measure of change and how it affects individuals and the workplace.

- The variable chosen may not be the best to measure downsizing.
- Decisions about the rate of layoffs and the type of layoffs for any given Section 3161 event are made on a site-wide basis and therefore, differences between level 3s may be statistically significant but not conceptually meaningful.
- We did not measure directly organizational changes other than downsizing (e.g., restructuring, outsourcing, work stoppages, downsizing by means of attrition)⁴¹ in the model.

Elements of the study design and the relationship between exposure and outcome influenced the potential to see significant effects.

- The cross-sectional design used is less able to detect differences in outcome measures than a longitudinal study examining impacts over time.⁴²
- Unlike the study of many acute and chronic occupational diseases, in studying downsizing we do not know the shape of the relationship between exposure and effect, the latency period if any between exposure and effect, and the most important outcomes to characterize.⁴³
- Our model assumes a linear relationship between downsizing exposure and outcome: the greater the downsizing, the greater the outcome. It may be that this is an incorrect assumption and that the true exposure-outcome relationship is captured by a non-linear relationship.⁴⁴

In summary, it was not clear at the start of the study how intertwined downsizing and organizational restructuring were. This real world problem posed significant methodological issues that we have attempted to address. However, we recognize that, though broad, our choice of measures and models may not be the most comprehensive

⁴¹ A recent study by Amabile and Conti (1999) measured downsizing using three self-report measures. They found that anticipated downsizing and workgroup stability were more likely to be associated with the outcomes of interest (creativity) than the reported rate of completed downsizing.

⁴² The recent Kivimaki (2000) study examined downsizing and health data at three intervals during a five-year period. Their design enabled them to observe a relationship between downsizing rate and sickness absence as well as between downsizing and job strain over time.

⁴³ In conducting preliminary analyses we did explore other measures of downsizing rate. Yet even when we limited our analysis to the impact of downsizing events within the 12 months before the survey, no clearer picture emerged at Oak Ridge, the only site with annual events over the entire study period, or at other sites without recent events.

⁴⁴ When we tested a quadratic term for downsizing in the Oak Ridge model, we did not identify additional significant relationships. This may again reflect problems with how the downsizing data was defined or collected.

way to disentangle the complex relationship between downsizing and change. Since downsizing is a change existing within a complex network of events, more work is needed to determine how best to measure it as an independent variable. Downsizing represents one kind of organizational change (in this case used as a means to increase efficiency and respond to reduced budgets) and it may be important to measure the concomitant organizational changes such as departmental restructuring and contract changes.

It remains to be determined whether downsizing rate was generally not significant because there is indeed no effect on health or because the metric we used to capture downsizing may have been ill suited in this case. Employees at NTS were very aware of and, at times, concerned about new management styles introduced by Bechtel Nevada and the fact that BN is a construction company newer to the variety of work at NTS than prior contractors. One employee wrote: “The upper management at this site is very controlling, demanding and has poor people skills.” Another employee noted: “We are completely overstaffed with middle and upper management while being severely understaffed by technical and crafts people. Since new management in 1996, I have never received a job description or annual review.” Other studies that have found an association between rates of downsizing and health similarly report that changes in work characteristics including increased work load/demand, decreased job control and decreased support account for a large portion of the effect size (Vahtera and Pentti, 1999).

IXB. Does a Fair Downsizing Process Result in Fewer Negative Impacts?

- **Downsizing process variables emerge as significant predictors.**

While neither the downsizing rate nor the rate of voluntary layoffs emerged as significant predictors for the outcomes of interest, several of the downsizing process variables did. Both individual downsizing experiences and fairness/justice were significantly related to four of the nine outcomes at NTS and half the outcomes when looking at results from the five sites together. It is possible that the nature of the downsizing for DOE contractor personnel--with national communication and guidelines (Section 3161) about the process--made process issues of paramount interest to the workforce. In essence, the employee experiences downsizing through the process, including fairness, justice, communication, interpersonal treatment and personal experiences of downsizing. The process is both perceived and felt more directly, giving it more meaning. Workers may believe that they have the ability to make positive changes to the downsizing process and to organizational climate whereas input into setting workforce numbers is not perceived as feasible. The outcomes used in our study are probably best suited to pick up these relationships as they are predominantly self-reported individual measures.

- **The rate of voluntary layoffs is not associated with healthier outcomes.**

The rate of voluntary layoffs, which we have assumed measures levels of worker involvement in the process and a worker’s control over outcome, was significantly related to only two outcomes study wide (included in the model for three sites). In both

instances the association was with a more negative outcome (with a lower MCS score here at NTS and with more job insecurity at LANL). One problem with this measure as it was ultimately derived is that it reports on the rate of voluntary downsizing but does not compare voluntary to involuntary downsizing within a level 3. For example, a level 3 may have a higher voluntary rate than another group and also have more involuntary layoffs than the comparison group (accounted for only by total downsizing rate).

- **A more fair downsizing process is associated with greater job security and lower survivor syndrome.**

Employees who perceived that they were respected and had an opportunity to participate in the downsizing process reported fewer medical symptoms. These workers had better mental health scores, more job security (seen at all five sites), and less frustration, anger, sadness and depression. In contrast, those who perceived a less just or fair process experienced a greater sense of sadness, guilt, and "aloneness" or survivor syndrome (seen at four of the sites). According to Noer (Noer 1993), this latter group is more likely to experience negative effects on work performance such as less risk-taking and lowered productivity. Their sense of lessened job security and reduced organizational commitment may deleteriously affect other aspects of their work lives.

Other studies have found that employees experiencing survivor syndrome have diminished trust with their co-workers, less job satisfaction, and increased conflict with colleagues. And, it is clear from our qualitative data as well as the downsizing experiences index that workforce restructuring touches everyone, not just those who are laid off. Across sites, people report fewer health problems (symptoms and/or conditions) the more fair they perceive the downsizing process. This may support other authors' hypotheses that in a setting with greater justice, stressful events (e.g., downsizing, restructuring) are less disruptive, potentially leading to fewer negative health outcomes. At NTS, many employees commented on fairness in day-to-day management of the site, including several comments on discrimination (individuals listed bias against former employees, women, and people of color). In the words of one employee: "They [Bechtel] also have an attitude toward dollars more than fairness in [the] workplace."

An organization may experience these employee effects in the form of reduced workforce cohesion and lowered productivity. Our qualitative results indicate that there is a perceived relationship between increased reporting of health complaints, utilization of health care services and heightened insecurity and low morale, although the available EAP data do not permit us to test this association.

In our study, the justice questions relate to the fairness of rules, procedures and implementation: that is, a focus on interactional and procedural justice. We did not study distributive justice because separation benefits were similar across the DOE complex and generally perceived as generous or fair. For example, focus group participants did not discuss the adequacy of layoff packages offered to separated employees. While this focus is supported by others who emphasize the role of management in helping employees adapt to change (Dowd and Bolus, 1998), it may underestimate the importance of rewards (mentioned extensively in survey comments) and monetary support during times of change. A study by Brockner and others found

that adequate compensation to those laid off reduced the survivor syndrome symptoms amongst remaining employees (Brockner, et. al., 1987).

The findings for justice/fairness are important for an organization that is considering downsizing. Employees' perceived lack of justice and fairness in the process can lead to negative mental and physical health affects as well as reduced efficiency and decreased group performance and morale. Conversely, we find the opposite in efficient, more open and fair organizational units. Developing mechanisms for employee participation, creating and adhering to organizational procedures, and open, timely, and honest communication can be major focal points for positive intervention. It is interesting that fairness emerged as significantly associated with outcomes, even though the DOE had well-defined policies to mitigate adverse impacts from downsizing, particularly by offering benefits to separated employees.

- **Workers who experienced more elements of downsizing reported negative health effects.**

The measure of an individual's direct encounters with downsizing was significantly associated with lower mental health scores (MCS) and with greater job insecurity at all five sites and with more medical symptoms at four sites. At NTS, the downsizing experiences index was significant for the three outcomes just mentioned as well as with increased reporting of medical conditions. The index can be seen as an individual measure of downsizing. These employees represent a significant at-risk group: the six elements measured included implementing the RIF, changing jobs or departments, having close friends laid off, and being laid off and rehired.

In this era of chronic downsizing and restructuring, we need to pay closer attention to those on the front lines implementing, observing and experiencing the new policies. Site managers can examine each downsizing element to determine those most predictive of negative health and functioning outcomes and whose impact can be mitigated through interventions.

IXC. Do Work Environment and Job Strain Affect Health During Times of Change?

In this study of downsizing organizations, several measures of job control and organizational climate emerge as variables related to the health and organizational functioning outcomes. The organizational climate, which might best be thought of as the unspoken rules of conduct, appears to directly affect individual health and measures of workplace functioning. The employees' perceptions of management support, communication, and commitment to a vision and goals, are important aspects of the work environment. Where the environment is perceived as positive, employees report better individual and organizational health. Climate, as manifested by management policies and procedures, supervisor support and by a commitment to a safe workplace, is an area in which a relatively small investment can reap a large harvest of employee benefits.

- **Job strain was developed as a key measure in this study of organizational change.**

We chose the Job Strain Model as the theoretical core of our analysis as it appeared to be directly applicable to the study of the effects of chronic strain in the DOE workforce. Job strain did emerge as a key theme in the focus groups and interviews, and survey results confirm that increased job strain is associated with poor health outcomes. We do not know what component of the strain is caused by the downsizing, although it is clear that as DOE's mission, budget, and contracting mechanisms change, there are fewer personnel and monetary resources. The possibility for greater demand, both on individuals and organizations, along with fewer resources to meet the demand, and less say in performing one's job may all lead to strain. The Job Strain Model captures the dimensions of organizational and work changes brought about by downsizing. Its content domains facilitate a study of the effects of chronic strain in the DOE workforce.

- **Qualitative findings point to job strain as a source of stress in the workplace.**

Our findings in interviews and survey comments suggest that changes in the DOE mission along with reducing the workforce affect stress levels within the organization. In particular, it may be that increased job demand or a corresponding decrease in control has led to greater job strain within some organizational units. It appears that many workers felt lucky to still have a job, but in return faced constant uncertainty about the future. One employee wrote: "I'm tired of doing the work of everyone that's been RIFed or quit." At a site where empty offices abound, people are concerned about their job future as well as the ability of to accomplish the required work "without sacrificing quality and accuracy" and this can easily undermine a workers' sense of control.

Many respondents wrote about micro-management and how that affected their ability to carry out their jobs. In the minds of some workers, the lack of a decision-making role for most employees is exacerbated by the many layers of management: "There are too many managers with no responsibilities who are attempting to create little empires that cause costly redundancies." Others commented that relationships with management, particularly immediate supervisors, were good and that most people had adjusted well to significant organizational and contractor changes. A theme emerged, however, about a focus on profits and how that can lead to bad operational decisions and practices.

- **Study expands the traditional use of the Job Strain Model.**

Our findings highlight the relationship between strain and mental and physical health outcomes as well as between strain and morale and job security, expanding upon the documented relationship to cardiovascular disease and musculo-skeletal disorders. Schnall and Landsbergis, in a 1994 article, summarized the existing literature on this topic indicating increased risk of cardiovascular disease or all-cause mortality for individuals in high-strain occupations compared with subjects in other occupations. Others have shown that reduced control and significant workload pressure can inhibit creativity in the workplace (Amabile and Conti, 1999). Our study, however, examines how well strain predicts a variety of outcomes including physical health, mental health, and organizational outcomes.

Job strain proved to be an important predictor for outcomes in this study: employees with higher strain did less well on four of the nine measured outcomes than those with lower strain scores. Modifying job strain, either by reducing demand or increasing control, could improve employee outcomes. Prior to an intervention, further analysis could tease out which dimension of job strain should be altered, demand or control or both. However, we do need to consider some methodological concerns that have been raised in the literature. Hurrell and others (Hurrell, et. al., 1998 and Kasl, 1987) have discussed the problem with self-reported measures of job stress. Many researchers discuss the need to further identify and collect objective measures of job stress.

Although we were unable to utilize objective measures of job strain, we did collect objective measures of downsizing, and two objective outcome measures, used in the level 3 analysis. All of the outcome measures in our individual level model presented in this report as well as most of the co-variates come from self-report data. Hurrell also raises questions about the lack of predictive validity that self-report measures of strain have shown for morbidity (Hurrell, et. al., 1998). These concerns may be somewhat offset by the fact that many of these scales have been extensively used in similar research efforts and have standardized norms from large samples.

- **Employees value effective communication from management but it does not predict better health outcomes.**

Based on the qualitative findings and previous studies that document a link between downsizing and poor communication (Noer, 1993), it appeared that communication would emerge as an important variable in the survey. However, communication was only associated with the job security and morale outcomes at NTS and with only nine outcomes across all five study sites. Employees discussed communication extensively in the focus groups: whether their own supervisors communicated effectively, whether there was good communication between upper management and middle management, when information about reductions were shared, and the impact of good and poor communication. It is surprising that a topic discussed so extensively in interviews and focus groups would not be associated with more study outcomes. The concept of communication, though, is covered in several items in the downsizing fairness/justice scale that was significantly associated with many outcomes.

- **Workplace violence and harassment is associated with worse health outcomes.**

At NTS, experience of violence and harassment was a predictor of worse health outcomes. Recent studies have suggested that organizational changes at work, including downsizing, may be associated with increases in workplace violence (Sauter, et. al., 1999). At present the nuances of the relationship are not clear but policy planners and implementers need to look closely at this possibility when instituting changes in work organization. Steps can be taken to ensure that monitoring of harassment and violent incidents is adequate and that employees and managers are equipped to prevent incidents and to handle them when they do occur.

- **Employees are concerned about new safety procedures.**

Although neither the overall health and safety scale nor the toxic and noise exposure measures were important in the statistical model, these reflected issues often discussed in the focus groups. Respondents believe that safety breaches are likely to increase as a result of increased workload, greater stress, and more workers in positions for which they are not properly trained. As at the other sites, there were many comments on the amount of paperwork and procedures related to the work and skepticism as to whether it improves workplace safety. Increased workload may become a safety concern. As stated in the survey comments, "Downsizing has reached a critical level concerning employee safety and health. Over the last several years, many safety and health programs have been eliminated or severely compromised due to budget cuts. Unfortunately, this trend will continue until the 'big one' hits (fatality, multiple injury or severe property damage)."

- **The importance of support and concerns about management guide change.**

Stronger supervisor and co-worker support were both predictive of increased morale. When either of the support variables were statistically associated with the outcomes, the relationship was generally with the mental health and organizational functioning outcomes. At NTS, that trend is broken: we found that greater support from one's supervisor is related to employee's physical health but, surprisingly, that it predicts worse physical health (on all three outcomes). At both INEEL and Oak Ridge we found that more supervisor support is associated with the reporting of more medical conditions. One reviewer suggests that it may be a case where the direction of the relationship is reversed and that employees with worse health get more supervisor support. These findings underscore the importance of looking at social support. Our study did not measure whether social support modifies the relationship between job strain and health outcomes as is hypothesized in the job strain literature. We can, however, link the quantitative finding that supervisor support is associated with higher employee morale and the qualitative finding that many employees are critical of management, including what they see as top-heavy management, too many layers of management, poor communication, and lack of trust. If these concerns with management and employee-management relations are widespread they may be contributing to poor morale and associated workplace impacts.

- **Findings for bargaining unit members may point to the importance of workers' involvement in downsizing and change processes.**

It would be interesting to look further at the differences between bargaining unit and non-union employees. At NTS, for instance, being a union member was significantly associated with less perceived stress and, borderline ($p=.055$), with fewer medical symptoms. Bargaining unit members often have a clearer sense of criteria for downsizing (as stipulated in the contract). This suggests that having more information and perhaps a voice in the process makes one less susceptible to stress-related health impacts. Organizations can reinforce worker voice and control by inviting employee groups into the process and giving them decision making power.

IXD. Does Downsizing Interact with Other Variables to Impact Employee Health and Well-Being?

We did not find statistically significant relationships to the study outcomes when we paired downsizing rate with other variables such as conflict resolution, supervisor support, job strain, fairness and race/ethnicity, using Oak Ridge data. In light of these findings, we did not test these interaction terms in models for NTS or the other three sites. We believe that we were limited in our ability to detect the importance of these interactions by the same data limitations described with respect to the downsizing measure in Section IXA. Given that our measure of downsizing was rarely associated with the outcomes of interest on its own, we were not able to effectively test the hypothesized moderating effect of these other variables on the impact of downsizing on individual health and functioning at work (Hypothesis 4).

X. SITE-SPECIFIC FINDINGS, RECOMMENDATIONS AND NEXT STEPS

The workplace and its employees exist in a complex and interdependent social structure. Worker health, as a function of physical and social-psychological factors found in the work environment, can be affected when that environment is disturbed. Downsizing and restructuring represent departures from the homeostasis typical of workplaces as little as ten years ago. While downsizing rate as measured here had few statistically significant effects at NTS or the other study sites, the manner in which the workplace and its management and workers respond to change has significant impacts on health as found in this study. In addition, work structures can be seen to influence health (e.g., a matrix structure or patterns of communication and conflict resolution), particularly when these structures appear inadequate to the specific work environment or do not adapt successfully during times of change.

In our study of employees of NTS and four other DOE sites, each at its own stage of downsizing, we found that job strain, organizational climate and methods of implementing change are, in fact, associated with employee health and organizational functioning. While this cross-sectional study could not elucidate the natural history of downsizing and its impact over time on employees, we did identify opportunities for change within downsizing organizations that can improve employee health and organizational well-being. In the DOE complex, these are areas that may be more amenable to positive change than the actual downsizing rate.

Several of the major findings at NTS and the study overall are fruitful to examine in light of potential interventions. The variables that were related to employee health may suggest possibilities for workplace interventions to mitigate the negative impacts on employee health and workplace functioning.

XA. Findings at the Nevada Test Site

- **Employees who perceived that downsizing was implemented with clearly explained reasons, worker input, open respectful, truthful and unbiased communication with employees, and consistent and fair rules experienced fewer negative health effects.**
 - A process perceived as just and fair was associated with fewer reported medical symptoms.
 - Greater fairness was associated with fewer survivor syndrome symptoms.
 - The more fair the downsizing, the less job insecurity was expressed and the higher the reported morale.

- **Employees who reported more direct experiences of the downsizing, had poorer mental and physical health status and a greater sense of job security.**
 - A higher score on the downsizing experiences index was associated with a greater number of medical symptoms and conditions.
 - These employees had lower mental health scores (MCS).
 - The more downsizing elements experienced, the lower the job security expressed.

- **Employees who experienced greater job strain reported an increase in adverse individual and organizational functioning outcomes.**
 - Higher job strain was associated with poorer reported mental health status, increased symptoms of survivor syndrome and increased stress.
 - Workers with high strain jobs experienced greater job insecurity.

- **A supportive supervisor and co-workers, good organizational relations and a safe workplace are associated with better employee health and organizational functioning.**
 - Employees who reported receiving greater support from their manager and co-workers saw higher morale amongst their co-workers.
 - Employees who perceive that their managers have good relations with DOE or feel that there is healthy resolution of conflict at the site reported fewer instances of poor work performance.
 - The perception of a less safe workplace was associated with lower morale, while a belief that one is exposed to toxicants was predictive of more medical symptoms.
 - Qualitative data reports to a perceived association between poor management (unfair practices, poor communication, etc.) and low morale and motivation.

- **Employees who experience threats or acts of violence, harassment or discriminatory treatment have worse health outcomes.**
 - Employees who reported more experiences of violence, harassment or discriminatory treatment reported worse physical health (on all three measures).

- These employees were also more likely to report lower overall mental health and more perceived stress (although lower survivor syndrome) at NTS.
- An increased experience with violence or harassment was predictive of greater job insecurity and greater frequency of poor work performance.

XB. Recommendations for Intervention

Together, these findings suggest possibilities for workplace interventions to mitigate the negative impacts on employee health and workplace functioning. In order to be most effective, an intervention design should address multiple levels of the organization and a variety of approaches.

- **Interventions can vary and should focus on a variety of targets for change.**

We identified prime areas for intervention and possible activities based on the findings at NTS and the five sites overall. Our recommendations incorporate information from new research on prevention and reduction of workplace stress. Ganster has identified the importance of identifying and targeting multiple levels of organizational intervention. Interventions can target policies or structural changes, procedures or group functioning, or the individual (Ganster, 1999).

We grouped our intervention recommendations by the level of the organization on which they focus.

Policy/structural

1. Develop more mechanisms for employee participation and involvement in decision making to address problems identified by our study. Sites can use existing employee groups and bargaining unit groups and can create new employee involvement teams as needed.
2. If future downsizing or other significant organizational changes are anticipated, devote even more resources to developing processes and policies that emphasize clear and consistent procedures, and open, timely, and honest communication.
3. Prepare and train managers who must plan or implement a downsizing or restructuring.
4. Engage employees in planning any future organizational change to provide information, help create plans and assist in implementing decisions. Again, existing and new employee groups can be utilized.
5. Develop flexible work schedules to respond to employee concerns about workload, work demand, poor work-home balance and long commute.
6. Review and, if necessary, work with existing systems to address employee-management problems, as well as complaints about unfair organizational or downsizing practices.⁴⁵

⁴⁵ While creating a dispute resolution system is a structural response to workplace issues, in its implementation it can either focus on the individual and single cases or cases can be viewed in their entirety as a way of understanding systems issues.

7. Determine if workplace violence and harassment are prevalent, consider how to handle possible increases as a result of downsizing and enhance the policies regarding workplace violence (how supervisors should handle it, preventive programs, support for those who experience it, etc.).

Procedures/group functioning

1. Establish mechanisms to closely monitor work demands and elements of job control, particularly immediately following significant changes to a work unit or to the site.
2. Offer training for managers on: effective supervision, providing support, communication styles, communicating respect, and listening skills, etc.
3. Involve work groups in identifying stressors and ways to address them.
4. Offer programs intended to reduce factors that lead to violence, harassment and discrimination as a way to improve the health of survivors.
5. Provide employee training on workplace diversity and the impact of harassment or discriminatory treatment on individuals and the work environment.
6. Determine whether climate or other physical changes for a group will assist with an employee's ability to get his/her job done.
7. Establish programs that encourage employees to respond to workplace change openly (e.g., seminars that target survivor syndrome and other noted responses to change).

Individual level interventions

1. Work with employees to analyze and, if needed, improve the design of jobs or workstations.
2. Implement stress reduction or exercise sessions.
3. Provide sessions for people who have to implement the downsizing.
4. Provide counseling sessions for those who have experienced workplace violence.
5. Allow for employee input into the design of one's day and approach to work tasks.
6. Establish clear, non-discriminatory policies for EAP participants.

In addition to our research findings, many studies have documented the link between job strain and cardiovascular disease. A recent study looking at changes in psychological distress during a two year downsizing process identified co-worker support and job influence as protective factors and higher job insecurity, strain and role ambiguity as contributors to psychological distress (Woodward, et. al., 1999). This indicates, for example, why it is important to address those variables that contribute to job insecurity as they may also result in negative psychological health effects. Indeed, at the Nevada Test Site we noted overlap in the variables that were predictive of job insecurity and one or more of the three psychological health outcomes, particularly fairness, job strain, and workplace violence.

On the policy level, a recent study documents that over the course of a downsizing event hospital personnel reported worsening perceptions of the quality of patient care and the hospital's commitment to quality care and quality improvement, as well as more negative perceptions about their employer and management-employee relations (Woodward, et. al., 1999). These findings suggest the importance of leadership and attention to management-employee relations during times of structural change.

- **EAP programs can do more to mitigate poor mental health outcomes.**

Information collected about the employee assistance program coupled with findings of vulnerability to stress during times of organizational change provide direction for EAP programs. Interventions aimed at mitigating poor mental health outcomes must:

- work with those implementing the downsizing to ensure that procedures and interactions are perceived as fair and consistent;
- target the susceptible employee population (and those with most direct impacts) including those implementing downsizing and work units that have been restructured or where people have seen many colleagues laid off;
- involve the at-risk worker population to develop and implement workshops; and
- introduce programs and workshops early on in the workplace change event.

A complicating factor in using EAPs as a resource during workplace change, particularly at DOE sites, is that employees may be reluctant to seek mental health services for fear of losing security clearance. Some sites, like Pantex and Y-12, have chosen to use off-site EAP providers to disassociate the service from the site (DOE will still go to the EAP to check mental health histories as threats to national security). It may be useful for DOE and contractors to clearly communicate the policies regarding seeking mental health services and renewing clearance.

XC. Next Steps

- **Boston University School of Public Health can develop intervention programs to address research findings.**

A workplace intervention project designed to reduce employee stress and improve health and workplace functioning can be approached in several ways. Boston University School of Public Health proposes to work with one of the study sites to develop such an intervention project. The intervention will address key factors at the identified site that appear most related to negative health and organizational outcomes and will promote factors identified as protective to individual health and organizational functioning. The intervention will include comparison groups and have a strong evaluation component.

An intervention model that has been identified as particularly successful in achieving positive outcomes is the participatory model. Companies are increasingly turning to employee teams to address workplace concerns, acknowledging the high quality decisions and the likelihood of follow-through. Stakeholder involvement leads to greater commitment and therefore likelihood of higher participation as well as interventions that are more suited to a particular group given the participation of local experts (Lawler III, 1986; Israel, et. al., 1986; and May and Schworer, 1994).

In such a participatory model, teams of employees review the findings and help to create interventions and solutions best suited to their workplaces. An employee involvement approach may help a site to avoid the sense that they are simply trying to

figure out ways to lay off individuals in a more efficient or cost-effective manner, but rather are trying to improve work quality of life, job control and health and safety.

Each intervention element must be: 1) grounded in research findings from this and other studies; 2) linked to a theoretical construct (with expected target behavior or perception identified); 3) specific in scope and target; and 4) coupled with expected changes and means for measuring those changes. It is possible that some structural or policy interventions will be developed outside the scope of these teams to be implemented in one or more of the experimental groups.

XD. Topics for Further Inquiry

Several areas for additional research emerged from our study. Some of the areas for further inquiry are listed here.

- **Theoretical**

- Understand the natural history of the effects of downsizing and other organizational change on health using a longitudinal study design.
- Understand the phenomenological issues of naming and classifying the elements of organizational change.
- Explore the statistical relationships between perceived fairness of the downsizing process and health and organizational functioning in a longitudinal study.
- Conduct further interaction analyses looking at whether the downsizing fairness scale (instead of downsizing rate) interacts with other variables in influencing the health and organizational related outcomes.

- **Methodological**

- Develop new measures of downsizing and decisions about how to classify individuals who may, for example, retain a job but be shifted to a new employer (e.g., is this someone who has been downsized or is this a survivor?).
- Develop ways to measure organizational restructuring and other changes.

- **Multi-level Intervention**

- Test hypotheses about the importance of voice, control and communication and role of union membership using an intervention model.

- **Outcome Issues**

- Test the impact of downsizing and other changes on usage of medical and EAP services and estimate the impact of these changes on employee psychological and family concerns.
- Determine and understand barriers to using EAP counseling.
- Develop a better way to identify and measure incidence of violence and harassment.
- Develop and implement a monitoring program to identify discrimination.

ACKNOWLEDGEMENTS

“The Prevention of Stress and Health Consequences of Downsizing in the Nuclear Defense Industry” was a five-year research study (October 1995 - September 2000). The National Institute for Occupational Safety and Health (NIOSH) sponsored the research under a Memorandum of Understanding between the Department of Energy (DOE) and the Department of Health and Human Services.

The conclusions and views are those of the Principal Investigator, Dr. Lewis Pepper, and other authors at Boston University School of Public Health. Many people contributed to this research over the past five years. At the beginning of our report we acknowledged the more than 6,000 employee participants and some individuals from this study site who offered substantial assistance.

Two experts in the field of psychology and work stress reviewed this report, offering comments on the adequacy of the data and statistical methods as well as the accuracy of the conclusions. We wish to thank Joel Brockner and Soo Yee Lim for agreeing with NIOSH to undertake this peer review. We received excellent editorial assistance from Randy Garber.

The following is a list of some individuals from Boston University School of Public Health (BUSPH), NIOSH and DOE who assisted with this research:

BUSPH

Current research team:

Lewis Pepper, Principal Investigator	Miriam Messinger, Project Manager
Leslie Boden, Co-Principal Investigator	Molly Jacobs, Research Assistant
Janice Weinberg, Biostatistician	Jean Cantey-Keiser, Data Analyst
Christine Lloyd Traviglini, Data Programmer	
Emmanuel Entekop and Lou Donato, Student Researchers	

Additional assistance earlier in the study (BU staff and consultants):

Eileen McNeely, Original Project Manager	Pamela Kocher, Research Assistant
Lisa Sullivan, HLM Advisor	Libby Samaris, Focus Group Facilitator
Tom Mangione, Survey Development	Jody Lally, Research Staff
Jacqueline Ashba, Data Programmer	Casey Zuckerman, Student Researcher

NIOSH

Larry Murphy, Project Officer	Marcus Wilkins, Fiscal Oversight
Travis Kubale, Communication Specialist	Soo-Yee Lim, Research Advisor
Michael Colligan, Human Subjects Review Board	

DOE

Gerald Peterson, Epidemiologist, Environmental, Safety and Health Staff of the Office of Worker and Community Transition (OWCT), including Marilyn Balcombe, Terry Friese and Laurel Smith

REFERENCES

1. Agar M.A. *The Professional Stranger*. New York: Academic Press; 1980.
2. Alexander S., Ruderman M. The Role of Procedural and Distributive Justice in Organizational Behavior. *Social Justice Research*. 1987;1(2):177-198.
- 2a. Amabile T., Conti R. Changes in the work environment for creativity during downsizing. *Academy of Management Journal*. 1999; 42 (6):630-640.
3. Association A.M. Workforce Growth Slows, AMA's 13th Annual Workforce Survey Shows. *More Hiring, More Firing, More Companies Doing Both at Once; Corporate Restructuring and Reengineering Result in Both Job Cuts, Additions*: <http://www.amanet.org/research/press.htm>; October 26, 1999.
4. Balcombe M., *Department of Energy Displaced Workers Survey Final Results*, 1995, Office of Worker and Community Transition, Dept. of Energy: Oak Ridge.
5. Brockner J. The Effects of Work Layoffs on Survivors: Research, Theory, and Practice. In: Barry Straw, L.L. Cummings, ed. *Research in Organizational Behavior An Annual Series of Analytical Essays and Critical Reviews*. Greenwich, Connecticut: JAI Press; 1988.
6. Brockner J., Grover S., Reed R., DeWitt R., O'Malley M. Survivors' Reactions to Layoffs: We Get By With a Little Help From our Friends. *Administrative Science Quarterly*. 1987;32:526-541.
7. Brockner J., Wiesenfeld B., Martin C. Procedural Justice and Survivors Reactions to Job Layoffs. *Organizational Behavior and Human Decision Processes*. 1995;63:59-68.
8. Cameron K.S., Freeman S.J., Mishra A.K. Downsizing and Redesigning Organizations. *Organizational Change and Redesign*. 1993:19-63.
9. Caplan R.D., Cobb S., French J.R.P., Van Harrison R., Pinneau R. *Job Demands and Worker Health*. Washington D.C.: NIOSH Publication; 1975.
10. Cascio W., Young, C., *Corporate Downsizing: A look at the last 15 years*, 1996, U.S. Department of Labor:
11. Cascio W.F. Learning from Outcomes: Financial experiences of 300 Firms that have Downsized. In: Gowling M., Kraft J., Quick J.C., eds. *The New Organizational Reality: Downsizing Restructuring and Revitalization*. Washington DC: American Psychological Association; 1998.

12. Denzin N. *The Research Act*. New York: McGraw Hill; 1978.
13. Dowd S.B., Bolus N.E. Stress Resulting from Change and Restructuring: A Cognitive Approach. *Family and Community Health*. 1998;21(2):70-78.
14. Ferrie J.E., Shipley M.J., Marmot M.G., Stansfeld S.A., Smith G.D. An Uncertain Future: The Health Effects of Threats to Employment Security in White-Collar Men and Women. *American Journal of Public Health*. 1998;88(7):1030-1036.
15. Folger R. Distributive and Procedural Justice in the Workplace. *Social Justice Research*. 1987;1(2):143-159.
16. Fryxell G.E. Perceptions of Justice Afforded by Formal Grievance Systems as Predictors of a Belief in a Just Workplace. *Journal of Business Ethics*. 1992;11:635-647.
17. Ganster D. Presentation at the American Psychological Association meeting. Baltimore, MD; 1999.
18. Greenberg J. Organizational Justice: Yesterday, Today and Tomorrow. *Journal of Management*. 1990;16(2):399-432.
19. Henkoff R. Getting Beyond Downsizing. *Fortune*; 1994.
20. Hurrell J. Are You Certain?- Uncertainty, Health, and Safety in Contemporary Work. *American Journal of Public Health*. 1998;88(7):1012-1013.
21. Hurrell J.J., Nelson D.L., Simmons B.L. Measuring Job Stressors and Strains: Where We Have Been, Where We Are and Where We Need To Go. *Journal of Occupational Health Psychology*. 1998;3(4):368-89.
22. Israel B.A., Schurman S.J., House J.S. Action Research On Occupational Stress: Involving Workers As Researchers. *International Journal of Health Services*. 1989;19(1):135-155.
23. Ivancevic J., Matteson M. Application of the Triangulation Strategy to Stress Research. In: Hurrell Murphy and Sauter, and Cooper, eds. *Occupational Stress: Issues and Developments in Research*. New York: Taylor and Francis; 1988.
24. Johnson J.V., Hall E.M. Job Strain, Workplace Social Support and Cardiovascular Disease: A Cross-Sectional Study of a Random Sample of the Swedish Working Population. *American Journal of Public Health*. 1988;78:1335-1342.
25. Karasek R.A.J. Job Demands, Job Decision Latitude, and Mental Strain: Implication for Job Redesign. *Administrative Science Quarterly*. 1979;24(6):285-308.

26. Kasl S.V. Methodologies in Stress and Health: Past Difficulties, Present Dilemmas, Future Directions. In: Kasl, Cooper, eds. *Stress and Health: Issues in Research Methodology*. Chichester, England: Wiley; 1987.
27. Kivimaki M., Vahtera J., Pentti J., Ferrie J.E. Factors Underlying the Effect of Organisational Downsizing on Health of Employees: Longitudinal Cohort Study. *British Medical Journal*. 2000;320:971-975.
28. Kozlowski S., Chao G., Smith E., Hedlund J. Organizational downsizing: Strategies, interventions, and research implications. In: Cooper, Robertson, eds. *International Review of Industrial and Organizational Psychology*: John Wiley & Sons Ltd.; 1993.
29. Lawler III E.E. *High Involvement Management*. San Francisco, CA: Jossey-Bass; 1986.
30. May D.R., Schwoerer C.E. Employee Health By Design: Using Employee Involvement Teams In Ergonomic Job Redesign. *Personal Psychology*. 1994:861-876.
31. McNeely E., *In the Shadow of the Organization: Work and Well-being on the Front Line. A Comparative Analysis of the Psychosocial Milieu of Work in Hospitals and Its Effect on Employee Health*. 1994, Brandeis University, Waltham, MA.
32. Moorman R., H. Relationship Between Organizational Justice and Organizational Citizenship Behaviors: Do Fairness Perceptions Influence Employee Citizenship? *Journal of Applied Psychology*. 1991;76(6):845-855.
33. Niehoff B., Moorman R. Justice as a Mediator of the Relationship Between Methods of Monitoring and Organizational Citizenship Behavior. *Academy of Management Journal*. 1993;36(3):527-556.
34. Noer D.N. *Healing the Wound: Overcoming the Trauma of Layoffs and Revitalizing Downsized Organizations*. San Francisco: Jossey-Bass Publishers; 1993.
35. OWCT, *Annual Report on Contractor Work Force Restructuring, FY 1997, 1998*, Office of Worker and Community Transition, U.S. Dept. of Energy: Washington, D.C.
36. OWCT, *Annual Report on Contractor Work Force Restructuring, FY 1998, 1999*, Office of Worker and Community Transition, U.S. Dept. of Energy: Washington, D.C.
37. Parker K.P., Chmiel N., T.D. W. Work Characteristics and Employee Well-Being Within a Context of Strategic Downsizing. *Journal of Occupational Health Psychology*. 1997;2(4):289-303.
38. Pearlin L. The Socological Study of Stress. *Journal of Health and Social Behavior*. 1989;30:241-256.

39. Pearlstein S. Down with the Organizational Chart. *The Washington Post National Weekly Edition*; 1993.
40. Rothman K.J., Greenland S. *Modern Epidemiology*. Philadelphia, PA: Lippincott-Raven; 1998.
41. Sauter S.L., Hurrell J.J., Fox H.R., Tetrick L.E., Barling J. Occupational Health Psychology: An Emerging Discipline. *Industrial Health*. 1999;37:199-211.
42. Schnall P.L., Landsbergis P.A. Job Strain and Cardiovascular Disease. *Annual Review in Public Health*. 1994;15:381-411.
43. Sommer S., Luthans B. The Impact of Downsizing on Workplace Attitudes, Differing Reactions of Managers and Staff in a Healthcare Organization. *Group and Organization Management*. 1999;24(46-70).
44. Spradley J.P. *Participant Observation*. New York: Holt, Reinhart and Winston; 1979.
45. Tesch R. Comparing Methods of Qualitative Analysis: What do they have in common? Presented at the American Educational Research Association Annual Meeting; Washington, DC; 1987.
46. Vahtera J., Pentti J., *Employees in the Storm of Economy: Development of Psychosocial Work Environment between 1990-1997*, 1999, Finnish Institute of Occupational Health: Helsinki.
47. Van Yperen N.W., Snijders T.A.B. A Multilevel Analysis of the Demands-Control Model: Is Stress at Work Determined by Factors at the Group Level or the Individual Level? *Journal of Occupational Health Psychology*. 2000;5(1):182-190.
48. Woodward C.A., Shannon H.S., Cunningham C., et. al. The Impact of Re-Engineering and Other Cost Reduction Strategies on the Staff of a Large Teaching Hospital. *Medical Care*. 1999;37(6):556-569.

A. Section 3161 of the National Defense Authorization Act for Fiscal Year 1993

(Public Law 102-484, Oct. 23, 1992)

Subtitle E—Defense Nuclear Workers

**SEC. 3161 DEPARTMENT OF ENERGY DEFENSE NUCLEAR FACILITIES
WORK FORCE RESTRUCTURING PLAN**

(a) **In General.**—Upon determination that a change in the work force at a defense nuclear facility is necessary, the Secretary of Energy (hereinafter in this subtitle referred to as the “Secretary”) shall develop a plan for restructuring the work force for the defense nuclear facility that takes into account—

- (1) the reconfiguration of the defense nuclear facility; and
- (2) the plan for the nuclear weapons stockpile that is the most recently prepared plan at the time of the development of the plan referred to in this subsection.

(b) **Consultation.**—

- (1) In developing a plan referred to in subsection (a) and any updates of the plan under subsection (e), the Secretary shall consult with the Secretary of Labor, appropriate representatives of local and national collective-bargaining units of individuals employed at Department of Energy defense nuclear facilities, appropriate representatives of departments and agencies of State and local governments, appropriate representatives of State and local institutions of higher education, and appropriate representatives of community groups in communities affected by the restructuring plan.
- (2) The Secretary shall determine appropriate representatives of the units, governments, institutions, and groups referred to in paragraph (1).

(c) **Objectives.**—In preparing the plan required under subsection (a), the Secretary shall be guided by the following objectives:

- (1) Changes in the work force at a Department of Energy defense nuclear facility—
 - (A) should be accomplished so as to minimize social and economic impacts; should be made only after the provision of notice of such changes not later
 - (B) than 120 days before the commencement of such changes to such employees and the communities in which such facilities are located; and
 - (C) should be accomplished, when possible, through the use of re-training, early retirement, attrition, and other options that minimize layoffs.
- (2) Employees whose employment in positions at such facilities is terminated shall, to the extent practicable, receive preference in any hiring of the Department of Energy (consistent with applicable employment seniority plans or practices of the Department of Energy and with section 3152 of the National Defense Authorization Act for Fiscal Years 1990 and 1991 (Public Law 101-189; 103 Stat. 1682)).
- (3) Employees shall, to the extent practicable, be retrained for work in environmental restoration and waste management activities at such facilities or other facilities of the Department of Energy.

Appendix A

- (4) The Department of Energy should provide relocation assistance to employees who are transferred to other Department of Energy facilities as a result of the plan.
- (5) The Department of Energy should assist terminated employees in obtaining appropriate retraining, education, and reemployment assistance (including employment placement assistance).
- (6) The Department of Energy should provide local impact assistance to communities that are affected by the restructuring plan and coordinate the provision of such assistance with—
 - (A) programs carried out by the Department of Labor pursuant to the Job Training Partnership Act (29 U.S.C. 1501 et seq.);
 - (B) programs carried out pursuant to the Defense Economic Adjustment, Diversification, Conversion, and Stabilization Act of 1990 (Part D of Public Law 101-510; 10 U.S.C. 2391 note); and
 - (C) programs carried out by the Department of Commerce pursuant to title IX of the Public Works and Economic Development Act of 1965 (42 U.S.C. 3241 et seq.).

(d) **Implementation.**—The Secretary shall, subject to the availability of appropriations for such purpose, work on an ongoing basis with the representatives of the Department of Labor, work force bargaining units, and States and local communities in carrying out a plan required under subsection (a).

e) **Plan Updates.**—Not later than one year after issuing a plan referred to in subsection (a) and on an annual basis thereafter, the Secretary shall issue an update of the plan. Each updated plan under this subsection shall—

- (1) be guided by the objectives referred to in subsection (c), taking into any changes in the function or mission of the Department of Energy defense nuclear facilities and any other changes in circumstances that the Secretary determines to be relevant;
- (2) contain an evaluation by the Secretary of the implementation of the plan during the year preceding the report; and
- (3) contain such other information and provide for such other matters as the Secretary determines to be relevant.

(f) **Submittal to Congress.**—

- (1) The Secretary shall submit to Congress a plan referred to in subsection (a) with respect to a defense nuclear facility within 90 days after the date on which a notice of changes described in subsection (c)(1)(B) is provided to employees of the facility, or 90 days after the date of the enactment of this Act, whichever is later.
- (2) The Secretary shall submit to Congress any updates of the plan under subsection (e) immediately upon completion of any such update.

B. Background Literature

Workplace stress

What is work stress?

In a 1992 survey by Northwestern National Life Insurance Co., four out of 10 employees (40%) indicated that their jobs were "very" or "extremely stressful." The report, along with numerous similar corporate and public opinion surveys, found that the workplace is a significant source of stress for working Americans. The causes of such stress range from the anxieties produced by corporate downsizing, to factors that result in physical disorders such as carpal tunnel syndrome, to harassment and violence in the workplace, to tensions from or between work and home.

Although there is popular recognition and acceptance that work stress adversely impacts a workforce, there is much less agreement about what stress is, how it operates to impact health, and what aspects of health are actually affected by it. There are also problems with definition and taxonomy. Stress has been considered as an environmental condition, as an appraisal of an environmental condition, as a response to an environmental condition, and as a form of relationship between environmental demands and a person's abilities to meet the demands. Although there is much controversy about the epistemology of stress, there is agreement that it is a complex phenomenon related to health, in which the psychophysiological pathways between stressors and health outcomes are uncertain.

Stressors refer to the experiences, physical and psychological, that give rise to stress and include both events and chronic strains (Pearlin, 1989). While events may have direct effects on stress outcomes, they also produce indirect effects, or strains, in a particular system. In considering workplace-related stress, one must recognize that stressors may occur on multiple levels. For example, stressors may act at the job or individual level. In this setting, schedule, work pace, the physical work environment, and job content all can affect the worker. Stressors, such as role ambiguity, organizational structure (hierarchy), and lack of employee involvement, operate at the organizational level affecting the individual. Extra-organizational stressors, such as a globalizing economy and resultant job insecurity or downsizing, affect the individual through the constant representation of economic transformation in the mass media and the reality of competitive markets. Lastly, the impact of non-work stressors on working individuals, such as home life, children, and working spouses, appears to be growing.

How does stress influence health?

Each of these "classes" of stressors influence the stress process. While there is concurrence that these factors affect health, there is little agreement as to the method of their effect, the mode of interaction with each other, and ultimately what each represents and how to measure them.

Work stress research has attempted to examine the issues of cause, relationship, mechanism, and outcome. Investigators have described many environmental factors believed to be stressors such as overtime, shift work, and unemployment as well as psychosocial concepts such as overload, role conflict, and role ambiguity. Kasl has

Appendix B

attempted to characterize the essential elements of stressful work (Kasl, 1987). His taxonomy includes the following:

- a) Tends to be chronic rather than intermittent.
- b) There is external pacing of work demands by machines, payment mechanisms, or competition.
- c) Habituation or adaptation to the chronic situation is difficult and some sort of vigilance or arousal must be maintained.
- d) A failure to meet demands leads to adverse consequences.
- e) There is a spillover from work role to other areas of functioning.

This classification does not clarify the etiologic and mechanistic dynamic of stress.

Much research has been oriented toward developing an integrated model of stress that is capable of identifying and predicting which characteristics of work are stressful. This research, conducted over the last 40 years, contains two similar but distinct theoretical models. These two theories have attempted to integrate stress models from cognitive psychology and physiology.

What are the models for studying stress?

The Person-Environment (P-E) Fit Model, was developed in the early 1970s. Its main premise is that strain develops when there is a discrepancy between the demands of the job and the abilities of the person to meet those demands (demand-ability dimension), or between the motives of the person and the environmental supplies to satisfy the person's motives (motive-supply dimension) (Caplan, et al., 1975). Dimensions measured include workload and job complexity. Motives include income, participation, and self-utilization. Supplies refer to job benefits such as income sufficient to satisfy the motives of the individual.

The model distinguishes the objective environment and person from the subjective environment and person, where subjective refers to the perceptions of the individual. Strain then arises due to poor fit between the subjective person and the subjective environment. The major emphasis of the P-E Fit model is on the subjective perception. The model does not acknowledge the role of objective workplace stressors other than their influence on a worker's perceptions. Some researchers have criticized the P-E Fit model because of its limited ability to predict what work conditions are likely to result in stress.

The Job Demand-Control (D-C) Model posits that strain results from the characteristics of work, rather than from subjective perceptions of the individual worker (Karasek, 1979). Strain arises as the result of imbalance between demands and decision latitude (control) in the workplace, where lack of control is seen as an environmental constraint on an individual's response capabilities. The control dimension consists of two components that are usually highly correlated in job situations: personal control over decision making, and skill level and variety. In contrast to other models of job stress, the D-C model emphasizes that psychologically demanding situations alone do not cause adverse reactions of being stressed. Instead, a major factor is whether the individual has control over his or her actions in meeting demands. The D-C Model recognizes that the essential characteristics of a stressful work environment are that it simultaneously places demands and creates environmental constraints on an individual's response capabilities. The stressful work

Appendix B

environment highlights the imbalance between the demand and the response that leads to strain.

The D-C Model characterizes jobs by their combination of demand and control. For example, jobs with high demand and low control (waiters, VDT operators, and machine-paced workers) have high strain. These jobs typically have a high division of labor and a de-skilling of tasks. D-C researchers have demonstrated that jobs with high demand and high control have low strain.

This model, also known as the "job strain" model (as developed by R. Karasek) states that the greatest risk to physical and mental health from stress occurs to workers facing high psychological workload demands or pressures combined with low control or decision latitude in meeting those demands. Job demands are defined by questions such as "working very fast," "working very hard," and not "enough time to get the job done." Job decision latitude is defined as the ability to use skills on the job as well as the decision-making authority available to the worker. The "job strain" model emphasizes the interaction between demands and control in causing stress, and objective constraints on action in the work environment, rather than individual perceptions or "person-environment fit."

A number of computational forms of job strain have been used in the job strain literature (Schnall and Landsbergis, 1994). As will be described later, this study uses a quotient term (demands divided by latitude) to operationalize job strain.

Why study work stress?

The issue of job stress is of utmost importance to the public health community and working people. The economic costs of job stress in general (absenteeism, lost productivity) are difficult to estimate. As already mentioned, the health and financial impact of job stress has attracted the attention of corporate and public opinion researchers. A 1997 survey by Princeton Survey Research Associates found that "three-fourths of employees believe the worker has more on-the-job stress than a generation ago." A 1992 report by the St. Paul Fire and Marine Insurance Company concluded: "Problems at work are more strongly associated with health complaints than are any other life stressor—more so than even financial problems or family problems."

Job insecurity and health

Ferrie and the Whitehall group (studying British Civil Servants in a longitudinal study for over twenty years) in a 1998 article examined changes in the health status of British civil servants whose employment security was threatened (Ferrie, et al., 1998). As part of the ongoing Whitehall study, these researchers measured self-reported morbidity and physiological risk factors among workers in departments threatened with reorganization and downsizing compared with those from other departments that were not threatened. This longitudinal study demonstrated an adverse trend in self-reported morbidity as well as for physiological measurements such as cholesterol and anginal pain. These changes were not explained by changes in health-related behaviors among the subjects. This article demonstrated that the anticipation of job loss was associated with significant changes in self-reported complaints and physiologic parameters.

Appendix B

Downsizing literature

Downsizing, or large-scale layoffs, has been adopted over the last decade as a management tool with the purported aim of strengthening a company by means of reducing budgets and personnel.

Initial studies indicate that there may be significant organizational repercussions after a downsizing. A study by the American Management Association showed that 40% of organizations responding reported that productivity had sagged after downsizing, and nearly one fifth reported that quality had suffered. This study also documented a decline in morale (reported by 58% of companies) and greater employee turnover (American Management Association, October 26, 1999). As the economy improves, retention will become an even bigger issue.

What are the effects of downsizing on employees?

Within the field of psychology, David Noer has looked at outcomes from downsizing, with a focus on individual responses. Major findings include fear, insecurity, frustration and anger, sadness and depression, sense of unfairness, reduced risk-taking, and lowered productivity. Noer and others call this compilation of symptoms "survivor syndrome," a syndrome originally identified in studies of survivors of Hiroshima/Nagasaki and the Holocaust (Noer, 1993). A follow-up study of organizations implementing layoffs found that many of these symptoms persisted for five years although employees had become resigned to the outcomes (Noer, 1993). Henkoff also reported fear and anxiety, as reactions to downsizing as well as employees' concerns that they may be the next to lose their jobs (Henkoff, 1994). Sommer and Luthans found a decrease in organizational commitment, in trust among coworkers, and in job satisfaction following a downsizing event at a health care organization (Sommer and Luthans, 1999).

A few studies (summarized in Sommer and Luthans, 1999) found negative personal and job outcomes associated with downsizing. One study (Cameron, et al., 1993) found significant associations between downsizing and decreased morale and between downsizing and increased conflict in the workplace. Another study found negative impacts on interpersonal relationships, physical health, and emotional health (Kozlowski, et al., 1993)

Parker and colleagues studied the effect of strategic or planned downsizing on employee job satisfaction and job-related strain (Parker, et al., 1997). Employees in a company that had introduced planned employment changes were followed over a four-year period. Although measured demand increased, well-being and job satisfaction did not decrease. The authors concluded that the managed strategic downsizing actually improved employees' sense of control because of new work characteristics introduced as part of the reorganization. Therefore, the authors conclude, downsizing that is planned and not reactive and that includes employee involvement does not necessarily lead to adverse outcomes.

Finally, Woodward and colleagues measured changes in employee health and organizational function in a longitudinal study of a Canadian teaching hospital undergoing "re-engineering" and downsizing (Woodward, et al., 1999). The authors reported that measures of worker emotional health deteriorated, job demands increased

Appendix B

and coworker support decreased, and work distress spilled over into the out-of-work lives of many of the study participants. These employees participated in many of the planning activities for the organizational changes and downsizing. However, in contrast to the Parker study, Woodward reports significant health impacts on employees resulting from the planned and strategic changes.

Joel Brockner writes of varying relationships between job insecurity and productivity, with mild levels of insecurity enhancing productivity (Brockner, 1988). He discusses survivor syndrome in terms of its impact on relationships and organizations. Brockner writes extensively about fairness and reports that how employees react to a downsizing event is related to their perceptions of how fair and justified the action was (Brockner, et al., 1995).

Justice and fairness in the workplace

Research shows that perceptions of fairness are important in the workplace and should be considered as an independent variable when analyzing organizational functioning and health (Folger, 1987; Alexander and Ruderman, 1987; Fryxell, 1992; and Greenberg, 1990). Robert Folger discusses the cognition theory of justice in which employees are more likely to be resentful of an outcome if they believe there was a more fair or ethical way to achieve the outcome. Alexander and Ruderman found a significant association between perceptions of fairness and job-related attitudes of workers (Alexander and Ruderman, 1987). Both Fryxell and Greenberg see that justice is a complex concept and compare distributive and procedural justice. Distributive justice is concerned with the allocation of rewards and resources in an equitable manner (Niehoff and Moorman, 1993). Procedural justice focuses on whether employees believe that policies and procedures are determined and implemented in a fair and consistent manner (Niehoff and Moorman, 1993).

Greenberg cites a 1987 study by Sheppard and Lenicki in which managers describe fair and unfair treatment including items such as "providing adequate information before actions are taken" and "assigning challenging and meaningful work fairly" (Greenberg 1990, p. 405). This description sounds like another parameter of justice defined by Moorman and Niehoff as interactional justice (Moorman, 1991). The concept of interactional justice encompasses how workers are treated by management, employee involvement in decision-making, voice, respect, and fairness.

Concepts from the literature are used in this study

The Demand-Control Model is empirically applicable to study the effects of chronic strain in the DOE workforce. Changes in the DOE mission and the reduction of the workforce bring into question the effect of chronic strain in the organization. In particular: Will decreases in resources within the DOE increase worker demands? Will the prospects of involuntary layoffs undermine the control of workers? What effects will the "flattening" of the organization, as part of the downsizing strategy, have on the availability of support? Given that chronic strain results from the interplay of demand, control, and support, these are serious questions.

This study focuses on the health impacts resulting from a stressor's (downsizing) effects on an organization and its employees and the resultant individual and organizational strain. The D-C Model of organizational stress is attractive because it is clearly defined

Appendix B

compared to other organizational climate models. The Job Content Questionnaire (JCQ), the measurement tool for the model, includes scales for worker control (authority over tasks plus discretion over the utilization of skills), demands (psychological and physical demands), and social support (supervisor support and coworker support). These scales are included in this study as job strain (a compilation of demand and control), supervisor support, and co-worker support.¹

Job security is one of the organizational outcomes used in this study. We use several physical and mental health measures as outcomes. We do not test the relationship between job security and health in this study.

Downsizing is the stressor that we studied. We constructed a model to examine the impact of both the magnitude of the downsizing (measured as a rate) and the approach to downsizing (four scales to measure type of layoffs, process and individual experience). The outcomes we examine are variables mentioned in previous studies including job security, survivor syndrome, morale and work performance. We incorporated other key concepts (e.g., conflict, job satisfaction, etc.) as co-variates in our model.

Our study utilized two fairness scales. One is a four-item procedural justice scale in which we chose two interactional justice and two formal procedure questions from a 12-item scale (Moorman, 1991). In the survey section focusing on downsizing at the site (survey section E), we included a 14-item scale on the downsizing process. This scale includes tested questions on justice (seven items measuring formal procedures and interactional justice) as well as questions to elicit perceptions about the fairness of the downsizing process (three items on employee involvement and communication) and the outcome of the downsizing (four items on efficacy, retraining, and frequency).

¹ Other JCQ scales or items included are: noise exposure, toxic exposure, and job security.

C. Qualitative Data: Importance and Use

The importance of qualitative data

Ethnographic data, or descriptive information, which uncover patterns of employee culture, provide an important research strategy for studying questions and populations that may be inaccessible using other research techniques. Ethnographic methods produce in-depth and detailed data through direct quotation and careful description of situations, events, people, interactions, and observed behaviors (Agar, 1980 and Spradley, 1979). Interviews with key informants, work-site observations, and focus group discussions permit the researcher to understand the world as seen by the respondent within the context of the respondent's everyday life. This information provides powerful insight about the dynamics of situations, experiences, and relationships.

The use of open-ended survey questions, interviews, and focus groups to elicit DOE workers' perceptions of downsizing, restructuring, organizational culture, health, and performance encouraged more explicit explanations than our ongoing parallel research activity of the close-ended survey. The questions tapped the variables of interest for the study: How do employees characterize the effects of downsizing? What are the employees' understandings of the impact of downsizing on the work demands, control, and social support? How do employees perceive their health and performance to be affected by workforce restructuring?

Ethnographic methods yield different types of information

- Individual interviews are helpful in detailing individual perceptions, as they provide the opportunity to go into depth in a one-on-one setting.
- Focus groups are an efficient way to gain a wide range of information. Group discussions prod individuals to remember shared experiences and to compare ideas in reaction to the statements of others. Semi-structured focus groups also permit greater attention to the themes of the study (i.e., characteristics of downsizing, organizational culture, health, and performance) and allow generic issues to surface around pivotal points.
- Open-ended survey questions provide an opportunity to capture employee-volunteered comments in response to a broad request for 1) additional information regarding concerns not addressed in the close-ended survey questions and 2) thoughts on improving their work life. We will utilize responses to the second open-ended question in crafting an intervention project.
- Direct work site observations (tours) provide researchers with a context for employee perceptions and the means by which to interpret the correspondence between stated beliefs and behavior.

How qualitative data is summarized and analyzed

Qualitative research can produce a large volume of information that must be organized thoughtfully so as to take advantage of the breadth and depth of the data. The qualitative data analysis process requires careful methodology; it has to be systematic and goal-

Appendix C

oriented, reducing the qualitative information in such a way that it becomes distilled to its essentials, rather than simply diminished in volume, and leading to a result that others can accept as representing the data. This organizing scheme for extracting essentials is known as classification (Tesch, 1987). The outcome consists of the reduction or condensation of these data to a description that extracts the most important features of the phenomenon under study and explicates the patterns that are discovered. Ethnographic material has proved invaluable in improving instrumentation and scale reliabilities in other research that considered similar study variables (McNeely, 1994).

Programs for computer-assisted classification and analysis of text can be extremely useful tools for the management of qualitative data. We created custom-designed Filemaker Pro and Microsoft Access databases to assist us in housing, classifying, and analyzing qualitative data from the focus groups and open-ended survey questions. The analysis of the interviews was conducted by hand.

The use of qualitative data was particularly valuable for this study, where the intent is to understand the employee experience of downsizing and then develop an approach to downsizing resulting in dynamics that preserve the health and productivity of workers. The qualitative data, including interviews, focus groups, observations, were used in several ways:

- as a source of preliminary information on issues and dynamics at each site (interview data);
- to paint a more complete picture of each of the study sites (focus group data);
- to identify key constructs and themes for the quantitative survey instrument and, later, to refine questions;
- to prioritize the items for the survey and the statistical model; and
- to understand relationships uncovered in the survey and archival data.

The integration of the qualitative and quantitative data was particularly important, as it provided insights for answering our research questions.

D. Data Collection: Methods and Evaluation

Site selection

The initial step in the study was to select Department of Energy sites to include in the study. A letter of introduction was sent to regional DOE offices describing the study. During this time, DOE was designing a generic research protocol for notifying sites about research projects, which included getting approval from each site's human subjects review board. Applications were made to the human subjects review board of NIOSH, Boston University, and sites that had a functioning board.

An initial list of sites subject to 3161 downsizing was compiled. We wanted to include sites that differed on key variables including:

1. site mission
2. facility type (laboratory, production, clean-up site)
3. site size and location.
4. rate of union membership
5. downsizing rate and experience
 - rate of exposure
 - number and content of support programs for surviving and displaced employees
 - level of worker participation in the process

Important organizational considerations included a willingness to allow salaried and non-salaried employees to participate, availability of data, and management representatives open to an extensive research protocol including surveys and focus groups. We were only interested in sites that had or were expecting to experience downsizing.²

We attempted to collect demographic, work organization, and downsizing data from DOE headquarters and the site. Some data were either unavailable or not available for the population of interest. Phone interviews were conducted with stakeholders at the potential study sites. The purpose of these inquiries was to determine the feasibility of conducting the study at each location and to narrow the sample selection based on that information. We also completed a profile of the union activity/membership at each and made contact with all major bargaining units prior to site visits.

Funding for this study began September 30, 1995. At the end of June 1996 we delimited our sample to five sites: Pantex, Idaho, Nevada, LANL, and Rocky Flats. Subsequently, Rocky Flats was dropped from the study sample (issues of access and site cooperation) and the Y-12 Plant on the Oak Ridge Reservation was re-added, offering an example of a site with significant downsizing and other organizational changes (split contracts, new contractors, and outsourcing).

² The Pantex Plant in Amarillo, Texas was initially selected as a control site. Our first visit to Pantex was in November 1996. At that time, it was clear that they were going to have a downsizing event (which subsequently was carried out in early 1997).

Appendix D

Instrument development

We developed focus group guidelines as well as questions for site record review and preliminary phone interviews. We wrote an interview instrument with targeted questions for informants from different organizational areas (budget, safety, medical, employee assistance, etc.). The interview instrument was refined prior to each site visit to incorporate feedback and to include site-specific issues.

Site visits

The initial research efforts were site visits to collect the preliminary qualitative data. Generally, two to three research personnel attended each site visit and were often accompanied by personnel from NIOSH and/or DOE headquarters.

The goals of the visit were: 1) to develop on-site relationships; 2) to appreciate first hand the conditions in the environment that people connect with stress; 3) to collect via individual and group interviews current accounts of stress and downsizing; and, 4) to identify ways of measuring health and performance effects in the historical record.

In order to meet these goals, we undertook the following over the course of one five-day or two three-day visits:

6. interviews with top and middle management for the prime contractor and major subcontractors, particularly in divisions or departments of primary interest to this project (safety and health; occupational medicine; security; outplacement; public relations; and human resources, including benefits, compensation, staffing and diversity, among others);
7. meetings with data collectors and managers in the divisions of interest;
8. interviews with key DOE field or operations office personnel who work with the contractor on safety and health or personnel issues;
9. interviews with representatives of major unions and community groups;
10. focus groups of employees, divided by job category and representative of the job breakdown at the site (not at the Nevada Test Site); and
11. a community meeting to allow family members, former workers, and other community members the opportunity to contribute to the study.

Interviews

Interviews were used to gather information about:

- the structure of the site;
- processes and policies related to downsizing, personnel or other issues;
- data availability; and
- individual perceptions of downsizing.

Some of the interviews were with individuals responsible for managing the data that was important for our study. We collected sample records to determine the format and availability of records from 1991 through June 1998. We also collected policy statements and reports related to study issues.

Appendix D

Community meetings

Community meetings allowed us to disseminate information about the study more widely and to collect perceptions, ideas and critiques from family members, former employees and the general community. We sponsored community meetings in four of the study communities (Oak Ridge, Tennessee; Los Alamos, New Mexico; Amarillo, Texas; and Idaho Falls, Idaho), each attended by 15-30 people. No meeting was organized in Las Vegas but a meeting was scheduled with some former workers.

Focus groups

As described in the body of this report, focus group research was a key data element in this study. We conducted focus groups at four of our five sites: INEEL, Pantex, Y-12, and LANL. We did not conduct focus groups at NTS as the initial (and only) site-visit for qualitative data collection was in March 1998, just prior to administering the completed employee survey. In place of a focus group, the site visit team held a discussion group with representatives of the Southern Nevada Building Construction and Trades Council (SNBCTC).

Worker communication and notification

Discussed in the body of the report.

Evaluation of initial research and data collection

There were extensive process evaluation measures throughout this research protocol. All steps were clearly documented, the rationale for decisions and changes to the protocol was recorded, and participation levels at each stage were summarized. The project managed the funds allocated to this study in an efficient manner. We used a participatory evaluation methodology. Formal and informal feedback from site contacts, study partners, and study participants was always solicited and was of critical importance. Our protocols and instruments were designed collaboratively with input from people at each site during the design process so that the research would be relevant to the concerns and interests of the affected population.

Site contacts (contractor management, local DOE management, and union leadership) made suggestions about how best to approach their employees, language and methods that would be more or less successful at their site, and constructs pertinent to their work experiences. Site Institutional Review Boards, medical directors, and others in upper management reviewed the employee survey and plans for administration. Our research partners and funders--NIOSH and the DOE--offered input throughout the process and the human studies review boards of both entities reviewed the study protocol annually.

The greatest challenges during this phase of the research were to meet deadlines and establish site participation and access agreements. While DOE expects contractors to participate in DOE-related health studies, some contractors were unclear as to how to fit

Appendix D

these requirements into their contracted work.³ Timelines were continually pressed because of the number of contacts needed to finalize plans and competing work demands on our points of contact. Conducting a study in a high-security environment is challenging, particularly, when study personnel do not have government security clearance.

Our status as outsiders in this system had contradictory effects. On the one hand, it made some contacts wary of sharing data while on the other it encouraged greater honesty from some as we were perceived as neutral. Other structural hurdles at some sites were getting access to human resources personnel given that our central contacts were environmental safety and health professionals, and educating our contacts about this non-traditional exposure study.

Overall, this research yielded the information needed to develop and edit the employee survey and to proceed with further archival data collection and the data analysis. Some specific challenges and actions taken during this phase of the project are highlighted below.

- Some contractors were not receptive to the study and the incumbent commitment of resources.

We dropped one study site after almost a year of attempting to secure cooperation and replaced it with Oak Ridge. Oak Ridge/Y-12 Plant under the leadership of LMES was perhaps the easiest site at which to arrange access and participation, because contractor management were receptive and contractor and local DOE study contacts were exceptionally helpful.

- No obstacles were encountered in conducting interviews or focus groups. At the five sites, attendance at focus groups of invited employees ranged from 20% to 50%. We attributed this mainly to unexpected changes such as shift in work schedule, conflicting work requirement, or sick time. While we recognize that self-selection for participation influences the outcome, participants had a wide variety of work experiences and opinions about the downsizing process and researchers used summaries of the groups to identify themes rather than relying on each voice as objective finding.

³ We began this study while a new DOE protocol for human studies was being developed; copies were then distributed to sites but the information did not filter down to all study contacts.

Appendix E

E. The Boston University Workplace Survey

Sections and scales, summarized

1. Job information

management level	job category	site and job tenure
shift	pay/union status	hours worked
work with other groups		second job

2. Job characteristics

job demand	role ambiguity	feedback quality
job security	violence at work	toxic & noise exposure
job control (skill discretion, decision authority)		

3. Organizational factors and climate

supervisor and co-worker support		morale
innovation	mission	organizational commitment
justice	conflict resolution	communication
DOE relations	safety	

4. Individual experiences (of the workplace)

work performance	matrixing structure	workload dissatisfaction
job satisfaction	perceived stress	stress index

5. Organizational change

goals of the downsizing		opportunity
skill loss		survivor syndrome
downsizing experience		downsizing process/fairness

6. Health information

medical conditions		medical symptoms
general health inventory (SF-12, physical and mental health components)		
health behaviors (drinking, tobacco use)		

7. Demographics

gender, race/ethnicity, age group, marital status		
spouse's work life		# of children
income		health insurance status

Appendix F

F. Survey Sampling and Administration Protocols for the *Boston University Workplace Survey*

Survey Sampling

1. Sample size

The survey was conducted at five sites, sampling employees from six prime contractors and two subcontractors at the five sites.⁴ We initially set the sample size at 10,000.⁵ Based on the total population at the five sites we set the sampling fraction at 42%. The number of employees sampled at each site, by contractor, is listed below.

Site	Contractor	Sample size/(%)	total # of employees
Pantex	Mason & Hanger	1,180 (44.5%)	2,861
	Subsample: BSI	94	
LANL			
	University of CA. Regents	2,793 (42.7%)	6,535
	PTLA	206 (47.9%)	430
	JCNNM	529 (44.0%)	1,203
INEEL	LMITCo	2,368 (42.3%)	5,596
NTS			
	Bechtel Nevada	921 (45.1%)	2,092
	Wackenhut	113 (55.1%)	205
Oak Ridge	LMES	2,442 (42.6%)	5,733
TOTAL	5 sites/ 8 contractors	10, 646 (43.2%)	24,655

2. Database for sampling and tracking/mailing

We requested that each contractor send us a database of all their current employees and include the following fields: name, address (building and/or mail stop), level 3 (name of division or department), level 2 (name or code for work group), gender, race/ethnicity, age, and phone number. Some contractors did not include demographic information and instead provided us with summary data for the site for gender, race/ethnicity, age groups,

⁴ A third subcontractor, the MK Ferguson company at Oak Ridge, was not included in the survey sample because more than 60% of their employees are seasonal and/or contractual employees. We decided to not include MK Ferguson in the survey because 1) as a construction subcontractor their organizational structure and work force were significantly different from the other eight contractors and 2) we would not be able to adequately ensure confidentiality given the small pool of permanent employees (170).

⁵ Subsequently, we altered the parameters of employees to be included at the Oak Ridge site, increasing the pool from employees affiliated just with Y-12 operations to all Lockheed Martin Energy Systems employees. This increased the pool of people to be sampled from ~3,500 to 5,733 with a sample of approximately 1,000 more employees than initially anticipated.

Appendix F

and percent of work force that is unionized. Most files were dbf or Excel files. After we drew a sample, the sampled names were entered into the Access Database used to send mailings and monitor returns.

3. Sampling process

a) Deciding on functional units for analysis

We analyzed data using a hierarchical linear model, in order to look at findings on multiple levels including individual, organizational, and contractor/site. At each site, we determined a suitable organizational level for sampling, referred to as level 3. We looked for a level wherein most of the units would have at least 20 employees.

Level 1 is the individual, level 2 is similar to a workgroup (reporting to only one supervisor), and level 3 is usually comprised of several workgroups or sections (called division, department, directorate). Given that each contractor uses different organizational language, we employ the term level 3 for the sampling unit. The survey questions are generally geared at level 1 (individual) or level 2 (group) with some referring to the whole site.

b) Exemptees

Prior to sampling, names of employees to be exempted were removed. Employees not eligible to take the survey included:

- those who had taken a pilot test of the survey during one of our visits to the site;
- points of contact and those who had signed the cover letter and/or reviewed the survey for approval (IRB contacts, general managers, union leaders, etc.); and
- at Pantex, those who had previously participated by taking the BSI survey were removed from the general pool as we planned to mail surveys to them separately under a different protocol.

c) Merging level 3s

Prior to sampling, level 3s with fewer than 20 employees were merged to create a larger unit wherein we could better protect confidentiality. Merges were based on one or both of the following parameters:

12. Selected level 3s report to the same higher group or manager.

13. Selected level 3s have similar functions.

The first step was to merge level 3s with fewer than 20 employees. When that was not possible, or to accomplish the parameters listed above, we merged a small level 3 into a level 3 with more than 20 people.

d) Sample

We sampled approximately 42% of employees with each of the eight contractors (exact fractions are listed above). The number to be sampled from a given contractor was determined and the sample was then drawn by level 3 according to the following rules:

- if level 3=20, take all employees
- if level 3>20, take a fraction of employees (or 20 if fraction <20) (fraction was determined based on the number of employees at the site, the number to be sampled, and the number and size of level 3s)
- for level 3s that have <20 employees
 - group smaller level 3s (see above)
 - sample the appropriate number based on rule 2 (fraction of merged group)

Appendix F

4. Organizational codes and survey labeling

The organizational code is the code to identify the sampling unit and it is labeled on the outside of the survey and then becomes part of the unique identifier. The organizational code is comprised of up to six characters. To maintain confidentiality, we assigned a letter to each level 3. The code includes the site-specific level 3 organizational name (i.e. Department, Division, Section, Directorate) followed by an alphabetical character (A-YY), unique for each level 3. For example, human resources division would be labeled Division A (or DIVA). Level 3s that were merged were labeled with the same code. In addition, the organizational code identifies the level 2 only if more than 13 people were sampled in a given level 2; in this case a number is appended to the level 3 label (e.g. Division A01), otherwise the spaces are held by "ZZ" (e.g., DIVCZZ).

When surveys were returned, an individual identifier was assigned and entered into the survey database with all other data. When a postcard was returned, the mailing database was updated. There is no way to connect the mailing database and the survey database. The full organizational identification code identifies the organizational unit but not a person. It consists of 12 characters:

- 1 first initial of site (P, L, I, N, or O) and
- 2 first initial of contractor (M, U, J, P, L, B, W, or L)
- 3-8 org code (letters and numbers) from one to six characters as described above
 - If ORGCODE < 6 characters, "Z" will be used at end to hold remaining places
 - if an individual removes the org code from their survey, it is coded "ZZZZZZ"
 - the letter (and number) is preceded by (DIR, DEP, SEC or DIV)
- 9-12: individual identifier 0001-9199 with numbers assigned by site.

PANTEX	0001-0999
And BSI	9001-9199
LANL	1000-3999
INEEL	4000-5999
NTS	6000-6999
Y-12/OR	7000-8999

e.g. code: **NBDEPAZZ6253**
Nevada Test Site (N), Bechtel Nevada (B)
org code/level 3: Department A (DEPA) survey# : 6253

5. The Nevada Test Site Sample

Bechtel Nevada Sample

There are 25 departments (level 3s) and 2,092 employees.

There are 15 sampling units (13 level 3's with < 20 employees).

We created 3 sampling units from the 13 based on similar functions (mostly executive/director level) and that they report to the same manager.

Sample size = 921 Returns= 627

Appendix F

Wackenhut Security, Incorporated (WSI) Sample

There are 11 sections (level 3s).

There are 4 sampling units (9 levels 3's with < 20 employees)

We created 2 merged sampling units based on similarity of reporting and level of function.

Sample size = 113

Returns= 72

Survey administration

The Boston University Workplace Survey was administered to contractor employees at our five DOE study sites, and subcontractor employees at Los Alamos National Laboratory (Johnson Controls Northern New Mexico (JCNNM) and Protection Technology of Los Alamos (PTLA)) and the Nevada Test Site (Wackenhut Security Inc. (WSI)).

Administration began July 1, 1998 and was completed in November 1998.

We presented management with three options for administering the survey (March 1998.) Balancing issues of cost, confidentiality, and response rates, management from all sites decided upon a survey that would be mailed to employees at work for completion during work time.

Survey packets were boxed and shipped to a designated site contact and distributed to employees via internal mail. The survey packet consisted of the following:

- Cover letter --signed by contractor and subcontractor managers, DOE Operations Office manager, site medical director, and union leaders
- Informed consent form
- *Boston University Workplace Survey*
- Tracking postcard (business reply mail)
- Return envelope (business reply mail)

Participants were instructed to mail the survey in the envelope provided and to send the tracking postcard separately. An employee's name and study ID# were printed on the tracking postcard as the sole means to determine whether to send reminders.

All tracking postcards were logged into the tracking database within one day of being received. Reasons for not completing the survey (communicated on the tracking postcard, in letters or on returned surveys) were also recorded in the database.

Reminders sent to increase response rates

A series of three follow-up mailings were used to increase response rates. The mailings were staged 10 days, four weeks and seven weeks from the initial mailing. The content of each follow-up mailing is described below:

Mailing 2: Reminder/Thank you postcard

Mailing 3: Same contents as original mailing with new cover letter

Mailing 4: Reminder Letter

Mailings #3 and #4 were only sent to individuals who had not returned their tracking card indicating a returned survey. Because the tracking card was our primary method to indicate a returned survey, anyone who 1) returned a survey without also sending the

Appendix F

tracking card, 2) included the tracking card with their survey, or 3) whose postcard was lost in the mail, also received a follow-up mailing.

Survey mailings to NTS employees

Mailing #1: August 19

Mailing #2: August 27

Mailing #3: September 22

Mailing #4: October 16

Survey publicity and promotion

In addition to the follow-up mailings, a series of employee notification methods were used to publicize the survey in and around the time of the first mailing. Increasing employees' awareness of the study and reminders were thought to boost participation. Methods used at each site varied slightly based on available mediums and are described in detail in the site-specific administration section. The general content of the publicity protocol and rationale for each piece is listed below:

- *Press Release in site newsletter, one month prior to first mailing*
Purpose: To provide an update on the status of the project and to inform employees of the up-coming employee survey.
- *Updates to union leaders about survey*
Purpose: To keep union leaders apprised of the survey status and ask that they encourage their members to participate.
- *Press Release in site newsletter, one to two weeks prior to mailing #1*
Purpose: To announce the survey mailing and staff site visit
- *All employee e-mail, one day prior to employees receiving mailing #1*
Purpose: To notify employees that surveys should be in their mail boxes and provide location and times of project staff's site visit.
- *Local press news release, day of site visit*
Purpose: To inform the general community about the study and to emphasize the importance of employee participation in the survey.
- *Site Visit, two to five days after employees received the first mailing*
Purpose: To be available to address employee questions and concerns, and collect completed surveys.
- *Bulletin board announcements posted, one week after mailing #1.*
Purpose: To provide a visual reminder to employees to fill out and return the survey

Publicity Methods at NTS

- Site Lines press release #1, July edition
- Site Lines press release #2, August edition
- All Employee email, Bechtel Nevada August 19
- Administrative employee email, Wackenhut Services Inc, August 19
- Protective Services briefing, WSI August 19-26
- Site Visit: August 25, 26 (Les Boden)

G. Archival Data Collection, Rate Calculation and Evaluation

Purpose and process for collecting archival data

During the first few site visits to Pantex and INEEL, we reviewed extensive records to determine those “objective” organizational data that would be useful for the study. We were interested in archival records that were relatively complete in paper or electronic form for the study period (1991-1998), that were considered to be well kept by the record keepers, and that might shed light on health and safety changes related to organizational change. The records we reviewed⁶ had numerous limitations.

Based on the model for analysis and contractor responses to data availability requests (sent spring 1998), we established guidelines for selecting data sets to pursue:

- summary data must be available from (or attributable to) the level 3 work unit (and ideally at level 2) utilized in the survey sampling protocol;
- data sets must be available at all five sites;
- monthly or quarterly data must be available (preferably monthly);
- data should be available for the entire study period (January 1991-June 1998) or for as many years as possible.

From the original list of data sets, we eventually pursued these five areas from the contractors:

1. sick time/paid time off data;⁷
2. overtime usage;
3. downsizing data;
4. accident and illness data; and
5. Employee Assistance Programs information and data

The specific data elements, reason for inclusion, and intended use of each data type are described below. Based on results of the initial research into this organizational outcome data, we chose not to pursue data on employee concerns (including labor relations/union grievances) or absenteeism. Regional economic indicator data was also pursued from publicly available sources.

Defining, collecting, and preparing data sets

We solicited organizational outcome and other archival data from the main contractor at each site, plus a total of three other sub- or additional prime contractors: Johnson Controls Northern New Mexico (JCNNM) and Protection Technology Los Alamos (PTLA) at Los Alamos National Laboratory (LANL), and Wackenhut Security (WSI) at the Nevada Test Site. Data was requested for January 1991 through June 1998. In some cases the entire

⁶ Records reviewed during initial visits were: medical records, health claims data, worker compensation claims, sick leave data, safety and regulatory affairs data, employee assistance program data, employee grievances, EEO records, outplacement data, procurement records, human resources data including employment levels and attrition, and downsizing data (reports, numbers, support program information, outplacement program data).

⁷ At two sites, sick time is part of a paid leave or paid time off policy. We collected paid time off data when no sick leave information was available. While these raw numbers measure different phenomena, we felt we would be able to utilize the data for within site analyses although not for comparison with other sites.

Appendix G

- county level unemployment data
- per capita income by county and
- local housing data (average house price, changes over time)

Data was collected from the US Census Bureau and state departments of labor. This data is used only for background information but was not included in the cross-site model because there were too few observations in the model.

Evaluation of quantitative data collection process

Appropriate steps were taken to solicit input into the development of the survey instrument. We believe (and received feedback) that the survey covered the most important issues related to downsizing and health as specified in the literature and identified by site participants.

Response rates for mailed surveys can be quite low, yet it was the only administration method acceptable to site management at the five sites. We developed a system where employees used work time to complete the survey as a method of increasing participation. We also included systems to preserve anonymity of responses as well as several rounds of follow-up to non-responders to achieve our goal of a 50% response rate.

Overall, we attained a response rate of 54% with nearly 60% at three of the sites. The response rate was lowest at Oak Ridge (48%). The low rate may reflect the fact that Oak Ridge was the only site in the middle of restructuring activities at the time of the survey (both a contractor change and downsizing). The immediacy of the issues had the potential to lead to greater participation or lower participation as people are more preoccupied with their work and the changes around them. We received comments from employees as to why they or others would not complete the survey. Reasons mentioned included: feeling "over-surveyed", concerns about confidentiality despite assurances from researchers, fear of ones supervisor hearing or seeing the responses and potential repercussions, particularly during a period of downsizing.

It appears as though communication strategies to publicize the study and survey reached the intended population, although we did not conduct a formal assessment of notification methods.

There were significant challenges regarding the collection of archival data at study sites. These are sites that have and continue to undergo tremendous change. These changes have an impact on continuity of data, continuity of staff, and the amount of time our contact people have to assist us on this project. We made final determinations about which data sets to collect based on what was of greatest relevance to the study and what we could collect electronically,⁸ for some period, at all five sites.

The contractor changes at two of the five sites meant that organizational outcome data was not available in a consistent format across the study period for those sites (INEEL and NTS). At Y-12, restructuring and shifting of some employees to a new contractor had similar results: the 1998 LMES population is not easily traceable back in time as it includes employees who were previously at a central administrative branch that served several operations besides Y-12 and are now part of Y-12.

⁸ It was not feasible, given a limited budget and personnel, to review paper records.

Appendix G

Specific challenges included:

- Data collection, particularly data from 1991-1995, took longer than anticipated to retrieve.
- It was difficult to trace data from defunct organizational units to the current organizational structure. Research staff worked with site experts to determine how to further aggregate or dis-aggregate data, tracing departments that had been merged, renamed or phased out.
- Some data sets that we chose to collect have complicating issues. Researchers made decisions about how to use data that were not comparable across site or study period. For example, the two sites offering "paid leave" or "paid time off" were excluded from the model that examines sick time rates as an outcome (presented in the *Five-Site Final Report*).

Appendix H

H. Exposure and Outcome Data Fields and Data Mapping

We obtained exposure and outcome data from the five sites for 1991-June 1998. The data sets included: sick time, overtime, CAIRs and downsizing data. A request for CAIRs data for all prime contractors operating at the five study sites during 1990-1998 was submitted to DOE Headquarters, Office of Occupational Safety and Health. The remaining three data sets were requested from each contractor's Human Resources (HR) office.

Bechtel Nevada (BN)

Paid time off data were available monthly from January 1996-June 1998. Our Human Resources site contact fit the older paid time off data to the organizational structure in June 1998. Data fields submitted include:

- Level 3 name (department), level 2 name (section), organizational code, month, year, number employees in section, paid time off hours used

Data were aggregated into the corresponding level 3s and mapped to the appropriate survey label. We were able to match 100% of the level 3s to a survey label.

Sick time data for previous contractors (REECo, EG&G and RSN) were not available through BN as all record systems changed when BN became contractor. We were only able to obtain annual sick time totals for the previous contractors (pre BN) from the Nevada DOE office. None of this data can be connected to the current organizational groups.

Overtime data company-wide were available by month from January 1997 – June 1997. Bechtel Nevada began tracking overtime by level 3 beginning in July 1997. Data from July 1997- June 1998 was obtained by level 3. Data fields submitted include:

- For January 1997-June 1997: month, year, contractor employment numbers, number of hours of overtime used.
- For July 1997 – June 1998: month, year, level 3 name, level 3 population, overtime hours

For the period from July 1997- June 1998, 86% of level 3s were matched to a survey label accounting for 92% of the reported over time hours.

CAIRs data were obtained for Bechtel Nevada for January 1996 – June 1998. With the help of our site contact at BN, we were able to map 78% of the personal accident/injury records to our survey label.

CAIRs data for REECo employees were obtained for 1991-1995. We requested CAIRs data for the remaining prime contractors who worked at the site during the same period but none were received. For the REECo records, accounting codes were listed in the department field of the CAIRs datafile and were decipherable only by using a REECo accounting code handbook. We used the accounting code handbook and discussions with a former REECo HR employee working for BN to translate REECo work units into current BN organizational framework. Records were then matched to a BN level 3 and mapped to a survey code. Using this method, we were able to map 97% of the CAIRs records for REECo from 1991-1995

Appendix H

Downsizing data for three events under Bechtel Nevada were collected. Data fields submitted include:

- Level 3 name, month employees received notices, year, and whether the reduction was voluntary, involuntary or early retirement.

Data for the several downsizing events that occurred from 1991-1995 were collected from DOE Nevada. Only year-end totals could be obtained for each prime contractor broken down by the total number involuntarily or voluntarily reduced. As this data was at the contractor level, it could not be mapped to a level 3.

Wackenhut Security Incorporated (WSI)

Sick time data were collected for the entire study period (January 1991- June 1998) quarterly by level 3 (section). Data fields collected include:

- Level 3 name, quarter, year, sick time hours, level 3 population

We were able to match a survey label to 100 % of level 3s.

Overtime data were collected for the entire study period as well. Quarterly records by level 3 were received and included the following fields:

- Level 3 name, quarter, year, overtime hours, level 3 population

We were able to match 100% of level 3s to a survey code.

CAIRS data were obtained for the entire study period. 78% of CAIRS personal accident/injury records were matched to a survey label.

Downsizing data for all events between 1991-1998 were collected. The following data fields were received:

- level 3 name, month and year of event, involuntary or voluntary event, and number downsized

We were able to match 100% of level 3 data to a survey code.

Appendix I

I. Site Visits to the Nevada Test Site

Summary statistics of each visit

Visit: 1

Dates of visit: 3/9-12/98

of staff attending: 3

Research staff attending:

BU: Dr. Lew Pepper, Co-Principal Investigator; Miriam Messinger, Project Manager; Molly Jacobs, Research Assistant

NIOSH: Soo-Yee Lim

Number of participants this visit:

Interviews: 25

Meetings:

Opening Meeting 11 attendees

Southern Nevada Building & Construction Trades Council 11 attendees

1 focus group 9 employees (0 females)

4 pilot testing groups 32 employees (14 females)

Visit: 2 **Survey Administration**

Dates of visit: 8/25-26/98

Summary: One staff person, Les Boden, was available to answer employee questions about the survey and to collect completed surveys.

J. Overview of Employee Assistance Program Data

EAP data requested

Organizations use Employee Assistance Programs (EAPs) to help assist employees in resolving their personal problems with the intention of improving organizational productivity. Of primary interest to our study was the role EAPs play in mitigating the psychological impacts that workplace changes have on employees. We collected both qualitative and quantitative data at the five study sites to characterize the content of these programs and describe how often they are used. Telephone interviews were conducted with EAP directors and/or counseling staff to acquire descriptions of the following:

- types of services offered
- referral patterns to the EAP
- standard office procedures
- outreach programs
- staffing levels
- diagnostic trends observed during times of downsizing

Formal requests to obtain utilization statistics were sent to the EAP Director. We requested the following monthly data elements for the entire study period along with fiscal EAP budgetary statistics:

- number of employees utilizing service
- presenting problem during intake
- number of intake sessions (% spouse/dependents)
- number of repeat sessions (% spouse/dependents)
- number of workshops

Budgetary information which provided a means to assess a site's commitment in providing EAP services was not obtained from any of our sites. Only one site offered a reason for not sending this information: "It's none of your business."

EAP Services at the Nevada Test Site

We interviewed EAP personnel at Y-12 and reviewed EAP utilization data. Trends, observations and recommendations based on the analysis follow.

NTS uses an on-site EAP within the Occupational Medicine Department (before Spring 1999 EAP was organized within the Human Resources Department) and is available to all employees working at the test site. The same EAP serviced the site when multiple contractors managed NTS before 1996. The EAP currently operates with one counselor and one part-time support staff and averages 140 contacts per month at the time of our interview. Employees primarily come to use the program through self-referral; prompted by seeing a flier, pamphlet, word of mouth or through suggestion of supervisors.

The EAP coordinator characterized a natural history of employee complaints and concerns around the downsizing. Two chief complaints that were consistent throughout all years of downsizing and during the consolidation under Bechtel Nevada were emotional problems

Appendix J

and family problems. The EAP saw a few cases of stress that they attribute at least partially to potential job loss. Employees came to the program with physical complaints that couldn't be explained by their physicians. Most often complaints were attributable to depression.

Family problems emerged as a focus during this time period. For the most part, these were preexisting problems that had not been recognized or handled when the work environment was more stable. The EAP staff hypothesize that these home issues came to the forefront when there was no longer a safe-haven for the employee at work. When their work life was dissolving, individuals needed to rely on their family but realized that the family situation was not stable. Employees sought out the EAP to aid in their family crises because that was the element they felt had hope for change. Stress from work and reduced patience led to concerns about parenting.

No utilization data was collected from NTS. The EAP director explained that their database was inaccessible because of information system changes. Due to Y2K compliance, restoring EAP's database was not a priority project for the information technology department and was not likely to happen within our needed timeframe.

Appendix K

K. Description of Survey Scales and Alpha Coefficients

Measure	Description
Psychological Job Demand	A 9-item Karasek scale (_____) measures the psychological demands of one's work (part of Job Strain Model). (1, Strongly Disagree - 4, Strongly Agree).
Role Ambiguity	A 4-item Caplan scale (_____) examines how clearly job expectations and responsibilities are understood (1, Never - 4 Always).
Feedback Quality	A 3-item NIOSH scale ($\alpha=0.87$) asks about the quality and timing of information necessary to do one's job well (1, Never - 4, Always).
Job Security	A 6-item scale ($\alpha=0.72$) with items from Karasek's job insecurity scale and newly constructed items. Measures how secure one feels in his or her current job as well as perceptions regarding new job opportunities (1, Not at All True - 4, Very True).
Toxic Exposure	3 Karasek items ($\alpha=0.76$), measures one's perceived threat from environmental work conditions including chemicals, air pollution and disease pathogens (1, Not Exposed - 3, I am Exposed, and it is a sizable or great problem).
Noise	1 Karasek item that measures one's perceptions of exposure to noise at work (1, Whisper - 4, Shout).
Skill Discretion	This 6-item Karasek scale ($\alpha=0.77$) captures the spectrum of skills used in one's job. First of two "Decision Latitude" or control scales that form the Job Strain Model. (1, Strongly Disagree - 4, Strongly Agree).
Decision Authority	A 3-item Karasek scale ($\alpha=0.79$) measures decision-making authority in one's job. Second of two "Decision Latitude" or control scales that form the Job Strain Model. (1, Strongly Disagree - 4, Strongly Agree).
Macro Decision Authority	2 Karasek items ($\alpha=0.43$) that measure one's influence over work group decisions and whether decisions are made democratically (1, Strongly Disagree - 4, Strongly Agree - 9, I work alone).
Workplace Violence	An index of 3 items taken from a scale developed by Mangione measures hostility in the workplace (1, Yes - 2 No). Reverse scored.
Supervisor Social Support	A 5-item Karasek scale ($\alpha=0.88$) asks respondents whether their supervisor provides personal support and facilitates productivity (1, Strongly Disagree - 4, Strongly Agree).
Co-worker Social Support	A 6-item Karasek scale ($\alpha=0.84$) measures the degree to which co-workers are perceived as competent, cooperative, understanding and supportive (1, Strongly Disagree - 4, Strongly Agree).

Appendix K

Measure	Description
Morale	A 2-item Lim scale ($\alpha= 0.88$) rating personal and co-worker morale at work (1, Very Low - 5 Very High).
Innovation	A 5-item Industry/Corning scale ($\alpha= 0.83$) asks how supportive one's work environment is to new ideas and open dialogue (1, Strongly Disagree - 5 Strongly Agree).
Organizational Involvement	Part of Cook and Wall's (1980) Organizational Commitment scale ($\alpha= 0.68$) which measures how involved one is in the work place (1, Strongly Disagree - 5, Strongly Agree).
Organizational Identification	Part of Cook and Wall's (1980) Organizational Commitment scale ($\alpha= 0.82$) which measures how closely respondents identify with their employer (1, Strongly Disagree - 5, Strongly Agree).
Mission	A new BU 3-item scale ($\alpha= 0.63$) inquires about one's understanding and opinions regarding the site's mission, as well as if one's work contributes to the mission (1, Strongly Disagree - 5, Strongly Agree).
Procedural Justice	A 4-item scale ($\alpha= 0.91$) truncated from Moorman & Niehoff measures the justice in decisions and procedures used by supervisors (1, Strongly Disagree - 5, Strongly Agree).
Conflict Resolution	A 6-item Industry scale ($\alpha= 0.81$) asks how problems are addressed within work groups and between contractors (1, Strongly Disagree - 5, Strongly Agree).
Organizational Communication	A 3-item BU scale ($\alpha= 0.86$) asks how strong communication is between management levels in the organization (1, Strongly Disagree - 5, Strongly Agree).
DOE Relations	A 4-item BU scale ($\alpha= 0.82$) examines employee perceptions of the DOE and how well they interact with the site (1, Strongly Disagree - 5, Strongly Agree).
Safety	An 8-item Murphy/NIOSH scale ($\alpha= 0.90$) measures safety and health practices (1, Strongly Disagree- 5, Strongly Agree).
Perceived Stress	A 4-item truncated scale ($\alpha= 0.76$) from Cohen (1981) measures the degree to which situations in one's life are appraised as stressful (1, Never - 5, Very Often).
Coping/Stress Index	A 4-item Industry scale ($\alpha= 0.90$) quantifies work stress in addition to the degree to which work stress is managed by the organization (1, Strongly Disagree - 5, Strongly Agree).
Work Performance	A 6-item scale ($\alpha= 0.53$) (Mangione) measuring concepts of absenteeism, poor work habits, confrontations, and injuries (1, Never - 6 or more times).

Appendix K

Measure	Description
Job Satisfaction	A 4-item Caplan scale ($\alpha= 0.84$) measures elements of job satisfaction including job training and decision involvement (1, Never - 4, Always).
Workload Dissatisfaction	A 3-item Caplan scale ($\alpha= 0.85$) measures the satisfaction with the amount, pace and type of one's workload (1, Never - 4, Always).
Matrixing	A new 8-item Mangione scale ($\alpha=0.80$) asks matrix employees to comment on issues such as divided loyalties, no home work group, not knowing co-workers, being a "generalist" rather than a "specialist," conflicting instructions, and supervisors being unable to thoroughly review the employee's performance (1, Not at All True - 4, Very True).
Restructuring Goals	A BU index of 8 potential goals for the latest restructuring. Respondents are asked to choose what 3 primary goals were and check whether or not those goals were achieved.
Opportunity	A 7-item Lim and Martin scale ($\alpha=0.91$) measures the type of opportunities that emerged in one's job after restructuring (1, Much Less Often - 5, Much More Often).
Survivor Syndrome	A 6-item Lim scale ($\alpha=0.83$) measures the adverse psychological effects experienced after downsizing(s) (1, Much Less Often - 5, Much More Often).
Skill Loss	2 items created by Murphy which ask respondents to recall the frequency that co-workers who left after the most recent restructuring had key knowledge and/or skills which were not replaced (1, None -4, 6 or more).
Downsizing Experiences Index	A BU index of 7 possible ways the respondent was affected by restructuring during 1991-1998 (possible scores 0-6).
Fairness or Downsizing Process Perceptions	A BU 14-item scale ($\alpha=0.87$) measures perceptions of the processes used during the last major restructuring (1, Strongly Disagree - 5, Strongly Agree)
Medical Conditions	An index of medical conditions and whether each condition was diagnosed by a physician and if it was bothersome in the last six months (scored as 0-8, 1 point for each condition ever experienced).
Medical Symptoms	An index of medical symptoms experienced in the last 30 days (scored as 0-10, 1 point for each condition ever experienced, with symptoms grouped into five physical systems).
Short Form Health Survey (SF-12)	A 12-item version of the Short Form Health Survey (1996) comprised of two component scales: physical health (PCS) ($\alpha=0.57$) and mental health (MCS) ($\alpha=0.69$).

Appendix K

Measure	Description
Medical Assistance	2 items that inquire whether or not employees feel reluctant to seek medical or psychological support (1, Strongly Disagree-5, Strongly Agree).
Drinking	2 items which inquire the number of days per week the person drinks and the number of drinks consumed per day.
Alcoholism	4 items which are symptomatic of alcohol abuse, scored as an index (possible score 0-4, 1 point for each yes answer).
Smoking	An index of the type of tobacco product used, when use started, the average number used per day and the age when quit habit.

Appendix L

L. Variables Collected: Description, Scale Scores and Use in Models

Independent Survey Variables Included in HLM and Level 3 Models (ST and TRC)

Variable Name	Survey #	Scoring Equation and Interpretation
Downsizing Experiences Index	E5	Index of # of ways directly affected by the downsizing from 0-6. Scored as percentage: $[(\# \text{ impacts } 0-6)/6] \times 100$ High score is worse = more experiences
Fairness or Downsizing Process Perceptions	E6	Reverse score items "1" and "n" then sum all fourteen items. High score is better = a more fair process

Co-variate (control and mediating) Variables Included in the Hierarchical Linear Model (HLM) and (when indicated) the Level 3 Models

Variable Name ("+" indicates in Level 3 model for sick time outcome; "~" indicates in Level 3 model for TRC outcome)	Survey #	Scoring Equation and Interpretation
Job category	A2	10 DOE categories summarized in 6 groups.
Years at site	A3	Continuous, High score = longer tenure
Pay Status + ~	A7	4 categories summarized into dichotomous term: 0= non bargaining unit; 1= bargaining unit employee. Interpret findings for bargaining unit members.
Psychological Job Demand + ~ (part of job strain)	B1	$B1a + B1b - B1c - B1d - B1f + B1g + B1e + B1h + B1i$ High score is worse = more demand
Toxic Exposure ~	B4	$B4a + B4b$ High score is worse = exposed & concerned
Noise	B5	High score is worse = noisier
Skill Discretion + ~ (part of control element of job strain)	B6	$[B6g + B6i + B6a + B6e + B6f + (5 - B6h)] \times 2$ High score is better = more skill discretion
Decision Authority + ~ (part of control element of job strain)	B6	$[B6b + B6c + (5 - B6d)] \times 4$ High score is better = more decision-making
Workplace Violence and Harassment	B7	Sum "yes" responses High score is worse = more experiences of Violence or harassment.
Supervisor Social Support + ~	C1	$C1a + C1b + C1c + C1d + C1e$ High score is better = more support
Co-worker Social Support + ~	C2	$C2a + C2b + C2c + C2d + C2e + C2f$ High score is better = more support
Conflict Resolution	C8	$C8a + C8b + C8c$ High score is better = better at resolving Workplace conflicts
Organizational Communication	C9	$C9a + C9b + C9c$ High score is better = better communication

Appendix L

Co-variates in HLM Model and Level 3 Models (continued)

Variable Name	Survey #	Scoring Equation and Interpretation
DOE Relations	C10	C10a + C10b + C10c + C10d High score is better = better relations
Safety & Health	C11	C11a + C11b + C11c + C11d + C11e + C11f + C11g + C11h High score is better = safer and healthier
Matrixing	D6	D6b + D6c + D6d + D6e + D6f + D6g + D6h + D6I High score is worse = more challenging experience as a matrixed employee
Drinking +	F11-F12	Multiply (F11) * (F12) to get Number of drinks per week High score presumed worse = more drinks
Alcoholism	F13	Create a cage/index. No = 0 and Yes = 1, range 0-4 (0 = Not affected) High score is worse = more symptoms
Smoking +	F14	Dichotomous: never vs. current and former smokers
Gender	G1	1= female 2= male Interpret findings for females
Race/ethnicity	G2	6 categories; in model scored as 1=Caucasian, 2=person of color Interpret findings for non-whites
Education level	G3	7 categorical responses; summarized as continuous # of years of education High score = more years of education
Age	G4	Categorical High score = older
Marital Status	G5	5 categories summarized in dichotomous form: 1=never/prior marriage, 2= married Interpret findings for married respondents
Children	G6	Summarized in dichotomous form: children at home yes or no Interpret findings for people With children at home

Appendix L

Outcome Variables included in HLM

Variable Name	Survey #	Scoring Equation and Interpretation
Job Security	B3	B3.i – B3.a + B3.b + B3.d + B3.g + B3.h High score is worse = more insecure About job future
Morale	C3	C3.a + C3.b High score is better = better employee morale
Perceived Stress	D1	D1.b and D1.c reversed score then... D1.a + D1.b + D1.c + D1.d High score is worse = more stress
Work Performance	D3	D3.a + D3.b + D3.c + D3.d + D3.e + D3.f High score is worse = more instances of Poor work performance
Survivor Syndrome	E3	Sum all 6 items (all in same direction) High score is worse = more symptoms
Medical Conditions	F1	No = 0, Yes = 1 (range 0-8) High score is worse = more conditions Reported (self- or doctor- diagnosed)
Medical Symptoms	F2	Sum within each body system: No = 0, Yes = 1 High score is worse = more symptoms reported
SF-12 (MCS and PCS)	F3-F9	Score according to SF-12 manual High score is better = better physical or mental health

Archival Data (see Appendix H for rate calculation)

Variable Name	Source	Variable type	Model or reason for exclusion
Downsizing Rate	Contractor	Independent	HLM and Level 3 model High score presumed worse = more Downsizing in the level 3
Voluntary Rate	Contractor	Independent	HLM and Level 3 model High score presumed better = more Of the downsizing in the level 3 is voluntary
Overtime Rate	Contractor	(considered as outcome)	Excluded because data not collected for exempt employees High score = more overtime hours Taken per capita in the level 3
Sick time Rate	Contractor	Outcome	Level 3 model (No sick time data Available for NTS or INEEL —combined within paid leave) High score = more sick time hours Taken per capita in the level 3
Total Recordable Cases Rate (TRC)	DOE	Outcome	Level 3 model High score = more accidents (cases) Per capita in the level 3

Appendix L

Variables Excluded from Analysis in HLM and/or Level 3 model

Variable Name	Survey #	Reason Not Used*	Scoring Equation
Management level	A1	4	3 categories
Tenure in current job	A4	1	Similar to tenure at site
Shift, time in shift, overtime hours, days with other groups	A5, 6, 8, 9 and 11	5 (low variability)	A5 categorical A6, 8, 9, 11 continuous
Role Ambiguity	B2	1 (morale .4)	B2a + B2b + B2c + B2d
Feedback Quality	B2	4 and 1 (borderline w/ fairness)	B2e + B2f + B2g
Macro Decision Authority	B6	5 (alpha=.43)	B6j + B6k
Innovation	C4	1 (with many)	C4a + C4b + C4c + C4d + C4e
Organizational Involvement	C5	6	(reverse score C5a) + C5b + C5c
Organizational Identification	C5	1 (morale .58)	(reverse score C5f) (C5d + C5e + C5f)
Mission	C6	2	If "yes," then... C6b + C6c - C6d
Procedural Justice	C7	1 (.44 fairness)	C7a + C7b + C7c + C7d
Coping/Stress Index	D2	1 (perceived stress -.54)	D2a+ D2b+ D2c+ (reverse score D2e)
Job Satisfaction	D4	6	D4a + D4b + D4c + D4d
Workload Dissatisfaction	D5	1 (job satisfaction)	D5a + D5b + D5c
Restructuring Goals	E1	2	1) percent choosing each goal 2) of those choosing a given goal, percent saying "yes" it was achieved
Opportunity	E2	6	E2a + E2b + E2c + E2d + E2f + E2g
Skill Loss	E4	4	Kept as separate items
Medical Assistance	F10 a, b	4	Two items summed

Several single (or 2) item concepts were dropped (including A10, 13, 14, C4f, D5d, B1j, B3e, B3 c/f, D2d, C7e/f, G6, G8, G9) because of ranking of conceptual importance and/or because they were not validated scales.

*Reason not used where: 1= correlated to another variable (.4 or greater)

2= >8% missing

3= Collection not consistent across site

4= lower conceptual priority due to limited space in model

5= low variability/range of responses or low alpha

6= variable type unclear (functioned as either co-variate or outcome)

Appendix M

M. Outcome Measures Compared to National Data Sets

Results of One-Sample T-Test

Outcome Variable	Total Sample		Females		Males	
	NTS	All Sites	NTS	All Sites	NTS	All Sites
SF-12 PCS						
Sample size	665	5520	179	1651	480	3816
Mean Difference	2.85***	2.17***	4.19***	2.41***	1.66***	1.42***
Standard Deviation	5.82	7.19	6.03	8.01	5.73	6.76
SF-12 MCS						
Sample size	665	5520	179	1651	480	3816
Mean Difference	-1.56***	-2.43***	-2.29**	-2.72***	-1.68***	-2.7***
Standard Deviation	9.92	10.38	10.55	10.57	9.58	10.28
Perceived Stress						
Sample size	687	5741	186	1703	493	3969
Mean Difference	-0.20	0.18***	0.1	0.62***	0.48***	0.79***
Standard Deviation	2.90	2.86	2.84	2.87	2.94	2.85

where ** = $p \leq 0.01$, *** = $p \leq 0.001$

Appendix N

N. Survey Comment Analysis Categories

Category	Sub-category
Relationships/Management	employee-employee relations employee-supervisor relations employee-management relations middle-upper management relations evaluation of management evaluation of supervisor(s)
Security/Future	personal future at site personal future beyond site recent job change interest in job change site mission and site future
Union	contractor-union interactions and issues personnel issues relative to union and non-union status
DOE	DOE oversight and involvement at site DOE and contractor DOE and government funding
Physical work environment	worker comfort and accommodations infrastructure upkeep/maintenance
Workplace changes (other than downsizing)	hiring externally versus promoting from within military personnel influx contractor changes subcontracting outsourcing
Job demands	physical requirements workload work schedule
Human Resource Issues	sick leave policy health insurance benefits salary/pay issues overtime handling of personnel issues (ex: firing people)

Appendix N

Survey	<p>comments on survey instrument personal info about responses (for example, responses related to accident)</p>
Health	<p>personal health issues stress Medical Department</p>
Safety	<p>hazards reporting safety concerns and DOE compliance dynamic between safety and productivity</p>
Downsizing/restructuring	<p>communication about downsizing personal impact impact on site process/implementation perceptions/fairness history/previous experiences</p>
Organizational factors	<p>program implementation/project completion procedures/regulations/paperwork security breaches/waste/fraud/abuse (include drugs and alcohol) training and support</p>
Climate/Psychological work environs	<p>morale conflict resolution innovation employee accountability professional atmosphere feedback/rewards teamwork/isolation</p>

Appendix O

O. Hierarchical Linear Modeling (HLM) Results Nevada Test Site Results Presented for each of nine outcomes

Step 7: Medical Conditions

Effect (variable)	Estimate	Standard Error	DF	t	Pr > |t|
INTERCEPT	8.61021151	10.5946889	16	0.81	0.4283
Ratio Downsizing	-19.76295979	10.9137106	471	-1.81	0.0708
Downsizing Experiences Index*	0.05544469	0.02422907	471	2.29	0.0226
Fairness*	0.01373530	0.06311593	471	0.22	0.8278
Ratio Voluntary	13.00263219	10.9656617	471	1.19	0.2363
Strain*	0.18710954	0.1137727	471	1.64	0.1007
Gender	-0.16101508	1.50374426	471	-0.11	0.9148
Race	3.30962850	1.38613832	471	2.39	0.0173
Education	-0.33893819	0.31067946	471	-1.09	0.2758
Age	0.09270226	0.06500651	471	1.43	0.1545
Married	-0.46483322	1.27750452	471	-0.36	0.7161
Kids	-1.26521544	1.12139125	471	-1.13	0.2598
Smoking	0.63294169	1.09568634	471	0.58	0.5638
Drinks/week	-0.09269769	0.08811048	471	-1.05	0.2933
Alcoholism*	0.07086355	0.03456335	471	2.05	0.0409
JOB Craft/Service	-1.76359659	2.19367563	471	-0.8	0.4218
JOB Laborer/Gen Ser/	1.61098078	2.48405354	471	0.65	0.5170
JOB Mgmt	-0.57986697	1.96490591	471	-0.3	0.7680
JOB Oper/Tech	1.32100702	2.00593765	471	0.66	0.5105
JOB Prof/Admin	1.43069364	1.74961302	471	0.82	0.4139
JOB Scient/Eng	0.00000000	.	.	.	.
Site years	-1.59520936	1.41291306	471	-1.13	0.2595
Pay Status	-1.05146657	1.83359221	471	-0.57	0.5666
Matrix*	0.00845587	0.02361002	471	0.36	0.7204
Conflict*	-0.02002677	0.05082327	471	-0.39	0.6937
DOE*	-0.02041162	0.04528843	471	-0.45	0.6524
Safety*	-0.09157402	0.05837637	471	-1.57	0.1174
Violence*	0.07130814	0.02527228	471	2.82	0.0050
Supervisor Support*	0.09047823	0.04062494	471	2.23	0.0264
Co-worker Support*	0.02127170	0.05590008	471	0.38	0.7037
Toxic*	0.03718539	0.04205461	471	0.88	0.3770
Noise*	-0.02719934	0.04146819	471	-0.66	0.5122
Communication*	-0.04943153	0.03534763	471	-1.4	0.1626

*scales standardized
Significant findings in bold.

Appendix O

Step 7: SF-12 Physical Component Scale (PCS) of the Short Form Health Survey (SF-12)

Effect (variable)	Estimate	Standard Error	DF	t	Pr > |t|
INTERCEPT	73.91407353	7.62745058	17	9.69	0.0001
Ratio Downsizing	16.31816748	7.64816	468	2.13	0.0334
Downsizing Experiences Index*	-0.01101405	0.01726525	468	-0.64	0.5238
Fairness*	0.00057050	0.04483607	468	0.01	0.9899
Ratio Voluntary	-3.35904365	7.82243754	468	-0.43	0.6678
Strain*	-0.05989295	0.08109306	468	-0.74	0.4605
Gender	-0.54636623	1.07524238	468	-0.51	0.6116
Race	-1.22776887	0.99261193	468	-1.24	0.2167
Education	0.38463853	0.22350905	468	1.72	0.0859
Age	-0.02233931	0.04651822	468	-0.48	0.6313
Married	-0.11494169	0.91638298	468	-0.13	0.9002
Kids	-0.43393476	0.80247078	468	-0.54	0.5889
Smoking	-0.61878953	0.78204095	468	-0.79	0.4292
Drinks/week	0.07858883	0.0630153	468	1.25	0.2130
Alcoholism*	-0.05823578	0.02495208	468	-2.33	0.0200
JOB Craft/Service	0.01498171	1.56071616	468	0.01	0.9923
JOB Laborer/Gen Ser/	-1.38665328	1.78170038	468	-0.78	0.4368
JOB Mgmt	2.04474195	1.39698323	468	1.46	0.1440
JOB Oper/Tech	-1.68614209	1.43770757	468	-1.17	0.2415
JOB Prof/Admin	2.61518400	1.25259703	468	2.09	0.0374
JOB Scient/Eng	0.00000000	.	.	.	.
Site years	0.77114604	1.03401731	468	0.75	0.4562
Pay Status	0.40004216	1.29930807	468	0.31	0.7583
Matrix*	0.00284834	0.01702524	468	0.17	0.8672
Conflict*	0.01203904	0.03637354	468	0.33	0.7408
DOE*	0.01449227	0.03221978	468	0.45	0.6531
Safety*	0.00615592	0.04204842	468	0.15	0.8837
Violence*	-0.05184421	0.01804835	468	-2.87	0.0043
Supervisor Support*	-0.08638828	0.02911775	468	-2.97	0.0032
Co-worker Support*	0.01958020	0.04046899	468	0.48	0.6287
Toxic*	-0.01517174	0.0300592	468	-0.5	0.6140
Noise*	0.03831674	0.02946084	468	1.3	0.1940
Communication*	0.01447052	0.02533027	468	0.57	0.5681

*scales standardized

Significant findings in bold.

Appendix O

Step 7: SF-12 Physical Component Scale (PCS) of the Short Form Health Survey (SF-12)

Effect (variable)	Estimate	Standard Error	DF	t	Pr > |t|
INTERCEPT	50.62162406	11.4960969	17	4.4	0.0004
Ratio Downsizing	5.30675464	11.5273101	468	0.46	0.6455
Downsizing Experiences Index*	-0.05974296	0.02602219	468	-2.3	0.0221
Fairness*	0.18686724	0.06757695	468	2.77	0.0059
Ratio Voluntary	-29.17145051	11.7899813	468	-2.47	0.0137
Strain*	-0.48517836	0.1222235	468	-3.97	0.0001
Gender	-0.51373245	1.6206058	468	-0.32	0.7514
Race	0.80676215	1.49606513	468	0.54	0.5900
Education	0.04021359	0.33687294	468	0.12	0.9050
Age	0.06676598	0.07011228	468	0.95	0.3415
Married	-0.75196244	1.38117283	468	-0.54	0.5864
Kids	-0.28205999	1.20948432	468	-0.23	0.8157
Smoking	1.01800904	1.17869246	468	0.86	0.3882
Drinks/week	-0.01473604	0.09497668	468	-0.16	0.8768
Alcoholism*	-0.07884506	0.03760779	468	-2.1	0.0366
JOB Craft/Service	3.08493564	2.35231209	468	1.31	0.1903
JOB Laborer/Gen Ser/	1.79878528	2.6853796	468	0.67	0.5033
JOB Mgmt	-1.44812946	2.10553374	468	-0.69	0.4919
JOB Oper/Tech	1.62897620	2.16691348	468	0.75	0.4526
JOB Prof/Admin	0.43483320	1.88791479	468	0.23	0.8179
JOB Scient/Eng	0.00000000	.	.	.	.
Site years	2.23459325	1.55847134	468	1.43	0.1523
Pay Status	2.72840240	1.9583177	468	1.39	0.1642
Matrix*	0.02395127	0.02566045	468	0.93	0.3511
Conflict*	0.06549496	0.05482221	468	1.19	0.2328
DOE*	0.00429621	0.04856167	468	0.09	0.9295
Safety*	-0.02993341	0.0633754	468	-0.47	0.6369
Violence*	-0.05478924	0.02720248	468	-2.01	0.0446
Supervisor Support*	0.03478277	0.04388628	468	0.79	0.4284
Co-worker Support*	0.05816993	0.06099488	468	0.95	0.3407
Toxic*	-0.02233928	0.04530524	468	-0.49	0.6222
Noise*	0.01158540	0.04440338	468	0.26	0.7943
Communication*	0.05707469	0.0381778	468	1.49	0.1356

*scales standardized

Significant findings in bold.

Appendix O

Step 7: Survivor Syndrome

Effect (variable)	Estimate	Standard Error	DF	t	Pr > |t|
INTERCEPT	65.12876699	12.1993031	17	5.34	0.0001
Ratio Downsizing	12.39606810	13.4756019	457	0.92	0.3581
Downsizing Experiences Index*	0.00601965	0.02765591	457	0.22	0.8278
Fairness*	-0.22787287	0.07223755	457	-3.15	0.0017
Ratio Voluntary	-4.30365747	14.0591493	457	-0.31	0.7597
Strain*	0.39419846	0.13024688	457	3.03	0.0026
Gender	0.90271453	1.73615769	457	0.52	0.6034
Race	0.04790985	1.59206202	457	0.03	0.9760
Education	0.52167589	0.35885692	457	1.45	0.1467
Age	-0.05516037	0.07470975	457	-0.74	0.4607
Married	-0.30860608	1.45849785	457	-0.21	0.8325
Kids	-1.34504519	1.28598957	457	-1.05	0.2961
Smoking	1.43944612	1.26202413	457	1.14	0.2546
Drinks/week	-0.09592766	0.10050255	457	-0.95	0.3403
Alcoholism*	0.07528316	0.0393139	457	1.91	0.0561
JOB Craft/Service	2.50783918	2.58975175	457	0.97	0.3334
JOB Laborer/Gen Ser/	3.38488238	2.8991631	457	1.17	0.2436
JOB Mgmt	2.06050290	2.30087265	457	0.9	0.3710
JOB Oper/Tech	3.95791544	2.29300411	457	1.73	0.0850
JOB Prof/Admin	1.66953759	2.10125894	457	0.79	0.4273
JOB Scient/Eng	0.00000000	.	.	.	.
Site years	2.22619971	1.63285473	457	1.36	0.1734
Pay Status	-0.07644072	2.11159366	457	-0.04	0.9711
Matrix*	0.02136696	0.02725752	457	0.78	0.4335
Conflict*	-0.10121027	0.058372	457	-1.73	0.0836
DOE*	-0.02571743	0.05246144	457	-0.49	0.6242
Safety*	0.02906731	0.066967	457	0.43	0.6645
Violence*	-0.06696936	0.02904504	457	-2.31	0.0216
Supervisor Support*	-0.05375617	0.04666993	457	-1.15	0.2500
Co-worker Support*	-0.05149472	0.06410106	457	-0.8	0.4222
Toxic*	-0.02858166	0.04880175	457	-0.59	0.5584
Noise*	-0.00602202	0.0475636	457	-0.13	0.8993
Communication*	-0.06340298	0.04078258	457	-1.55	0.1207

*scales standardized

Significant findings in bold.

Appendix O

Step 7: Medical Symptoms

Effect (variable)	Estimate	Standard Error	DF	t	Pr > |t|
INTERCEPT	53.12113004	19.0480456	16	2.79	0.0131
Ratio Downsizing	-6.20022564	19.3194254	475	-0.32	0.7484
Downsizing Experiences Index*	0.09005879	0.04363213	475	2.06	0.0396
Fairness*	-0.29762641	0.11331762	475	-2.63	0.0089
Ratio Voluntary	16.81391179	19.5619258	475	0.86	0.3905
Strain*	0.37510029	0.20522987	475	1.83	0.0682
Gender	-2.84570288	2.71642626	475	-1.05	0.2954
Race	1.64709786	2.50617562	475	0.66	0.5114
Education	-0.48846817	0.56216612	475	-0.87	0.3853
Age	-0.22132793	0.11722188	475	-1.89	0.0596
Married	-0.13504508	2.30594616	475	-0.06	0.9533
Kids	0.24657968	2.01611867	475	0.12	0.9027
Smoking	0.37926737	1.97783987	475	0.19	0.848
Drinks/week	-0.08001283	0.15961076	475	-0.5	0.6164
Alcoholism*	0.18201151	0.06258311	475	2.91	0.0038
JOB Craft/Service	-3.22610287	3.96041718	475	-0.81	0.4157
JOB Laborer/Gen Ser/	-1.04888180	4.51280905	475	-0.23	0.8163
JOB Mgmt	3.83704762	3.53469814	475	1.09	0.2782
JOB Oper/Tech	-0.37243136	3.61867854	475	-0.1	0.9181
JOB Prof/Admin	-1.47227163	3.14741678	475	-0.47	0.6402
JOB Scient/Eng	0.00000000	.	.	.	.
Site years	3.77598983	2.56378728	475	1.47	0.1415
Pay Status	-6.34378289	3.30443139	475	-1.92	0.0555
Matrix*	-0.05990533	0.04243588	475	-1.41	0.1587
Conflict*	-0.01542332	0.0920939	475	-0.17	0.8671
DOE*	-0.03676111	0.08157593	475	-0.45	0.6525
Safety*	-0.14915706	0.1054807	475	-1.41	0.158
Violence*	0.10064977	0.04600216	475	2.19	0.0292
Supervisor Support*	0.23722060	0.07334036	475	3.23	0.0013
Co-worker Support*	-0.15152760	0.10090778	475	-1.5	0.1339
Toxic*	0.15753977	0.07586346	475	2.08	0.0384
Noise*	-0.09500725	0.07488067	475	-1.27	0.2051
Communication*	-0.07835675	0.0638447	475	-1.23	0.2203

*scales standardized

Significant findings in bold.

Appendix O

Step 7: Work Performance

Effect (variable)	Estimate	Standard Error	DF	t	Pr > |t|
INTERCEPT	36.10940109	8.93681118	17	4.04	0.0008
Ratio Downsizing	16.07824342	9.07645685	477	1.77	0.0771
Downsizing Experiences Index*	-0.01247859	0.02049932	477	-0.61	0.5430
Fairness*	-0.07106504	0.05323703	477	-1.33	0.1826
Ratio Voluntary	-9.04844316	9.19334335	477	-0.98	0.3255
Strain*	0.03739031	0.09643869	477	0.39	0.6984
Gender	-0.59329558	1.27340165	477	-0.47	0.6415
Race	-1.30476238	1.17829984	477	-1.11	0.2687
Education	-0.33199506	0.26398472	477	-1.26	0.2091
Age	-0.12772099	0.05513307	477	-2.32	0.0209
Married	-0.39690653	1.08430578	477	-0.37	0.7145
Kids	2.73187403	0.94424615	477	2.89	0.0040
Smoking	-1.41520076	0.92874668	477	-1.52	0.1282
Drinks/week	0.13491826	0.07503839	477	1.8	0.0728
Alcoholism*	-0.01324246	0.02942322	477	-0.45	0.6529
JOB Craft/Service	0.16683871	1.85638723	477	0.09	0.9284
JOB Laborer/Gen Ser/	-0.07225812	2.11178423	477	-0.03	0.9727
JOB Mgmt	0.36635152	1.66306158	477	0.22	0.8257
JOB Oper/Tech	2.43848491	1.69752298	477	1.44	0.1515
JOB Prof/Admin	0.69462399	1.47809633	477	0.47	0.6386
JOB Scient/Eng	0.00000000	.	.	.	.
Site years	1.32171457	1.19981129	477	1.1	0.2712
Pay Status	-1.41900084	1.54119104	477	-0.92	0.3577
Matrix*	-0.01619630	0.01995085	477	-0.81	0.4173
Conflict*	-0.09500115	0.0432166	477	-2.2	0.0284
DOE*	-0.09291523	0.03829971	477	-2.43	0.0156
Safety*	0.07679104	0.04950761	477	1.55	0.1215
Violence*	0.05241578	0.02150247	477	2.44	0.0151
Supervisor Support*	0.01166562	0.03444325	477	0.34	0.7350
Co-worker Support*	-0.06317783	0.04741963	477	-1.33	0.1834
Toxic*	0.04746466	0.03557326	477	1.33	0.1827
Noise*	-0.06664828	0.03501799	477	-1.9	0.0576
Communication*	-0.04203882	0.03002104	477	-1.4	0.1621

*scales standardized

Significant findings in bold.

Appendix O

Step 7: Perceived Stress

Effect (variable)	Estimate	Standard Error	DF	t	Pr > |t|
INTERCEPT	40.64714297	12.1562452	17	3.34	0.0038
Ratio Downsizing	13.78102515	13.1490096	474	1.05	0.2951
Downsizing Experiences Index*	0.02352731	0.02780888	474	0.85	0.3980
Fairness*	-0.13960125	0.07268958	474	-1.92	0.0554
Ratio Voluntary	9.75088456	13.7761262	474	0.71	0.4794
Strain*	0.58286945	0.13083054	474	4.46	0.0001
Gender	3.31433280	1.72671424	474	1.92	0.0555
Race	1.82966487	1.59408218	474	1.15	0.2516
Education	-0.22013270	0.35960023	474	-0.61	0.5407
Age	-0.11268461	0.07499024	474	-1.5	0.1336
Married	-0.29338330	1.46804921	474	-0.2	0.8417
Kids	1.89248624	1.28058992	474	1.48	0.1401
Smoking	-0.63879875	1.2583536	474	-0.51	0.6119
Drinks/week	0.06923205	0.10151339	474	0.68	0.4956
Alcoholism*	0.12579951	0.03987764	474	3.15	0.0017
JOB Craft/Service	-2.66995180	2.55969476	474	-1.04	0.2974
JOB Laborer/Gen Ser/	1.76807409	2.88799311	474	0.61	0.5407
JOB Mgmt	-3.20114069	2.30551532	474	-1.39	0.1656
JOB Oper/Tech	-2.08769261	2.30617977	474	-0.91	0.3658
JOB Prof/Admin	-0.86363595	2.07332997	474	-0.42	0.6772
JOB Scient/Eng	0.00000000	.	.	.	.
Site years	-0.47029278	1.63013775	474	-0.29	0.7731
Pay Status	-4.30774023	2.09192371	474	-2.06	0.0400
Matrix*	-0.01849749	0.02713847	474	-0.68	0.4958
Conflict*	-0.04421556	0.05854847	474	-0.76	0.4505
DOE*	-0.02319411	0.05203795	474	-0.45	0.6560
Safety*	-0.04461557	0.06719092	474	-0.66	0.5070
Violence*	0.06199917	0.02928289	474	2.12	0.0348
Supervisor Support*	0.02809735	0.04667243	474	0.6	0.5475
Co-worker Support*	0.02811221	0.06434299	474	0.44	0.6624
Toxic*	-0.00917969	0.04919768	474	-0.19	0.8521
Noise*	0.05704654	0.04769885	474	1.2	0.2323
Communication*	-0.04538123	0.04084782	474	-1.11	0.2671

*scales standardized

Significant findings in bold.

Appendix O

Step 7: Job Security

Effect (variable)	Estimate	Standard Error	DF	t	Pr > |t|
INTERCEPT	65.85354176	11.280494	17	5.84	0.0001
Ratio Downsizing	-3.25928985	18.1444703	452	-0.18	0.8575
Downsizing Experiences Index*	0.06592436	0.02568286	452	2.57	0.0106
Fairness*	-0.18510073	0.06770308	452	-2.73	0.0065
Ratio Voluntary	-10.12761077	21.1350458	452	-0.48	0.6320
Strain*	0.29076542	0.12036625	452	2.42	0.0161
Gender	0.62070152	1.63164967	452	0.38	0.7038
Race	-1.35655724	1.46307184	452	-0.93	0.3543
Education	-0.71097873	0.33383004	452	-2.13	0.0337
Age	0.08110473	0.06969098	452	1.16	0.2451
Married	3.15710795	1.3393351	452	2.36	0.0188
Kids	1.29735308	1.17882379	452	1.1	0.2717
Smoking	0.16073980	1.16330091	452	0.14	0.8902
Drinks/week	-0.01569571	0.09292497	452	-0.17	0.8659
Alcoholism*	-0.01631316	0.03636476	452	-0.45	0.6539
JOB Craft/Service	1.90335617	2.39201827	452	0.8	0.4266
JOB Laborer/Gen Ser/	-0.96667181	2.72953414	452	-0.35	0.7234
JOB Mgmt	-0.55781073	2.1475279	452	-0.26	0.7952
JOB Oper/Tech	-0.65702474	2.12672339	452	-0.31	0.7575
JOB Prof/Admin	-0.77342127	2.00309906	452	-0.39	0.6996
JOB Scient/Eng	0.00000000	.	.	.	.
Site years	-4.05268233	1.53515633	452	-2.64	0.0086
Pay Status	-2.52849443	1.95784706	452	-1.29	0.1972
Matrix*	-0.00027443	0.02489741	452	-0.01	0.9912
Conflict*	-0.01602666	0.05361212	452	-0.3	0.7651
DOE*	-0.03871766	0.04812278	452	-0.8	0.4215
Safety*	0.02585884	0.06214826	452	0.42	0.6775
Violence*	0.06284499	0.02745407	452	2.29	0.0225
Supervisor Support*	-0.04165706	0.04318373	452	-0.96	0.3352
Co-worker Support*	0.00549973	0.05974329	452	0.09	0.9267
Toxic*	0.05677373	0.04596504	452	1.24	0.2174
Noise*	0.06819138	0.04454777	452	1.53	0.1265
Communication*	-0.10038541	0.03812251	452	-2.63	0.0087

*scales standardized

Significant findings in bold.

Appendix O

Step 7: Morale

Effect (variable)	Estimate	Standard Error	DF	t	Pr > |t|
INTERCEPT	-17.03212259	12.3441121	17	-1.38	0.1855
Ratio Downsizing	-0.53261209	14.4294905	477	-0.04	0.9706
Downsizing Experiences Index*	-0.04115144	0.02830163	477	-1.45	0.1466
Fairness*	0.04559488	0.07360427	477	0.62	0.5359
Ratio Voluntary	-21.07376125	15.5578744	477	-1.35	0.1762
Strain*	-0.23559097	0.13339124	477	-1.77	0.0780
Gender	-1.03615633	1.76106842	477	-0.59	0.5566
Race	-1.04036072	1.62123681	477	-0.64	0.5214
Education	0.27236274	0.36580202	477	0.74	0.4569
Age	-0.05567352	0.07616881	477	-0.73	0.4652
Married	-1.14719618	1.49259147	477	-0.77	0.4425
Kids	1.81893889	1.29928704	477	1.4	0.1622
Smoking	0.12289229	1.27918768	477	0.1	0.9235
Drinks/week	0.01327695	0.10308926	477	0.13	0.8976
Alcoholism*	0.00495464	0.04049818	477	0.12	0.9027
JOB Craft/Service	-1.19126940	2.62352194	477	-0.45	0.6500
JOB Laborer/Gen Ser/	0.15387153	2.95203174	477	0.05	0.9585
JOB Mgmt	0.88069023	2.35577432	477	0.37	0.7087
JOB Oper/Tech	-2.88272877	2.34802997	477	-1.23	0.2202
JOB Prof/Admin	0.31396104	2.14217936	477	0.15	0.8835
JOB Scient/Eng	0.00000000	.	.	.	.
Site years	0.44386294	1.66182883	477	0.27	0.7895
Pay Status	2.91018488	2.13342292	477	1.36	0.1732
Matrix*	0.03391727	0.02762472	477	1.23	0.2201
Conflict*	0.17663458	0.05941605	477	2.97	0.0031
DOE*	0.00588800	0.0529552	477	0.11	0.9115
Safety*	0.18349583	0.06851954	477	2.68	0.0077
Violence*	-0.02749478	0.02985187	477	-0.92	0.3575
Supervisor Support*	0.26011350	0.0474206	477	5.49	0.0001
Co-worker Support*	0.26815930	0.06541232	477	4.1	0.0001
Toxic*	0.01843327	0.05020015	477	0.37	0.7136
Noise*	0.09332730	0.04841539	477	1.93	0.0545
Communication*	0.19706471	0.04152916	477	4.75	0.0001

*scales standardized

Significant findings in bold.

Appendix P
P. HLM 7 Step Summary for Selected Variables

Physical Health Outcomes

Bold = significant at *** ≤0.001 ** ≤0.01 * ≤0.05

Norm PCS (SF-12)

Variable	MODEL STEPS					
	2	3	4	5	6	7
	B	B	B	B	B	B
Downsizing ratio	4.66*			7.65	7.1	7.6*
Impact		0.02		0.02	0.02	0.02
Fairness		0.03*		0.03	0.03	0.04
Percent vol		5.84		8.2	7.33	7.8
Strain			0.06	0.07	0.07	0.08
Gender					0.84	1.08
Race					0.95	0.99
Age					0.04	0.05
Marital status					0.88	0.92
Alcoholism					0.02*	0.02*

Medical Conditions

Variable	MODEL STEPS					
	2	3	4	5	6	7
	B	B	B	B	B	B
Downsizing ratio	5.78			9.42	9.89	10.91
Impact		0.02**		0.02**	0.02	0.02*
Fairness		0.04**		0.04	0.04	0.06
Percent vol		6.13		9.66	10.04	11.0
Strain			0.09***	0.09***	0.1***	0.11***
Gender					1.14	1.5
Race					1.29*	1.39*
Age					0.06	0.07
Marital status					1.19	1.28
Alcoholism					0.03	0.03

Medical Symptoms

Variable	MODEL STEPS					
	2	3	4	5	6	7
	B	B	B	B	B	B
Downsizing ratio	11.4			19.73	18.02	19.32
Impact		0.04***		0.04**	0.04**	0.04*
Fairness		0.07***		0.08***	0.08***	0.11**
Percent vol		11.97		21.44	18.46	19.56
Strain			0.16***	0.17***	0.18***	0.21
Gender					2.13*	2.72
Race					2.4	2.51
Age					0.11	0.12
Marital status					2.23	2.3
Alcoholism					0.06*	0.06**

Appendix P

Mental Health Outcomes

Bold = significant at: * <= .001 ** <= .01 * <= .05**

Variable	MODEL STEPS					
	2	3	4	5	6	7
	B	B	B	B	B	B
Downsizing ratio	8.35**			12.5	10.58	11.5
Impact		0.02**		0.02*	0.02*	0.03*
Fairness		0.05***		0.05***	0.05***	0.07**
Percent vol		8.04**		13.73	10.9	11.79**
Strain			0.1***	0.10***	0.10***	0.12***
Gender					1.3	1.62
Race					1.42	1.5
Age					0.06	0.07
Marital status					1.31	1.38
Alcoholism					0.04*	0.04*

Variable	MODEL STEPS					
	2	3	4	5	6	7
	B	B	B	B	B	B
Downsizing ratio	16.19			14.43	15.1	13.48
Impact		0.03		0.02	0.03	0.03
Fairness		0.05***		0.05***	0.05***	0.07**
Percent vol		13.0		16.24	16.78	14.06
Strain			0.10***	0.11***	0.11***	0.13**
Gender					1.43	1.73
Race					1.5	1.59
Age					0.07	0.07
Marital status					1.39	1.46
Alcoholism					0.04*	0.03

Variable	MODEL STEPS					
	2	3	4	5	6	7
	B	B	B	B	B	B
Downsizing ratio	9.08**			11.88	11.25	13.15
Impact		0.02		0.02	0.03	0.03
Fairness		0.05***		0.05***	0.05***	0.07***
Percent vol		7.26*		12.72	11.52	13.78
Strain			0.10***	0.11***	0.11***	0.13***
Gender					1.33	1.73
Race					1.5	1.59
Age					0.07	0.07
Marital status					1.39	1.47
Alcoholism					0.04***	0.04**

Appendix P

Organizational Outcomes

Bold = significant at: *** <=.001 ** <=.01 * <=.05

Job Security

Variable	MODEL STEPS					
	2	3	4	5	6	7
	B	B	B	B	B	B
Downsizing ratio	18.47			18.21	18.52	18.14
Impact		0.02*		0.02	0.02*	0.03**
Fairness		0.04***		0.05***	0.05***	0.07**
Percent vol		16.13		21.5	21.68	21.14
Strain			0.09***	0.10***	0.10***	0.12*
Gender					1.37	1.63
Race					1.39	1.46
Age					0.06	0.07
Marital status					1.29*	1.33*
Alcoholism					0.04	0.04

Work Performance

Variable	MODEL STEPS					
	2	3	4	5	6	7
	B	B	B	B	B	B
Downsizing ratio	6.32**			9.48	8.79*	9.08
Impact		0.02		0.02	0.02	0.02
Fairness		0.04***		0.04***	0.04***	0.05
Percent vol		6.23		10.11	9.01	9.19
Strain			0.08***	0.09*	0.09*	0.10
Gender					1.04	1.27
Race					1.17	1.18
Age					0.05***	0.06*
Marital status					1.09	1.08
Alcoholism					0.03	0.03

Morale

Variable	MODEL STEPS					
	2	3	4	5	6	7
	B	B	B	B	B	B
Downsizing ratio	13.15*			17.87	18.94	14.43
Impact		0.03		0.03	0.03	0.03
Fairness		0.06***		0.06***	0.06***	0.07
Percent vol		12.15		20.42	21.55	15.56
Strain			0.12***	0.12***	0.13***	0.13
Gender					1.67	1.76
Race					1.75	1.62
Age					0.08	0.08
Marital status					1.62	1.49
Alcoholism					0.04	0.04