



**MAKING ZERO INJURIES A REALITY:
FOCUS ON SHUTDOWNS, TURNAROUNDS AND OUTAGES**

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A Report to
The Construction Industry Institute
The University of Texas at Austin

Under the Guidance of
CII Project Team 160A
Achieving the Zero Injury Objective on Shutdown Projects

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Executive Summary

This report describes a study of safety on shutdown, turnaround and outage construction projects, commonly referred to as shutdowns. The objective of this study was to examine the different practices, and policies used by general contractors on shutdown projects and to determine how they affect safety performance.

The number of Occupational Safety and Health Administration (OSHA) recordable injuries per 200,000 worker hours was used as the measure of safety performance. The results identified several variables that were associated with lower injury rates on shutdown construction projects. Practices that are associated with good safety performance included planning (pre-project and pre-task), safety education, worker involvement, evaluation and recognition, subcontractor management, accident/incident investigations, and drug and alcohol testing. Practices contributing to effective safety performance, unique to shutdown projects, included worker familiarity with the project, methods used to buildup the workforce, units of time used in scheduling, workweek schedule and project duration, work crew size and type of contract.

All the statistically significant factors found to effect injury rates are presented. Factors that constituted trends with safety performance are also presented.

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CHAPTER 1

INTRODUCTION

The construction industry continues to be one of the most demanding and dangerous industries in the United States. The diversity of construction projects and their ever changing nature expose workers, unlike any other work setting, to new hazards virtually every day. To counteract this, proactive construction personnel have taken major steps in identifying and eliminating the causes of accidents on job sites. Safety has become one of the most important aspects of concern on many construction projects. Construction firms are realizing that the initial investment and the continuous efforts to maintain a good safety record do pay off by not only reducing injuries on the job site, but by also contributing to an “on time” and “within budget” project delivery.

As past research was being conducted on large construction projects (Hinze and Wilson, 1998), it became evident that there was a need to study in greater depth the best safety practices on shutdown, turnaround, and outage projects. The terms shutdown, turnaround, and outage are often used interchangeably. While the term “shutdown” may technically imply that this is an unscheduled or emergency stoppage of plant operations, it is readily used in place of the term “turnaround” which technically infers that the stoppage of plant operations has been planned to install upgrades in the equipment, replace worn out equipment, or to perform required maintenance for which operations must cease. The term “outage” is most commonly used in power plants, but the term shutdown is also understood in that sector of the industry. While there are technical differences between the terms, they are, as mentioned, frequently used interchangeably in

the field. The term “shutdown” will be used from this point onward, with the understanding that the other terms might also apply just as well.

Shutdown projects are quite unique when compared to other construction or maintenance projects. They are more like construction projects when they require additional workers to be hired to accomplish the work. They are more like maintenance projects when there are sufficient numbers of on-site workers that can be assigned to perform the work. Regardless of the type of project they resemble, they are different from other projects in that the work has a particularly tight timeline. Shutdowns, depending on the amount of work required, are performed within days or within a matter of a few weeks. Only very large shutdown projects will take more than two months.

The timelines are understandably tight in that the revenues generated by the plant or facility come to a halt once the operations are stopped. Thus, it is not uncommon for some shutdowns to be scheduled with night shifts and work being performed seven days a week.

Shutdown projects are unique and the achievement of safety on these projects is a particularly challenging task. Despite this, several firms have mastered the undertaking of shutdown projects while embracing the principle of zero injuries.

Previous research has covered many areas of construction safety, including what the leading firms of the industry are doing to minimize worker injuries, but in recent years very little has been done in isolating and analyzing the methods and practices used to achieve strong safety performances on shutdown construction projects.

The unique aspects of shutdowns should now be clear. There is a rapid buildup ofⁱⁱ the workforce and there is a particularly stringent deadline imposed on the performance

of the work. It is true that conventional construction projects have a period in which the workforce is built up and there are often penalties imposed if the project is not completed on time; however, shutdown projects have the workforce built up in an accelerated fashion and the time restrictions are much tighter. Both of these features can be problematic if safety is not properly addressed. Having a greater understanding of best practices that pertain to shutdown projects will provide valuable information to both contractors and owners. This knowledge will be helpful in ensuring the safety of shutdown projects, including the short duration shutdowns and the long-term or major shutdowns. It is the purpose of this research to investigate the safety practices of shutdown construction projects to identify those practices that make one project safer than the next.

By identifying methods that have proven effective in reducing worker injuries, the construction community will be provided with guidance for the effective means to achieve the lowest possible injury frequency rate.

This study attempted to explore in depth the various means by which contractors achieve optimal safety management on shutdown projects. The dynamics of shutdown projects are so different from conventional construction projects that it is not realistic to include the shutdown data with that of the other projects. A separate effort is needed to more fully understand shutdown projects, especially in terms of how project safety can be best assured.

CHAPTER 2

LITERATURE REVIEW

“Attention to safety in the construction industry has increased dramatically in the United States over the past few decades. The 1990s can properly be called the ‘decade for construction safety’. Several factors have led to the greater emphasis on safety. Although construction work has become safer, there is still much to be accomplished. Since there is now a strong concern for safety in the construction community, one can hope that further improvements will continue to reduce the numbers of fatalities and serious injuries in the industry” (Hinze, 1997). An extensive search of the literature revealed that no publications have been written on any aspects of safety that relate particularly to shutdown projects. An expanded effort on shutdown projects appears well warranted.

A 1979 study conducted by Charles L. Harrison investigated safety practices in large construction projects. That study showed a comprehensive view of what the safety programs of very large construction firms were like at the time.

The Construction Industry Institute (CII) conducted a study in 1993 that contributed significantly in defining five (High Impact Techniques) safety management practices needed to be taken in order to achieve optimal safety performance. This study was followed by a validation study conducted in 1998 (Hinze and Wilson, 1998). Further study by the Construction Industry Institute conducted under Jimmie Hinze (2001) expanded upon the techniques identified by the CII study in 1993 and generated a list of a total of nine essential safety techniques to be employed in the construction industry.

Zero Injury Techniques

The Zero Accidents Task Force was formed by the CII to continue research into the important area of worker safety. Their research (1993) identified five "High-Impact Zero Injury Safety Techniques" that were being used by contractors to attain the "Zero Injury" objective. The task force defined "safety excellence" as reaching a 1.00 or less on the Bureau of Labor Statistics and OSHA Lost Workday Case Incidence Rate (LWCIR). Both small and large owners and contractors can benefit by including the five practices in a strong, basic safety program. The high-impact zero injury practices identified by the task force were:

1. Pre-Project/Pre-Task Planning for Safety
2. Safety Orientation and Training
3. Written Safety Incentive Program
4. Alcohol and Substance Abuse Program
5. Accident/Incident Investigations

The results of that study also showed that zero lost workday incidents are achievable on larger projects. Of the 25 projects studied, eight had zero lost workday cases, nine had an LWCIR of 1.0 or better (greater than zero and not exceeding 1.0), six had LWCIR between 1.0 and 2.0, and two had LWCIR of 3.40 and 4.37, respectively. The projects ranged in size from approximately 200,000 to 6,300,000 work hours completed at the time the research was conducted. The study further defined the projects with LWCIR of less than 1.0 as excellent and those greater than 1.0 and not exceeding 4.4 LWCIR as "good in safety."

The research was unable to find projects with a LWCIR nearer the BLS/OSHA 1990 national average of 6.7. Such "poor safety" projects were not identified for inclusion in the study. The task force could only compare the "good" to the "excellent" projects. Doing so, however, resulted in very identifiable differences in the safety management practices employed. The research clearly showed that the implementation of the five high-impact techniques should assist companies in improving their safety performances and achieve zero or near zero LWCIR performances (CII Publication 32-1, May, 1993).

Zero Injury Techniques Validation

The National Center for Construction Education and Research (NCCER) and the M. E. Rinker, Sr. School of Building Construction at the University of Florida conducted a survey to examine the impact of the Zero Injury Techniques report published by the CII (Hinze and Wilson, 1998).

“Results of this study show that construction firms are implementing a variety of programs to improve safety performance. More importantly, these programs are effective in favorably influencing safety performance, whether measured in terms of recordable injury incident rates, lost time injury incident rates, or experience modification rates. While there is some concern regarding the merits of safety incentives, there is a general agreement that the five high impact techniques play a vital role in safety performance. Contractors are continuing to devise means by which safety program enhancements can be made. The commitment to safety is clearly sincere. Further developments in safety enhancement programs can be expected” (Hinze and Wilson, 1998).

The five impact techniques identified by the 1993 CII were expanded upon by the findings of a 2002 study conducted by Jimmie Hinze. The results of that study revealed the importance of employing several safety techniques in the construction industry. These findings were grouped into the following nine categories:

1. Demonstrated management commitment
2. Staffing for safety
3. Planning: pre-project and pre-task
4. Safety education: orientation and specialized training
5. Worker involvement
6. Evaluation and recognition/reward
7. Subcontract management
8. Accident/incident investigations
9. Drug and alcohol testing

Note that the five High Impact Techniques identified in the 1993 study are included in these nine categories. Some of these continue to play the same role as was existent in 1993, but others are being implemented with greater sophistication and with greater effectiveness.

Demonstrated management Commitment

The safety culture of a company is greatly impacted by the role its management plays. To have any impact, this role must be noticeable at the project level. Worker safety is emphasized when management makes its presence known in a large project environment. Through inspections from home office management or participation in

safety initiatives such as training and orientation, accident and incident investigations or observation tours, management can contribute significantly to the overall safety performance of the project. It is imperative that top management demonstrates its commitment to the project level in some manner. Better safety performances were recognized on projects where someone from the home office made project safety inspections more frequently.

Top management can also convey its commitment to safety by becoming involved in some manner in the investigation of worker injuries. Hinze's (2002) findings showed the importance of top management being involved in the investigation of every injury accident, including both OSHA recordable or lost workday cases. The projects where top management was involved with the investigation of every recordable injury had much lower injury rates than the ones where this involvement was 50 percent or less.

Staffing for Safety

The implementation of a safety program on any project includes the people, means, and resources utilized to achieve a strong safety performance on a construction project. The safety staff assigned to the project is one of its most valuable resources. Several findings (Hinze, 2002) showed the importance of project-level safety personnel, safety communication tools, and personal protective equipment to the overall safety objective.

Safety Representatives

Most of the projects had full-time safety representatives. The safety representatives reported to the area safety director in the main company office on more than half of the

projects surveyed (Hinze, 2002). On the majority of the projects, these full-time safety representatives were employees of the general contractor and were not consultants for the project(s). However, some of the projects had their safety representatives fulfill responsibilities on other projects at the same time. Projects where the safety representatives had responsibilities on other projects reported a higher median injury rate than those with full-time safety representatives. It follows that projects should have their full-time safety representatives involved in regular project management meetings and have the safety representatives copied on information related to the project progress (costs, scheduling, quality, etc.).

Safety Personnel

While not statistically significant, the results of Hinze's (2002) study appear to support the theory that safety personnel are more effective at reducing injuries when they are responsible for fewer workers.

These findings seem to imply that when consultants are utilized, the company has not made a full commitment to the safety mission. Also, the findings suggest that in-house personnel are more effective since they are aware of the safety needs of the project and are more fully focused on that objective.

It is not sufficient to have a safety representative on the project. The safety personnel must be effective. How can this be achieved? The research results imply that the manner in which safety personnel are incorporated into the organizational structure has an influence on safety performance. Specifically, better safety performances were noted on those projects in which the safety personnel reported directly to someone in the

main office. Safety personnel appear to have greater freedom if they report to someone in the main office whose primary mission is safety. Line personnel on site have the intervening objectives of time, cost, and quality that might be viewed as being potentially in conflict with the safety mission. In addition, safety performances were better on those projects where safety personnel reported that they were viewed in a positive manner.

Personal Protective Equipment (PPE)

Safety equipment is one of several resources for safety at the project level. The majority of the projects studied by Hinze (2002) required their workers to wear hard hats, safety shoes and safety glasses at all times. Workers are generally required to provide their own safety shoes, while safety glasses and hard hats are provided by the employers. How safety is budgeted for may impact safety performance. The projects that have separate budget allocations for safety, or where a budget is established at the corporate level, generally have better safety performance records. By having a special budget allocation for safety, whether at the project or corporate levels, safety expenditures are probably not seen as an expense that requires any bargaining. A commitment in the budget for safety means that there is no conflict between safety expenditures and expenditures for other cost items.

Planning: pre-project and pre-task

Safety programs must be relevant to the jobsite if they are to be effective. One way this is done is by developing a site-specific safety program. It has been noted that site-specific safety programs are not automatically created for every project, as some firms

have no site-specific safety programs. Hinze's (2002) findings show that the better safety records are associated with companies that prepare site-specific safety programs on a greater proportion of their projects. Preplanning was shown to be beneficial for project safety.

Another important part of job site safety consists of conducting a hazard analysis prior to each major phase of work. There are various terms for this practice including task safety analysis, safety task analysis, activity safety analysis, pre-task safety planning, and others. The essence of the practice is that the workers in the crew make a conscious effort to identify major hazards that are posed by a task to be performed. Prior to beginning the work on that task, the crew will devise means to eliminate or reduce the dangers. Hinze (2002) showed that pre-task planning pays dividends in terms of safety performance. Firms that conduct pre-task safety planning, or that assess the hazards of each task to be performed, have better safety records.

Safety education: orientation and specialized training

Training is regarded as one of the core requirements of an effective safety program. OSHA requires all employers to establish and supervise programs for the education and training of all employees in the recognition, avoidance and prevention of unsafe conditions. This includes such typical subjects as electrical lockout; entry into confined spaces, trenching operations, back injury prevention, fire protection, blasting, substance abuse, crane safety and rigging, fall protection and many others.

Toolbox meetings are most often considered the first safety program element to be implemented. All of the construction firms studied conducted toolbox-safety meetings on

their job sites and the majority (90%) held them weekly (Hinze, 2002). However, 51% of contractors did not specify which day of the week they were held and claimed that this would vary from week to week. Mondays were found to be a common choice for the contractors and some firms stated they conducted these meetings daily.

The most important training that contractors can provide begins with the orientation of new hires. Research findings have consistently shown that new workers are most likely to be injured during the first few weeks of employment. Generally, all new hires and all workers new to the jobsite should attend orientation sessions, even if they are experienced and already very skilled.

Training is a key component of the safety programs of most construction firms. Training generally begins with orientation training for new workers. The companies with better safety records provided orientation training to all company employees. Safety orientation helps new hires become familiar with the jobsite layout, company policies and other types of information initially unknown to them when working on an unfamiliar project. The orientation of salaried personnel was found to also have a measurable impact on safety performance.

The orientation of workers can follow different procedures. The basic approaches are sessions that are either formal or informal. Formal orientation is a means by which there is greater assurance that every worker receives the same standardized information. Formal orientation has been shown in other research studies to be more effective in reducing injuries than is informal orientation. Most contractors in the Hinze study (2001) provided their new hires with formal orientation.

The need to educate and train workers continues throughout the life of a project. Training may have to be conducted on confined space entry, lockout/tagout procedures, fall protection, equipment safety, trenching, flagging, work zone safety, and a diverse number of other safety-related subjects. Obviously, some workers may need one type of training while other workers will need training in another subject

Most firms have a policy of providing training to workers during the workday. Although this is a widely implemented practice, a few firms indicated that this was not the case. The firms can reinforce the importance of safety and the integral nature of safety to the jobsite when training is part of the workday, with workers being paid while they receive training. The results of the Hinze (2002) study also show that this is associated with better safety performances.

Training effectiveness can be measured to some extent by assessing the knowledge of those individuals who receive the training. If the “students” learn the material being taught, then the training is effective. If there is no evaluation of the knowledge imparted, students are less likely to be focused on the material being presented. Results show that the companies with better safety records are those that administer a test at the conclusion of training sessions.

Most (95%) of the safety training is conducted by in-house personnel. A few of the respondents had such training conducted by outside personnel. “Better safety records were noted when in-house personnel conduct the training. Certainly, such training is probably more applicable and relevant when in-house personnel conduct the training.”(Hinze, 2002) Perhaps in-house trainers are more aware of the specific safety needs of the firm. Hiring in-house trainers also demonstrates the commitment that the

company has to training. On the other hand, hiring outside personnel may result in obtaining the services of qualified safety personnel, but the individuals may not be fully aware of the specific needs of the firm.

While in-house personnel can be effective to reduce jobsite injuries, it may also be important to recognize when other types of training might be more appropriate. For example, a specialized class on a particular subject may not be able to be taught as effectively by in-house personnel. Firms must recognize when their training needs cannot be adequately met with in-house programs. It was found that safer performances were associated with firms that used outside classes to provide some of their safety training.

Most of the firms (98%) in the Hinze (2001) study provided safety meetings/training sessions for their foremen, with 9% providing them weekly, 24% providing them monthly, 33% providing them quarterly, 23% providing them annually, and the remainder providing them at various times such as at milestones, after accidents, when the phase of work changes, etc. Meetings that are held at supervisory levels tend to include many important issues, including resolving current health and safety problems, providing a forum for planning safe construction activities, and planning ahead for upcoming operations. These trends reflect how serious these firms are in implementing their safety standards.

Training may extend beyond company employees. It was found that firms had better safety records when they also provided orientation training to the subcontractor employees as they arrived on the jobsite. This is a way that the firm can ensure that every worker on the jobsite has received at least some level of desired safety training.

Much of the training must be tempered with a focus on the specific tasks being performed on the jobsite. In other words, the training must be relevant. Where does the training material actually come from? There are many different sources of safety information. OSHA materials were considered to be a primary source of safety information by 65% of the firms. The firms utilizing these OSHA materials in their training efforts had better safety records. Some contractors considered trade journals, commercially available text materials, and videos as valued sources of safety information. Companies that used NIOSH materials as a resource also tended to have better safety records.

In the data analysis, the safety records of firms were compared by taking into account the number of different resources used for their safety training materials. This showed that firms using a combination of more resources for safety had lower injury rates when compared to firms that used fewer resources.

Alcohol and Substance Abuse Programs

From the Hinze (2002) research results, a strong drug and alcohol abuse program had a significant overall impact on reaching the zero injury objective. The use of drug and alcohol abuse programs in construction has profoundly improved safety in the workplace. There were many sources for effective program guidelines. Many of the contractor associations offered guidelines for their members. These programs varied widely in their thrust. "Test sample handling protocol" and the "accuracy of the testing laboratory" are the most critical aspects of such programs.

Distinctive elements found by the research

There are many elements of drug and alcohol abuse programs. The elements that were distinctly prevalent in the projects achieving safety excellence were:

- * Regular inspections for contraband.
- * Screening tests conducted at random.
- * Screening tests conducted for alcohol.
- * Lower tier contractors required to have drug and alcohol abuse programs.
- * Programs administered to ALL employees.
- * Screenings done after accidents (post accident).

Accident/Incident Investigation

Conducting rigorous accident/incident investigations sends a message of management concern to all employees on a project. Failure to investigate accidents sends a message of management disinterest and apathy toward worker safety. Hinze (2002) found that contractors who were able to achieve zero or near zero injuries on their projects had rigorous procedures on all aspects of accident investigations. Such investigations find the real or root causes of accidents, result in recommendations for accident prevention and insure that follow up action does occur.

Worker Involvement

Worker involvement in the safety process is one of the most important aspects of project safety. Many safety professionals have stated that most injuries are the result of unsafe actions or behavior and that the unsafe conditions play a minor role. With the

actions of workers being the major cause of injuries, it would appear prudent to take special notice of them. Behavior reflects attitudes to a large extent. To change behavior requires innovation. Perhaps the most significant innovations in construction safety in recent years relate to means by which workers are involved in the safety process. Since the 1993 CII study, the industry has taken major steps in the delicate area of worker behavior assessment.

Safety Committees

There is no formalized protocol in the construction industry for the formation and use of safety committees. Thus, many variations will be found on construction sites. Typically, a safety committee is made up of five to eight workers, possibly a foreman, and possibly a safety representative. These workers will generally be selected from different crafts. The role of the committee might initially be to make a job tour each week to identify unsafe conditions and any noted unsafe behavior. The job safety audit might take about two hours, but this may vary considerably from project to project. Projects that employed safety committees tended to have better safety records.

The safety committee is a standing committee that will be active for the life of the project, but the membership typically will change. For example, in a safety committee of six workers, one new member might be added to the committee each week as a veteran committee member “drops off”. This will permit the training value received in the safety committee to be realized by more workers. The veteran will be more “enlightened” about safety and will continue to be watchful of unsafe conditions and unsafe behavior as the new committee member becomes more informed about project safety.

Results of Hinze's study (2002) indicate that the means used for the selection of workers to serve on the safety committee is associated with safety performance. The better safety records were noted on those projects where workers would volunteer for service on the safety committees. Workers who volunteer for such service seem to have a stronger commitment to the mission of the safety committee.

Behavior-Based Safety

Behavior-based safety techniques usually involve a behavioral checklist to observe performance and then to give specific supportive and corrective feedback (Geller 1997). This consists essentially of observations that are made of other workers as they perform their tasks. After the observation period of a few minutes to a few hours is completed, a debriefing session is held with the observed worker. This session is to reinforce the good safety practices that were observed and to address means of making improvements in those practices that place the worker or others at risk. These techniques have been used to a limited extent in the construction industry in the past few years. Research results indicate that projects that implemented a formal behavior-based program had better safety performances (Hinze, 2021). Better safety performances seem to be realized on projects where safety observers were employed.

Projects which have their management and supervisory personnel receive overview training in behavior-based safety philosophy and concepts makes these supervisory and managerial personnel a part of the program. This training helps make the program run smoother and, as a result, improves safety performance.

Most projects employ hourly craft workers on the observation teams (Hinze, 2002). Typically, the observation team was comprised of five percent of the workforce, with an average length of training to be an observer consisting of approximately 9.4 hours. The team observed other workers on a daily or weekly basis. The average time for one safety observation was approximately 2.5 hours. It was recommended that projects with behavior-based programs should generate a formal report for each observation. Management can use the information obtained by the observers in different ways to implement continuous improvements on their projects.

Most projects do not record the names of workers on the observation forms. This is referred to as the “No name, No blame” policy. Better safety performances have been associated with those projects that record observation reports.

Perception Surveys

Worker safety perception surveys are often employed by projects in order to gage the overall status of safety among the workers. While the specific nature of these surveys may vary considerably between projects, the following represent areas of interest included in such:

- The workers’ overall feelings of safety
- Worker comfort levels around bringing-up safety concerns to someone else’s attention
- Employees’ perception of a company’s support you if they refused to work in an unsafe environment
- Support for safety at a first line supervisory level

- The employees' perception of the company's overall commitment to safety

Worker safety perception surveys can provide general feedback on safety. These surveys can provide projects a good idea on how field employees view safety. Contractors might conduct these surveys on a weekly, monthly, quarterly or annual basis. Conducting safety perception surveys has prompted some projects to claim that the changes they have made (as a direct response to these surveys) resulted in improved attitudes towards safety. Many of the projects that conduct safety perception surveys often implement additional hours of safety training as a result of these surveys. Projects employing worker safety perception surveys were shown to have better safety records than those projects not conducting such surveys (Hinze, 2002).

Evaluation/Recognition and Reward

Safety incentives have been shown to be beneficial on some construction sites. Incentives may be established exclusively to reward safety performance or they can be part of a broader project incentive program that could include schedule, cost and quality. In this latter case an integrated incentive program will need to be designed by the parties with methods of measurement and milestones established to manage the program with fairness.

Implementation

"Monetary incentives" were ranked as one of the highest items of distinction between the "excellent" and "good" projects (CII Publication 32-1, 1993). Safety

incentives come in two basic forms: gift items and monetary awards. Historically, "good safety performance" awards to craft workers have been the "gift" programs using items such as ball caps, jackets, belt buckles, radios, and various types of gift certificates.

The key result of monetary incentive awards to workers was the way communications opened up with the start of the incentive program (CII Publication 32-1, 1993). When incentive money is at stake, employees feel the urgent motivation to insure that all safety items are highlighted and covered in discussions.

Administration

Once the amount of the incentive is determined, care must be used to insure equity is established. Frequent payments were found to be commonplace. The typical format was monthly awards combined with an end of the project award. Awards are typically based on reaching "Zero" injury goals for a month or quarter. Separate checks given to each trades person by their foreman is typical. The check amount for each eligible person is for "hours worked that month" multiplied by the "cents per hour" award. In some of the projects studied the owners participated in funding the incentive program. In other cases the contractor funded the program.

Observations and cautions

The CII project team 160 felt that the expense of a properly structured incentive program is more than offset by the cost savings in achieving safety excellence and, in fact, will yield a net profit.

Clear, simple, and concise communication of the incentive program to craft workers is essential. So that everyone knows how he or she is performing, this communication should be ongoing. Incentive payments to craft workers need to be at reasonable frequency, such as monthly or quarterly as the longest interval. They should be paid in a separate "Safety Incentive" check. The incentive programs were not used to replace other essential elements of a fully developed safety program. In fact, if an effective safety program was not already in place, the project team pointed out that monetary incentives may not yield an improvement. Incentive programs are not easy to administer to the satisfaction of every single employee. Managing incentive programs will be especially troublesome when all employees who work on the project are not eligible for the incentive payments. This can be overcome by careful structuring the incentive program.

Subcontractor Management

Subcontractors played a significant role on many of the projects that were included in past research. Firms often pre-qualify their subcontractors before considering them for the contract. Safety is usually factored in as a major criterion in the pre-qualification process. Many projects consider the EMR along with the safety record (incident rate) of subcontractors when selecting them. Projects that pre-qualify their subcontractors generally have better safety performance records than projects that do not pre-qualify their subcontractors (Hinze, 2002).

Projects should require their subcontractors to submit project specific safety plans as this results in lower injury rates (Hinze, 2002). By submitting a project-specific safety

plan, the general contractor has greater assurance that the subcontractor has thought through the project and is more likely to perform the work in a safe manner.

Past research has shown that better safety records were associated with projects where subcontractors held daily safety meetings (Hinze, 2002). Those conducting daily “toolbox” meetings are probably those with a pre-task safety-planning program in place. The most popular day to conduct weekly toolbox meetings is Mondays.

In general, it appears that the general contractors should be pro-actively involved with subcontractor safety. In other words, the general contractors should not maintain an “arm’s length” approach to subcontractor safety. General contractors should expect the subcontractors to adapt to the safety standards of the project. Sanctions can be put in place for subcontractors that do not comply with project safety requirements.

CHAPTER 3

RESEARCH METHODOLOGY

The purpose of this study was to explore in depth the various means by which contractors and owners achieve zero injuries on shutdown projects. The dynamics of shutdown projects are so different from conventional construction projects that it is not realistic to include the shutdown data with that of the other projects. A separate effort was deemed necessary to more fully understand shutdown projects, especially in terms of how project safety can be best assured. The roles of the facility owners and the shutdown contractors were the focus of this research.

The 2002 Hinze study identified nine effective safety techniques and since then many of the companies that lead the ongoing efforts to improve overall safety on the job site and reduce the number of injuries, have implemented these techniques. However, no formal effort has been made to subsequently assess the impact of these techniques in shutdown project settings. This study will examine the extent that these techniques are used and at the same time determine the overall effect they have on the safety performance of the shutdown projects where they are implemented.

Data Collection

One study, focused on shutdown construction projects, was conducted. The questionnaire contained questions about the five high impact techniques suggested by the CII (1993) study and the additional four techniques further suggested by the Hinze (2001) study. Questions also were included about the implementation of innovative approaches