



**A Social Science Plan**  

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**for**  

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**Employee Safety**  

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**in the**  

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**National Park Service**  

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Employee Safety  
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June 1998

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# I

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## Introduction

The purpose of this report is to provide a plan for social science research on employee safety in the National Park Service (NPS). Employee safety is essential to the mission of the NPS; a primary responsibility of all organizations is to protect its employees from harm. NPS employees are injured and sometimes killed in a variety of ways (Baylous 1997, Halainen 1997, Rozas 1997). Accidents and incidents have occurred to NPS park managers, maintenance workers, motor vehicle operators, laborers, interpreters, scientists, and law enforcement officers (Rozas 1997). Hence, improving employee safety is a major responsibility of the NPS.

The plan was commissioned by the Risk Management Division of the NPS. It was prepared by Dr. Gary Machlis, NPS Visiting Chief Social Scientist, and Dr. Seth Tuler. The plan is based on: a) an analysis of federal, department and agency policies and regulations concerning employee safety, b) a detailed review of the social science literature relevant to employee safety, and c) a workshop and interviews with NPS officials and employees. The draft plan was reviewed by NPS safety managers and peer reviewed by external social scientists. The plan was produced by

the NPS Social Science Program, as part of its technical assistance activities to the NPS.

Since the mid-1970s, studies of high-risk activities and employee safety have been performed by psychologists, geographers, engineers, and sociologists. Risks from natural disasters, occupational accidents, household accidents, and large-system failures have been examined. Research has been conducted on high-profile events such as the Mt. St. Helens eruption, forest fires, and the Three Mile Island, Chernobyl, *Exxon Valdez*, and *Challenger* accidents. Research has also been conducted on more common activities, such as vehicle operation, logging, equipment inspection and maintenance, and handling of hazardous materials.

Results from these studies have pointed to the importance of social factors—the social, psychological, cultural, managerial, and organizational variables that influence employee safety. Knowledge of social factors has proven useful in improving safety and reliability in a variety of occupational settings. Understanding social factors is important to the mitigation and prevention of accidents to NPS employees.

This understanding requires a sound scientific basis. Hence, social science is a necessary and important component of NPS efforts to improve employee safety. A plan for NPS employee safety research can identify and prioritize research needs, increase the usefulness of research results, improve the delivery of information, and reduce costs. The objectives of this plan are to:

- identify the needs for social science research related to NPS employee safety,
- propose a research agenda and specific research projects, and
- propose an action plan, schedule, and budget for implementing the research.

### **Challenges to NPS Employee Safety**

The NPS faces important challenges to ensuring employee safety, including:

- a higher accident rate than other federal agencies with similar responsibilities,
- increasingly complex work tasks that emerge from the NPS mission,
- evolving Department of Labor and Department of the Interior (DOI) regulations,
- significant organizational change within the NPS, and
- limited budgets, resources, and staff at all levels of the NPS.

NPS employee accident rates are higher than those in other federal bureaus within the DOI and in the US Forest Service (Baylous 1997, Rozas 1997). According to the Office of Workers' Compensation Programs (OWCP) Lost Time Data Reports, injuries per 100 employees in the NPS were approximately double the DOI-wide rate in 1992-1996; NPS employees had 6-7 accidents per 100 employees annually during these years (Rozas 1997). In some regions and in some park units, the accident rates were higher. For example, the Western Region and the National Capital Region had higher accident rates than other regions; Yosemite NP and Rock Creek Park had higher rates than other units within their regions (Rozas 1997).

The activities during which accidents occur are varied (Rozas 1997, Halainen 1997). According to DI-134 reports (available only through 1994) and NPS Morning Reports, accidents occur in the NPS for many of the same reasons they occur in all workplaces (Rozas 1997, Halainen 1997). NPS accidents have occurred during equipment maintenance and repair, vehicle operation, law enforcement, landscaping, animal handling, materials handling, and trail maintenance activities. Accidents have occurred both on and off the job.

In addition, NPS accidents occur in activities that result from the unique combination of organizational culture, work environment, and job requirements of NPS employees. These include (but are not limited to) search and rescue, visitor services, and firefighting. Unlike many employees of other bureaus and agencies, NPS employees have more interactions with the

public, and must balance preservation of natural resources with visitor enjoyment (Singer 1997). Such interactions can create unique work requirements.

The types of accidents occurring to NPS employees are varied, based on DI-134 data, Lost Time Data, and NPS Morning Reports (Rozas 1997, Halainen 1997). Employees have suffered cuts and lacerations, sprains and fractures, and discomfort (such as backaches and fatigue). Serious permanent injuries and deaths have also occurred. Full-time, seasonal, and contractor employees have been involved in accidents. Safety problems are not isolated within divisions, regions, or units; accidents are occurring to many types of employees and throughout the NPS.

In response, some national, regional, and park managers have become involved in a variety of efforts to understand and address the causes of employee accidents, injuries, and deaths (Peterson 1997, Seely 1997, Siler 1997). These activities are partly a response to federal policies toward employee safety. Federal policy is evolving, as the Department of Labor and the Environmental Protection Agency promulgate new regulations that impact employee safety. Examples include new regulations for the handling and disposal of hazardous materials (Singer 1997, Hurt 1997), and an extensive interagency effort to address risk and safety in wildland firefighting (Broyles 1997).

In addition, organizational change within the NPS affects employee safety. The Risk Management Division is revising the primary NPS policy document, NPS-50, to emphasize safety issues (Seely 1997). Reorganization has decentralized many initiatives. Several parks have implemented innovative safety programs (Belden 1997, Siler 1997, Singer 1997), including Yellowstone NP, Olympic NP, Lake Mead NRA, Grand Canyon NP, Carlsbad Caverns NM, Bandelier NM, and others. Initial reports suggest that these new and modified programs may be effective in reducing accident and injury rates (Siler 1997, Seely 1997, Singer 1997, Bornholdt 1997, Belden 1997). For example, at Grand Canyon NP OSHA-reportable accidents have dropped by over 30% (Singer 1997).

However, these are new programs, and their long-term effectiveness have yet to be proven. In most cases, parks are continuing with “business as usual.” In response to a Director’s request for information, only 10% of parks indicated they had adopted a new approach to risk management (NPS 1996a). The effectiveness of both old and new approaches is inconsistent across the National Park System. There are important differences in park characteristics, the degree of management attention to safety, and the kinds of employee activities at different units (Peterson 1997, Seely 1997, Siler 1997). The effectiveness of current safety approaches is difficult to measure. And while some statistics on employee safety and accident rates are available, there are important gaps in information (Bornholdt 1997, Seely 1997, Siler 1997).

### **Overview of the Report**

In this introductory chapter, the purpose and scope of the social science plan are outlined. The social sciences included in the plan are briefly defined and described. The objective of the plan is to identify the needs for NPS social science research on employee safety. The plan is applicable Service-wide. Its scope is limited to research critical to providing a safe working environment for all NPS employees.

Chapter 2 provides a policy analysis of NPS requirements and rationale for social science research on employee safety. Legislative statutes, policy documents, and management plans are reviewed. They reveal a formal mandate and specific responsibilities for conducting social science in support of NPS employee safety.

Chapter 3 provides a review of social science literature relevant to employee safety in the NPS. The chapter begins with a broad overview of research literature generally relevant to employee safety. Then, the review focuses on literature related to safety of activities similar to those performed by NPS employees, as well as research conducted on NPS safety issues.

Chapter 4 describes the research priorities of NPS management, supervisors, and other employees. Information was obtained



during a workshop with the Risk Management Council and telephone interviews with other individuals involved in employee safety.

Chapter 5 provides a social science research agenda on NPS employee safety. The agenda is organized around a series of interdependent research projects. Each project has an estimated budget and schedule.

Chapter 6 presents a comprehensive action plan to accomplish the research needed to improve NPS employee safety. The action plan is organized into several stages, so that critical work can be accomplished as funds become available.

The report includes several appendices. These present employee safety research questions identified through a nominal group process, a list of individuals interviewed, and references.

### **The Social Sciences Defined and Described**

The social sciences are those disciplines of science that study humankind in relation to its cultural, social, and physical environment. They are one of the three main divisions of knowledge, the others being the natural sciences and the humanities. There is considerable overlap. History, for example, involves elements of both humanities and social sciences; geography includes both physical geography (a natural science) and human geography (a social science).

While formal listings and opinions vary, several disciplines are commonly considered as social sciences: anthropology (and closely related ethnography), archeology, economics, geography (human rather than physical), psychology, political science, and sociology.

The NPS currently has programs in anthropological and historical archeological research, as well as an established Applied Ethnography Program. Much work is conducted by these programs in support of NPS cultural resource management, and in response to legal requirements such as the National Historic Preservation Act (1966, amended 1992), and the Native American Graves Protection and Repatriation Act (1990). The above

programs are essential to the NPS, however, their research agenda and organization are beyond the scope of this plan.

Hence, this plan for social science related to NPS employee safety focuses on the following social sciences: economics, geography, psychology, political science, and sociology. While these disciplines interact, each focuses upon certain units of study and driving forces important to understanding human behavior. Each has usefulness to the NPS; several are of direct importance to ensuring employee safety in the NPS.

**Economics** (both macro- and micro-economics) treats markets, industries, and economies as key units of study; the driving force of change is economic value broadly defined. Economics can aid NPS managers through studies of costs and benefits of different employee safety management strategies and the resource requirements for promoting effective employee safety programs in different types of NPS units.

**Geography** (specifically human geography) treats regions, landscapes, and other spatial units (governmental, organizational, ecological, and so forth) as critical. The central concern is the spatial distribution of people, resources, and culture. Geography can aid NPS managers through studies of hazard management strategies, spatial patterns of risk, and the role of environment in accidents.

**Psychology** has the individual as its key unit, and decision-making, behavior, and communication are central driving forces. Psychology can aid NPS managers through studies of factors that contribute to the stress and fatigue of individuals and teams, factors that encourage risk-taking behaviors by individuals, the role of attitudes and incentives on employee decisions, and the effectiveness of training procedures.

**Political science** focuses on institutions of the state (at many levels); the central engine of change to many political scientists is power and its use. Political science can benefit NPS managers through studies of employee participation in worker safety programs and management policies that support employee safety.

**Sociology** treats social groups, organizations, and communities as key units of study, with human behavior as its central concern. Sociology can aid NPS managers through studies of demographic trends in the workforce, organizational culture, and employee behavior and opinions regarding safety policies.

These social sciences are also important partners in *interdisciplinary research*. New disciplines such as environmental economics, organizational psychology, industrial ecology, and human factors research have emerged as important scientific fields relevant to the NPS and employee safety.

Economics, geography, psychology, political science, and sociology form the core social sciences discussed in this plan.

## II

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# Policy Rationale for NPS Social Science Research on Employee Safety

The NPS has a strong mandate to conduct social science research on employee safety. The rationale can be found in general and specific policies directing the management of the NPS, and in national, regional, and individual park unit planning documents.

### **The Federal Mandate for Employee Safety Research**

The national mandate for employee safety research emerges from the Occupational Safety and Health Act (OSHA), which states:

It shall be the responsibility of the head of each Federal agency to establish and maintain an effective and comprehensive occupational safety and health program...The head of each agency shall (after consultation with representatives of the employees thereof):

- 1) provide safe and healthful places and conditions of employment...

- 2) acquire, maintain, and require the use of safety equipment, personal protective equipment, and devices reasonably necessary to protect employees;
- 3) keep adequate records of all occupational accidents and illnesses for proper evaluation and necessary corrective action... (P.L. 91-596, Sec. 19(a)).

OSHA has been codified by the Department of Labor in 29 CFR part 1960. In accordance with OSHA, the head of each federal agency is required to designate a Safety and Health Official, establish Safety and Health Committees, implement training programs, and keep records. For example, the Safety and Health Official has a variety of responsibilities, including the development of:

- a) plans and procedures to evaluate occupational safety and health program effectiveness at all operational levels (29 CFR 1960.6(b)(5)),
- b) priorities with respect to the factors which cause occupational accidents, injuries, and illnesses in the agency's workplaces so that appropriate corrective actions can be taken (29 CFR 1960.6(b)(6)).

Social science research on employee safety is clearly mandated by OSHA, as it is a necessary tool for:

- developing effective employee safety programs (such as studies of training effectiveness, employee motivation, and risk communication),
- applying activity/job hazard analysis (such as studies of hazards and their control through behavioral modification),
- conducting rigorous incident and accident investigations (such as studies of the behavioral causes of accidents), and
- evaluating the performance of safety programs and policies (such as studies of lost-time accident frequencies, commitment of management to a safety culture, and the reliability of inspection and maintenance activities).

The requirements of OSHA as they pertain to the DOI are addressed in the *Safety and Health Handbook* (DOI 1991). The

*Handbook* defines requirements, both generally and for specific activities (such as aviation, motor vehicle, and watercraft operation), in the areas of:

- personnel responsibilities,
- standards, procedures, and guidelines,
- training,
- job hazard analysis,
- data collection,
- program and management evaluation, and
- accident investigations and reporting.

The requirements create a mandate for social science research on employee safety. Social science is necessary, for example, to conduct:

- hazard analysis (such as studies of behavioral safeguards to prevent or mitigate hazards),
- training (such as training for team leadership skills),
- program and management evaluation,
- data collection, and
- accident investigations (such as studies to evaluate individual and group behaviors in near-accident situations).

Furthermore, as part of its compliance with OSHA, a *Supervisor's Annual Job Safety Interview Guide* was developed by the Designated Agency Safety and Health Official. The interview guide is a tool for supervisors to collect important information from their employees about safety and health. It is intended to support supervisor's efforts to identify problems, take corrective actions, and train and motivate employees to act safely. Specifically, the policy implemented by the *Guide* is intended to:

- facilitate accountability and program improvement,
- increase organizational safety and health awareness,
- support the creation of a safety culture inclusive of all employees and activities, and

- assist in the recognition of quality safety and health performance.

Social science research is required to achieve such policy goals.

### **The Department of the Interior Mandate for Employee Safety Research**

Employee safety research is also mandated in Federal legislation pertaining to the DOI. The mission of the Department is “to protect and provide access to our Nation’s natural and cultural heritage and honor our trust responsibilities to tribes.” In accomplishing this mission, the DOI has committed to:

- advancing scientific research and monitoring to improve our understanding of the interaction of natural and human systems and to reduce the impacts of hazards caused by natural processes and human actions,
- providing useful scientific information for sound resource decision-making, and
- applying laws and regulations fairly and effectively, placing priority on compliance and enforcement, prevention and problem-solving.

By establishing these commitments, the DOI acknowledges the importance of research on employee safety. For example:

- to reduce the impacts of hazards caused by human actions requires attention to the role of management and employees in accidents,
- to provide useful scientific information for resource decision-making requires an understanding of how employees can do their jobs effectively and safely, and
- to apply laws and regulations effectively and promote compliance, enforcement, prevention, and problem-solving requires input on employee behaviors, motivations, education, and training, as well as commitment to safety by managers.

In some cases, policies are created by the DOI and apply to the NPS. These policies provide further rationale for research on

NPS employee safety. In two occupational groups, Department-wide activities have particular relevance to NPS employee safety and social science research: aviation and firefighting.

The Office of Aircraft Services develops and implements aircraft safety policies and procedures for all bureaus within the DOI. For example, the policy of the Aviation Safety Program is:

Supervisors and managers at all levels are responsible for the safety of aviation operations under their control. Within this policy are the practical requirements to provide safe working conditions, prevent injuries to employees, and protect property from damage (Office of Aircraft Service, 352 DM 1.3A).

This policy provides rationale for social science research on employee safety, as there is a long tradition of applying social science to the improvement of safety in the field of aviation.

The DOI Aviation Safety Program includes requirements for training, staffing, accident and mishap reporting and investigation. The requirements provide rationale for research that can improve safety in helicopter and fixed-wing aviation for all bureaus in the DOI. In addition, the Aviation Safety Program provides technical assistance for special activities. Such activities may also require additional training, and it is the responsibility of the bureau (such as the NPS) to identify and present additional training needs and research unique to their specific programs, for example, short haul flights to move wildlife (Brugeman 1997).

Furthermore, the Secretary of the Interior was required “to conduct a study to determine the appropriate minimum altitude for aircraft flying over National Park System units” (P.L. 100-91, 18 August, 1987). This legislation can be interpreted as mandating social science research related to employee safety, as these concerns are critical issues in the design and implementation of search and rescue and firefighting activities. This Act required that research be conducted in specific units of the National Park System on the effects of fixed wing and helicopter over-flights.



The research was to address, among other issues, “the values associated with aircraft flights over such units of the National Park System in terms of visitor enjoyment, the protection of persons or property, search and rescue operations, and firefighting” (P.L. 100-91, Sec. 1(c)(4)).

The Interagency Task Force on Firefighting develops and implements firefighting safety policies and procedures for all bureaus within the DOI and the US Forest Service. The policy of the Interagency Task Force on Firefighting establishes rationale for social science in employee (and volunteer) safety; there is a history of applying social science to firefighter safety in urban, rural, and wildland environments.

In addition, Congress has enacted legislation concerning forest firefighting planning, training, and interagency cooperation (16 U.S.C. 551b, 1990). As part of this legislation,

Secretaries [of Agriculture and the Interior] should assess the capabilities of educational institutions and other public and private organizations to provide such training programs.

The legislative requirement for training and training center program assessment clearly mandates social science for employee safety.

## **The NPS Mandate for Social Science Research**

### ***National Policies and Plans for Social Science Research***

There is a viable national mandate for social science research to be conducted by the NPS. It emerges from the NPS Organic Act and NPS mission, enabling legislation, management policies of the agency, agency-wide initiatives, regional initiatives, and park unit initiatives. The Organic Act of 1916 established the NPS and set forth its mission:

to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations (16 U.S.C. Sec. 1).

Social science research is clearly mandated by the NPS mission statement as it is a necessary tool for protecting resources and providing for enjoyment. The mandate extends to research on employee safety. The NPS Risk Management Division and safety managers need social science research to ensure employee safety while accomplishing the NPS mission.

Policies in the National Park Service are governed by the *NPS Management Policies* (NPS 1988). This document is the basic Service-wide policy document of the NPS. A general mandate for social sciences emerges from the manual. It contains specific guidelines regarding the role of science in fulfilling the NPS mission. The manual states:

The Service will develop, gather, compile, store, analyze, update, and employ adequate natural, historic, *social, economic and demographic data* relevant to planning and management at each park (2:5; italics added).

To gather this information, a systematic program of research is authorized:

A program of natural and *social science research* will be conducted to support NPS staff in carrying out the mission of the National Park Service by providing accurate scientific basis for planning, development, and management decisions. The science program will be focused on applied research necessary to direct management actions in pursuit of park objectives as stated in legislation and planning documents. (4:2-3; italics added).

This authorization applies to social science research on employee safety because the provision of employee safety is federally mandated. Furthermore, such research is a component of fulfilling the NPS mission and making sound management decisions. Examples are studies of employee safety implications in alternative management plans for the removal of exotic species in parks.

Issues related to employee safety appear in a number of specific areas of the policy manual. For example, employee safety is a stated component of planning for wildland firefighting (4:15), emergency preparedness and emergency operations (8:6),

aircraft use (8:8), maintenance (9:5), solid waste management (9:5), and hazardous materials and toxic waste (9:6). In addition, employee safety is a component of the policy statement on Visitor Safety and Protection (8:5), where it is stated that:

The National Park Service will strive to identify recognizable threats to the safety and health of persons and to the protection of property, by applying nationally accepted codes, standards, engineering principles, and the requirements of the *Loss Control Management Program Guideline* (NPS 1991).

Social science is a necessary component of identifying threats to employee safety and health. Examples are studies to identify behavioral, communication, social, and organizational factors that contribute to safety in hazardous activities.

More recently, *Risk Management in the National Park Service* contains the following policy statement:

It is the policy of the National Park Service to establish and effect a risk management process to ensure the safety and health of its employees and the public, to maximize the utilization of its human and physical resources, and to minimize monetary losses thereby advancing the mission of the Service (NPS 1994).

To carry out this policy, goals are identified that provide rationale for social science to secure employee safety and health.

These goals are to:

1. Create a safety and health culture inclusive of all employees and activities.
2. Improve our ability to identify and abate unsafe practices and conditions.
3. Implement effective safety and health resourcing strategies.
4. Facilitate accountability and program involvement through evaluation and monitoring.
5. Increase organizational safety and health awareness and program communication.

In addition, the *1997 Strategic Plan, Interim Service-wide Mission*

*and Long-term Goals* states as Mission Goal IVa: “The National Park Service uses current management practices, systems, and technologies to accomplish its mission” (NPS 1997). Social science research is needed to effectively meet this goal.

More specific guidance about NPS social science is derived from other NPS policy documents. The basic policy document related to employee safety for the NPS is the *Loss Control Management Guideline* (NPS 1991), which defines requirements for achieving a safe and healthy work environment for NPS employees. A basic program requirement for managers and supervisors is to:

Establish and maintain a staff of safety and health professionals in the Washington and Regional Offices, and at major operating units, as well as appropriate collateral-duty personnel at all other sites, to advise management in the development and implementation of an effective safety and health program (1:1).

The requirement that management obtain advice provides rationale for social science activities related to employee safety. Additional requirements, related to training, inspection, monitoring, and evaluation suggest additional needs for social science research on employee safety.

*Usable Knowledge: A Plan for Furthering Social Science and the National Parks* provides further rationale for NPS social science (Machlis 1996). This planning document identifies eight major topic areas that require social science research. One of these topics—What organizational and employee issues face the NPS?—suggests a need for social science research on NPS employee safety. Examples include conducting demographic analyses of employees having accidents and studying factors that influence job satisfaction, risk perceptions, employee motivations, and organizational safety culture.

### ***NPS Regional Policies and Plans for Social Science Research***

Regional management plans for the NPS also reflect the need for social science as a necessary component to managing for NPS employee safety. For example, in a 1996 memo, the Intermountain Field Area Director wrote:

Safety, for the most part, has been managed as a reactive, crisis-driven program. We wait for the accident and then take action to “do safety.” As we examined park responses [to a request for information about safety programs], we found that what seems to be missing is a safety process within the management system that drives safety improvements and holds management accountable for measurable results. As one Superintendent put it, “It is rhetoric without responsible recourse.” We have provided lots of safety programs for parks to administer, but we have not provided managers with the processes to make safety a daily reality in their work environments.” (6/3/96; these policy goals were repeated in the *Denver Service Center Safety Program Action Plan* (June 1996).

Consequently, the Intermountain Field Area (now Intermountain Region) circulated a *Risk Management Strategy for the Intermountain Field Area* which expresses a purpose “to improve performance, prevent accidents and losses, and reduce costs” and a mission “to have an organizational culture that values and has the will to create and sustain a safe and healthy environment with a goal of zero loss of human and material resources” (NPS 1996b).

Regional policies establish a mandate for social science on employee safety, such as research on creating and maintaining “safety cultures,” testing the effectiveness of safety programs, and mechanisms for management accountability. For example, the Intermountain Region has adopted an Action Plan (Siler 1997). The plan contains activities to:

- transfer safety programs developed in the private sector to park units,
- evaluate pilot projects,
- design and implement training programs, and
- develop baseline surveys on safety.

As part of the approach, a *Key Elements Survey* is applied as part of a “behavior modification” strategy (Siler 1997). The survey is an evaluation system and provides a method for systematic

analysis of each job or activity performed. The objectives of the Survey are to identify and prioritize safety program deficiencies, establish an action plan to correct deficiencies, and enable management to monitor and measure improvement. For example, a *Safety Key Element Action Plan* has been designed for use in Rocky Mountain NP. The need for social science is reflected in this approach, as it is an important element in workplace safety identification, modification, evaluation, and monitoring activities.

***NPS Park Unit Policies and Plans for Social Science Research***

Policies and plans for social science research on NPS employee safety exist at the unit level within the National Park System. The Grand Canyon NP Superintendent expresses the rationale for social science research on employee safety:

Accidents are preventable occurrences, and all accidents have multiple causes. By aggressively investigating and correcting basic or root causes of all injuries and near-misses, our system will be improved and future incidents will be prevented. Supervisors are responsible for ensuring that all accidents are investigated, root causes identified, and opportunities for improvement are implemented (NPS 1996c).

An alternative approach that is being adopted in several parks is based on the reduction of lost-time accidents through a “structured return to work program” (Belden 1997). Such a plan has been implemented at Lake Mead NRA. The plan calls for modifying the work activities of individuals that have been injured. Employees are given new activities they can perform even with their current injuries (such as a desk job). The plan has included a process for identifying “modified work assignments” that can be performed by people with different kinds of injuries. In the past, such individuals would have been part of the workers compensation claims process and would not have been brought back to work as early. Such an approach to managing lost time accidents provides rationale for social science research. For example, structured back-to-work plans can require an understanding of how to motivate employees and how to apply

programs to park units with different conditions (such as management styles and work assignments).

### **Summary**

Legislation, policies, and plans provide a mandate for social science research on employee safety in the NPS. The rationale emerges from two streams of policy. First, the NPS is required to provide a safe work environment for its employees. This requirement emerges from federal legislation and DOI policies and planning documents. Second, the NPS has a responsibility to conduct social science. This responsibility emerges from national legislation, DOI and NPS policies, and from regional and park unit plans. The combination of responsibilities to provide a safe work environment and to conduct social science provides a mandate to conduct social science research on NPS employee safety.

## III

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# Prior Social Science Research

This chapter reviews prior social science research relevant to employee safety in the NPS. The goal of the review is to summarize what is known and to identify additional research needs. The review is based on a representative sample of social science work generally relevant to employee safety, and a comprehensive review of research that is directly relevant to NPS employee safety. A bibliography is included (Appendix I).

A framework for understanding the factors that influence safety is presented in the following sections. First, research on how accidents occur is reviewed. Then, research on key social factors that contribute to accidents are reviewed. These social factors can be categorized in terms of influences that come from:

- the characteristics of individuals,
- the characteristics of groups, and
- the characteristics of organizations.

### **How Accidents Happen**

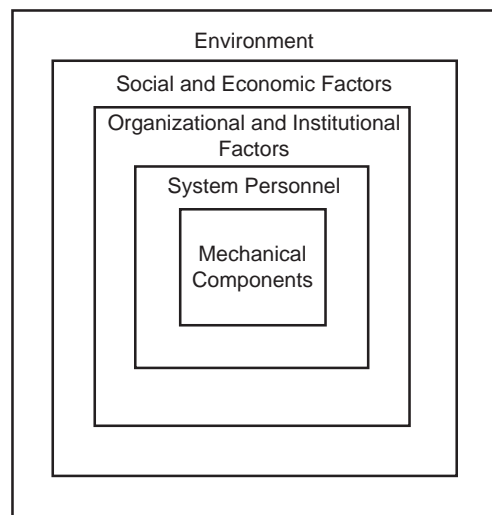
A “technical task” is defined as a set of practices combining



people and technologies to fulfill specific management objectives. For example, firefighting, search and rescue, trail maintenance, and road maintenance are technical tasks performed by employees of the NPS. Efforts to improve occupational safety must consider technical tasks as a “total system” in which individual components interact (National Research Council 1988, Robinson 1982). Such systems can be characterized as having five parts:

- mechanical components,
- system personnel (individuals and groups),
- organizational and institutional factors,
- social and economic factors, and
- the environment in which activity occurs.

These features are represented in Figure 3.1. At each level, and for the interactions among them, there are social factors that can cause or contribute to accidents/incidents (Rasmussen 1982, Hoffman et al. 1995). For example, inadequate administrative support may lead to faulty plans or use of inappropriate equipment. Similarly, improper or inadequate actions of employees may lead to accidents.



**Figure 3.1 Technical tasks as total systems**

Organizational, social, and environmental characteristics may have significant influences on safety and reliability in technical tasks. These features of employee work environments can contribute to accidents because they influence how the work is done (Hoffman et al. 1995, Perrow 1984). Managerial and political pressures can directly affect safety and reliability in performance. Weather conditions can influence the safety of performing tasks (Mekjavic et al. 1988). For example, administrative pressures to finish trail and building maintenance before peak tourist season begins can influence safety of personnel in the NPS. Harsh winter weather conditions can similarly influence safety of NPS personnel in work activities, such as road maintenance and search and rescue activities.

A broad view of safety that looks at the relationships among individuals, institutions, and social and environmental features has proven useful in the design, evaluation, and management of safety in a variety of large-scale technological systems. Examples of such systems include nuclear power plants, chemical processing plants, offshore oil platforms, and air, marine, and vehicle transportation systems (Reason et al. 1990, Slappendel et al. 1993, TriData 1996, Tuler 1988). This broad perspective “has great potential for delivering results that yield useful recommendations for safety improvements” (National Research Council 1988:12). Employee safety in a wide variety of NPS activities can be usefully addressed by considering the behaviors of individual employees, the influences of management on the way work is performed, and work conditions. For example, wildland firefighting safety is influenced by the ways that individual employees behave, the quality of their equipment, political pressures to control fires in park units, administrative planning, and the conditions of the fire and terrain. These kinds of issues and interactions can be found in many of the work tasks found in the NPS.

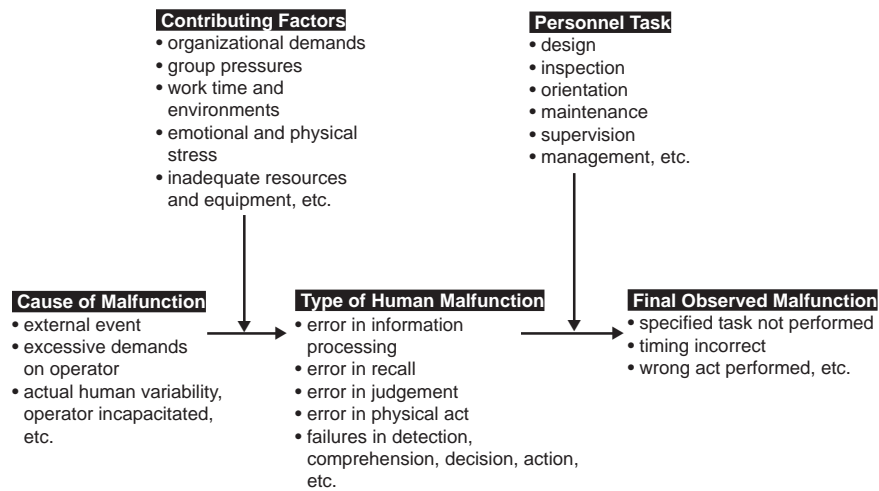
Frequently, analyses of accidents use “human error” as a catch-all term for unexplained causes of accidents. Such analyses are not very helpful in understanding why certain events occurred

and can focus blame on specific individuals not necessarily at fault (Rasmussen 1982, Svenson 1986). Recent research suggests that “human errors” are a result of many interacting elements in a technical task. Errors may be characterized as mismatches between humans and their tasks or machines (Rasmussen 1982). Mismatches can occur as a result of:

- human variability,
- technical variability or failure,
- required interactions that are incompatible with human physical or psychological limitations, and
- required interactions that are incompatible with organizational and environmental constraints.

Mismatches may change as employees develop skills, knowledge, and experience (Rasmussen 1990); prior experience is an important part of safe and reliable performance (Brown and Groeger 1988, National Research Council 1993).

Many “human errors” or mismatches occur every day during people’s normal activities. Behaviors of individuals play an important role in most accidents, “typically not due to particularly exotic errors or mistakes, but to slips and misunderstandings which are commonplace in normal human activity and which have their tragic effects only under particular circumstances” (Holmes 1987). Mismatches are often the result of many interacting individual and contributing factors. Causes of malfunctions combine with additional factors that contribute to an “error” in human action (see Figure 3.2). The final results of the mismatch will depend on the nature of the task. For example, project designers, supervisors, and operator and maintenance crews may each make independent and small errors that cumulatively result in an accident. Thus, attempts to improve safety, reliability, and performance in technical tasks are fundamentally linked to the elimination or control of contributory factors.



**Figure 3.2 A model of error in human action**

Factors that contribute to employee accidents have been studied in many situations. For example, Table 3.1 shows factors that may contribute to human errors in nuclear power plant emergency response systems. Similarly, analyses of forest-work injuries have often found the items listed in Table 3.2 as contributory causes to accidents.

**Table 3.1 Factors contributing to errors in nuclear emergency response systems**

- administrative constraints in the sharing of information
- rigidity in plans, procedures, and command structure
- varying degrees of delay in communications
- organizational and personnel rivalries and conflicts
- excessive cognitive and physical workload and time pressure
- hazardous working conditions
- transitions from low to high activity and vice versa
- large population potentially affected
- public response unpredictable
- high volumes of indirect, abstract, and technical information
- uncertainties in information
- lack of direct control over plant components
- unfamiliarity of tasks and decisions
- simultaneous needs for limited and dispersed resources

[Source: Tuler 1988]

**Table 3.2 Contributory causes to forest-work injuries**

<b>Machinery, Tools, and Equipment</b>
chain saw vibration and noise
chain saw kickback
forest machine design
protective equipment
maintenance
<b>Personnel Characteristics</b>
sensory capacities
perception and decision-making
skill and technique
experience, education, and training
physiological work capacity
age
<b>Work Organization</b>
task demands
task variety
rest breaks
hours of work
supervision
mechanization
payment method
contracting
safety organization
<b>Physical Environment</b>
climate lighting
terrain and flora

[Source: Slappendel et al. 1993]

Research has shown that it is possible to control factors that may contribute to accidents. Because mismatches may occur at any time, the best way to decrease their effects are to design systems that remove the opportunities for weaknesses to matter. Such systems provide a “buffer zone” for human variability in performance (Pitz 1993, Rasmussen and Goodstein 1987). These controls can be achieved by removing the contributing factor, by making the “total system” less sensitive to errors, and by providing opportunities to correct errors before they result in an accident. These are all options that can be important to the promotion of NPS employee safety.

Factors that may contribute to mismatches and error recovery are found at all levels of the “total system” (Rasmussen 1982,

Reason et al. 1990, Slappendel et al. 1993). Key contributory factors from individual, group, and organizational characteristics are discussed in the following sections.

### **Individual Characteristics**

The way an individual behaves in a specific situation is related to many factors that influence the physiological and/or psychological characteristics of the individual. Physiological factors are related to such aspects of a person as strength, hearing, and visual perception. Psychological factors are related to a person's comprehension, judgment, communication, and decision-making skills. These factors can influence the safety and reliability of decisions, judgments, and actions.

The ways that people make judgments and decisions in a variety of situations have been extensively studied (Slovic et al. 1988, Keinan et al. 1987). The primary generalizations from this research are that:

- People often have difficulties making decisions, inferences, and judgments in complex situations (Slovic et al. 1988). For example, in complex situations there is often one simple and obvious solution that is selected. It is, however, sometimes incorrect or inefficient.
- Different decision strategies may greatly affect outcomes. Poor decisions can lead to the addition of small errors that can cause a future accident (Telfer 1989).

Research on human problem-solving and decision-making suggest that people do not always use all the information available to them (Fischhoff 1986, van der Colk 1988). Among the most important reasons are:

- information quality is often inadequate to fulfill requirements for appropriate decisions and judgments,
- an individual's capacity for processing large amounts of information is limited,
- time delays can be important, and
- decisions are frequently made in situations that allow only limited attention to any particular item or issue.

In addition, decisions and judgments may be based on issues beyond those of “correctness,” “effectiveness,” or “safety.” Safe choices may actually be of secondary importance relative to other goals. Other motivating factors may be equally or more important—such as speed of performance, financial cost, fulfilling role expectations, and emotions. For example, NPS employees may believe it is necessary to conduct potentially dangerous activities because they improve visitor experiences or protect resources.

Research on human decision-making indicates that predictable mistakes occur because individuals develop biases and “rules of thumb” to simplify a complex world and guide judgments (Tversky and Kahneman 1974, Fischhoff 1986, Tuler 1988). While there is some debate over how strongly such biases influence behaviors in real-world settings, patterns which are often observed include:

- overconfidence in estimations, plans, and skills,
- underestimation of time constraints and risks,
- attempts to verify previously held beliefs by searching for and accepting confirmatory evidence and ignoring or forgetting contradictory evidence,
- exaggeration of personal immunity from threats,
- oversimplification of others’ behavior,
- limited examples used to make statistical inferences,
- difficulties assessing probabilities and exponential processes,
- ignorance of subtleties,
- tendency toward conservatism,
- thinking in causal series and ignoring side effects,
- previous experiences often used as basis for future choices,
- options which are not readily observable may not be considered, and
- complacency in familiar situations.

Because biases and “rules of thumb” serve the important function of allowing people to operate with limited information in different situations, they cannot be dismissed as dangerous or useless. For example, during emergency search and rescue operations such strategies can help save time that can make a difference between life and death. However, in certain unfamiliar situations they may lead to inappropriate choices or actions. “Over-training” may create problems in novel situations where skills and unconscious reactions suddenly become irrelevant or even detrimental (Holmes 1987). For example, search and rescue personnel may respond to a unique situation using prior experience and “rules of thumb” that can result in increased risk of harm because they are not applicable to the current situation.

The problems related to effective decision-making and judgments are compounded in decision environments where:

- a series of interdependent decisions are required,
- task specifications and the situation can change rapidly,
- available information may be dependent on prior outcomes, and
- decisions alter the environment and context of operations (Slovic et al. 1988, Brehmer 1987).

Such decisions reach their conclusion in actual behavior. Three levels of behavior have been identified in human action (Rasmussen 1990). These are behaviors based on these kinds of activities:

- *Automatic or routine activities*: performance is automatic, controlled, and skilled (e.g., how to shift gears or use brakes, operate chain saws),
- *Familiar activities*: performance is based on remembered rules and procedures applied in familiar situations (e.g., how to pass a car, dispose of wastes, operate heavy machinery), and
- *New and unfamiliar activities*: performance is based on the use of prior knowledge and may require complex processing of information (e.g., driving in severe weather in an unfamiliar location, carry out search and rescue and firefighting).



Incorrect or faulty implementation of decisions are not uncommon (Fell 1976). They may occur because there may be obstacles to the intended action (Reason et al. 1990). For example, the handling characteristics of a vehicle may not be responsive to the demands of a driver and/or insufficient safety margins may not allow a slow vehicle to be avoided. These types of problems are typically the focus of human factors engineers that attempt to design human-machine systems to minimize risk. Actions made at the highest level of behavior (i.e., new and unfamiliar behaviors) are susceptible to error because of lack of time, inadequate information, and other similar constraints.

In addition, there may be unintended departures from a planned action or desired goal (Reason et al. 1990). For example, drivers may unintentionally accelerate when their intention was to brake. Similarly, driver fatigue may slow reaction times needed for difficult maneuvers. Behaviors related to routine and familiar actions may be inappropriately executed because the context is not appropriate for the selected action.

The ability of individuals to detect, comprehend, judge, decide, and act may be influenced by a variety of stress factors associated with a technical task. In some cases, researchers have argued that stress factors can positively influence behaviors and decision-making (Klein 1996). However, much research has focused on the ways that stress factors can compound difficulties of performing routine, familiar, and unfamiliar actions.

A variety of stress factors can affect NPS employees, ranging from characteristics of the tasks they must perform, the physical conditions in which they work, and the social environment in which they work. Examples that have been observed in many types of work are listed in Table 3.3. Stress factors result from differences between task demands and an individual's ability to respond. Stress factors have been documented and studied in a large number of contexts and include physical, physiological, psychological, and social factors (Anderson et al. 1995, Faff and Tutak 1989, Hockey 1983).

**Table 3.3 Factors contributing to employee stress during work**

<b>Physical/Physiological</b>
noise
vibration
hot or cold (e.g., protective clothing)
temperature
comfort (e.g., backache)
visual illusions (e.g., "flicker")
disorientation
inadequate nutrition
dehydration, heat exhaustion
caffeine, alcohol, nicotine
muscle fatigue
sleep cycle disruption, inadequate rest
<b>Psychological/Social</b>
mental workload, mental fatigue
boredom
anxiety, concern for safety
anger, frustration
sensory overload, sensory deprivation
time pressure
previous errors
domestic social problems
marital/family problems, separation from family
financial problems
legal problems
paperwork, irksome tasks, reporting requirements
liaison with supervisors
safety/organizational culture

Time pressure is a very important stress factor. It has been studied in a number of situations, including aviation, vehicle operation, emergency response, and nuclear power accidents (Edland and Svenson 1993). Important effects of time pressure on individual decision-making and judgments include:

- impeding the use of available information,
- increasing reliance on simpler decision rules,
- increasing risk-averse behavior,
- reducing use of information sources,
- increasing dependence on rules of thumb,
- causing oversampling of data,

- affecting the logical analysis of inputs,
- causing “tunnel vision” and perceptual narrowing,
- decreasing the use of comparative or evaluative decision strategies,
- increasing attention in tasks with closest deadlines regardless of importance,
- increasing weight to negative or most important factors, and
- considering fewer alternatives (Tuler 1988).

Additional problems can result when time pressures reduce an individual’s ability to recover from accidents and mistakes.

Other features of a technical task may also impose stress. For example, the wearing of fire, heat, and chemical protective clothing can lead to physical stress (Faff and Tutak 1989). Working in hot and cold climates can increase stress (Mekjavic et al. 1988). Task requirements such as mountain climbing and activities at high altitudes can lead to hypoxia and physiological stress that can degrade performance in physical activities (Skjenna 1981). Alcohol, caffeine, and nicotine can have similar effects on a person (Osborne and Rogers 1983). Previous experience with injuries or accidents can increase job stress (Rundmo 1995). These are all features of many activities performed by NPS employees on a regular basis.

Current research is inconclusive on the role of stress. The ambiguity of research results arises in part because the stress felt by individuals depends on perceptions and specific contexts of the situation. People respond to stress in a variety of ways (Mann 1993). For example, dangerous situations can cause personal anxiety (Idzikowski and Baddeley 1983), though it has also been reported that experience with stressful situations/activities can reduce stress in activities that occur at a later time (Ursin et al. 1978). Stress levels can differ among individuals in the same situation (Luczak 1991). For example, one person may be afraid of heights, while another is not. Moreover, multiple stress factors are often simultaneously present in a situation; NPS employees

are frequently exposed to multiple stress factors such as dangerous working conditions, time pressures, fatigue, and unfamiliar situations.

Stress combinations depend on the key elements of a technical task: mechanical components, system personnel (individuals and groups), organizational and institutional infrastructure, social and economic factors, and the natural environment in which activity occurs. For example, stress combinations can include:

- background stress from day to day living,
- characteristics of the task,
- characteristics of the work environment, including management and external pressures, and
- characteristics of the equipment used in the technical task.

The importance of stress factors results from their ability to:

- increase workload and decrease coping ability,
- impair the perception of hazards,
- impair decision-making and judgments,
- lead to inappropriate avoidance behavior, and
- lead to fatalities or injuries.

All these outcomes have important implications for employee safety in the NPS.

In part, the affect stress has on an individual is related to characteristics of that individual. Human factors and occupational safety research have extensively studied the ways that personalities and attitudes contribute to accidents by influencing the ways that people make judgments, decisions, carry out actions, and react to stress (Dedobbeleer and German 1987, Geller et al. 1996, Lester and Bombaci 1984). Personality traits refer to relatively enduring characteristics that can affect judgments and decisions (Helmreich 1984). Attitudes are less deeply held aspects of a person than personality traits, and are thought to be modifiable by training and experience.

Interest in these issues stems in part because of their influence on motivation. For example, hazardous thought patterns or attitudes that are thought to influence individual judgments in aviation include:

- anti-authoritarian attitudes ('don't tell me what to do!'),
- impulsiveness ('do something now!'),
- beliefs of invulnerability ('nothing can happen to me'),
- 'macho' attitudes ('I can do this'),
- feelings of resignation ('what's the point of trying?'), and
- deference ('I will do what you suggest')

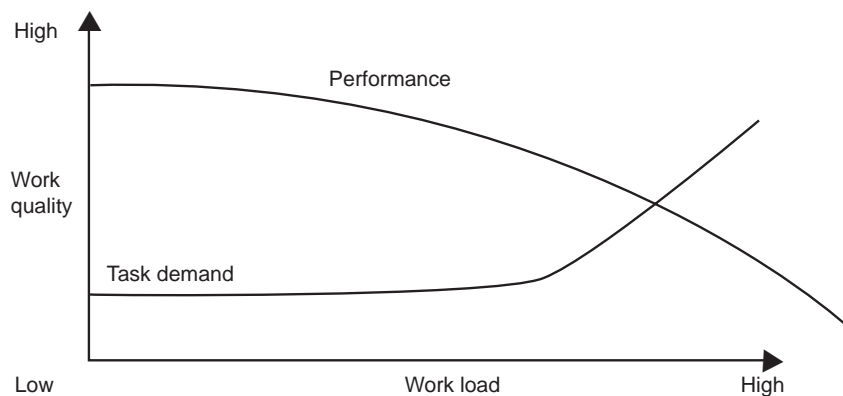
These kinds of attitudes have been observed in many work situations, including the NPS (Tuler et al. 1992). However, few studies have been completed on the prevalence and impacts of such attitudes (Lester and Bombaci 1984, Telfer 1989, Telfer and Ashman 1986).

In some cases, motivations and attitudes are linked to risk-taking orientations of individuals (Machlis and Rosa 1990, Tuler et al. 1992, Yates 1993). The propensity for employees to adopt self-protective behaviors has been a long-standing area of research (Cohen 1993, Geller et al. 1996, Weinstein 1987). An understanding of when and why individuals adopt self-protective behaviors is important to improving safety in NPS work environments. Cohen (1993) has proposed several categories of self-protective behaviors, all of which are relevant to NPS employees. They include:

- proper use and operation of the hazard control systems (e.g., helmets, ventilators),
- good work habits in performing job tasks (e.g., using seat belts),
- increased awareness and recognition of workplace hazards,
- acceptance and use of personal protective equipment,
- observance of housekeeping and maintenance measures to keep work areas,

- proper response to emergency situations, and
- self-monitoring and early recognition of any signs or symptoms of hazardous exposures or activities.

Researchers have found that individuals can maintain high levels of performance (e.g., detection, comprehension, problem-solving) while working on tasks even as demands and mental effort increase. However, as effort continues to increase, a point will be reached where the individual cannot continue to maintain the same level of performance. As shown in Figure 3.3, the result can be an abrupt deterioration in performance. Thus, “mental workload” of employees has been extensively studied (Gopher and Donchin 1986, Kirk and Parker 1994, National Research Council 1993). Mental workload has been noted as an important factor in the safety of diverse activities, including driving, power plant operations, emergency medical service, and natural disaster relief (National Research Council 1993). Mental workload can be an issue for NPS personnel who must, for example, work long hours during peak seasons or during emergency situations.



**Figure 3.3 Individual performance as a function of mental workload**

A variety of factors have been suggested as contributing to mental workload in technical tasks. As Table 3.4 shows, they include factors that increase levels of stress, affect operator capabilities, and increase task demands. In fact, many of the

factors are the same as those identified as contributing to accidents and “human error.”

**Table 3.4 Factors contributing to employee mental workload**

<b>Personal Characteristics</b>
temperature (hot or cold)
comfort (e.g., backache)
inadequate nutrition
dehydration, heat exhaustion
caffeine, alcohol, nicotine
disorientation (e.g., whiteout)
sleep cycle disruption, inadequate rest
muscle fatigue, mental fatigue
boredom
anxiety, concern for safety
anger, frustration
sensory overload, sensory deprivation
<b>Task Variables</b>
visual constraints (visibility)
vibration, noise, jolting
degree of risk/danger
continuous need for concentration and monitoring
time to complete task
number, complexity, urgency, variety of subtasks
reaction effort required
unavailability of resources
familiarity with procedures, familiarity with environment

Closely related to mental workload and stress are feelings of fatigue. While most people associate fatigue with feeling physically tired or not enough sleep, fatigue can also be associated with mental activity (Holding 1983). Subjective feelings of fatigue have been suggested as contributory causes to accidents and failures in a variety of mental and physical activities (Holding 1983, National Research Council 1993). Prior research has suggested:

- linkages between fatigue and perceptual tasks, including visual sensitivity, concentration, and monitoring tasks,
- a strong relationship between types of shifts or work hours and accident frequencies,
- performance deterioration with the onset of fatigue, and

- changes in risk-taking behavior may occur as fatigue increases or decreases.

In some cases, the effects of fatigue on performance have been ambiguous (Borowsky and Wall 1983). Some studies of air pilot performance have found little correlation among factors commonly thought to lead to fatigue and degraded performance. In addition, the impact of individual differences with respect to sensitivity to fatigue is not well documented or studied (Chidester 1990). In spite of conflicting results, fatigue is thought to be an important factor in the safe performance of technical tasks.

### **Group Characteristics**

In many systems, groups of people must interact to perform a task. In the NPS, groups and teams of employees play a role in the performance of many activities, including trail and building maintenance, visitor services, search and rescue operations, firefighting, and law enforcement. While necessary, interactions of people in groups can also create conditions that lead to accidents or mishaps. Group interactions can lead to risk-taking or incorrect decisions in different situations (Hare et al. 1997, Hirokawa and Scheerhorn 1986). These results can occur during the planning, operational, maintenance, and emergency response phases of technical tasks. This section summarizes research on group decision-making and safety.

Researchers have suggested several factors that may lead to faulty decisions in a group or team. They include:

- improper assessment of a situation,
- establishment of inappropriate goals and procedures,
- improper assessment of alternative decisions,
- establishment of faulty information on which to base a decision, and
- faulty reasoning.

Individuals can enable faulty decisions in group decision-making (Hare et al. 1997). In particular, faulty group decision-making



can often be traced to the influences of specific group members on communication and social factors such as deferment to peers. However, individuals also can prevent faulty decisions by counteracting negative influences, such as by convincing others to reject flawed beliefs, perceptions, and inferences.

Faulty decisions by groups may be a result of different kinds of group behaviors (Hare et al. 1997). They include:

- the “risky shift” phenomena, in which a group chooses more risky alternatives than its individual members,
- group polarization, where the choice of a group is more extreme than the individual choices,
- “group think,” where a group arrives at a consensus decision without adequately evaluating all alternatives,
- false consensus, where individuals of a group falsely believe that a consensus has been reached, and
- pluralistic ignorance, where group members believe that they are alone in their beliefs.

In some cases, pressures for group consensus may be very strong. Such pressures result from the characteristics of the group and the social environment in which they interact (Swap 1984). The characteristics fall into several categories:

- composition (e.g., group size, individual personalities, isolation of a group),
- leadership characteristics (e.g., centralization of authority, style of leadership),
- task characteristics (e.g., demands and requirements of task, timing of task demands, interdependencies among different tasks), and
- decision rules (e.g., ability to reverse decisions, criteria used for making decisions, social context of group decision-making).

The form of consensus generated by group think is of particular concern because it may contribute to more risky decisions (the “risky shift” phenomenon). In groups experiencing group think

“the powerful forces of perceived ‘togetherness’ act in concert to render the possibility of failure unthinkable—and if not unthinkable, then certainly unspeakable” (Reason 1987:124). For example, accidents in nuclear power plants have occurred after frequent statements by employees that they were impossible. General beliefs that severe accidents are not possible or rare may lead to inadequate planning for safety.

In some cases, familiarity among members of a group may result in negative consequences, such as group think. However, research also suggests that familiarity is important in group behavior because it can reduce misunderstandings between individuals and improve the reliability of communications. Such a view has contributed to recent research on crews and teams (Guzzo and Dickson 1996).

### **Organizational Characteristics**

Much research has focused on the ways that organizational characteristics can influence individual behavior (Mitroff et al. 1989, Rochlin et al. 1987, Wilpert 1995). Incorrect perceptions and poor choices may result from:

- rigid organizational beliefs and practices,
- restrictions of the social and cultural environment,
- political interests,
- supervisor-subordinate relations and responsibilities,
- institutional constraints, and
- communication constraints.

In turn, such incorrect perceptions or poor choices may influence the behavior and effectiveness of a group’s individual members, and ultimately employee safety.

The dynamics of individual interactions in organizations depend partly on the organizational culture, work situation (e.g., management-employee relations, job requirements), and organizational structure. Research has addressed issues of incentives, disciplinary actions, information and education, as well as

behavior modeling to encourage safe work practices and to avoid risk-taking (DeJoy 1996, Peters 1991, Stetzer and Hofmann 1996). Factors that appear in the research literature include:

- pressure (authority, peer, heavy responsibility),
- job requirements (ill-defined job requirements, lack of resources, expectations too high or impossible, multiple tasks—selective attention by workers and management),
- conflicts among personnel (personality, procedural, substantive),
- conflicting assumptions related to tasks or roles (management vs. designer, management vs. operating personnel),
- rigid organizational beliefs, assumptions, and rules,
- rules and procedures not maintained,
- communication systems not adequate or unavailable,
- quality of work environment (lack of job satisfaction),
- industrial actions (slow-downs, strikes),
- systems (or co-workers) considered unreliable or untrustworthy,
- mindsets (attitudes toward safety, professionalism, productivity), and
- lack of coordination, trust, understandings among organizations.

The concepts of “organizational culture” and “safety culture” are receiving much attention (Schein 1990, Weick 1987). Interactions among individuals within an organization are partly a result of how the individuals believe the organization functions. These beliefs arise through an organizational culture. Organizations may create specific standards, rules, traditions and roles to which employees must adhere. Recent research has focused on the institutionalization of “safety cultures” to establish standards for safety and reliability (INSAG 1991, Dedobbeleer and Beland 1991). Research has specifically addressed the ways that “high reliability” organizations are created, maintained, and function

(Rochlin et al. 1987, Roberts 1989, Weick 1987). High reliability organizations are particularly good at avoiding errors and accidents, and recovering from them if they do occur.

In addition, studies suggest that organizational culture can play an important role in motivation, commitment, and performance of risky activities (Mitroff et al. 1989, Tuler et al. 1992). Organizational culture may alter employee perceptions of activities and the way that potential costs and benefits are weighed. Organizational culture may lead to performance of an activity even when workers may feel their personal risks are high. Moreover, personnel may “voluntarily” increase their risks in order to perform the activity according to institutionally established standards and expectations. Wilpert (1995) notes that a basic tenet of high-reliability organizations is a strong organizational culture—but this can actually increase risk-taking and encourage cover-ups when official safety rules are violated.

Deliberate deviations have also been the subject of research on occupational safety and related activities (Klen and Vayrynen 1984, Reason et al. 1990, Wagenaar 1993). For example, investigators of traffic accidents have considered the role of deliberate deviations from practices considered necessary for safe operation of vehicles (Reason et al. 1990). Such “violations” are not necessarily illegal or reprehensible. Moreover, interpretations of what are considered violations are likely to differ among people. Thus, “violations can only be described with regard to a social context in which behavior is governed by operating procedures, codes of practice, rules, norms, and the like” (Reason et al. 1990:1316).

In many instances, organizations must manage hazards associated with technical tasks. For example, NASA needs to maintain safety of the space shuttle missions and the Department of Transportation needs to maintain safety in the transportation of hazardous materials. “Hazard management” is concerned with the prevention, mitigation, and recovery of technological accidents and natural disasters through the management of potential mismatches and social risk factors. Such activities are intended to:

- improve situational awareness,
- improve knowledge of rules, alternative actions, and possible consequences,
- enhance coordination,
- improve correspondence between plans and implementation,
- ensure that individuals and organizations are capable of coping with time constraints and unexpected situations, and
- identify gaps and inadequacies in existing procedures and plans.

Possible strategies for hazard management include eliminating exposure to the risk, limiting exposure to the risk, and mitigating or controlling the consequences of the risk (Kasperson et al. 1985). For example, in road maintenance tasks, safety can be increased by:

- reducing the times or distances to which operators are exposed to dangers,
- establishing administrative limits on the roadway mileage to be maintained or the lengths of work shifts, and
- installing additional safety equipment, such as airbags.

Risks are reduced because drivers' exposure to dangers is decreased and the potential consequences of an accident are reduced.

One widely discussed approach to changing safety-related behaviors is "performance-based feedback" (Geller et al. 1996). A performance-based feedback approach uses observation and measurement techniques to monitor behaviors and to provide feedback for modifying unsafe work practices. This approach to training for safety has been widely applied, including driving and industrial settings. It is also being applied to manage employee safety in several NPS units (Siler 1997). However, researchers have noted that there are limits to behavioral approaches to controlling work place hazards (Cohen and Jensen 1984, Geller et al. 1996). As Geller et al. note:

The research demonstrating the beneficial impact of behavioral observation and feedback on occupational safety has usually been short-term and small-scale, requiring outside agents (or consultants) to help implement the process. Large-scale and long-term application of behavior-change techniques requires the employees themselves to apply the effective intervention techniques (e.g., systematic behavioral observation and feedback) throughout the workplace (1996:1).

A critical observation from prior research is that activities should only be undertaken when operational capabilities for people and their equipment are not to be exceeded. Such lessons can be as simple as having enough drinking water to avoid dehydration or suitable protective clothing to prevent hypothermia. However, there are many examples of inadequate planning for normal as well as emergency situations that have led to accidents, including nuclear power plant, aviation, hazardous material transport, and military operations. In addition, organizations often fail to learn from prior mistakes and accidents. Effective hazard management requires that accidents and failures in plans be evaluated and lessons learned (England 1981, Malaterre 1990).

Researchers have considered the role of employee participation in planning of technical tasks; it is thought to increase safety, reliability, and performance (Cohen 1983, May and Schwoerer 1994). Employees that are actively engaged in technical tasks have first-hand knowledge about the psychological, physical, and material demands of the task. From personal experience they can develop and provide understandings that are otherwise unavailable to administrative planners and supervisors. Studies suggest that increased participation of employees in task design can lead to improvements in safety and reliability. Similarly, participation in planning of occupational tasks can improve work and task motivations and attitudes.

Personnel training in teams has been observed to be important preparation for any hazardous activity (Pitz 1993, Tannenbaum and Yukl 1992, Vojtecky and Schmitz 1986). Training may reduce the potential for decision and action failures by:

- improving awareness of the work environment,
- improving knowledge of rules, alternative actions, and possible consequences,
- enhancing coordination and group interactions,
- improving correspondence between plans and implementation, and
- ensuring that organizations are capable of coping with time constraints.

However, research suggests that in general, training may be of limited utility in improving performance in complex and unfamiliar situations (Pitz 1993, Vojtecky and Schmitz 1986). For example:

- unconscious use of “rules of thumb” learned over time may create problems where they suddenly become irrelevant or even detrimental in new situations (Svenson 1979),
- short decision times have been shown to cause individuals to revert to decision rules used before training (Zakay and Wooler 1984), and
- training has been observed to have only short-term and limited effects.

One solution proposed is for training to occur repeatedly. Another is to provide extensive training for unfamiliar or emergency situations (National Research Council 1993, Tuler 1988).

### **Employee Safety in the National Park Service**

This section describes research that has explicitly addressed employee safety in the NPS. The literature is limited; few studies have been conducted. Several case studies are discussed.

#### ***Olympic National Park Mountain Goat Removal Project***

Mountain goats were introduced to the Olympic Peninsula in the 1920s and have been causing damage to portions of Olympic NP (Olympic National Park 1987, 1995). To prevent further damage, Olympic NP personnel began in the early 1980s an experimental program to rid the park of the mountain goats. In 1988, a live capture and removal program was initiated.

The Olympic NP Mountain Goat Removal Project was based on a set of unique requirements and activities. The effort required innovative and difficult activities in some of the most remote and rugged backcountry areas of Olympic NP. Complex helicopter flights, difficult capture of goats from the air, and handling of goats on rugged terrain combined with social factors that influenced the capabilities of personnel to operate safely and reliably for intensive periods. The combination of these specific factors created physical and social hazards to personnel.

Research reviewed the risks that were related to the social context of the project and provided recommendations for their mitigation (Machlis et al. 1990, Tuler et al. 1992). Risks were involved in the nature of equipment used, characteristics of the animals, method of capture and removal, and drugs used to sedate the animals. Social factors created and contributed to a variety of safety risks to both personnel and mountain goats. Such social factors included overlapping organizational planning, authority, decision and judgment errors due to fatigue and stress, and employee values, attitudes, and behaviors.

In particular, the researchers found organizational culture to be an important mediating factor in determining both risk decisions of the team members as well as the level of their performance of risky activities (Tuler et al. 1992). The organizational culture of the NPS enabled the extraordinary performance of risky activities beyond what traditional approaches to risk-taking behavior would suggest. Although organizational culture may not have been the only factor that mediated the outcomes, it was observed to be critical in the Olympic NP Mountain Goat Removal Project.

The analysis concluded that specific changes to the program could enhance safety, reliability, and performance. Recommendations were related to:

- altering the project to reduce social risk factors,
- altering the social environment to reduce social risk factors,
- monitoring social risk factors associated with the project, and



- additional options, such as increased training.

The research did not evaluate specific risks associated with mechanical failure or provide a quantitative risk assessment of the project. While safety to the mountain goats was of much import and concern, it was not examined in the research. The research findings were part of the evidence used in the Draft Environmental Impact Statement for Mountain Goat Management (Olympic National Park 1995).

### ***Mt. Rainier National Park Winter Snow Removal Program***

Access to the Paradise Visitor Center of Mt. Rainier NP requires a continuous and sophisticated program of snow removal during the winter season. The program to maintain an open and safe road requires innovative skills and difficult activities in often unpredictable and harsh winter weather. The Mt. Rainier NP Winter Snow Removal Program is based on the use of several snow removal vehicles to remove snow between the Nisqually Entrance and Paradise Visitor Center. Performance of the needed activities results in the exposure of park personnel and visitors to a number of safety hazards. At several stages of the program, individuals could be and have been injured or involved in accidents causing property damage. A study to assess the social risks in the Snow Removal Program was conducted (Tuler et al. 1993).

In general, the authors found that snow removal activities were performed safely and efficiently. However, there was room for additional safety improvements. The analysis concluded that:

1. Catastrophic accidents that resulted in fatalities or severe injuries were relatively rare.
2. Accidents that resulted in minor or moderate injuries to park personnel or visitors or property damage were common. In many cases, the combination of changing weather and difficult working conditions with little room for error created accident situations, despite the best efforts of equipment operators. The characteristics of activities required to remove snow may change everyday because weather, road surface, and equipment may be different every day.

3. Visitors were a main source of risk. Unexpected encounters with snow removal equipment combined with insufficient visitor experience in winter driving lead to a relatively large percentage of accidents.
4. Sources of management-employee tensions were found in the organization of the program. Opportunities were available to reduce tensions with policy changes, monitoring and evaluation activities.
5. Vehicles used for the winter snow removal program were not always suitable for the required tasks. Frequent equipment breakdown often required operators to use vehicles inappropriate for the specific conditions.
6. Inadequate attention to safety problems may have contributed to safety hazards. Adequate data were not always available for accurate risk analysis and program evaluation.

The authors identified specific changes useful to enhance safety, reliability, and performance. Recommendations were based on:

- altering tasks to reduce social risk factors,
- altering the social environment to reduce social risk factors,
- monitoring social risk factors associated with program activities, and
- additional options, such as increasing training and providing information to visitors.

### ***Wildland Firefighting Safety***

A study of wildland firefighting safety is currently underway, sponsored by the National Interagency Fire Center (NIFC). The NIFC includes the NPS, US Forest Service, Bureau of Land Management, Bureau of Indian Affairs, and US Fish and Wildlife Service. The study is being conducted with the close collaboration of NIFC, the five federal agencies, and TriData (a private contractor). The study is being conducted in four phases; Phases 1 and 2 have been completed (TriData 1996, 1997). The four phases are to:

- identify existing organizational cultures and their contribution to safety problems,

- identify the elements of the desired organizational culture of the future to enhance safety,
- develop an implementation plan to create the desired organizational culture, and
- assist, monitor, and evaluate implementation of the plan.

The information for Phase 1 was generated through a literature review, interviews with federal and state wildland firefighters, and a national survey of a sample of federal wildland firefighters. Over 1,000 people have been contacted as part of the study.

A list of approximately 250 issues were identified as affecting firefighter safety. The issues fall into five general categories: organizational culture, leadership, accountability, human factors, and external influences that affect wildland firefighter safety (see Table 3.5). There was general consensus about the most pressing problems across agencies, ranks, gender, and ethnic groups. The high-priority needs related to firefighter safety were identified as:

- improving the experience level, training, and physical fitness of individual firefighters,
- improving attitudes toward safety, particularly in the minority of firefighters who do not seem adequately concerned about safety,
- ensuring that crew and division supervisors have the required characteristics, training, and experience to supervise during emergencies, and
- holding all ranks accountable for unsafe performance decisions.

A general conclusion of the Phase 1 report is that:

virtually every problem raised by firefighters had one or more solutions offered by firefighters to solve it. There is no need for a massive change in the approach to wildland firefighting. Rather, attention must be given to making the current approaches work better. The one big caveat to this is the availability of resources relative to expectations and the condition of the wildlands (TriData 1996:202).

**Table 3.5 Factors in wildland firefighter safety**

**Organizational Culture**

attitudes  
composition of the workforce  
experience of the workforce  
certifications  
symbols and insignia  
information flow  
dispatching  
equipment and protective clothing  
equipment of non-federal crews  
transportation to fires  
reporting and investigating safety problems  
rescues  
ethnic and gender issues

**Leadership**

fire management policy  
situational awareness  
appropriate use of various crews  
strategy and tactics issues affecting safety  
leadership experience and competence  
briefing and plans  
accountability  
challenging ones assignments  
safety officers

**Human and Psychological Factors**

self-image, self-esteem, self-assurance  
personnel practices: rewards, penalties, feedback  
training  
crew supervisors and firefighters ability to cope  
fatigue  
over-reliance on tools and shelters  
crew dynamics  
physical fitness

**External Influences that Affect Wildland Firefighter Safety**

political pressures  
public awareness and code requirements  
fuel build-up

[Source: TriData 1996]

The completion of Phase 2 of the study has resulted in the ranking of proposed “solutions” to the identified safety-related problems. The general approach to identifying solutions was based on a concern for the entire wildland firefighter system (or technical task) and the basic elements related to: 1) reducing exposure to fires, 2) increasing safety behavior at fires, and 3) escaping when necessary.

### ***Law Enforcement and Threats to NPS Employees***

In 1993, two employees of the NPS Southwest Region began a research project to assess the violence-related hazards to non-commissioned employees. The authors wrote:

acts of aggression and violence toward uniformed National Park Service personnel in the performance of their duties is increasing. These acts range from verbal abuse to threats to physical attacks, some of which have resulted in death. This violence is not gender specific...(Sikoryak and Dec 1994:1).

The evidence for these conclusions is based on a survey administered to Southwest Regional non-commissioned employees during 1994. At that time, there were 7,351 rangers employed by the NPS, 1,520 held permanent commissions, and approximately 900 held seasonal commissions. The authors estimated that approximately half of the non-commissioned rangers reported being harassed, threatened, or attacked during their work. The results of the survey are shown in Table 3.6.

**Table 3.6 Survey results about acts of aggression to Southwest Region NPS employees**

<u>% of respondents experiencing situation</u>	<u>Situation</u>
61	felt threatened
77	been verbally attacked
19	been touched or grabbed in an inappropriate manner
44	felt threatened or in danger by someone they knew
75	dealt with those under the influence of drugs or alcohol
50	dealt with groups such as gangs, political activists, etc.
57	felt unable to handle interpersonal situations due to lack of training
14	been threatened or physically attacked going to or from work

[Source: Sikoryak and Dec 1994]

In spite of these statistics, the authors observed that little focus had been placed on training of non-commissioned personnel. Situational awareness, stress management, risk assessment, fear management and response, and other strategies were not part of training programs. Respondents to the survey also provided information about the kinds of skill training that would be beneficial to help cope with threatening and violent situations, such as:

- how to assess a situation and determine when an unusual or uncomfortable situation is becoming dangerous,
- how to minimize or avoid risk, including how to defuse hostile situations or prevent them from escalating,
- how to converse without being argumentative,
- how to escape a dangerous situation and “buy time,” and
- how to identify individuals and groups that may present problems.

### **Current Research Needs on Employee Safety**

What is known about employee safety, and what further research is needed? There has been considerable research on individual, group, and organizational factors that contribute to failures in technical tasks. Much of this work is concerned with factors that influence perception, judgment, comprehension, communication, decisions, and behavior of employees. The social sciences have devoted much attention to these issues and they provide a useful perspective from which to assess and improve employee safety in technical tasks, including those performed by the NPS.

An important lesson from prior research is that technical tasks must be analyzed in terms of the “total system.” Individuals interact within the context of equipment, other personnel, organizational cultures, social and economic factors, and the environment.

Studies on “human errors” and their causes are not capable of explaining exactly why or when “mismatches” may occur, how the effects of stress, fatigue, and workload influence particular

individuals or groups. Nor can it fully explain why the reactions of individuals and groups can vary when exposed to similar factors. For example, there continues to be considerable debate over the exact definition of mental workload, models of workload, effective measurement techniques, and its implications. Much of the difficulty occurs because imposed workload is not the same as experienced workload.

Similarly, research on risk-taking, stress and fatigue is inconclusive. For example, Yates (1993:321) has noted that:

implicit in the term risk-taking is the idea that people are making conscious decisions to make a risky choice or engage in a risky activity. However, research has shown that in many accidents, that at first glance look like risk-taking behavior, the individuals did not take risk into account. It is as if risk-taking was inadvertent.

Knowledge of effective hazard management strategies remains limited. It is known that organizational cultures can be created and maintained that enhance safety and reliability. Furthermore, management commitment, training, and formal evaluation and monitoring programs have been found to improve hazard management, and thus, safety. However, the conditions under which safety cultures are created and sustained, and the different strategies for maintaining and improving employee safety that work best, are not completely understood.

Much of what is unknown is related to the many variables that influence the reactions of individuals in specific situations. Limitations in research occur because certain behaviors or situations have not been studied in detail. Limited research has addressed the unique combinations of work requirements, social and physical work environments, management commitment, organizational culture, and individual and group behaviors that occur in many of the tasks performed by NPS employees.

Hence, the current research literature offers an extensive body of findings, with many important gaps. These gaps suggest a research agenda for social science research related to NPS employee safety.

## IV

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# Views and Opinions from the Field

A key source of information on NPS employee safety research needs are NPS safety managers and employees, as well as safety managers from other DOI bureaus. A formal survey was not conducted. Rather, views of key individuals were sought to add to the development of a research agenda. One group workshop and 19 telephone interviews were conducted to obtain input from NPS safety and maintenance supervisors, NPS program specialists at the regional level and at specific park units, and safety managers from other agencies such as the US Fish and Wildlife Service and Bureau of Land Management. Participants identified key research questions relevant to employee safety.

In this section, the procedure and results of the group workshop are presented, followed by the procedure and results of the telephone interviews. A wide range of research questions emerged. The questions revealed several key areas of social science research needed to improve on NPS employee safety.

### **Group Workshop**

A workshop was held during the NPS Risk Management



Council meeting in Lakewood, Colorado on 5 March 1997. A list of participants is available from the NPS. The workshop was conducted by a moderator using a nominal group process. First, the purpose for developing a social science plan for NPS employee safety was presented. Second, the social sciences represented in the plan were listed (economics, geography, political science, psychology, sociology, and interdisciplinary research), along with examples of potential research questions. Third, participants were guided through three different worksheets in which they generated, selected, and ranked research questions.

On the first worksheet, each participant was asked to respond to the following question:

*What social science questions must be answered to improve employee safety and risk management in the NPS?*

Each participant wrote a list. Then, participants presented their research questions to the group. The moderator helped clarify each question, and the responses were recorded on flipcharts. Participants were then given a second worksheet which instructed, "From the posted list, please choose the five questions you believe are most important." The moderator tallied the results of the second worksheet and identified the research questions that were chosen most often by the participants.

Finally, participants were given a third worksheet which instructed, "From the final list, please give each question a share of 100 points. The more important you think the question is, the more points it should receive." The moderator then tallied the results, and a final list of top research questions—with total scores and rank as determined by the group participants—was presented to the group.

### **Workshop Results**

Workshop participants identified, prioritized, and scored the following social science research questions as most important. They are presented in rank order, with the total score in parentheses.

1. What can motivate NPS employees to be involved in risk management on a sustained basis? (410)
2. Why do NPS employees place themselves at risk when they know they are doing so? (240)
3. How can prevailing NPS attitudes be altered to encourage safety? (240)
4. What are the most effective ways to change attitudes and cultures in organizations and how can such change be effectively measured? (235)
5. Are there demographic differences among NPS employees in the perception of risk? (185)
6. What balance of incentives and discipline is most effective in motivating safe behaviors by NPS employees? (160)
7. What are the best available training strategies for changing safety attitudes? (160)

The questions revealed several key research topics. All of the questions on the list are related to the need to understand employee motivations for safe and unsafe behaviors. Several questions are related to the need for a better understanding about how and why employee perceptions of risks vary. Several questions reveal a desire to know more about what can be done to discourage unsafe behaviors and encourage safe behaviors. Two of the questions are concerned with the measurement of safety program effectiveness. Finally, several of the questions are concerned with the role of management in ensuring employee safety. A complete list of the research questions generated by the workshop is in Appendix II.

### **Telephone Interviews**

To obtain additional input, a series of telephone interviews were conducted with national, regional and park unit NPS employees, safety managers from the Bureau of Land Management and US Fish and Wildlife Service, and safety managers from the DOI with jurisdiction over activities conducted by the NPS (such as aviation and wildland firefighting). The individuals were asked a

series of questions about information needs for improving employee safety at individual, group, and organizational levels. They were also asked questions related to training, recordkeeping, and data analysis. Finally, they were asked what, in their view, are the most significant barriers to improving employee safety in the NPS. Nineteen individuals were interviewed between March and June 1997. Those contacted were safety officers at individual park units, regional safety managers, maintenance managers, interpretive specialists, fire safety managers, aviation safety managers, and training managers. NPS employees represented a diversity of park unit sizes and geographical locations. Appendix III lists the individuals contacted.

All interviews were conducted by the same researcher. Interviews with NPS employees followed the same format. First, the interviewer identified himself, and explained the reason for the call. Second, the purpose for developing a social science plan for NPS employee safety was presented. Third, the interviewee was asked a series of questions designed to solicit opinions and ideas regarding NPS employee safety research needs. Interviews with DOI, USFWS, and BLM employees followed a somewhat different format. Again, the interviewer identified himself, and explained the reason for the call. Then, the interviewee was asked a series of questions about their activities and how they related to or compared with NPS activities.

### **Telephone Interview Results**

Several themes emerged from the interviews. Several NPS employees were concerned with questioning what they viewed as untested assumptions about NPS employee safety. For example, one individual questioned the assumption that traditional approaches to safety management are not working; instead, he wanted to know what impact lack of resources has had on the ability to implement safety programs. Another individual was interested to know whether the NPS really has an employee safety problem that is worse than other bureaus in the DOI—or whether the seemingly high accident rates are related to the different kinds of work tasks and conditions that NPS employees

face. Several individuals questioned the assumption that safety program interventions developed in the private sector can be easily transferred to the NPS context.

Several research questions emerged from the interviews. They include:

- What are current employee safety conditions in the NPS—including accident causes and contributory factors, employee attitudes and perceptions, management attitudes and perceptions, and the effects of safety programs?
- What are the factors that influence employee motivations and attitudes, and how can safe work-practices be promoted through the use of incentives and penalties?
- What are the different approaches available to improve employee safety?
- What is the role of management in fostering employee safety?
- What is the role of organizational culture in promoting or discouraging safety?
- How can communication and sharing of safety information be improved?

Each of the questions is presented in more detail below.

*What are current employee safety conditions in the NPS—including accident causes and contributory factors, employee attitudes and perceptions, management attitudes and perceptions, and the effects of safety programs?*

All interviewees were concerned about a lack of information to assist in safety planning and evaluation. Most expressed a need for better understanding of the similarities and differences among parks and among DOI bureaus. Characteristics of bureaus and park units that were suggested as relevant to NPS employee safety included:

- mission and variety of activities,
- size,

- management styles,
- type of unit (such as national park, monument), and
- resources (such as having a full-time or collateral duty safety officer).

Other needs that were mentioned by interviewees included information about whether 1) gender is related to safety behaviors and accident rates, 2) “near accident” data can be useful, 3) accidents occur from unsafe conditions or a disregard of procedures, and 4) the use of checklists reduces accident rates.

*What are the factors that influence employee motivations and attitudes, and how can safe work-practices be promoted through the use of incentives and penalties?*

All of the individuals interviewed suggested research questions about the behaviors, motivations, and attitudes of individual NPS employees. Topics included:

- how to “internalize” concerns for safety on and off the job,
- the reasons individuals use or do not use protective equipment,
- the reasons individuals follow safety procedures,
- the different roles that “carrot and stick” approaches can play in promoting safety,
- how employees can be kept vigilant about safety, and
- the role of peer pressure.

For example, one individual asked whether “safety recognition programs” actually improve attitudes toward safety or cause discontent. Several individuals asked if it is possible to know when incentives and rewards are more appropriate than penalties in promoting safe work practices. One person wondered whether “mentoring” between old and new employees can effectively promote safe work practices.

*What are the different approaches available to parks to improve employee safety?*

This question was suggested by all the NPS safety managers interviewed. Three topics were brought up in the interviews. First, the safety managers all asked for more information about the kinds of information collection and analysis techniques that are available. Specific questions included:

- What are the most important types of information to collect?
- Should there be minimal requirements for data collection, analysis, and reporting?
- How can specific techniques be useful in improving employee safety (such as, perception surveys and job hazard analyses)?

For example, one individual asked about the different techniques that are available for analyzing accidents, so that contributory factors and “corrective opportunities” could be identified.

A second set of concerns were related to safety management approaches that are available to NPS managers. NPS safety managers expressed considerable interest in learning about the conditions at specific parks that can affect the appropriateness of different safety approaches. Currently, there is much attention on behavior-based safety programs that were initially developed in the private sector. Both proponents and critics of this general approach sought more information about how behavior-based programs can be transferred to the NPS. They wanted to know how different approaches can be compared, especially in relation to more “traditional” approaches toward employee safety. Also, several individuals were concerned about how managers and supervisors can determine what conditions need to be met before a particular approach is appropriate. A few would like more information about how differences among NPS units (such as size, centralization of management, full-time or collateral duty safety officers, types of units) can affect decisions about the effectiveness of safety strategies.

A third set of concerns was related to the role of training as a technique to improve employee safety. There are many types of training programs available to NPS employees. However, it was unclear to most of the NPS safety managers whether these programs effectively train in ways that promote safe practices. They sought information about:

- “state-of-the-art” training techniques,
- mechanisms to speed up training for newly identified hazards,
- how to use computer technology and the internet,
- how to train teams, and
- the role of periodic training.

*What is the role of management in fostering employee safety?*

Many of the interviewed individuals felt that efforts to improve safety should not focus only on the behaviors of the employees. Many wanted to know more about the ways that management supports or hinders employee safety programs. For example, one individual stated that the NPS “needs to look at the role of management and supervisors in contributing to safety problems, and not to focus only on what individuals are doing wrong.” There were questions about how to do this, expressed somewhat differently by the interviewees. For example, one individual asked how supervisors can set the “right example.” Another asked how accountability of managers can be established, and how managers can be more responsive to the concerns and needs of employees. Many of those interviewed were concerned about a lack of resources, and whether or not the availability of resources for safety programs is a condition that NPS management can change.

*What is the role of organizational culture in promoting or discouraging safety?*

Many of the interviewees from the NPS suggested that “safety culture” was a topic in need of further study. They wanted to know how safety can be embedded and reinforced within the

NPS organizational culture. In particular, they wanted to better understand different approaches to creating a “safety culture,” and what the effectiveness is of the different approaches toward establishing such a culture.

*How can communication and sharing of safety information be improved?*

A few of the interviewees were particularly concerned that safety information is not distributed and shared effectively among NPS divisions and DOI bureaus. For example, one individual was concerned about the difficulty of raising safety concerns that occur in other divisions or units because of an attitude that “it’s none of my business.” A few interviewees expressed similar concerns about how individuals can raise safety issues with peers and management in “non-confrontational” ways. These concerns led to questions about how such problems can be addressed within the NPS. A second set of issues raised by many of the interviewees was related to how safety information can be efficiently shared and how to communicate safety messages most effectively. They were especially interested in the effectiveness of “tail-gate safety” sessions, written materials, and face-to-face discussions.

### **Summary**

Several important themes for social science research on NPS employee safety can be identified from the group workshop and interviews. First, there is widespread acknowledgment that a lack of information about current conditions, practices, attitudes, and innovations is a barrier to improving employee safety. There is no firm understanding of baseline conditions from which meaningful comparisons can be made. Many of the interviewees expressed the opinion that assumptions about the driving forces and conditions of employee safety are untested. A variety of research questions were proposed to develop necessary baseline information for effective planning, safety activities, and evaluation.

Second, the Risk Management Council proposed research questions oriented toward the attitudes and behaviors of employees. Other individuals emphasized that NPS management plays



an important role in the current situation and must be a central focus of efforts to improve employee safety. A broader understanding is necessary about the ways that different ranks, units, regions, and divisions interact within the NPS. Essential to the success of a research program is an effort to understand roles of individual employees and management and the interaction between them.

Third, training was recognized as a vital component of efforts to improve employee safety. At the same time, there are many questions about the best ways to train. When and how to use different approaches is not well understood, and there is a strong desire to know more about effective safety training.

Fourth, the issue of “organizational culture” is a recurring theme. There is a strong recognition that safety is not something that is “added on” to work tasks. Rather, work must occur within a culture that emphasizes safety at all levels in all situations and at all times. How to create, maintain, and reinforce a “safety culture” within the NPS is an important question; those interviewed sought information about how to best establish an organizational culture that makes for a safe work environment and work practices. Importantly, there was no clear agreement among the interviewees about what such an “appropriate” culture might be.

These themes provide a significant and extensive set of topics and questions relevant to the development of a social science research plan for NPS employee safety.

## V

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# A Research Agenda

In this chapter, a social science research agenda for NPS employee safety is proposed. It is based on the policy analysis, literature review, workshop and interviews described in the previous chapters. It is organized around a series of specific research projects. The research projects are organized into three categories.

The first category of research involves *baseline inventory*. These projects are designed to document current conditions of employee safety—such as accident rates, causes, perceptions of employees and management. In addition, a baseline inventory of safety activities, including full-time and collateral personnel, safety programs, and financial resources is necessary to understand the relationships between organizational factors and individual behaviors. This research provides a necessary foundation for safety education, the development of effective safety programs, and changes in NPS organizational culture needed to establish employee safety as a top priority at all levels of the agency.

The second category of research involves *strategic science*. That is, it includes projects designed to help the NPS meet important

strategic goals related to employee safety. Projects include technology transfer and application of available research to improve training, a safety culture, and carefully evaluate safety programs to assess their effectiveness.

The third category of research involves *on-going technical assistance*. It includes projects that provide technical assistance to parks, clusters, regions and WASO-level divisions. Such technical assistance is focused on keeping managers up-to-date with new research findings, and assisting parks with specific, unique or unusual safety situations.

All three categories of research are necessary and important to improving employee safety in the NPS. The proposed work is cumulative; that is, the baseline inventory leads to strategic science which leads to on-going technical assistance. Hence, the research agenda consists of a set of interdependent research projects. Each are discussed below. For each project, an objective, general description, estimated budget, and schedule are described.

## **Baseline Inventory Projects**

### ***Employee Accident Profile***

One foundation of an effective employee safety program is a comprehensive, accurate and detailed understanding of the factors contributing to employee accidents. An NPS Employee Accident Profile is proposed. The Employee Accident Profile would focus on questions such as: Which employees (by age, region, technical task and so forth) are most at risk? What factors contribute to NPS employee accidents? Which factors are most critical? Which are most amenable to mitigation by NPS employee safety programs? What is the perceived role of management? The objective of the Employee Accident Profile would be to answer these questions.

Such questions were identified as critical in the workshop and employee interviews. The review of the literature suggests that effective safety programs are dependent upon an accurate and complete understanding of which accidents are occurring to

whom and the ways in which they occur. Finally, a comprehensive reporting system for employee accidents is mandated by federal legislation (OSHA).

An historical analysis of existing employee accident reports would be conducted, using statistical techniques borrowed from the fields of risk assessment, epidemiology and human factors research. An efficient and comprehensive accident profile form would be developed, in close consultation with the NPS Risk Management Division. The form would include data needed to examine contributory factors, and would be reviewed by experts in risk assessment and employee safety research. Data from the accident profile form would be used to create accident profiles for the NPS on an annual basis. Analysis should identify a set of key factors influencing accident rates as opposed to searching for single causes. Results should be benchmarked and compared to organizations that involve similar work and work conditions. The accident profiles would be used to target other research efforts, identify employees at risk (not individuals, but generic categories), identify contributory causes, and create effective training and safety programs.

An annual technical report and a brief report for employees would be prepared. A workshop for RMD managers would be conducted. Each year, the data would be integrated into a cumulative accident profile, so that trends in accident rates and contributory factors (needed to evaluate the effectiveness of safety programs) could be documented.

Approximate cost: \$50k the first year, 15k each additional year

Duration: 12 months to develop and establish; continued monitoring in following years.

### ***NPS Employee Safety Survey***

The second foundation of an effective employee safety program is a comprehensive and accurate understanding of how employees and managers perceive safety issues, and how their attitudes and behaviors influence safety on the job. An NPS Employee Safety Survey is proposed. The Employee Safety Survey would

focus on the following and similar questions: What are the perceptions of NPS employees and managers regarding safety issues? Are there important differences in these perceptions—among grade levels, positions, regions, kinds of parks, experience levels and age? The objective of the Employee Safety Survey would be to answer these and similar questions.

The need for an employee safety survey is based on the workshop, interviews, and literature review. For example, NPS risk managers expressed a strong interest in understanding the perceptions, attitudes, and values of employees and managers and how they influence safe work practices. The literature review reveals that attitudes, motivations, and perceptions play important roles in risk-taking behaviors, organizational culture, and the adoption of self-protective behaviors.

A survey of NPS employees (including managers) would be conducted. The survey would be designed in close consultation with RMD managers, risk managers at the region, cluster and park level, and employee organizations (such as the National Association of Park Rangers). The survey would be reviewed by experts in risk perception and employee safety research. The survey would include a large sample of full-time and seasonal employees, to provide a sufficiently detailed data set for in-depth analyses. The survey should be stratified by type of park unit—large natural areas, small historic sites, recreation areas, and so forth. The results would be used to identify critical safety needs, target employee safety programs, assist safety officers in working with managers and employees, and guide NPS policy regarding employee safety.

A technical report, brief report for employees, training materials and a workshop for RMD managers would be produced. The survey could be repeated in 5 years, so that changes in employee perceptions could be documented, and the effectiveness of NPS safety programs assessed.

Approximate Cost: \$75k

Duration: 9 months

## **Strategic Science Projects**

### ***Research Applications Project***

The accident profile and employee survey described above will provide the NPS with a comprehensive and accurate understanding of employee safety issues. It will identify contributory factors that are common to other organizations and technical tasks, as well as factors that are relatively unique to the NPS. Based on these results, a Research Applications Project is proposed. The Research Applications Project would focus on the following question: What social science research being conducted for other organizations can contribute to improving the NPS safety culture, and ultimately employee safety? The objective of the Applications Project would be to fully exploit available research that addresses the specific needs of the NPS derived from the baseline inventory research. For example, the Armed Services may have research results directly applicable to specific NPS technical tasks, such as search and rescue operations. Joint funding with other organizations and agencies should be pursued. Such an applications project is a cost-effective way of integrating social science research into NPS employee safety programs.

There is a lack of existing research on NPS-specific activities. Much of the literature is helpful. Yet it is limited because it does not address conditions that combine the complexity of the NPS work environment—tasks characteristics, employee and manager attitudes, social/political factors—and the physical work environment. Interviewees, especially risk managers, expressed an interest in applying available research/information more efficiently, developing better information sharing, and communication mechanisms.

A detailed literature review would be conducted, targeted at factors identified in the accident profile and employee survey. The review would include research being conducted by industry, government, defense and other sectors. Interviews with safety officers in industry, government, defense and other sectors would be conducted again, targeted at specific NPS needs.

Results would be used to provide practical applications to NPS employee safety programs—new safety procedures or policies, new training approaches or materials, and so forth.

A technical report and workshop for RMD managers would be produced. Once conducted, the applications project should be updated every two years to ensure that NPS employee safety programs take advantage of the most recent and relevant research.

Cost: \$25k for the first year; \$10k each additional year

Duration: 6 months

### ***NPS Safety Programs Evaluation***

Improving employee safety is a critical challenge for the NPS, and this challenge is part of the NPS Strategic Plan, its Government Performance and Results Act (GPRA) requirements, and several other NPS plans at all levels of the agency. A growing number of employee safety programs are being implemented at the park, cluster, region and national level. Early evaluation of these pilot programs is important, and an NPS Safety Programs Evaluation is proposed. The project would focus on questions such as: Which existing NPS safety programs are effective, which are not, and why? Which programs are most effective, and why? What safety programs, not currently used by the NPS, might be effectively applied to the NPS? The objective of the Safety Programs Evaluation would be to develop criteria and measurement tools to carefully evaluate NPS safety programs, and conduct evaluations of several existing and potential programs.

The research literature demonstrates that maintaining employee safety requires on-going evaluations and monitoring of employee accidents. Interviewees expressed great interest in knowing what works when—what options are available to different parks, for different employees, and for different tasks. To do this requires evaluation of existing and pilot projects. There is also a policy rationale: OSHA requires evaluation, such as job/hazard analysis and evaluation.

Criteria and measurement tools would be developed in close consultation with the RMD and experts in safety program evaluation. three to five on-going NPS safety programs would be evaluated—at least one at the park, regional and national levels. One or two safety programs currently available but not yet used by the NPS would be evaluated, using the same criteria and measurement tools.

Approximate Cost: \$40k per year for two years

Duration: 2 years

### **On-going Technical Assistance**

Many of the safety issues in the NPS are relatively unique, and specific to an individual park unit or a specialized technical task. Technical assistance is often required in developing effective safety procedures related to these special safety concerns—helicopter removal of goats in Olympic NP and snow removal operations at Mt. Rainier NP are examples. Special problems assistance would enable the RMD and park managers at all levels to have access to technical assistance in dealing with the social factors associated with specialized safety concerns. Application of results from baseline inventory and strategic science projects would be emphasized. Approximately two or three small projects, from literature reviews to on-site consultations, would be conducted each year, depending upon NPS needs.

Approximate Cost: \$20k per year

Duration: 12 months

These projects represent a social science agenda on employee safety for the NPS. The next chapter recommends an action plan for accomplishing the research.





## VI

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# Action Plan

The research agenda described in the previous chapter is critical to improving employee safety in the NPS. There are several alternative ways the agenda can be realized; that is, the necessary research designed, conducted, completed, and the results integrated into NPS safety programs. Three approaches are practical.

The first approach is to treat each of the research projects as a separate effort, and contract them separately through competitive process. Universities, consulting firms, insurance companies (specializing in risk management), and non-profits (such as the National Safety Council) would be eligible to compete for the contract. Requests for Proposals (RFP) would be created for each project (with assistance from the NPS Social Science Program), and a panel of social scientists and NPS risk managers would review proposals and select a winning contractor for each project. An advantage of this approach is that each project could attract specialists with unique skills relevant to the project. A disadvantage is the increased administrative effort in preparing the RFPs, selecting the contractors, and overseeing the various contracts and projects.

A second approach is to hire—as an NPS employee—a researcher with experience in employee safety research. A job description would be created around the research tasks associated with the research agenda described earlier. The position would likely be at the GS-12/13 level (based on similar positions in other agencies and the private sector), and would report to the Risk Management Division. The individual hired would be responsible for conducting research, communicating the results to managers, providing technical assistance and training, and assisting in special safety projects as requested. The advantage to the NPS would be increased access to safety research expertise, continued research effort over the long-term, and reduced cost for small projects and technical assistance. Disadvantages include the need for a wide range of skills (from program evaluation to survey design) in one individual, an increase in NPS FTE requirements, and higher costs for large research projects involving staff and field expenditures.

A third approach is to create a long-term working relationship with a university and university faculty with expertise in safety research. In this approach, an RFP would be developed for the employee safety research as a package of projects, to be awarded under a cooperative agreement between the NPS Risk Management Division and the winning university. The cooperative agreement would be for a term of 3-5 years, and funds would be provided to conduct the research and technical assistance described in this plan. The advantages of this approach include access to wide scientific expertise, university resources (such as libraries), graduate student assistance, continuity and interdependence of the research projects, objectivity of findings, publication of results in peer-review journals, and increased accountability. Disadvantages include administrative requirements associated with the cooperative agreement, and the need to find a university (or consortium of universities) with the requisite expertise.

It is recommended that the latter approach—a 3-5 year cooperative agreement with a university or consortium of universities—be pursued. The benefits are significant, including lowered costs,

flexibility, accountability, and access to state-of-the-art employee safety research. The following action plan is based on this approach. It is organized around several stages, which can be accomplished as funds are available.

### **Stage 1. Organizing for Science**

*1.1 A social science liaison should be appointed for the Risk Management Division.* This individual would be responsible for coordination of the research program with the NPS Social Science Program, and for communication and coordination of social science research with the safety managers of the NPS. The work would require .15 FTE, and the individual should be located at Denver, WASO or in a regional office.

*1.2 A Request for Proposals (RFP) should be prepared.* The RFP would seek to establish a 3-5 year cooperative agreement with a university or consortium of universities. The cooperative agreement would cover social science research on NPS employee safety as described in this plan. It would describe the responsibilities of both the university and the NPS. The NPS Social Science Program would assist in the preparation of the RFP, as requested. The RFP should be widely distributed to universities, with a special emphasis on universities with research programs on risk, employee safety, and hazards management.

*1.3 A cooperating university or university consortium should be selected.* A review panel would be assembled to review submitted RFPs. The panel should include representatives of the Risk Management Division, NPS safety managers at the region and park level, and social scientists. The NPS Social Science Program would assist as requested. Based on submitted RFPs, a winning cooperator would be identified. A site visit would be held, and a final cooperative agreement would be prepared and signed.

*1.4 The cooperating university or university consortium should appoint a project leader.* This individual would serve as project leader for all research projects conducted under the cooperative agreement, and would be a liaison to the NPS Risk Management Division and the NPS Social Science Program.

**Stage 2. Baseline Inventory**

*2.1 The Employee Accident Profile should be initiated.* The Employee Accident Profile is a critical foundation to further research and improvement of NPS employee safety. It should be conducted by the university project leader, in coordination with the NPS liaison. The NPS Social Science Program should provide peer review and other assistance as requested.

*2.2 The NPS Employee Safety Survey should be conducted.* The survey is a critical foundation to further research and improvement of NPS visitor safety. It should be conducted by the university project leader, in coordination with the NPS liaison. The NPS Social Science Program should provide peer review and other assistance as requested.

**Stage 3. Strategic Science and Technical Assistance**

*3.1 Based on the results of Stage 1 research, the Research Applications Project should be initiated.* It should focus on employee and management safety issues identified in the Employee Accident Profile and the Employee Safety Survey. It should be conducted by the university project leader, in coordination with the NPS liaison.

*3.2 The NPS Safety Programs Evaluation should be initiated.* It should focus on several pilot NPS safety programs, and provide evaluation information useful in meeting GPRA requirements, improving existing programs, and expanding efforts to other units or regions of the NPS. It should be conducted by the university project leader, in coordination with the NPS liaison. The NPS Social Science Program should provide peer review and other assistance as requested.

*3.3 The cooperating university or consortium of universities should initiate a program of on-going technical assistance.* It should include special problem assistance as described in this plan. It should be conducted by the university project leader in coordination with the NPS liaison.

**Stage 4. Program Review**

*4.1 The program of employee safety research conducted under the cooperative agreement should be reviewed.* The review should focus

on both the scientific merit of the work accomplished and the practical usefulness of the work to the NPS. A review panel should be assembled and include representatives of the Risk Management Division, NPS safety managers, and social scientists with expertise in employee safety. The review panel should make recommendations on improving, reducing, extending or expanding the program of employee safety research.

*4.2 If continued research on NPS employee safety is recommended by the review panel, a new social science plan should be prepared, and a new cooperative agreement established.*

Table 6.1 provides an estimated budget for completing this action plan in four years.

**Table 6.1 Estimated budget for four-year NPS research program on employee safety (in thousands of dollars)**

Project	Year				Total
	1	2	3	4	
Baseline Inventory					
Employee Accident Profile	50	15	15	15	95
Employee Safety Survey	75	—	—	—	75
Strategic Science					
Research Applications Project	—	25	10	10	45
Safety Programs Evaluation	—	40	40	—	80
On-going Technical Assistance	—	—	20	20	40
TOTAL	125	80	85	45	335



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# Appendices





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## **Appendix II. Questions Identified During Nominal Group Process**

### ***NPS Risk Management Division Meeting, Lakewood, CO, March 1997***

- 1) How do organizations behave so as to achieve funding goals?
- 2) What can motivate NPS employees to be involved in risk management on a sustained basis?
- 3) Why have NPS employees NOT used available information to reduce employee accidents?
- 4) Why is safety not considered a value in the NPS?
- 5) Is safety a concern within the NPS (broadly)?
- 6) What ways are there to change attitudes about an inherently dangerous workplace?
- 7) Why do NPS employees resist change?
- 8) Why do NPS employees place themselves at risk when they know they are doing so?
- 9) How can we reduce macho attitudes (broadly) among employees that lead to unsafe behavior?
- 10) Do our employees value their own safety?
- 11) How do workers develop their perceptions of acceptable risk?
- 12) Are there gender differences in the perception of risk among employee safety?
- 13) Does personal career development take priority over safety concerns?
- 14) What qualities are most important in safety professionals in communicating and managing risk, particularly assisting others in doing so?
- 15) How do we receive and maintain NPS leadership support for risk management when such leadership is continuously changing?
- 16) What are the values and norms of both ranger and maintenance cultures that result in decisions that lead to at-risk behaviors?
- 17) Are there demographic differences among NPS employees in the perception of risks?
- 18) What controllable factors (e.g., scheduling, preparation) influence outcomes in life-threatening conflicts?

- 19) Why does NPS culture require employees to make significant sacrifices (broadly)?
- 20) How can prevailing NPS attitudes be altered to encourage safety?
- 21) How do “life conditions” of individual employees affect safety and can such conditions be monitored?
- 22) What are the best available training strategies for changing safety attitudes?
- 23) How can passive employees be encouraged to be assertive?
- 24) Why do supervisors frequently ignore unsafe behavior?
- 25) What balance of incentives and discipline is most effective in motivating safe behaviors by NPS employees?
- 26) What is the relationship between visitor risk communication and employee safety?
- 27) What is the existing perception of safety in the NPS?
- 28) What is the education difference between the NPS and other comparable federal agencies?
- 29) Which NPS positions are perceived to have high levels of acceptable risk?
- 30) What factors in NPS history have had the most influence on NPS attitudes toward safety and how can the negative factors be overcome?
- 31) How can the NPS distinguish between legitimate and false injuries and do so effectively and while protecting the rights of employees?
- 32) How do NPS subcultures lead to unsafe practices?
- 33) Is there a relationship between training of risk managers and the accident rate?
- 34) What role does politics play in creating risk situations and what can be done to manage that?
- 35) Why do some NPS functions achieve adequate budgets while risk management does not?
- 36) How can employee safety research be applied to visitors?
- 37) Are supervisors acting as safety role models, and if not, why not?
- 38) Where and when are most accidents?
- 39) Why doesn't the NPS learn from past risk accidents?

- 40) How can management best communicate to employees a concern for individual safety as opposed to program?
- 41) How can we encourage employees to care about co-worker safety?
- 42) How do NPS managers value and perceive the safety of full-time, seasonal, and volunteer employees?
- 43) What is the existing NPS manager's perception of risk in the NPS workplace?
- 44) What is the NPS visiting public's perception of employee safety (general and specific)?
- 45) How do time pressures impact risk situations?
- 46) How do workplace physical factors impact attitudes and behaviors?
- 47) What are employee's attitudes toward employee safety programs?
- 48) Is there a relationship between NPS lack of workers compensation case management and long-term disability claims, and if so, what is it?
- 49) Are there multiple strategies for risk communication that can be best applied to specific NPS employees and are they being used?
- 50) How can the NPS define "acceptable risk?"
- 51) Is there a perceived need for professional risk managers at some or all levels of the NPS?
- 52) How do NPS employees value and perceive full-time and part-time (collateral duty) safety managers?
- 53) Why do NPS employees resist safety?
- 54) How can managers maintain quality control of the risk management program while preserving local manager options?
- 55) What are the most effective ways to change attitudes and cultures in organizations and how can such change be effectively measured?
- 56) Do demographic differences among employees lead to different responses to discipline and incentives related to safety?
- 57) What are the major elements in our society that affect employee's attitudes and perceptions about risk?
- 58) What are the factors that influence managers to make decisions that put employees at risk?



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## **Appendix III. Individuals Interviewed to Gather Views and Opinions from the Field**

### ***Park units***

Robert Belden, Safety Specialist, Lake Mead National Recreation Area, NV  
Gary Bornholdt, Safety Manager, Sequoia and Kings Canyon National Parks, CA  
Myra Dec, Chief Interpreter, Grand Portage National Monument, MN  
Steve Iobst, Chief of Park Maintenance, Rocky Mountain National Park, CO  
Don Singer, Safety & Occupational Health Manager, Grand Canyon National Park, AZ

### ***Regional***

Deanne Adams, Team Leader for Education and Visitor Services, Columbia Cascades Support Office, NPS  
Paul Broyles, NPS Fire Operations and Safety Specialist, Fire Management Program Center, NPS  
Ruth Brugeman, Office of Aircraft Services, Department of the Interior  
Doug Erskine, Operations Director, Fire Management Program Center, NPS  
Mike Fees, Program Manager, Great Lakes System Support Office, NPS  
Bill Halainen, Management Assistant, Delaware Water Gap NRA, NPS  
Stephen Hastings, Service-wide Maintenance Training Manager, Horace M. Albright Training Center, NPS  
Vern Hurt, Regional Risk Manager, Midwest Regional Office, NPS  
Ray Peterson (retired), Regional Safety Manager, Pacific Northwest Region, NPS  
Richard Powell, Chief, Risk Management Office, NPS  
Mark Seely, Regional Safety and Occupational Health Specialist, Pacific West Region, Columbia Cascades Support Office, NPS  
Nelson Siler, Regional Safety Manager, Southwest Region, NPS

### ***Other Agencies***

Ken Rozas, Bureau Safety Manager, US Fish and Wildlife Service, Lakewood, CO  
Kathy Shell, Bureau Safety Manager, Bureau of Land Management, Lakewood, CO