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The development of a job-related non-discriminatory physical abilities test for the firefighters at the Nevada Test Site

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THE DEVELOPMENT OF A JOB-RELATED NON-DISCRIMINATORY PHYSICAL ABILITIES TEST FOR THE FIREFIGHTERS AT THE NEVADA TEST SITE

by

Nickele A'lise Miller, B.S.

Bachelor of Science
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A thesis submitted in partial fulfillment of the
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ABSTRACT

The Development of a Job-Related Non-Discriminatory Physical Abilities Test for the Firefighters at the Nevada Test Site

by

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A job-related, non-discriminatory Physical Abilities Test (PAT) was developed for the Nevada Test Site (NTS) firefighters. The PAT was developed through firefighter interviews and tabulated call responses between 1990 and 1995. The interviews and task history yielded a job analysis from which six routine, physically demanding tasks were identified and developed into a test battery. Eleven NTS firefighters tested the proposed PAT for reliability. Subjects were timed on the six tasks. The total time for completion, including the change from bunker gear to wildland gear, was also recorded. An Intra-class Reliability coefficient was calculated for each task and total time. Task reliability values ranged from .59 to .92 and R = .89 for total time. A repeated measures ANOVA revealed no significant changes from Test 1 to Test 2 ($p > .05$). Descriptive statistics were also presented. The mean, standard deviation and range were calculated for each subject on each task, total time to complete, and walking time between tasks.

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Finally, I would like to thank my parents Donna and Gerald Miller, for their unconditional support and for teaching me to believe, that anything is possible, if you just believe in yourself. I want people to know how much I truly love you both. This Poem is dedicated to you.

Children Do Not Realize

Until we're grown, we never know
or fully realize
How sweet & kind our parents are.
How gentle & how wise
We simply take for granted,
From day to passing day,
Each sacrifice they make for us
In their own loving way...
But then we grow
And finally learn.
The way that children do.
How much their love
Has really meant,
How thoughtful they've been too.
And so this comes
With all the thanks
You both deserve and more
For there aren't
Two greater parents
Than the ones I Love and Adore!!!

-----author unknown

CHAPTER 1

INTRODUCTION

Firefighting is a physically demanding and hazardous occupation (Bahrke, 1982; Brownlie et al., 1985; Davis et al., 1982). Physical Abilities Tests (PAT) are designed to screen firefighter applicants to determine whether or not they can physically perform the job safely. Studies have documented that the stressful demands of firefighting have caused a higher than normal incidence of job related injuries and an increased risk of premature death (Bahrke, 1982; Cady et al., 1979, 1985). PAT components that are developed, by law, must be job-related and non-discriminatory for all applicants. Job performance standards are components used to measure the ability of an individual to perform a job. An established standard of fitness for firefighters is essential in successful job performance. Public and firefighter safety is highly impacted by firefighters physical capabilities. Reduction of accidents and injuries is the result of this standard (Adams et al., 1986; Cady et al., 1985; Menley, 1979). Although many PAT's are reliable and valid, there are others that have adverse impact. Adverse impact is when an individual has been discriminated against due to circumstances beyond their control such as age, sex, race, and religion. Further, PAT's are often discriminatory against minority groups, females and the physically impaired (Fleishman, 1979).

Several studies (Campion, 1983; Fleishman 1988; Hogan 1991) have led to the

increasing use of physical fitness screening to evaluate firefighter applicants.

In order to comply with the equal opportunity legislation, employment equity programs, and affirmative action incentives, it is imperative that Physical Abilities Tests be composed of tests that are specific and essential to the physical requirements of firefighting. The physical demands of firefighting tasks and the physical fitness needs required to meet those demands must be clearly stated (Gledhill, 1992).

Since the PAT represents fitness to do the task, the test should be administered yearly.

The Nevada Test Site employs firefighters and supports a fire department. However, the physical demands, and job specific tasks in their unique situation have not been determined.

Purpose of the Study

The purpose of this study was to develop a Physical Abilities Test for firefighters at the Nevada Test Site that was job-related and non-discriminatory.

Need for the Study

The job of a firefighter is physically demanding, requiring cardiovascular endurance, muscular endurance, muscular strength, balance and flexibility (Brownlie et al., 1985; Davis et al., 1982; Gledhill et al., 1992). With physically demanding jobs there is a tendency for a higher incidence of injuries (Adams et al., 1986; Cady et al., 1985; Menley, 1979). A test that measures the actual tasks routinely performed will determine if the applicant is capable of doing the job. Hiring individuals who can physically do the

job might reduce unnecessary workers compensation claims. Studies indicate that low-back injuries alone occur with greater frequency in physically unfit workers, and that a good pre-employment PAT can reduce the incidence of these injures (Campion, 1983). Therefore, "...improved screening devices are needed to both insure that job performance requirements are met, and to protect the well being of prospective employees"(Campion, 1983).

Limitations of the Study

1. Eleven subjects are minimal for establishing PAT norms, however there are only twenty-eight firefighters employed at the Nevada Test Site, including administrative and fire prevention personnel.

2. Due to security, as well as the infrequency of calls no actual observation of on the job performance was possible.

3. There were no females in the population to be tested.

CHAPTER 2

RELATED LITERATURE

History of Physical Abilities Testing

> It is a laughable sight to see those guilds of cobblers and tailors ...when they march in procession...stooping, round shouldered limping men, swaying from side to side. They look as though they had all been carefully selected for an exhibition of these infirmities. (p. 283)

These observations of sedentary workers came from Bernadino Ramazzini in 1713, who authored one of the first texts of Occupational Health and Physical problems. Occupational fitness has been studied and classified for hundreds of years.

The paper and pencil tests used in the Army Alpha Test of World War I were the forerunners of large-scale military selection and classification techniques (Yerkes, 1918). Pilot aptitude tests were developed from the extensive research in World War II, and with this research, techniques were used to test a pilots ability to fly (Flanagan, 1947; Guilford, 1947). Psychological and psychomotor performance practical tests were developed by the 1950's to evaluate occupational fitness of air crewman (Shepard, 1957).

Modern military assessment centers for personnel selection are, based on these earlier physical fitness and occupational performance tests (Melton, 1947; Murray & MacKinnon, 1946). In the 1960's research conducted by Fleishman and his colleagues inspired the Army Air Forces Aviation Psychology Program to conduct performance

evaluations (Fleishman, 1975a, 1975b, 1975c, cited from Fleishman 1988).

Hiring practices became a human rights issue led by the Equal Employment Opportunity Commission in the United States. Alternatives to the paper and pencil tests needed to be developed (Shepard, 1990). Many factors were considered in this undertaking such as, employee safety, equality for all members of society, and how to categorize and define ability measurements. Physically demanding jobs needed employee screening tests (Nottrodt & Celantano, 1984).

Documentation of job-relatedness was determined to be essential when dealing with fairness practices of the labor force. Litigation and proposed legislation caused an emphasis to be placed on developing new ability tests, which could help predict performance in a job situation (Fleishman, 1988). The emphasis on the development of contemporary ability tests has been redirected from evaluating physical fitness to predicting job performance (Hogan, 1991). In the early 1960's, Fleishman identified abilities that could account for job performance under a wide range of job tasks (Fleishman, 1962a, 1967, 1972a). Motor abilities involved in occupational sectors and motor abilities involved in physically demanding jobs were found to be independent (Hempel & Fleishman, 1955). Although an agreement of the efficacy of measurements could not be reached many are still used; such as, agility, speed, strength, and muscular endurance criteria are still being used, but categorizing and defining them were difficult.

Analysts rated tasks by the skill requirements of the job. Abilities were given a scale rating. These skills range from physical to sensory, and after thousands of evaluations, many were selected and put into more than 50 scales (Theologus, Romashko, & Fleishman, 1973). The Manuals for Ability Requirements Scales put the physical and

sensory tasks in combination with actual job tasks (Fleishman, 1975a, 1975b, 1975c as cited in Fleishman, 1988). An occupational profile using these scale standards can be extremely useful by determining qualifications for excellent job performance (Fleishman & Mumford, 1988).

The PAAM (Physical Abilities Analysis Manual) was originally designed as a physical agility test for firefighters (Brumbach, G. B., Romashko, T., Hahn, C. P., Fleishman, E. A., 1974 as cited in Fleishman, 1988; Brumbach, G. B., Romashko, T., Fleishman, E. A., Hahn, C. P., 1975 as cited in Fleishman, 1988). It assessed nine physical and related strength factors specific to the upper and lower body (Myers, Gebhardt, & Fleishman, 1980). The nine factors could be used to evaluate the physical abilities required in new jobs and provide a basis for selecting tests to measure each of those abilities (Fleishman, 1979). Although supported by research with solid theoretical background, it would be unwise to rely exclusively on these ratings as a sole determination of assessing physical demands of a job (Campion, 1983). This method of personnel selection became widely used by agencies employing policemen, paramedics, maintenance workers, and automobile mechanics (Fleishman, 1988).

The introduction of the Equal Employment Opportunity (EEO) legislation encouraged a larger number of females and minorities to seek employment in positions that were physically demanding. Physically challenging sectors of the job market became more accessible to a wider variety of people. This increased the need for a properly developed strength testing and selection program. A program that was properly developed would provide protection for prospective employees as well as current

employees because it would ensure that job requirements were met (Chaffin, 1974; Chaffin, Herrin, & Keyserling, 1978; Keyserling, Herrin, & Chaffin, 1980).

Research has proven that a physically unfit worker has a higher risk of lower back injury. These types of injuries could be drastically reduced using accurate selection programs (Campion, 1983).

With a greater diversity of persons applying for physically demanding jobs, research for accurate testing methods that would lead to appropriate employee selection has greatly increased (Fleishman, 1988). Developing a set of universal standards to meet all needs would be highly impractical. However, proper analysis of physiological factors can relate job standards to specific profiles. Each job skill should accurately reflect a job profile (Fleishman, 1979). Physiological factors in the work environment, including temperature, noise, toxic substances, humidity, and physical abilities such as strength, effort, body movement, vision and hearing have all been considered in designing a physical ability program (Nylander & Nelson, 1982 as cited in Campion, 1983). There are many advantages to strength testing programs. Employee safety, lower cost, ease of administering the test, are just a few of the advantages (Keyserling et al., 1980). However, research does not address whether or not strength tests are likely to show gender differences and adverse impact (Campion, 1983).

According to Sparks (1982), who reviewed the topic of job analysis using definitions, methods, instruments, research, and EEO legislation, and no one system can meet all the needs of a proper job analysis.

Adverse Impact

Adverse impact is when an individual is not hired for a job based of the criteria of

selection. The Uniform Guidelines of 1978 provide some guidance.

> A selection rate for any racial, sex or ethnic group which is less than 4/5 or 80% of the rate for the group with the highest rate will generally be regarded ... as evidence of adverse impact... (p. 38297)

Prior to 1964, physically demanding jobs were regulated by legislation at the State level, presumably to protect women and minorities under various working conditions. This protection directly affected female and minority job opportunities in the labor force, since job criteria and standards for males and females were different (Weeks v. Southern Bell and Telegraph Co., 1969).

Title VII of the Civil Rights Act of 1964, preventing age, race, color, religion, and national origin and sex discrimination was enacted to provide protection against selection processes, for all jobs.

All applicants applying for physically demanding jobs must now be judged solely on their abilities and qualifications. The Civil Rights Act also states that an employer may not administer an ability test that would in any way discriminate on the basis of because of age, sex, color, origin or religion. If an employee feels they have been discriminated against in job selection, the Civil Rights Act of 1964 (1972) is a valuable litigation starting point.

The possibility always remains that adverse impact can occur with regard to physical abilities and that discrimination against certain handicaps and certain ethnic individuals can result. If this were the case, an employer could be in violation of the Vocational Rehabilitation Act of 1973 (Campion, 1983). A sequence of steps developed by the Supreme Court helps establish a prima facie case under the Disparate Treatment Doctrine. Plaintiffs must show:

> (i) they belong to a protected classification, (ii) they applied and were qualified for a job for which the employer was seeking applicants, (iii) despite their qualifications, they were rejected, and (iv) after their rejection the position remained open and the employer continued to seek applicants from persons of complainant's qualifications. (McDonnel Douglas Corp. v. Green, 1973; Arvey and Faley, 1989, p. 79)

Physical requirement standards are needed to help prevent injuries and accidents in jobs that demand high levels of performance, muscular strength and cardiovascular endurance, even though they prove to be the most difficult to enforce.

The Uniform Guidelines on Employee Selection Procedures (1978) were implemented to investigate compliance with guidelines and ensure valid documentation of the associated physical stipulations (Hogan, 1991). Test validity is essential since females in strength and endurance tests are screened out more often than males, regardless of ethnicity (Fleishman, 1988), although there is always some portion of the population (both male and female), due to physical makeup, that cannot perform the work. Stressing physical relatedness and relevance in a job is imperative to reduce adverse impact on females. Validity is crucial (Hogan & Quigley, 1986).

Several studies have been conducted with large sample sizes (Schmidt & Hunter, 1977; Cascio & Phillips, 1979). These studies included the metal trade industry an electric power company and, city government jobs. In larger sample sizes the adverse impact was not notable, when male to female ratios were proportionate. Tests related work tasks to job performance, and were administered to all subjects equally. These job performance tests proved to be more cost-effective and more acceptable to all employees, regardless of gender or race, thereby proving to be much better than the standard paper and pencil tests. As Kleiman and Faley (1985) stated "that traditional alternatives to paper-and-pencil tests have at least equal validity and less adverse impact" (p. 810-811).

These studies were conducted in areas requiring a high level of physical muscular and cardiovascular endurance. It was important to develop strong and consistent methods of testing and scoring. Elimination of all adverse impact is nearly impossible, but with valid job selection criteria the task will be easier.

Guion (1966), emphasized that:

> All employment practices are discriminatory. It is necessary to hire some applicants and to not hire others. Thus, tests are discriminatory by nature and are used to identify individuals who are likely to be more qualified for a job than others (p. 25)

Broadened protection of the 1972 Civil Rights Amendment blanketed educational, state, and governmental agencies. This legislative protection provided an avenue to enforce Title VII, with the EEOC (Equal Employment Opportunity Commission) (Arvey & Faley, 1989).

EEOC and the Equal Opportunity Act

The Equal Employment Opportunity Commission (EEOC) is comprised of the Secretary of Labor, Chairman of the EEOC, Attorney General representing the Department of Justice, Chairman of the United States Civil Service Commission, and the Chairman of the Civil Rights Commission (Arvey & Faley, 1989)

President Johnson signed the Civil Rights Act in 1964 (amended in 1972). This act protected the rights of the employee. An employer could no longer discriminate against any sector of society in the hiring process. Title VII specifically outlines steps an organization must adhere to in hiring decisions:

> 1. To fail, refuse to hire, discharge any individual, or otherwise to discriminate against and individual with respect to his compensation, terms, conditions, or privileges of employment because of the individual's race, color, religion, or national origin; or
> 2. To limit, segregate, or classify employees or applicants for

> employment in any way which would deprive, or tend to deprive, any individual for employment opportunities or otherwise adversely affect his stature as an employee because of such individual's race, color, religion, sex or national origin. (42 U.S.C. §2000[e][2][A], 1970 Hogan & Quigley, 1986, p. 1194)

The first Federal Executive Agency Guideline for Employee Selection Procedures' was published on November 23, 1976 in the Federal Register. The guidelines were considered to a weak attempt at solving a great problem. The very next day the previous set of guidelines were republished, and for two years the EEO and the Civil Rights Commission struggled to resolve their differences. In 1978 the agencies collectively published the Uniform Guidelines on Employee Selection Procedures. In 1984, due to reorganization during the Reagan administration, the responsibility for EEO legislation enforcement fell to the EEOC.

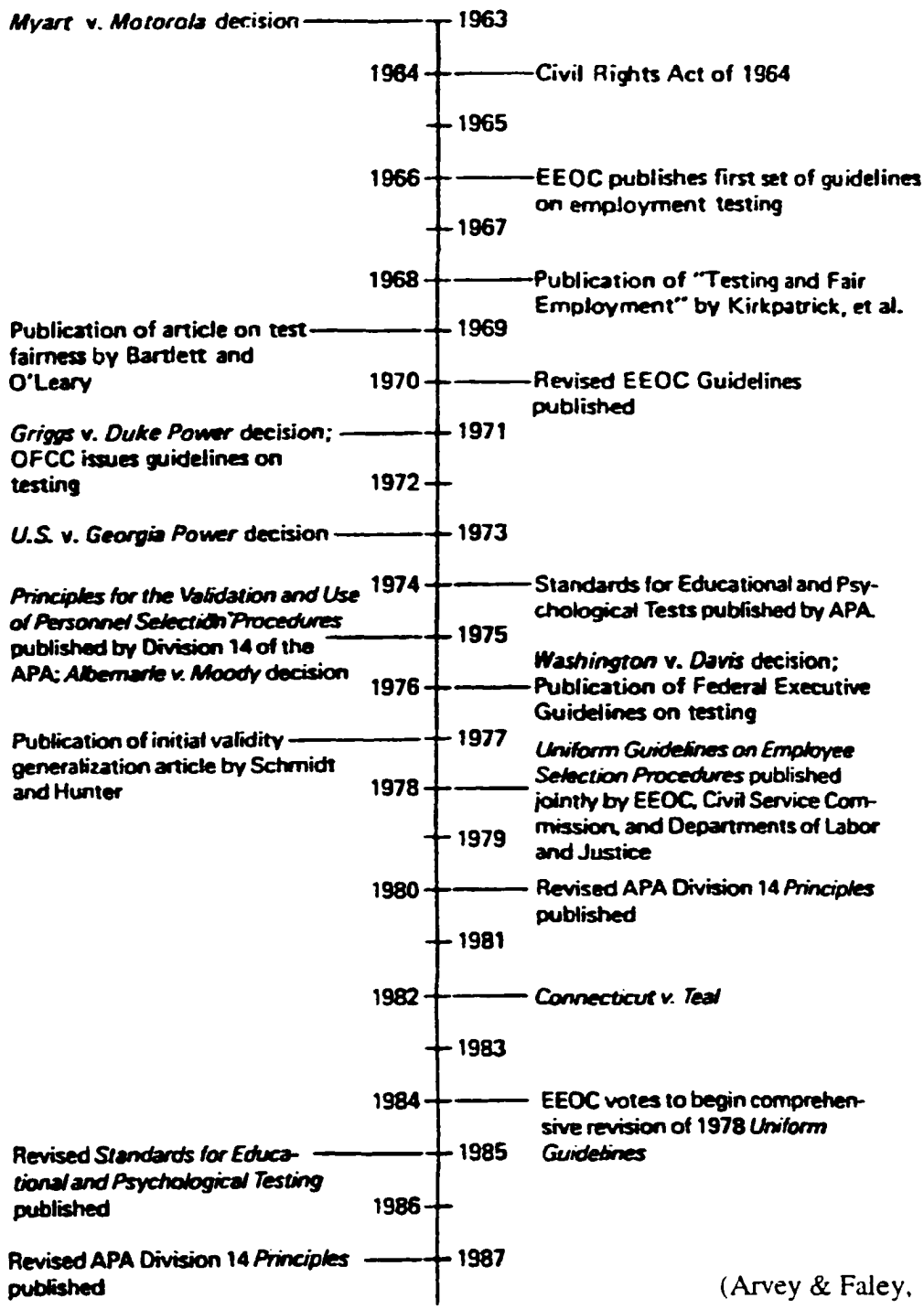
Under current written legislation, executive orders are under the direction of the President or another branch of government. Private business contracts with the United States Government each year amount to billions of dollars. Non-compliance with the Civil Rights Act 1964 (1972), and Title VII specifically, can be very costly for the contractor and sub-contractors. In 1965, Lyndon Johnson, issued an executive order imposing certain obligations when doing business with the federal government.

> The contractor will not discriminate against against any employee or applicant for employment because of race, color, religion, sex or national origin. The contractor will take affirmative action to ensure that applicants are employed, and that applicants are treated during employment, without regard to race, color, religion, sex, or national origin. ([Sec. 202(1)] Arvey & Faley, 1989, p. 66)

The OFCC (Office of Federal Contract Compliance) merged with two EEO agencies to create the OFCCP (Office of Federal Contract Compliance Programs) in June 1975. The reason for this merge was because the OFCC could actively pursue

compliance with unannounced visits to contractors. But the legal arms of the EEOC were tied, they had to wait until a complaint was filed before they could intervene.

Shown below is a time chart indicating major events involving test discrimination.



(Arvey & Faley, 1989 pp. 86)

Litigation Impact

The outcomes of litigation in the courts have shown that measurements between aptitude tests and job performance tests must be clearly defined, and it is critical to show the validity of any given measurement within the test. A relationship must be shown to be necessary to a safe and efficient job performance and needs to be considered job related. Qualification tests that directly measure physical abilities are not widely acceptable to the court system.

In most court rulings there is an inadequate job analysis in test selection, and not enough rational relationship shown between the test selection and job performance. The relationship must be shown to be necessary to a safe and efficient performance on the job (Officers for Justice v. Civil Service Commission, 1975; Harless v. Duck, 1980)

Guidelines in demonstrating job relatedness are available from many sources. Governmental agencies such as the EEOC, Civil Service Commission, Department of Labor and the Department of Justice have developed a high awareness, especially among the private sector contractors, of affirmative action regarding job relatedness as it applies to females and other minorities. The American Psychological Association and the Division of Industrial-Organization Psychology are two private organizations that also provide information. Miner & Miner, (1979), and Arvey & Faley, (1989), can also provide legal parameters pertinent to employee selection.

Frequent issues concerning the selection procedures of employees are: content validity, work sample tests, assessment tests, and criteria. It has been established that these validation techniques, among the few, are acceptable in the courts, along with the Uniform Guidelines of 1978 (Washington v. Davis, 1976).

Organizations are now trying to use the Content Validity (relationship between the test and the required tasks) approach for proving job-relatedness instead of the criterion-related research (a predictor (test) that is associated with a criterion (measure of job performance)). The Content Validity approach is increasingly accepted because it is associated with fair testing and lack of bias. Skill, knowledge, and needed behaviors are directly assessed with abstract, verbal or qualitative measurements in a content validation approach. Applicants and organizations react favorably to this newer concept. Guidelines such as the 1985 Standards and the 1987 Principles also look more favorable to the evidence of content validity. Content validity, as noted in the Standards as, "An ideal validation includes several types of evidence which span all three traditional categories." (Arvey & Faley, 1989).

Two concurrent validation (research validation by gathering the test and job information from employees) studies of physical tests were presented by the appeals court in Blake v. City of Los Angeles, 1979, to support the job relatedness of concurrent measurements. The first study compared performance on five physical tests with eleven measures of success in police academy training. Although some of the predictors correlated with some of the measures, the court ruled that modest comparisons "hardly establish that the physical test is intimately related to job performance as to be a business necessity." This decision was based upon the fact that no relationship was shown between training criteria and job performance. The court did not view this ruling as conflicting with Washington v. Davis (1976), in which a written test was upheld as valid, because it predicted training school performance and reinforced the need for criteria to be job related (Hogan & Quigley, 1986).

Sixty-six employment discrimination cases studied by Field and Holly, (1982), concurred with previous studies that a thorough job analysis survived legal challenges. 46.9% of the cases were decided in favor of the defendant (organization). Results from this study are consistent with reviews done by other organizations (Arvey & Faley, 1989; Bernardin & Betty, 1984; Cascio & Bernardin, 1981; Kleiman & Durham, 1981). In an appeals case between Guardians Association of NY City Police Department, Inc. v. Civil Service Commission (1980), test construct dilemmas considered were:

> To be fully representative of the job, a test should measure all the significant abilities needed for successful job performance, yet some abilities, especially in jobs of any complexity, are far along the construct end of the content construct continuum where successful validation is difficult. If a test tries to be representative and measure all significant abilities, including those that are clearly constructs, it risks the use of inadequate assessment devices, because the rigorous standard for construct validation will rarely be met. On the other hand, if the test makers acknowledge the difficulty of satisfactorily measuring constructs and test only for those abilities that are appropriate for content validations, they encounter the objection that the test is not sufficiently representative of the job. (23 Empl. Prac. Dec. [CCH] ¶31153, Hogan & Quigley, 1986, p. 1204)

Content Validity tests will continually be open to criticism unless jobs are performed in unchanged settings, and/or are somewhat simple and routine.

An analyst, when developing a job description test examines activities from minority and non-minority group members to obtain a true overall picture. To exclude one group or the other may not include all aspects of the job to be performed. Determining the potential bias of an analyst should be considered. Can a Caucasian analyst evaluate a prospective minority employee fairly and equally? Would a male analyst's interpretation be influenced by any degree when interviewing a female incumbent? Clarenbach, (1975)(as cited in Campion, 1983), suggested that sex-role stereotyping by the individual analyst is one of the factors responsible for the underrating

of women's work. In contradiction, Arvey, Passino, and Lounsbury, (1977), found little evidence to substantiate such a claim. They determined that analysts' ratings were independent of sex. In any case, it is important when conducting a job analysis to sample all representative employees from the current employee population and to use more than one analyst.

Physical Ability Test (PAT) Methodology

When developing a PAT, researchers define most essential elements first, duties and limitations of the job. Accurate descriptions of these elements illustrate relationship to safety and job performance effectiveness. Occupational requirements and constraints imposed on gender, age, and disability are additional essentials needing to be considered (Shepard, 1990)

According to the interpretation's of Hogan and Quigley (1986),

> At least three questions regarding job analysis typically arise in court cases 1) was a job analysis done, 2) The adequacy of job materials, and 3) The method selected for validation strategy and used if appropriate. (p. 1200)

Kleiman & Faley (1985), indicate the same job-analysis issue with concern in courts to the paper and pencil tests for employment.

As defined in the Uniform Guidelines (1978) job analysis is "a detailed statement of work behaviors and other information relevant to the job." (p. 38307)

The Uniform Guidelines have considerable influence in courts. (Albemarle Paper Co. v. Moody, 1975; EEOC v. E.I. Dupont deNemours & Co., 1978; Griggs v. Duke Power Co., 1971; Guardians Association v. Civil Service Commission, 1973). These cases illustrate the need to base any selection procedure, including Physical Abilities Tests (PAT) on these guidelines and professional standards (APA, 1980; Standards,

1985). This position is especially true if adverse impact was shown in the selection procedure. Any method is acceptable if the end result provides required valid data for strategy used.

Interpretations of six research resources conducted between 1975 and 1990 (Astrand & Rodahl, 1977; Bernaurer & Bonanno, 1975; Campion, 1983; Hogan & Quigley, 1986; Nottrodt & Celantano, 1984; Shepard, 1990) show the many varied conclusions of compiled data for job analysis tests and recommendations for further research. However, constraints begin to emerge as one pursues their data and the end result is yet another view of the complexity of a job analysis study.

Defining necessary work task steps appeared to take precedence in all studies. It was important to identify and minimize potential physical injury on the job, and determine inherent hazards of each. Additional criteria included determination of specific muscular groups involved, endurance duration, and the physical demands required in each situation.

It was also concluded that a combination of methods proved to have the most valid results, including the use of analytical procedures, probabilities, correlation's, utility analysis, content-reference, and construct-reference, and work sample tests. Experts in the field of analysis were essential. Sources of expertise could include job incumbents, first line supervisors, subject-matter experts or a classified Rater (an individual who is an expert about that particular job and giving information based upon that expertise, i.e., an incumbent firefighter rating the job of firefighting).

Multi-dimensional aspects in jobs (endurance and strength) were another consideration since presuming a job is physically demanding without valid data to back

up this conclusion would be asking for trouble. The idea of the test batteries was to help predict job success or failure through the selected screening process and the optimal performance cutoff scores. As stated by Campion (1983):

> The conceptual link between job requirements and the cut-off scores chosen for selection tests must be made explicit, and if documented, made defensible. Physical Abilities Tests have been proven to have an adverse impact against females, and will probably be legally challenged and the cut-off scores will thereby determine the degree of adverse impact. (p. 545)

Adverse Impact was a major concern in all studies. The need for reliable assessment of physical ability predictors to lessen Adverse Impact will be an ongoing research dilemma.

Work-sample tests are among the most predictive and, in almost all studies, were in the top half of the tests with the highest validity coefficient. Campion (1972) conducted work sample tests on maintenance mechanics. Based on a complete job analysis, four tasks were selected as potential predictors of job performance. Thirty-four maintenance employees were asked to perform these tasks while being closely observed and rated by job experts. The supervisors of these employees provided independent ratings of each on three criteria: use of tools, accuracy of work, and overall mechanical ability. The resulting data clearly demonstrated that the work-sample test was a more accurate predictor of job performance than the traditional pencil and paper test. O'Leary (1973) indicated that tests simulating an actual job are valuable on two counts: (1) they are directly and logically related to the behavior being predicted; and (2) they allow job candidates to obtain a "feel for the job" and learn about its potential suitability.

It is clear that experts in the field of job research define fitness according to their expertise. Exercise physiologists define fitness in terms of cardio-respiratory endurance

(Wilmore, 1977). The capacity to perform muscular activities is the backbone of most physical test batteries. Astrand and Rodahl (1977) noted muscular work in industrial settings is seldom maintained for long periods of time. This does not hold true, however, for some industrial professions, such as firefighters, disposal drivers, or high-pressure chemical cleaners. When a job required strenuous muscular performance over time, cardiovascular endurance will also be essential simply because the muscles require oxygen for continued contraction, while the vascular system must deliver oxygen and remove the by-products of metabolism.

Categories of task evaluation must accommodate a variety of physical requirements. Relatively few physically demanding jobs require "explosive" strength or stamina such as running and jumping or prolonged cardiovascular activity. One exception to this case is the firefighter (Brumbach et al., 1974 as cited in Fleishman, 1988; Gebhardt, Crump & Schemmer, 1985 as cited in Fleishman, 1988). Nottrodt and Celantano (1984) suggested that practical field tests are most useful when occupations have tasks that require both muscular strength and endurance. The reason for this is because these types of tests consist of both content and construct validity (an ability test that directly reflects actual work behaviors) is used. Courts are more often impressed by the actual act of dragging a heavy hose up a concrete staircase than by careful measurements of equivalent anaerobic power (Wilmore & Davis, 1979; Shepard, 1990). Physically demanding occupational tasks involve a multi-faceted job analysis. Consider a firefighter spraying a burning structure with a charged hose. This task requires the strength to resist the pressure of the charged hose, muscular and cardiovascular endurance to handle the hose for extended periods of time and, perhaps, balance if the

footing is slippery or if the firefighter must work from a ladder. This would conclude that a task evaluation must accommodate a variety of physical requirements (Hogan, 1991).

Work related injuries (usually related to the back) are a direct link to the physical fitness of the individual. Selecting employees that meet or exceed the recommended physical strength requirements will result in fewer on the job injuries, less physiological fatigue, and a greater level of performance (Chaffin, 1974; Chaffin et al., 1978; Chaffin, Herrin, Keyserling & Garg, 1977; Herrin & Chaffin, 1978; Keyserling et al., 1980; Park & Chaffin, 1975). The ultimate reason for test batteries is to provide a safer environment in which all employees can work without fear of discrimination or adverse impact.

There is not an end result to these studies because with each technological advancement, and unforeseen future jobs, new test batteries will need to be conducted and new job requirement assessments will need to be met.

Examples of Presently Accepted PAT'S

Acceptable PAT's must have an obvious job-relatedness, valid test content, and the ability to be scored and administered objectively.

The California Highway Patrol illustrates these principles (Wilmore & Davis, 1979). Candidates are assessed by scores on a 1.5-mile run, grip strength, bench press, vertical jump, sit and reach, and skinfold measurements. Job-relatedness is also evaluated by vaulting a (4'10"& 6') roadside barrier, dragging a simulated human body thirty meters across an expressway, and handcuffing a realistic dummy prisoner in specified time limits are also very relevant to the position of a highway patrolman.

Scores on vaulting, dragging and handcuffing are influenced by stature, body

mass, and opportunity to practice the test battery. Environmental conditions at the time of testing (i.e. inclement weather, poor illumination, and danger from traffic or physical adversaries), also play a factor, and can heavily influence outcome.

In the case of Hardy v. Stumf (1978), a test battery designed for the Oakland Police Officers, one of the test items consisted of scaling a six-foot fence. This test item disqualified six times as many women as men. The test item was upheld in the court. It was revealed in the job analysis that police officers when performing their duties, occasionally scale fences, and because of a city ordinance that limits fence height to six-feet it was therefore concluded that the test item was valid. The judge concluded "surely it is difficult to imagine a more accurate way of testing ability to scale a six-foot wall than to scale one..." and therefore... "it is unlikely that applicants incapable of learning to scale a six foot wall in preparing for the test will easily acquire the skill once in uniform."

However, in the case of United States v. New York (1979), the work sample test designed to "simulate real life conditions" of troopers was considered invalid. It was also determined that no valid relationship could be found between job behaviors and test content, or that any rational connection between test and analysis existed. The analysis was based upon the worker's personal knowledge, skills and abilities rather than job behavior. Task information that served as the basis for the test development conflicted with mandated safe procedures for job performance.

In a similar case, Berkman v. City of New York (1982), involved a work sampling test or firefighters. A job analysis was done, but the test items were not developed from this information. The judge concluded, "Since neither the dummy carry

nor the agility test arose out of any systematic analysis of observable work behaviors (although appearing to owe their justification to such and origin), the addition of the tests reinforced the need for criterion-related validity study." (Hogan & Quigley, 1986) (see Appendix K for list of Cases Litigated Involving Physical Tests for Employee Selection)

A study of police and firefighter departments personnel selection was reported by Hubbard, Hunt and Krause (1975), in which they presented no data and did not describe a method of developing job related strength and agility tests based on content validity strategy. Their procedure consisted of five basic steps: 1) task identification, 2) ratings of tasks for strength and agility factors, 3) review of possible tests to be recommended, 4) preliminary choice and try-out of the battery of tests and 5) preparation of a job-related analysis of the recommended tests. As a result of the try out, nine of the tests tried were recommended for a strength and agility test battery for selection of entrance level firefighters in Hartford Connecticut.

In Hull v. Cason (1978), another case concerning discrimination against blacks, the appeals court reversed a decision made by the lower courts. The appeals court found that a 5' 6" height standard and a 140 pound weight standard was valid for fire fighters. The plaintiff never determined a prima facie nor intentional case of discrimination. Therefore it reinstated the fire department's physical-ability test and minimum height and weight requirements.

Similar studies (Considine, W., Misner, J. E., Boileu, R. A., Pounian, C., Cole, J., and Abbatiello, A., (1976) and Wilmore & Davis (1979)) on firefighters and traffic officers respectively, dealt with test selection development. Three measurements were used, 1) biological measures including age, weight and percentage of body fat, 2)

physical fitness measures including grip strength, broad jump and 880 yard run, and 3) functional performance measures including climbing stairs, hose coupling, and carrying dummies.

Results were analyzed for race differences, inter-correlation, and factor structure. Measurements related well to job samples in both studies and were shown to have more face validity. Therefore, a valid reason for implementation was established.

Only those Physical Ability Tests following selected criteria are able to withstand scrutiny by the courts. Many cases in the appeals court have found this to be true. Physical Fitness Tests must prove evidence of job-relatedness, between training criteria and performance, to be acceptable, and provide a defense against employer discrimination.

History of the Nevada Test Site

Interspersed with the actual history of the area are a number of legends, which explain the reasons behind the names of many localities on the NTS. Sometimes it is difficult to separate myth from reality.

In the 1850's gold seekers would travel from Salt Lake to Los Angeles crossing what is now the Test Site. A number of wagons were abandoned at Forty-Mile Canyon when the gold miner's oxen were unable to pull them through the sand. Forty-Mile Canyon later became a stop on the Salt Lake-Los Angeles mail route (NTS News, 1969). Previous campsites of the nomadic Indians were located in Tippipah Springs, which was later used as a relay post on the mail route from Salt Lake to Los Angeles (U.S. Dept. of Energy, 1991). For a brief period from the 1920's, to the establishment of the Nevada Test Site in 1950, the area was used for mining, livestock grazing and hunting activities

(Nevada Legislative Counsel Bureau Research Division, 1983). There area was also a ranching headquarters for wild horse hunters (Tippipah Springs) who captured horses from Las Vegas and shipped them to be made into dog food. Skull Mountain, another distinctive area at the NTS was named because people would see the resemblance of a skull in the mountain. Frenchman Flat is supposedly named after a Frenchman, NaQuinta who, according to legend, prospected and ranched in the area. Yucca Flats, is named after a plant that grows so plentifully on the Test Site (NTS News, 1969).

During the 1920's approximately 1,500 people inhabited an area known as Wahomonie (Located in present-day Area 26, See Map 3 and 4) (Nevada Legislative Counsel Bureau Research Division, 1983) which means "pure gold" in the Piaute dilect. The name given to the historic group of Indians may be Paiute, Piute or Pahute, there is no conclusive evidence about which name is correct. Suggested but uncertain interpretations are "true Ute" for the first two and "water Ute" for the last. The word "pah" means water in the Indian dialect. Piaute is used in the literature to name the tribe, but Pahute is used to name the mountain range. (NTS News, 1969; Menke, 1973; University of California, Los Alamos Scientific Laboratory, 1965). Lack of ore findings by the summer of 1929 caused the camp to become deserted (Nevada Legislative Counsel Bureau Research Division, 1983).

In the 1940's about 500 Piaute Indians lived in the area now designated as the Test Site. After the 1940's there were no known inhabitants that frequented the area until 1950 when the NTS was established.

Nuclear tests were first conducted on the Pacific Islands. Five nuclear tests ranging in size from eighteen to forty-nine kilotons were conducted at Bikini and

Enewetak Atolls in the Pacific Ocean from June 1946 through 1948. When Korean hostilities broke out in 1950, attention again turned to a continental site. The Southern Nevada site was selected from a list of five possibilities which included : Alamogordo/White Sands, New Mexico; Dugway Proving Ground, Utah; Pamlico Sound/Camp Lejuene, North Carolina; and a 50-mile wide strip between Fallon and Eureka, Nevada (Nevada Legislative Counsel Bureau Research Division, 1983; www/nv.doe.gov/history/news&views/president.htm).

Southern Nevada met all necessary requirements for an atomic proving ground. The Atomic Energy Commission made the final decision based on favorable year round conditions, public safety, low population, security and the fact that the site was already under government control. It was a large area, had little rainfall, would be easy to protect against penetrators, and the geology of the area made containment of the radiation possible. The Nevada Test Site was therefore developed to provide a location in the United States to conduct nuclear weapons testing. (U.S. Atomic Energy Commission, 1965; www/nv.doe.gov/history/news& views/president.htm).

Remote mountain ranges of the Great Basin that are within the Test Site have certain geological formations that make it favorable for containment of radiation from nuclear testing. The Nevada Test Site is structurally complex and similar to other parts of Southern Nevada where there are many layers of rock and crust formation within the earth. The NTS has five layers of Paleozoic age basement rock which are overlaid by one layer of crust formation of volcanic tuffs "welded tuffs" of tertiary age, which are a dense form of compacted volcanic ash. This volcanic ash is located in the valleys and mountain ranges such as Yucca Mountain and Franchman Flat, and this crust formation is

as much as 2000 to 3000 feet thick (Johnson, 1957; Menke, 1973, United States Department of Energy, 1990).

Construction on the Nevada Test Site began on January 1, 1951. Then, on January 11, 1951, it was approved by President Harry S. Truman (www/nv.doe.gov/history/news&views/president.htm). It has been said that President Truman was in violation of Shoshone land rights and the 1863 Treaty of Ruby Valley. However, the lands were taken from the Western Shoshone and Southern Paiute tribes as an aerial bombing and gunnery range during World War II, and in 1952 the land was turned over to the Atomic Energy Commission for Nuclear Testing (Yowell, Raymond, 1992; NTS Environmental Impact Statement, PaulMcG@ aol.com, 1996).

Bordered on three sides by Nellis Air Force Bombing and Gunnery Ranges, opened at the onset of World War II, the NTS combined with the ranges, makes the nation's largest contiguous land area set aside for military and defense purposes, equaling 3.5 million acres. The NTS is now 864,000 acres. The original 435,200 acres were set aside for nuclear testing and acquired under Public Land Order 805, dated February 19, 1952, which included the closed drainage basins of Frenchman Flat and Yucca Flat. The crest of Yucca Flats held the main control point, which remains today. An additional 428,800 acres were added in the years of 1958, 1961, 1964, and 1967 (Nevada Legislative Counsel Bureau Research Division 1983, U.S. Atomic Energy Commission, 1965; www.ufomind.com/area51/org/nts/hist.html).

The NTS is divided into numbered areas of varying sizes, from 1-30, with the omission of Areas 13, 21, 24 and 28. There is no reason given why these numbers are

omitted although Area 13 is an off-site location in the Nellis Range north of Groom Lake (www.ufomind.com/area51/org/nts/).

This massive outdoor laboratory is larger than Rhode Island and several small countries. Located in the 864.000 acres is the town of Mercury (Area 23). Which is the main base camp and housed many buildings in it's time such as a cafeteria, bowling alley, swimming pool, post office, Weather Bureau building, hospital, theater and the like. (See Map 2 and 3). Some of which are still in working order today. Mercury is located approximately 65 miles north of the city of Las Vegas in Nye County (See Map 1).

On January 27, 1951, twenty-six days after being established, a one-kiloton atomic device was air dropped 1,060 feet and detonated in Frenchman Flat (U.S. Dept. Of Energy, 1991; www.nv.doe.gov/history/news&views/ president.htm). Thus the first of 226 announced nuclear tests began. As a safety measure, after an eight-kiloton device broke several store windows in Las Vegas, testing was moved from Frenchman Flat to Yucca Flats (see map 2) (Nevada Legislative Counsel Bureau Research Division, 1983; U.S. Atomic Energy Commission, 1965).

On October 31, 1958 President Eisenhower declared a moratorium on nuclear testing, but in September of 1961 testing was resumed when Soviet Union began a series of nuclear tests (Nevada Legislative Counsel Bureau Research Division, 1983; www/nv.doe.gov/ history/news&views/president.htm).

Until 1962 all nuclear detonations were under the control the Atomic Energy Commission (AEC) Albuquerque Project Office. With resumed weapons testing in the fall of 1961 the Nevada Operations Office was established on Mar 6, 1962 and given

control of the AEC's nuclear responsibilities. Today, the Nevada Operations Office is under management of the Department of Energy. (Nevada Legislative Counsel Bureau Research Division, 1983; www/nv.doe.gov/history/news&views/president.htm)

From July 1962 all nuclear tests were conducted underground. The Limited Test Ban Treaty that was signed in Moscow, Russia, August 5, 1963, prohibited any nuclear testing in outer space, the atmosphere or underwater (U.S. Atomic Energy Commission, 1965).

From 1951 to December 31, 1982 a total of 601 nuclear tests were announced as having been conducted at the Nevada Test Site (Nevada Legislative Counsel Bureau Research Division, 1983). By December 7, 1993 the U.S. had announced 1,051 nuclear tests. Of these, 925 were conducted at the NTS (www/nv.doe.gov/history/news&views /president.htm).

President John F. Kennedy made it a national policy that not all, nuclear tests be reported to the public. The Threshold Test Ban Treaty Signed by President Nixon on September 25, 1974 specifically limited all nuclear tests to be no greater than 150 kilotons but it was not approved by the U.S. until September 25, 1990 (www/nv.doe. gov/history/news&views/president.htm).

China, which conducted less than 2% of the worlds nuclear tests, did not test after August of 1990. France, announced in April 1992 they would stop nuclear testing (Nevadans for Peace, 1992).

On October 2, 1992 President Bush signed a nine-month moratorium stopping all nuclear testing. President Clinton pledged to continue this moratorium unless other nations began to test (www/nv.doe.gov/history/news&views/president.htm).

History of the NTS Fire Department and Need for Development of a PAT

The Olympic Food Company was the prime contractor for maintenance and operations at the NTS from early 1951 until 1954. They started the Nevada Test Site Fire Department in 1951. There is no written record of why a food company would undertake to start a Fire Department, the only reason was that they were the prime contractor, and the number of employees and buildings greatly increased, creating a need for fire prevention. There was a military firefighting unit stationed in Albuquerque, New Mexico would transfer to the NTS on temporary duty when any above-ground nuclear testing was conducted and leave after the testing was done. They worked out of the Desert Rock Fire Station, which also had a landing strip. Only military personnel and aircraft could take off and land.

The NTS first fire department consisted of about 25 men. There were no written guidelines for job employment. The 25 men were paid as firefighters. Although some of the men had previously worked at the Test Site, their backgrounds were diverse. The group included former construction workers, policemen, and even a librarian. Two shifts of volunteer firefighters would work alternating weekends helping to supplement the fire department work force. These volunteers, similarly, had varied work histories and qualifications. But all of the volunteer firefighters currently worked at the test site. They were paid overtime from their regular job to be there on the weekend. The NTS Fire Department could not have regular volunteers because of governmental requirements that had to be met to even walk or drive onto the test site. The volunteer firefighters helped out until the later part of the 1960's.

In 1954, when Reynolds Electrical Engineering Co. Inc. (REECo.) took over the

prime contract for the NTS, their responsibility was for camp operations, maintenance, and other types of construction or various operations at the test site. REECo. was owned by Edgerton, Germeshausen and Grier, Inc. (EG&G). EG&G was a subcontractor at the NTS that was responsible for technical services involved in nuclear testing.

In 1954, REECo. built a 200 square foot building as a fire station. Which housed only firefighting personnel. In 1963, a 10,000 square foot fire station was built. This building housed both personnel and equipment.

In the late 1960's, with the threat of war and increased nuclear testing, the NTS fire department increased its complement to about 125 men.

In the early 1970's due to various treaties with Russia there was a cutback in weapons development, and many NTS employees were released. The NTS fire department was reduced from 125 to about 60 men.

When some firefighters were terminated, they found jobs with other companies operating at the test site.

At this time eighteen to twenty men each were stationed in each of Area 6, Area 12, and Area 23 (see map 3). The firefighters worked in three shifts consisting of six firefighters each.

More cutbacks occurred in the 1990's, causing heavy layoffs, and only those with highest seniority status were kept in the fire department. With the absence of physical guidelines, newer incumbents although possibly more physically capable, were dismissed.

Twenty-one firefighters remained, all were located in Area 23 (Mercury). Eighteen firefighters worked in three shifts that consisted of six firefighter each. The

remaining three firefighters worked in fire prevention, and were not associated with the same shift schedule as the other firefighters.

In January 1996, Bechtel Nevada Corporation took over the prime contract for the NTS, which included all maintenance and operations at the NTS.

Firefighters were hired from the Teamsters Union. If positions could not be filled with union workers they would go outside the union to hire firefighters. In November of 1996 the department hired five new firefighters, hired from outside the union. This was the first time in history this had happened. This brought the fire department to a total of 28 men, including a chief and deputy chief.

Firefighting techniques remained constant, carrying heavy ladders and putting them against buildings, dragging unconscious people out of danger, fighting wildland fires, and any number of unexpected possibilities.

Even with technological advancements in equipment and clothing the firefighter is aware that he must be able to physically do his job and that other team members abilities would insure success in a dangerous situation.

Originally, firefighters clothing was bulky, heavy, and cumbersome, making job performance much harder and more physically strenuous. A new material called No-Mex was developed which was much lighter and provided the necessary fire protection.

Over the years, job descriptions and required standards for the Nevada Test Site firefighters have changed. Prior to 1990, the qualifications to be a NTS firefighter were that an applicant had to have three years experience at another fire department. In the 1990's a state certification as a Firefighter 1, which included the testing of basic skills and tasks a firefighter does such as handling and operating a fire hose and a written test.

had to be passed. The requirements for a Firefighter 2 certification, which included more complex written information and practical tests were also required. In 1994 the qualifications for the NTS were developed into having a minimum of three years previous job experience, a certification by the State of Nevada as an Emergency Medical Technician (EMT), and/or a Hazardous Materials Technician Certification, along with the Firefighter 1 and Firefighter 2 certifications.

In 1995, management at the Nevada Test Site Fire Department and the Director of Emergency Management realized that newer testing methods needed to be implemented to insure that highly capable firefighters were available in case of a national emergency. The physical abilities of the firefighters are crucial to this plan. The need for a Physical Abilities Test was apparent. Completion of this regimen would ensure that each member of the team would be capable of performing the job

CHAPTER 3

PROCEDURE AND METHODOLOGY

Subjects

All incumbent firefighters at the NTS participated in the survey part of the study (N= 27). Subjects answered and returned a questionnaire (see appendix B) which was designed to obtain demographic and task analysis information. The questionnaire included questions on age, gender, education, marital status, number of years as a firefighter, years at the Nevada Test Site and current pertinent certifications. Other questions regarded their perception of their physical fitness, identifying overall fitness, overall strength, upper body strength, flexibility, and endurance (cardiovascular fitness). Their current exercise habits were also assessed.

The task analysis part of the questionnaire recorded their perceptions of specific tasks and how important physical fitness was for the successful completion of these tasks. A ranking system was used to place them in categories of importance: 1-Very high or important 2-Relatively high or important 3-Average or somewhat important 4-Relatively low or not very important 5-Very low or not important.

First, questions were asked about the importance of upper body strength, lower body strength, flexibility, cardiovascular endurance, running speed and agility (ability to change direction quickly) on the job. Through interviews with captains, chiefs and other

experienced incumbent firefighters, fifty-two tasks performed by the NTS firefighter were compiled. Next, questions were asked regarding their perception of the importance of the tasks that had been identified. Finally, questions were asked about on-the-job injuries. (See results of questionnaire in Appendix C)

Research Design/Procedure

The study was divided into 8 phases:

1) Pre trial-questionnaire development period. A trial questionnaire was developed and given to a select group of firefighters for their input regarding completeness, clarity, ambiguity, readability and understandability.

2) The Administering of the Questionnaire. The trial questionnaire was then modified, based on input of the individuals rating the trial questionnaire. This modified questionnaire was then completed by all incumbent firefighters.

3) Examining of NTS daily work logs. Work logs, regarding all calls, types, frequencies etc., from 1990 to 1995 were examined and pertinent information was recorded.

4) Interviews. Interviews were conducted with all incumbent firefighters. The purpose of the interviews was to get the incumbent firefighters' perceptions of the most physically demanding tasks and their frequency of use.

5) Task analysis (responses to interview questions). The results of the interviews were recorded on a spreadsheet, which identified the most physically demanding tasks of firefighting.

6) Task analysis determination. The task analysis was made from interviews. The purpose was to determine the most frequently performed physical tasks on the job, and

which tasks were primarily strength and which were mainly cardiovascular. This analysis was done to determine the most appropriate tests for the proposed PAT. The task analysis was conducted by the researchers of the study, and the Chief of the Nevada Test Site Fire Department. They determined which tasks were the most physically demanding while also being routinely done on the job.

7) Development of test battery. From the interviews and task analysis, six routinely performed, physically demanding tasks were selected to make up a physical abilities test battery.

8) Evaluating the Physical Abilities Test (PAT). The PAT was then administered to the incumbent firefighters that volunteered to be tested. This was to determine the total time to complete the test, and determined the individual test item's reliability. These 8 phases are discussed in detail in the following section.

Pre-Questionnaire Development Period

A trial questionnaire was developed with the help of the fire chief, assistant fire chiefs and a few experienced incumbent firefighters. This questionnaire was to catalog information such as age, gender, education, years worked at Nevada Test Site, years worked at other fire departments and appropriate certifications. There were also questions to determine the perception of the respondent's present level of physical fitness. Respondents were asked: (1) to identify various job tasks, especially tasks which were very physical in nature, (2) give their perception of frequency of the tasks on the job, and (3) rank them according to their importance. Finally, possibilities of on-the-job injury were identified. To evaluate the questionnaire, it was critiqued by five current experienced employees: chief, deputy chief, assistant chief and two fire fighters. Beside

content, they determined if the questionnaire was readable, understandable and complete. The responses of this pre-questionnaire were analyzed, and the final questionnaire was developed accordingly.

Administering Questionnaire

The revised questionnaire was then administered to all twenty-seven NTS firefighters, who were asked to return the questionnaire within a week.

Evaluation of NTS daily logbooks

The NTS fire department keeps detailed work logs. Everything the fire department and incumbent does on the job is documented. From incumbents going to incidents or drills, to an individual going off duty, etc. All incidents are identified by date, type of incident, arrival time at the scene, arrival time back to station, personnel who went to the call and the result of the call. A tabulation was done of all calls from 1990-1995. The total number of calls per year, the type of call, and how many calls of each type were assessed and grouped into 4 types of categories: (1) medical assists, (2) haz-mat, (3) fire, and (4) false alarms/investigations. These were counted for each year and the percentages for each type of call were then determined. (See Appendix D & Table 1)

Interviews

All incumbent firefighters were interviewed. The results of the interviews were recorded. The data included the name of the person being interviewed, the date of the interview, and the length of the interview. The content of the data included the years worked at test site, the years worked at another fire department and their present position at the test site. Additionally, questions were asked about five typical firefighter scenarios:

vehicle extrication/medical assist, structural fire, vehicle fire, wildland fire and hazardous materials calls (Haz-Mat). The same questions were asked of all firefighters who were interviewed. The answers were analyzed, and when a difference between responses from interviewees occurred, the interviewer expanded the question to obtain more detail to possibly explain the difference in the responses. (See Appendix E for list of questions)

Task Analysis (responses to interview questions)

All data collected from the interviews was recorded on a spreadsheet for analysis. This data identified the most physically demanding, but routinely performed, tasks specifically related to the job. (See Appendix F for spreadsheet and Appendix G for Statistical results of spreadsheet)

Task Analysis Determination

From the data, it was then decided by the researchers and the Chief of the Nevada Test Site, which tasks were muscular in nature and which tasks were cardiovascular. The muscular tasks, were divided into upper body strength and lower body strength activities. They analyzed which were the most physically demanding tasks that were also routinely done on the job.

Test Battery

A PAT battery was developed based on the data collected. Six physically demanding tasks were identified as those that were frequently used on emergency calls and a test scenario was developed that simulated actual job situations.

Evaluating the Physical Abilities Test

Since a PAT must be both reliable and valid, the proposed PAT was administered twice (approximately a week apart) to determine test-retest reliability. Validity was

assumed from the task analysis and results from the interviews. All the tests were timed to determine the range of scores and their mean.

Description of Firefighting Equipment and Tasks at the Nevada Test Site

The following section deals with the various pieces of equipment that are used at the NTS. A description of the tasks along with how they are performed is also explained below.

The Phoenix tool and Hydraulic Generator

These pieces of equipment are used primarily in a vehicle extrication, when an individual is trapped in a crushed vehicle. The Phoenix tool, is used in different ways for doing different tasks using attachments. One attachment, the Ram, is used as an expanding jack to separate door jams, or raise a vehicle off a victim. Another attachment is the Cutters and Spreaders. This attachment is used to cut through parts of a vehicle: i.e., cutting through door jams, a steering wheel column, seat belts, brake pedals and the like. The last attachment used is a cutter, which also cuts parts of a vehicle. The Phoenix tool is operated by an oil-operated hydraulic generator that has two 30-foot long hoses enabling the Phoenix tool to move in and around the vehicle.

The Phoenix tool must be maneuverable and able to get in, out and around a vehicle. Depending on the type of accident, the Phoenix tool is handled by three firefighters, each using the necessary attachment.

The Hydraulic Generator, weighing 97 pounds, is usually the first piece of equipment unloaded at an accident scene and is carried by two individuals. Each of the attachments are carried by one firefighter.

A fire fighter is required to wear full gear (turnouts) on a Vehicle Extrication emergency. Vehicles can emit toxic and flammable vapors from the gasoline, so the possibility of a fire or an explosion always exists. Turnouts consist of a coat, pants, helmet, gloves, and self-contained respiratory breathing apparatus (SCBA). The SCBA has two sizes of air tanks: a 30-minute tank and a 60-minute tank. This gear is worn over regular uniform clothing.

In virtually all emergency situations a complete set of turnouts and SCBA is worn as standard operating procedure (See Appendix H. for weights of the equipment and clothing attire worn at the NTS).

Carrying a victim

When an individual has been trapped in a vehicle, or there is suspicion of any injury, the victim is carried from the accident to the ambulance by four qualified personnel, which includes firefighters and/or paramedics. A backboard is used. The backboard aids in stabilizing the head and spine. The victim is carried to the gurney where the paramedics take over. This task is probably one of the most frequently done tasks of all emergencies at the NTS. Victims of any emergency must be moved and the method of moving them is with the use of a backboard and transferring the victim to a gurney. At the NTS, this is necessary in a Vehicle Extrication.

Holding a Victims Head

In an accident where the victim cannot move or get out of the vehicle, the firefighter will stabilize the victim's head until a cervical collar (C-spine) can be put in place. After fitting the cervical collar the head is still held in a neutral position for added support until the individual can be put onto a backboard. The weight of a human head is

approximately 11 pounds, which makes the task strenuous if prolonged for an extended period of time. This task is mostly precautionary, but it is one of the most frequently done tasks at the NTS.

Fire Hoses.

Fire hoses are usually identified by their diameter ie. 1 ¾" diameter hose, 2 ½" diameter hose and 3" diameter hose.

The NTS covers a very large area of approximately 850,000 acres and extends from Mercury, Nevada to Tonopah, Nevada. There are large tracts of open range and many buildings are scattered throughout the area. Structural fires are not as common as range fires. However, because of the nature of the work done at the NTS, many of the buildings house extremely essential materials.

All 850,000 acres are carefully monitored for fires with various detecting devices. Fires sometimes require the fire trucks to travel several miles, which, because of the terrain, can take an hour or longer.

Water and hoses are an essential part of the equipment inventory on the fire trucks. The 1 ¾" hose is the smallest hose and is used to put out structural fires. It is arranged in the bed of the fire truck lengthwise, wrapping from one end of the truck to the other, and placed in 200 feet of pre-connected hose, in four, 50-foot sections. The fire-fighter lifts it out of the truck, when it is usually dropped on the ground, and is dragged to where it is needed. Since there is 200 feet of the 1 ¾", when the distance to the scene is not more than 200 feet, the hose is dragged the distance needed, which is usually within 100 feet of the structure. The rest is flaked out so water can flow freely to get the highest

pressure possible at the nozzle. Fire hydrants at the NTS are usually placed within 100 feet of every building.

The 1 ¾" hose is used as an attack line, because of its relatively small size, giving the firefighter the ability to move in and around a fire. It is usually handled by two firefighters, one directing the nozzle and the other maneuvering the hose.

The 2 ½" hose is also used in structural fires. This hose is used to deliver a much greater volume of water. The 2 ½" hose is manned by a minimum of two firefighters, one working the nozzle, and the other maneuvering the hose. The 2 ½" is also arranged in the bed of the fire truck lengthwise, wrapping from end of the truck to the other. There is 300 feet of pre-connected hose, in six 50-foot sections. It is taken off the bed of the fire truck in 50-foot sections by one firefighter.

The 3" hose is used in all fires where there is a fire hydrant present. This hose is a supply line from the hydrant to the truck's reserve tank. A firefighter loops the end of the hose to the hydrant and the truck's forward movement pulls approximately 400 feet off the truck bed. This supply line insures that the fire truck's holding tank will continuously hold 1250 gallons of water.

Exhaust fans

The exhaust fan, weighing 71 pounds, is a large industrial fan used in a structural fire to evacuate smoke from a building. It is carried by two firefighters and placed in the doorway of the building.

Ladders

There are various sizes of ladders used at the NTS: 12-foot, 24-foot extension, and 35-foot ladder. However, because no NTS building exceeds 5 stories, the

35-foot ladder is never used. The ladders are usually carried by two firefighters, although the 12-foot ladder is occasionally carried by one.

Wildland/Range fires

A wildland fire, involves many types of desert plant life: Yucca cactus, tumble weeds, Pinyon pine, Juniper, Joshua and Mesquite trees. Depending on the season these can be dry and burn readily. Wildland fires are invariably in very rough terrain often including steep, rock covered hills. Wildland fires put a great physical, and cardiovascular demand on the firefighters. This usually requires a lot of walking over difficult terrain while carrying the tools needed to fight the fire. The fire truck is driven as close as possible to the fire, but usually the firefighters have to walk some distance. Tasks involve cutting down trees and shrubs, turning over rocks and dirt, and shoveling dirt to help extinguish the fire. Firefighters carry shovels, chain saws, Polasky (pick/ax), and bladder bags. Firefighters usually carry more than one piece of equipment. Wildland gear is lighter in weight since wildland fires usually occur during the summer heat.

Bladder bags.

The bladder bag is specifically used to carry water for combating a wildland fire. It is the primary piece of equipment carried on a wildland fire. The bladder bag is made out of a rubber, and holds 3 gallons of water. On a wildland fire, a bladder bag is carried by every fighter.

Other tools: shovel, polasky (pick/ax), chain saw

A shovel, another important tool used in a wildland fire, is used mostly to extinguish the fire by shoveling dirt on it. The Polasky has two uses; one, to chop burning

trees or shrubs and two to loosen dirt to put on the fire. The chain saw is used to cut down burning trees. Most firefighters carry these tools.

Hazardous Materials Suits

When dangerous material such as chlorine gas, propane gas, gasoline, oil etc., are involved, the calls are referred to as hazardous materials (haz-mat) calls. The firefighter wears protective suits designed for dealing with these hazardous materials. These suits have different levels of protection: Level A, Level B and Level C. Level C is the least protective, and Level A the most protective. The Level A suit is a fully encapsulated suit made of a fiberglass material that has a Teflon shield so hazardous material cannot penetrate through the suit. The Level B suit is made out of a Life-Guard material that gives more protection than the Level C, but the material will burn, and is designed mostly to provide protection from chemical splashes. The Level C suit is made out of a lighter Saranex/Tyvex material and is used for less toxic substance such as oil. The suits, especially the Level A, are very cumbersome to work in. Regardless of protection level, a firefighter spends no more than 30 minutes in a hazardous material worksite, which includes the time it takes to get in, and out of the decontamination area. Once out of the contaminated area the hazardous materials are washed off the suit. The actual tasks performed may not be hard, but wearing the suit increases the difficulty of the task. During the summer, NTS temperatures can exceed 120 degrees Fahrenheit and the internal environment of the hazard suit can be 20-30 degrees higher. The danger of heat exhaustion is high. A 60-minute SCBA tank (a tank filled with compressed air that has 60 minutes of air) is also worn with all hazard suits.

The following are other routine tasks and situations experienced by the NTS firefighters.

Lifting and Pulling

One of the basic functions of a firefighter is handling a fire hose which varies in size and weight, from a 1 ¾", to the 2 ½" and lastly the 3" line. Their charged (fire hose full of water) weights are as follows: 67 pounds, 140 pounds and 204 pounds per 50' section respectively. During the task of fighting a fire, a firefighter may drag several hundred feet of "charged" fire hose from a fire truck to a fire location.

The firefighter must raise and set ladders of various lengths and weights: a 12-foot with hooks, a 24-foot extension, and the 35-foot. Their weights respectively are: 28 pounds, 71 pounds and 130 pounds. The heavier ladders are raised by teams of firefighters. Firefighters must participate in rescue work including lifting and carrying accident victims with or without assistance (which is very rare at the NTS). Rescue tools that vary in size and weight from simple hand tools such as a pike pole, 6 pounds, or Polasky (pick/ax), 6 pounds, to the hydraulic rescue tool such as the Phoenix tool and hydraulic generator weighing as much as 200 pounds altogether. The physical stress involved in maneuvering and using these tools is greater than that experience of merely lifting and carrying them.

Climbing

In the performance of a structural fire, an NTS firefighter may be called upon to climb ladders while wearing full gear carrying tools. Also, as part of the duties, the NTS firefighter will have to climb steep grades of mountains when fighting vegetation fires.

Wildland/Range Fires

Range fires are more common at the NTS than in cities. Range fires may require long hikes carrying heavy tools such as a chain saw (23 lbs.) or a Bladder bag full of water (42 lbs.). These hikes may be over extremely rough terrain and high elevations. Usually vegetation fires occur during extremely hot weather, which in Nevada can be well over 100 degrees. The high temperatures and terrain can add to the physical and emotional stress of the firefighter.

Below are additional physical stresses the NTS firefighter encounters in the performance of the job.

Protective Clothing

During all the fire fighting and rescue activity, the firefighter wears, in addition to his normal uniform clothing (NTS pants and shirt), protective clothing consisting of insulated trousers and coat, steel reinforced boots, helmet and gloves. This protective equipment is made out of a No-Mex material that has a thermal layer, which is a moisture protector. The protective clothing weighs approximately 25 pounds depending on the size of the individual. The respiratory protective equipment, which a firefighter wears in a smoky or toxic atmosphere, weighs 25 or 47 pounds depending on the size of tank worn. The total weight of the protective equipment of the fire fighter is nearly 60 pounds without considering any tools or equipment the firefighter must carry.

Exposure to Fire Gases

In the process of fighting fires, the firefighter is exposed to smoke and toxic gases generated by burning material. Although the firefighter wears the protective equipment that includes a respiratory apparatus (SCBA), it is not unusual that he might

receive some exposure before or after utilizing the protective equipment and this will add to the physical strains put on the body during that task.

Emotional Stress

Normally, a firefighter is engaged in various activities around the fire station such as equipment maintenance, housekeeping chores, training, rest and/or sleep when a fire alarm is sounded. He must psychologically and physically make the transfer from a reasonably relaxed state to a high-keyed mental, and physical state. This transition impacts upon the firefighter in varying severity depending upon his physical, mental and emotional condition. There is also obvious stress on the firefighter before, during and after the incident.

Alarm Board Operation

At the NTS firefighters are assigned to the position of Fire Alarm Board Operator. This requires that the firefighter handle all incoming alarms to the department as well as incoming business telephone calls. He is required to monitor hundreds of automatic fire alarm signal circuits, as many as 5 lines on one telephone, one emergency telephone system and one system that has 20 different radio frequencies, i.e. Net 85 for NTS fire department, Net 11 for medical, etc. When emergency communications are in progress, he must be able to grasp the emergency condition, decide what personnel and equipment need to be dispatched, and react instantly to initiate the emergency responses. Considerable mental and emotional stress can be experienced during this activity.

The next section is the written instructions the NTS firefighter incumbents read prior to performing the abilities test and is also intended for the new candidates to read:

Candidates Physical Performance Tests

"This procedure is to establish minimum performance standards for NTS firefighting. Further, it will provide the management with the means to evaluate and assist personnel in the development and maintenance of basic firefighting skills. The tasks are timed to develop a method of measuring performance. The intent of these standards is to promote proficient performance, which includes the integration of safety, competence, and speed. The following is the test description for the candidate to read."

PAT Instruction for Incumbents

"All of the test items, which make up this PAT (physical abilities test) are physical tasks that you routinely perform on the job. This is *not* the test. Your participation is helping to formulate the test. The test is primarily designed to screen future applicants, so that only capable individuals will be hired. You will have another firefighter who will be your partner to help you complete the first two tasks of the PAT. The balance of the test battery is made up of items that are to be performed without a partner. When you have completed the PAT, you will then help your partner complete the same two items."

"Except for the last task, all of the tasks will be performed in full protective gear and an operating 30- minute SCBA. The last task will be performed in wildland gear."

"All tasks must be done as expeditiously and efficiently as possible to get the best possible times."

The tasks and their sequences are listed below:

24 foot Ladder Stand

"With your partner, you will lift and remove a 24-ft ladder from brackets on a building that are 7-ft high, carry it 50 feet and stand it against a building. You will be positioned at the top of the ladder. You will be told once you have carried the ladder beyond the 50 foot marker, at that time your partner will proceed to put the butt end of the ladder against the building, while you proceed to raise the ladder rung by rung, while being spotted by two other firefighters. Once the ladder touches the building you will lift the butt end and pull it away from building to stabilize ladder.

Timing will start for the test on the command of "*GO*". You and your partner will then proceed to remove the ladder. Time will stop when the ladder has been set away from the building. You and your partner will then go directly to the next task."

Hydraulic Generator and Accessories Carry

"A simulated hydraulic generator and accessories are on a table at the height of the bed of the fire truck. You, and your partner, will lift the hydraulic generator and accessories, off the table, then together you will carry the generator and accessories past a marker 70 feet from the table and set the generator down. Timing begins when you and your partner pick up the generator and accessories, and will stop when you both pass the 70-foot marker and set down the generator and accessories. You will then go directly onto the next task."

1 ¾" Hose Drag

"You will be required to drag a charged (full of water) 1 ¾" hose charged 50 feet. One-hundred-fifty feet of charged hose is on the ground, connected to the fire hydrant. You are required to lift the nozzle end and drag the hose 50 feet to a point 50 feet away.

Timing will start when you have picked up the 1 ¾" hose which will be lying on the start of the fifty foot marker. Timing will stop when you have crossed the 50-foot marker with both feet. You will then go directly to the next task."

Dummy Drag

"You will pick up and drag a 175 pound dummy in the shape of a person 50 feet. The dummy will be lying on the ground next to a marked line. You will drag the dummy by putting your arms underneath the dummy's arms and clasping yours hands together. Your torso will be against the dummy's torso for stability. You will drag the dummy moving backwards across the line 50 feet away. Timing will start when you have picked up the dummy and the time will stop when the dummy's feet have passed the line fifty feet away. You will then go directly to the next task."

Phoenix tool: Cutter/Spreader Carry

"You will pick up the cutter/spreader and carry it with both hands for 50 feet. The cutter/spreader will be on the ground at the starting mark. You will bend down, pick up the cutter/spreader and carry it passed the finishing point 50 feet away. Timing will start once you have picked up the cutter/spreader, and timing will stop when you have crossed the 50-foot mark and set down the cutter/spreader."

"*NOTE:* In the next task you will be removing your protective gear and putting on wildland gear. This will be timed. Timing will start when you begin to remove your first piece of clothing, and time will stop when you have completed the changing of your protective equipment. Once completed you will go directly to the next task."

Bladder bag/ Shovel carry

"In wildland gear and at the starting point, you will be assisted to put on the bladder bag full of water and a shovel. You will then carry the equipment a distance of 50 ft on a level surface, then climb a flight of stairs and walk across a five foot platform, you will then turn around and go back down the stairs. Once you have reached the bottom you will then continue, by walking another 50 feet on level ground. Timing will start when you begin putting on the bladder bag and shovel, and the time will stop when you have passed the last line of the second 50-foot marker."

"*NOTE:* Each test station is timed in addition to the total time to complete the PAT. It is very important to *not* stop in between tasks, and to go directly from one task to the next since it is a continuous abilities test. The time will start on the command *"Go"* from the very first task, and end when you have crossed the last line of the second 50-foot marker on the last task."

Illustration of the required tasks and their sequence can be seen in (Figure 1) next page.

FIGURE 1

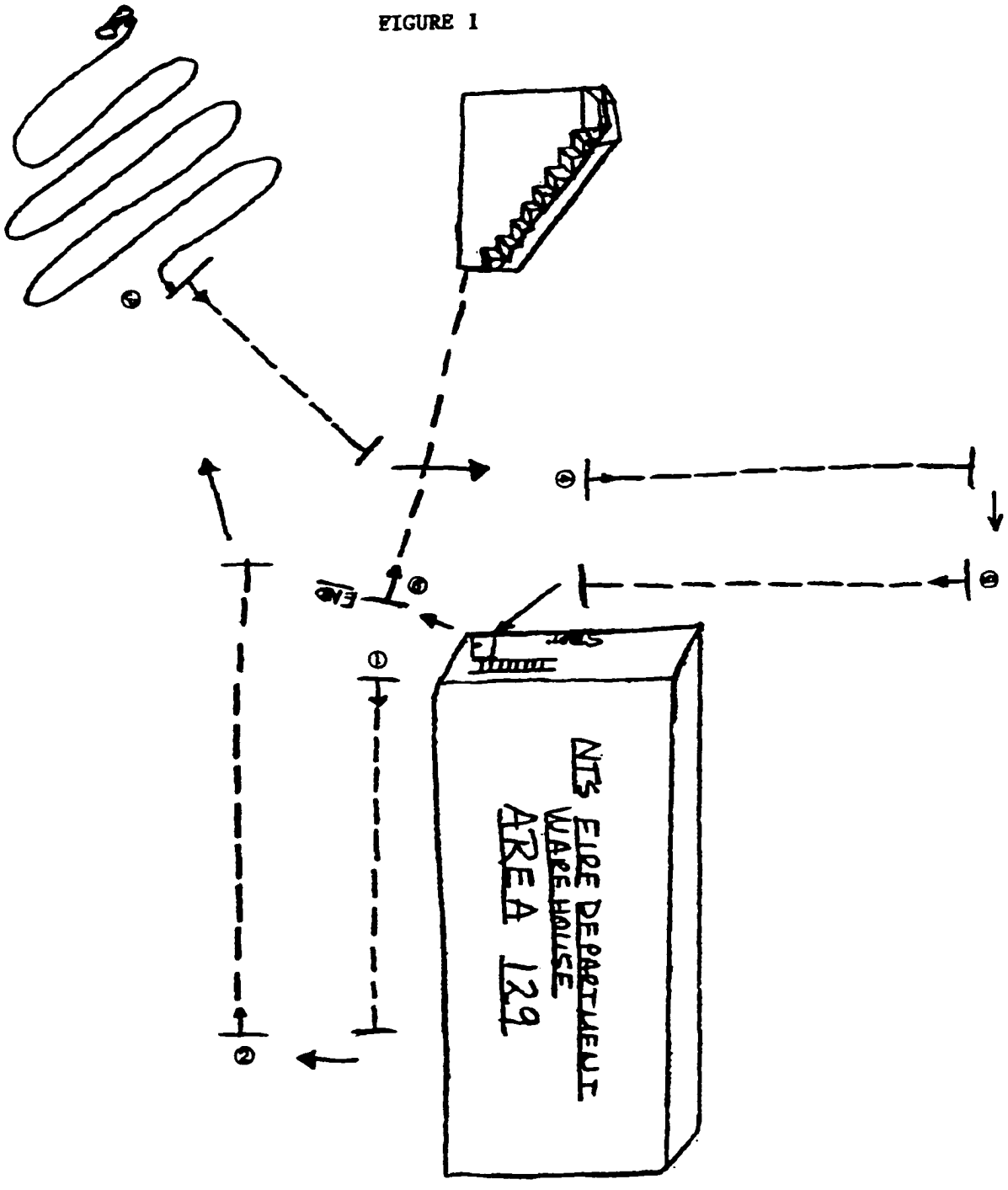


ILLUSTRATION OF THE PHYSICAL-
ABILITIES TEST

CHAPTER 4

RESULTS AND DISCUSSION

Development of the Physical Abilities Test (PAT) was based on the interviews of the incumbents, and the task analysis. Eight tasks were identified as being the most challenging physically and yet, routinely done on emergency calls. Six of the eight were used to create the PAT. Six tasks could be tested in a simulated job situation where the other two could not be put into a test scenario. These six items made up the PAT. In order to establish a time frame for the proposed PAT, incumbents were tested and timed.

Results of Questionnaire

The results of the questionnaire showed that approximately 70% of the NTS firefighters were over the age of 45. One hundred percent of them were male. Sixty percent had some college experience. Seventy percent of them were married. Ninety percent had been with the department for more than 10 years. One hundred percent had worked at other fire departments prior to working at the NTS. Ninety percent owned their homes. Fifty percent of them thought of themselves as having average fitness and seventy percent believed they were overweight (See Appendix C). The average age of the firefighters at the test site was 47, the average height was 5' 11" and the average weight was 200 pounds (See Appendix I for physical characteristics of NTS firefighters).

Attitudes to job and firefighter testing: forty percent of firefighters believe that to work at the NTS, physical fitness was only "somewhat" important, and forty to fifty percent believe that it is relatively important to have muscle strength, flexibility and cardiovascular endurance to do the job. Between sixty and seventy percent believed that while performing job tasks that there was a high probability of developing some back pain, joint pain, pulled muscles, heat and physical exhaustion. Forty-five percent believed there was a high probability of having a heart attack (See Appendix C for details).

Results of History of Calls from 1990-1995

A study of the daily work logs from 1990-1995, showed that during these five years (Appendix D), approximately 80% of the calls were false alarms; 6% were medical assists; 4% were related to hazardous materials spills; and 10% were fires (structural and wildland).

Result of Interviews

In the methodology chapter, each of the tasks using the various equipment listed below have been fully discussed. Following, are the results from the interviews; which include the average time of calls during which the various pieces of equipment are used, or the length of time a certain task is done. When appropriate, the average distance the equipment was carried is also reported.

The Phoenix tool & Hydraulic generator

The Phoenix tool and its accessories are used in 39% of all calls at the NTS. Since it weighs 97 pounds, carrying this is a difficult task. The average distance the Phoenix tool is carried is 66 feet and is rapidly and continuously used for an average of 16 minutes. The attachments, which are also heavy, are each used about 5 minutes.

Backboards

Backboards are the most commonly used piece of equipment, and are used 85% of all emergency calls. The average distance that the backboard and victim are carried is 50 feet. The weight of the victim can vary between 100 and 300 pounds.

Stabilizing the Head

Stabilizing the head is needed in 95% of all calls and the individual stabilizing the head does it for an average of 25 minutes.

Hoses

The 1 ¾" hose is used on 91% of calls. The average distance it is dragged is 197 feet.

In structural fires, the 2 ½" hose used on 96% of the time. The average distance it is dragged to the scene by two firefighters is 208 feet.

The 3" hose is used an estimated 89% of emergency calls and the average distance it is dragged to the scene is 137 feet.

Exhaust fan

An exhaust fan is used in 48% of all structural fires, it weighs 71 pounds and has to be carried from the truck to its position usually less than 10 feet away.

Ladders

The 24-foot extension ladder is the ladder most commonly used. It is carried on the side of the fire truck approximately 7 feet off the ground. It must be lifted from its position and carried to where it is needed. It is handled by two firefighters. The 24-foot ladder is used at 71% of all structural fires. It is carried, on the average, 65 feet to the fire.

Wildland fires

The main physical task done on a wildland fire is walking. At the average wildland fire the firefighter walks a distance of 4 miles.

Bladder bags

Bladder bags are the most common equipment used in a wildland fire. It is used on 77% of wildland fires, weighing 42 pounds and the distance carried is 4 miles. The average time of use is 45 total minutes, because water is used sparingly.

Other equipment

It is estimated that in a wildland fire a shovel is used 91% of the time, and is carried a distance of 4 miles by the firefighter. At the scene, the shovel is used about 40 minutes.

Hazardous materials suit

The level A hazardous suit, which is the heaviest and most cumbersome suit in which to work, it is used in 41% of all hazardous material calls. While in the suit the firefighter walks an average of 476 feet and is in the suit approximately 29 minutes.

From the results of the interviews, eight tasks that were considered most physically demanding were identified:

1) The use of the Phoenix tool & hydraulic generator during a Vehicle Extrication.

2) Carrying an individual from the scene of an accident.

3) The use of fire hoses in a structural fire.

4) Carrying a 24 foot ladder in a structural fire.

5) Ventilating a building in a structural fire.

6) Walking during a wildland fire.

7) The use of a Bladder Bag or shovel during a wildland fire, and

8) Wearing a hazardous materials suit Level A, during a Haz-Mat call. (See Appendix F and Appendix G for more details)

The Physical Abilities Test

The firefighter would complete six tasks in sequence, with no stopping between each task. The first two tasks required assistance from another firefighter. The same firefighter assisted when the test was repeated on the second day of testing. The total time to complete the PAT was recorded. In addition, each individual task was timed, and the time to change clothes (Bunker gear to wildland gear) was also timed. This change time was later taken out of the total time because it is not a realistic part of what they do on the job. The medical department of the NTS required that EMT's check blood pressure, pulse rate, and respiration rate before and after each test. During Task 1, when the firefighter raised the ladder there were two spotters, one on each side for safety. A summary of the six tasks are listed below:

Task 1: Firefighters would take a 24-foot ladder off bracket stands seven feet high then carry it fifty feet where it was then raised against a building.

Task 2: Firefighters carried a simulated hydraulic generator and accessories seventy feet.

Task 3: The firefighter dragged a 1 ¾" charged hose fifty feet.

Task 4: The firefighter dragged a 175-pound dummy fifty feet.

Task 5: The firefighter carried the Phoenix tool cutter/spreader fifty feet.

Task 6: The firefighter in wildland gear carried a bladder bag full of water and shovel walking fifty feet on level ground then climbing a flight of stairs (10' 6" in height)

simulating a hill then returning back down the stairs and walking another fifty feet on level ground.

When there was distance involved the timer informed the firefighter when they passed the line. The timer walked with the firefighter while they were performing the test.

Of the twenty-eight NTS firefighters, eleven volunteered to participate in the test-retest part of the study. It had been assumed that all incumbents would volunteer to be tested, since all were interviewed, the test was based on their information. In addition, the test was administered during their workday. Of the eleven who volunteered, some were openly not interested and a couple even belligerent. Reasons for non-participation by the other firefighters were because: 1) There were objections to setting standards that some incumbents would not be able to pass. 2) There were firefighters who questioned whether they could complete the test, and the consequence of that failure. 3) One individual who did volunteer was not physically approved by the Bechtel Nevada Corporate physician, even though the test is specifically job-related. 4) There were some animosities between the incumbents and management. 5) Others stated that they had more important things to do, even though it was on job time and they were present to watch the test. 6) One incumbent stated that this was not a good agility test, since he had transferred from another fire department where a PAT and physical fitness program had been implemented. 7) One subject who volunteered for the study did not participate because he worked the early morning on the day of his testing.

It was the purpose of this study to develop a Physical Abilities Test and then determine its reliability.

The results of the study were not as satisfying as originally hoped. This was due to a number of factors. 1) Since the UNLV Exercise Physiology Lab was contacted and asked to do the study it was believed that there would be 100% cooperation by the NTS Fire Department and the Director of Emergency Management. 2) Several significant personnel, who were working for Bechtel at the start of the study were no longer working for the company when the study was in its completion phase of administering the PAT. 3) After the background research, interviews and history was completed, the evaluation of the created PAT was planned. On the first day of testing, Bechtel's management personnel, the legal department and health risk management personnel, who questioned the authority and legality of the study, stopped the testing. 4) Because of Inter-departmental conflicts, and the fear of establishing times that may be difficult for firefighters to pass; the test was not well received by the incumbent firefighters, and only 11 of 28 volunteered.

All firefighters would have been tested twice and calculating the test-retest reliability. Unfortunately accurate and valid reliabilities could not be determined due to the following reasons:

1) Some individuals did not try to do the test in the best time possible (Subject 4-6, 11).

2) Extreme differences in weather conditions on the two test days made the two tests difficult to equate.

3) Having a partner on the first two tasks made the incumbent being timed rely on their partner's desire and ability to do well on those tasks.

4) Due to bad scheduling two incumbents were scheduled to work the morning shift the day of testing. One individual didn't participate for this reason the other individual

completed Test 2, not physically feeling up to the task. It affected his Test 2 times (Subject 11).

6) One incumbent made it obvious that he would take as much time as possible (Subject 6).

7) The number doing the test-retest reliability was small. (N=11)

The administration of the PAT was to determine the time it would take to complete the six- item test. Due to lack of motivation and other mitigating circumstances the investigators concluded that the times for the various tasks and the times for the complete test battery were questionable. It had been assumed that certain tests would be pass/fail, but other tests which required speed and quickness, would be timed. Due to the small participation, this was not done (See Appendix L for Subject Data).

Table 2, on the next page, shows the mean times and standard deviations for each test item as well as the total test time. Initially, the time to change clothes from bunker gear to wildland gear was to be included in the total test time. Task analysis proved that the task of changing from bunker gear to wildland gear was never done in the field, therefore the time taken to change clothes was subtracted from the total time. Also, some incumbents were taking this time to rest. In addition, the sum of the times for the six tasks was subtracted from the total time to give the time taken between tasks.

Although the above reasons negated a good reliable study, a reliability coefficient was calculated and is presented in Table 3. Even with limitations cited the trend in the reliability was good.

TABLE 2

Subject	Task 1	Task 2	Task 3	Task 4	Task 5	Task 6	Total Time	Walk Time
1	25.79	8.21	10.47	22.09	11.19	30.41	142.31	34.15
2	26.63	7.97	6.87	15.31	10.66	28.62	127.58	31.52
3	29	7.97	7.18	19	9.44	27.38	134.74	34.77
4	33.72	16.25	9.87	23.22	12.93	44.34	187.89	47.56
5	45.15	17.1	15.94	23.56	13.9	44.15	221.19	61.39
6	40.62	17.5	14.69	20.78	13.65	36.13	246.37	103
7	40.53	18.37	14.15	23.72	13.47	51.34	215.75	54.17
8	30.28	9.22	10.1	20.9	12.1	36.35	155.71	36.76
9	24.63	8.75	8.69	13.56	10.34	21.34	119.31	32
10	16.56	6.82	7.21	13.53	7.18	21.03	91.59	19.26
11	20.06	8.65	11.35	23.69	13.56	45.81	151.93	28.81
Mean	30.27	11.53	10.59	19.94	11.67	35.17	163.12	43.94
Median	29	8.75	10.1	20.9	12.1	36.13	151.93	34.77
Min	16.56	6.82	6.87	13.53	7.18	21.03	91.59	19.26
Max	45.15	18.37	15.94	23.72	13.9	51.34	246.37	103
Std	8.97	4.64	3.16	4.03	2.14	10.29	48.38	22.97

TABLE 3

	Reliability
Task 1. Ladder carry/raise	.86 relatively high
Task 2. Hydraulic generator accessory carry	.75 moderately high
Task 3. 1 ¾" fire hose drag	.59 low
Task 4. Dummy drag	.77 moderately high
Task 5. Phoenix tool Cutter/Spreader carry	.92 high
Task 6. Bladder bag and shovel walk/climb	.82 relatively high
Total time to complete PAT	.89 relatively high

(See Appendix M)

The test was set up and eleven NTS firefighters completed the PAT twice (See Appendix L for data). Based on the limited number of participants and the existing circumstances the test was analyzed. These reliabilities are based on the eleven subject's best times of the two tests. Table 2 shows the scores, means, range and standard deviations of each task, total time to complete PAT and walk time between stations. Which are now summarized below:

The data in Table 2 indicates that the first task (Ladder carry fifty feet, raise against a building), took an average time of 30.27 seconds, with a range of 16.56 to 45.15 seconds, and a standard deviation of 8.97 seconds.

The second task (Carrying a simulated hydraulic generator and accessories seventy feet), took an average time of 11.53 seconds, with a range of 6.82 to 18.37 seconds, and a standard deviation of 4.64 seconds.

The third task (Dragging a charged 1 ¾" hose fifty feet), took an average of 10.59 seconds, with a range of 6.87 to 15.94 seconds, and a standard deviation 3.16.

The fourth task (Dragging a 175-pound dummy fifty feet), took an average time of 19.94 seconds, with a range of 13.53 to 23.72 seconds, and a standard deviation of 4.03.

The fifth task (Carrying a Phoenix tool cutter/spreader fifty feet), took an average time of 11.67 seconds, with a range of 7.18 to 13.90, and a standard deviation of 2.14.

The sixth task (Carrying a full bladder bag & shovel walking fifty feet up a flight of stairs, back down and walking another fifty feet), took an average of 35.17 seconds, with a range of 21.03 to 51.34 seconds, and a standard deviation of 10.29 seconds.

The average, of the total time it took to complete the abilities test was 163.12 seconds, with a range of 91.59 to 246.37 seconds, and a standard deviation of 48.38 seconds.

The average time it took between stations was 43.94 seconds, with a range of 19.26 to 103 seconds, with a standard deviation of 22.97. See (Table 2) for results.

An example of inconsistency helps to illustrate: Subject 10 was a young, enthusiastic firefighter who physically tried on both tests. His total time was 91.59 seconds and his between tasks time was 19.26 seconds. Subject 6 who was unmotivated did the test in 246.37 seconds, which is 2.5 times the time of subject 10. The time between tasks for subject 6 was 103 seconds, 5 times the length time for subject 10 (See Table 2).

An analysis was performed to compare Test 1 and Test 2 on every task for every subject. When the time in changing clothes was taken out there were no significant changes from Test 1 to Test 2 ($p > .05$). (See Appendix N)

In conclusion, valid results of an Intra-class Reliability of the PAT, were not able to be established due to many mitigating circumstances. The best times of the two trials were used to determine a mean, standard deviation and range of each test item.

CHAPTER 5

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary & Conclusions

The purpose of this study was to develop a Physical Abilities Test (PAT) for the firefighters at the Nevada Test Site that was job-related and non-discriminating. The test was developed based upon interviews from all firefighters at the Nevada Test Site. A task analysis was then developed that summarized all the information obtained in the interviews. A study of the history of calls was done from 1990 to 1995. From the task analysis six tasks were identified as being the most physically demanding and routine tasks on the job. Those six tasks were then developed into a test battery that simulated job tasks.

The PAT was designed so that the firefighter continuously completed six job specific tasks. The firefighter was assisted by another firefighter of the first two tasks, and task six required the firefighter to change gear. The six tasks were:

Task 1: Taking a 24 foot ladder off seven foot high brackets that simulated the side of a fire truck then carrying it fifty feet where it was raised against a building. (assisted by another partner)

Task 2: Carrying a simulated hydraulic generator and accessories seventy feet. (assisted by another partner)

Task 3: Dragging a 1 ¾" charged hose fifty feet.

Task 4: Dragging a 175-pound dummy fifty feet.

Task 5: Picking up and Carrying the Phoenix tool cutter/spreader fifty feet and putting it down.

Task 6: While dressed in wildland gear, carrying a bladder bag and shovel, walking 50 feet on level ground, climbing a 10' 6" flight of stairs, turning around descending the stairs, and returning (50ft) to the finish point.

Once the PAT was developed, eleven NTS firefighters between the ages of 25 and 59 years volunteered to complete a test-retest reliability study. The firefighters were tested twice approximately one week apart. Each task, as well as the total time to complete the test was timed. Since the incumbents had to change from bunker gear to wildland gear that time was also recorded. The time it took to change from bunker gear to wildland gear was excluded from the total time because it was not a realistic part of what they do on the job.

Data Analysis

A One Way Repeated Measures ANOVA was used to detect the mean changes from Test 1 to Test 2. The results showed there were no significant changes from Test 1 to Test 2 (See Appendix N). An Intra-class Reliability coefficient was used to determine test reliability. The reliability of each task was: Task 1 = .86, Task 2 = .75, Task 3 = .59, Task 4 = .77, Task 5 = .92, Task 6 = .82, Total Time = .89. (See Appendix M)

Descriptive statistics on a typical firefighter at the Nevada Test Site were also presented. The mean, standard deviation and range were calculated from the best times

on each subject for each task, the total time to complete the test, and the walk time between tasks. The results are shown.

Task	Mean	Standard Deviation	Range
1	30.27 s	8.97 s	16.56 – 45.15 s
2	11.53 s	4.64 s	6.82 – 18.37 s
3	10.59 s	3.16 s	6.87 – 15.94 s
4	19.94 s	4.03 s	13.53 – 23.72 s
5	11.67 s	2.14 s	7.18 – 13.90 s
6	35.17 s	10.29 s	21.03 – 51.34 s
Total Time to complete PAT	163.12 s	48.38 s	91.59 – 246.37 s
Time Between Stations	43.94 s	22.97 s	19.26 – 103.00 s

(See Table 2 for more details on results)

Recommendations for improving the PAT

1. For better reliability more firefighters need to be tested. Using a small number (N = 11) prevents a good test-retest reliability and prevents making inferences about the total population.

2. The test should be developed so that the test subjects would need no assistance with any task.
3. The test would need to be modified so that the firefighter would not need to change gear during the PAT.
4. Clear and precise instructions need to be given to all the subjects.

4. It is mandatory to have good communication between the researcher and the administration as well as the administration and the incumbent firefighters.

Recommendations to Validate the PAT

1. Further study needs to be done to validate the PAT developed and a test-retest reliability needs to be determined.
2. Future studies must be done with complete cooperation from Bechtel Nevada or the prime contractor of the NTS and the director of Emergency Management.

Recommendations for further research

1. After the test is validated, decisions on which test items will be pass/fail and which items will be timed will need to be made. If timed, cutoff scores will need to be determined.

APPENDICIES

APPENDIX A

HUMAN SUBJECTS APPROVAL

AND

INFORMED CONSENT

UNLV

DATE: December 1, 1997

TO: Nickele A'lise Miller (KIN)
M/S: 3016

FROM: for Dr. William E. Schulze
Director, Office of Sponsored Programs
Member, Biomedical Sciences Committee
of the UNLV Institutional Review Board

RE: Status of Human Subject Protocol entitled:
"Development of a Physical Abilities Test for Fire Fighters at the Nevada Test Site That is Job-Related and Non-Discriminatory"

OSP #504s0997-073

This memorandum is official notification that the protocol for the project referenced above has been approved by the Biomedical Sciences Committee of the Institutional Review Board. This approval is approved for a period of one year from the date of this notification, and work on the project may proceed.

Should the use of human subjects described in this protocol continue beyond a year from the date of this notification, it will be necessary to request an extension.

If you have any questions or require any assistance, please Marsha Green at 895-1357.

cc: L. Golding (KIN-3016)
OSP File

Office of Sponsored Programs
4505 Maryland Parkway • Box 451037 • Las Vegas, Nevada 89154-1037
(702) 895-1357 • FAX (702) 895-4242

UNIVERSITY OF NEVADA, LAS VEGAS
EXERCISE PHYSIOLOGY LABORATORY

INFORMED CONSENT

CONSENT TO PARTICIPATE IN A RESEARCH STUDY ENTITLED:

A JOB RELATED NON-DISCRIMINATORY PHYSICAL ABILITIES TEST FOR THE FIREFIGHTERS AT THE NEVADA TEST SITE

PURPOSE:

Because you are an incumbent firefighter at the Nevada Test Site (NTS), you are asked to participate in a research study. A Physical Abilities Test (PAT) has been developed and there is a need to determine time limits for the test, and also determine the reliability of the test. This requires you to perform the test twice on two separate days, taking no more than 2 hours each time.

The specific tasks given were in sequence. A 24' ladder stand (assisted by another firefighter), hydraulic generator and accessory carry (assisted by another firefighter), a 1 ¾" hose drag, 175-pound dummy drag, Phoenix tool: Cutter/Spreader carry and lastly a bladder bag and shovel walk/climb. (See attached for drawing of sequence of tasks).

SUBJECTS:

We would like to test all incumbent firefighters.

PROCEDURES:

If you volunteer, we will ask you to perform this PAT twice, within one week of each other at the NTS. The PAT includes simulated tasks, which are routinely performed by you while you are on the job. Each test item will be timed.

RISKS:

There are always possible risks of falling or tripping and that the physical exertion may result in some muscle soreness, breathlessness and lightheadedness. Since the test items are tasks you do on the job routinely the risks should be minimal and no more physical than when you perform your job, but please be advised if you do feel any pain or unusual discomfort, you should report it immediately and be examined by a physician if necessary.

BENEFITS:

You will be helping to establish a PAT for the NTS, which should allow the recruitment of individuals who, can successfully do the job with a minimal chance of injury.

CONFIDENTIALITY:

There is no confidential information needed. However, the information from the study may be submitted to journals for publication, but only averages and ranges will be reported and no individuals will be identified, other than demographic data.

RIGHT TO WITHDRAW:

You may refuse to participate in this study and you also may withdraw from the study at any time. If the design or use of the data is changed, you will be so informed and my consent reobtained.

QUESTIONS:

You certify that your questions have been answered to your satisfaction. If you have any questions after you start the study, you may speak to Nickele A'lise Miller of Dr. Lawrence A. Golding who will be happy to answer them. The phone number to call is 895-3766. For any questions regarding the rights of research subjects, you may contact the UNLV Office of Sponsored Programs at 895-1357.

You will be given a signed and dated copy of this form

*****

YOUR SIGNITURE BELOW INDICATES THAT YOU HAVE DECIDED TO VOLUNTEER AS A RESEARCH SUBJECT AND THAT YOU HAVE READ AND UNDERSTOOD THE INFORMATION PROVIDED ABOVE.

_____	_____
Date	Signature of Participant
_____	_____
Date	Signature of Investigator
_____	_____
Date	Signature of Witness

APPENDIX B

QUESTIONNAIRE

UNLV Exercise Physiology Laboratory
and
Nevada Test Site

Demographic Informal & Task Analysis Survey

In **NO** way will you be identified by administrative personnel, only averages will be observed.

Introduction:
This study is to determine the amount and type of physical activity involved in being a Nevada test site fire fighter. The survey has nothing to do with your fitness to do your job, instead, it is trying to catalog the physical attributes to be a successful fire fighter team member. Thank you very much for participating in this study.

Respondent's Personal and Demographic Information:
Please check the appropriate spaces.

Age: Under 25 years _____
25 - 35 years _____
36 - 45 years _____
over 45 years _____

Sex: Male_____ Female ____

Education: High School _____
Some College _____
College Graduate_____
National Fire Academy _____

Marital Status:
Married _____ Single _____ Divorced _____

Number of years as a Fire Fighter:
Less than a year _____
1 to 5 years _____
6 to 10 years _____
more than 10 years _____

Other location:
_____
_____

Nevada Test Site
Number of Years_____

Certifications:

FF1	_____	Crash/Rescue	_____
EMT	_____	Inspections	_____
Driver/Operator	_____	FF2	_____
Haz/Mat	_____	Rope Rescue	_____
Fire Officer	_____	Fire Protection Systems	_____
Arson investigation	_____	Fire Technology	_____
Fire Instructor	_____	Vehicle Extrication	_____
Above & Below Rescue	_____	Extinguisher Certification	_____
Swift water rescue	_____	Other	_____
		Please List	_____

Living:

Do you own a home? Yes _____ No _____

Do you rent? House _____ Condo _____ Apartment _____

Physical Fitness:

How would you rate your physical fitness compared to the average man or woman?

	excellent	above average	average	below average	poor
1. Overall fitness	_____	_____	_____	_____	_____
2. Flexibility	_____	_____	_____	_____	_____
3. Overall strength	_____	_____	_____	_____	_____
4. Upper body strength	_____	_____	_____	_____	_____
5. Endurance	_____	_____	_____	_____	_____

(aerobic, stamina cardio-vascular fitness)

Exercise:

Do you presently exercise regularly? If so how many times a week.

0-1 _____ 2-3 _____ 4-5 _____ 6-7 _____ >8 _____

If so, what kind of workout? Primarily strength training _____

(Check one) Primarily aerobic _____

(Cardiovascular exercise)

Total Fitness Program _____

Other (explain) _____

Weight/Body Composition:

How would you rate your weight? Normal weight_____

Under weight _____ How many lbs.? _____

Overweight _____ How many lbs.? _____

Questionnaire:

This questionnaire is to determine your perception of the type and amount of physical activity that is involved in the job of being a Nevada Test Site fire fighter.

This questionnaire is YOUR perception, and no one else's. The purpose is not to discuss these responses with your fellow workers. These answers's should be yours.

When asked to rate a task or an attribute the following is a guide:

1 = Very high or important
2 = Relatively high or important
3 = Average or somewhat important
4 = Relatively low or not very important
5= Very low or not important

1. To work as part of the Nevada Test Site fire team do you think physical fitness (physical ability) is important? (Use the above ranking).

_____

2. Of the fitness attributes listed please rank them in importance.

Upper body strength _____
Lower body strength _____
Flexibility _____
Cardiovascular endurance _____
Speed _____
(running speed/speed of movement)
Agility _____
(ability to change direction/ quick movements)

3. Of the tasks listed below rate their importance (using the above ranking 1 to 5) and indicate by checking, whether the task is used occasionally or routinely(used all the time):

TASK	RANK	OCCASIONAL	ROUTINE
Donning bunker gear	_____	_____	_____
Donning air packs	_____	_____	_____
Lifting donut roll	_____	_____	_____
Pulling a charged hose	_____	_____	_____
Pulling uncharged hose	_____	_____	_____
Loading uncharged hose on truck	_____	_____	_____
Changing uncharged hose	_____	_____	_____
Using Level A Haz-Mat suits & walking 50 yards	_____	_____	_____
Using Level A Haz-Mat suits & walking 100 yards	_____	_____	_____
Using Level A Haz-Mat suits & walking 150 yards	_____	_____	_____
Using Level B Haz-Mat suits & walking 50 yards	_____	_____	_____
Using Level B Haz-Mat suits & walking 100 yards	_____	_____	_____
Using Level B Haz-Mat suits & walking 150 yards	_____	_____	_____
Using Level C Haz-Mat suits & walking 50 yards	_____	_____	_____
Using Level C Haz-Mat suits & walking 100 yards	_____	_____	_____
Using Level C Haz-Mat suits & walking 150 yards	_____	_____	_____
Lifting extinguishers (10-20 lbs.)	_____	_____	_____
Lifting extinguishers (21-30 lbs.)	_____	_____	_____
Lifting extinguishers(31-40 lbs.)	_____	_____	_____
Lifting extinguishers (41-50 lbs.)	_____	_____	_____
Lifting extinguishers (51-60 lbs.)	_____	_____	_____
Raise, climb & lower 10' ladder	_____	_____	_____

When asked to rate a task or an attribute the following is a guide:

1 = Very high or important
2 = Relatively high or important
3 = Average or somewhat important
4 = Relatively low or not very important
5= Very low or not important

TASK	RANK	OCCASIONAL	ROUTINE
Raise, climb & lower 24' ladder			
Raise, climb & lower 35' ladder			
Lift patients onto gurney or truck			
Load gurney onto truck			
Carry patients to gurney or truck			
Drag patients to gurney or truck			
Using Phoenix tool			
Working with SCBA (below ground)			
Working with SCBA (ground-2 stories)			
Working with SCBA (3-5 stories)			
Working with SCBA (6-10 stories)			
Investigation of building fire (below ground)			
Investigation of building fire (ground-2 stories)			
Investigation of building fire (3-5 stories)			
Investigation of building fire (6-10 stories)			
Operating nozzle			
Climbing steep grades & mountains (< 1 mile)			
Carrying tools & packs up a grade			
Confined space rescue			
Respond to aircraft incident			
Respond to Haz-Mat incident			
Respond to vehicle accident			
CPR			
Fighting fires (10 - 20 min)			
Fighting fires (21 - 30 min)			
Fighting fires (31 - 40 min)			
Fighting fires (41 - 50 min)			
Fighting fires (51 - 60 min)			
Fighting fires (< 1 hour)			

Especially important. From your experience and knowledge of the job , please list all other tasks that are important and not listed above. Please rank them also.

TASK	RANK	OCCASIONAL	ROUTINE
_____	_____	_____	_____
_____	_____	_____	_____

4. Do you have an opinion as to the possible injuries/conditions that can occur while performing the tasks listed above. Rank the following as: 1 = High probability 2 = Low probability

Back pain	_____	Low back strain	_____
Pulled muscles	_____	Physical exhaustion	_____
Heat exhaustion	_____	Joint pain	_____
Toxicity (air/fluid)	_____	AIDS	_____
Infections	_____	Heart attack	_____
Respiratory problems	_____	Other (please list)	
		_____	

Conclusion:
When completed and tabulated, if you would like a summary of the results, copies will be made available through Ann Lindsay. If you have any questions about this questionnaire or about the study you may call Lawrence Golding or Nickele Miller at UNLV, Exercise Physiology Laboratory, 895-3766.

APPENDIX C

RESULTS OF QUESTIONNAIRE

Results of Survey
UNLV Exercise Physiology Laboratory
and
Nevada Test Site

Demographic Informal & Task Analysis Survey

The data in this questionnaire if reported will not be identified by name, nor will administrative personnel identify you in no way, only averages will be observed.

Introduction:
This study is to determine the amount and type of physical activity involved in being a Nevada test site fire fighter. The survey has nothing to do with your fitness to do your job, instead, it is trying to catalog the physical attributes to be a successful fire fighter team member. Thank you very much for participating in this study.

Respondent's Personal and Demographic Information:
Please check the appropriate spaces.

Age:		**Sex:**		
Under 25 years	0.0%	Male 100%	Female 0.0%	
25 - 35 years	14.8%			
36 - 45 years	18.5%	**Education:**	High School	25.9%
over 45 years	66.7%		Some College	63.0%
			College Graduate	3.7%
			National Fire Academy	7.4%

Marital Status:
Married: 70.4% Single: 14.8% Divorced: 11.1% 2.7% didn't answer

Number of years as a Fire Fighter:

Less than a year	0.0%
1 to 5 years	0.0%
6 to 10 years	7.4%
more than 10 years	92.6%

Other location:
Connecticut, Roseburg OR, Buffalo NY
USAF, City of Las Vegas, Alton IL
ID Nat'l engineering lab
Range 4-27 years 81.5%, 18.5% didn't answer

Nevada Test Site
Number of Years: Range 4-28 years 100%

Certifications:

FF1	85.2%	Crash/Rescue	85.2%
EMT	63.0%	Inspections	66.7%
Driver/Operator	77.8%	FF2	77.8%
Haz/Mat	88.9%	Rope Rescue	14.8%
Fire Officer	48.1%	Fire Protection Systems	40.7%
Arson investigation	11.1%	Fire Technology	14.8%
Fire Instructor	22.2%	Vehicle Extrication	92.6%

Above & Below Rescue	25.9%	Extinguisher Certification	85.2%
Swift water rescue	0.0%	Other	0.0%
		Please List:	Fire Investigation. CPR instructor

Living:

Do you own a home? Yes 88.9% No 11.1%

Do you rent? House 7.4% Condo 3.7% Apartment 0.0%

Physical Fitness:

How would you rate your physical fitness compared to the average man?

	excellent	above average	average	below average	poor
1. Overall fitness	3.7%	37.0%	48.1%	7.4%	3.7%
2. Flexibility	3.7%	18.5%	48.1%	14.8%	14.8%
3. Overall strength	3.7%	33.3%	55.6%	3.7%	3.7%
4. Upper body strength	3.7%	33.3%	55.6%	3.7%	3.7%
5. Endurance (aerobic, stamina cardio-vascular fitness)	0.0%	33.3%	55.6%	7.4%	3.7%

Exercise:

Do you presently exercise regularly? If so how many times a week.

0-1: 3.7% 2-3: 63.0% 4-5: 22.2% 6-7: 11.1% >8: 0%

If so, what kind of workout? (Check one)

Primarily strength training	14.8%
Primarily aerobic (Cardiovascular exercise)	51.9%
Total Fitness Program	7.4%
Other (explain): Treadmill, walking, jogging	14.8%
11.1% didn't answer	

Weight/Body Composition:

How would you rate your weight?

Normal weight	29.6%
Under weight	0.0%
Overweight	70.4%

How many lbs.? Min-10 Max-50

This questionnaire is to, in part determine your perception of the type and amount of physical activity that is involved in the job of being a Nevada Test Site fire fighter. This questionnaire is YOUR perception, and no one else's. The purpose is not to discuss these responses with your fellow workers.

When asked to rate a task or an attribute use the following scale:

Rating Scale

1 = Very high or important
2 = Relatively high or important
3 = Average or somewhat important
4 = Relatively low or not very important
5= Very low or not important

1. To work as part of the Nevada Test Site fire team do you think physical fitness(physical ability) is important? (Use the above ranking).	1	25.9%
	2	29.6%
	3	37.0%
	4	7.4%
	5	0.0%
2. Of the fitness attributes listed please rank them in importance.		
Upper body strength	1	14.8%
	2	40.7%
	3	33.3%
	4	7.4%
	5	3.7%
Lower body strength	1	7.4%
	2	48.1%
	3	33.3%
	4	11.1%
	5	0.0%
Flexibility	1	11.1%
	2	33.3%
	3	44.4%
	4	7.4%
	5	3.7%
Cardiovascular endurance	1	37.0%
	2	37.0%
	3	18.5%
	4	7.4%
	5	0.0%
Speed	1	3.7%
(running speed/speed of movement)	2	3.7%
14.9% didn't answer this question	3	29.6%
	4	18.5%
	5	29.6%

Agility	1	7.4%
(ability to change direction/ quick movements)	2	22.2%
11.2% didn't answer this question	3	37.0%
	4	11.1%
	5	11.1%

3. Of the tasks listed below rate their importance (using the above ranking 1 to 5) and indicate by checking, whether the task is used occasionally or routinely(used all the time):

When asked to rate a task or an attribute use the following scale:

Rating Scale

1 = Very high or important
2 = Relatively high or important
3 = Average or somewhat important
4 = Relatively low or not very important
5= Very low or not important

TASK	RANK		OCCASIONAL	ROUTINE
Donning bunker gear	1	44.4%	37.0%	63.0%
7.5% did not answer the rank	2	25.9%		
	3	18.5%		
	4	3.7%		
	5	0.0%		
Donning air packs	1	44.4%	51.9%	48.1%
7.5% did not answer rank	2	25.9%		
	3	22.2%		
	4	0.0%		
	5	0.0%		
Lifting donut roll	1	3.7%	88.9%	7.4%
14.9% didn't answer rank	2	11.1%		
3.7% didn't answer	3	48.1%		
occasional or routine	4	7.4%		
	5	14.8%		
Pulling a charged hose	1	18.5%	74.1%	25.9%
7.5% didn't answer rank	2	29.6%		
	3	29.6%		
	4	14.8%		
	5	0.0%		
Pulling uncharged hose	1	18.5%	70.4%	29.6%
7.5% didn't answer rank	2	33.3%		
	3	33.3%		
	4	3.7%		

TASK	RANK		OCCASIONAL	ROUTINE
	5	3.7%		
Loading uncharged hose on truck	1	14.8%	66.7%	33.3%
7.5% didn't answer rank	2	18.5%		
	3	48.1%		
	4	11.1%		
	5	0.0%		
Changing uncharged hose	1	3.7%	85.2%	14.8%
11.2% didn't answer rank	2	25.9%		
	3	48.1%		
	4	11.1%		
	5	0.0%		
Using Level A Haz-Mat suits & walking	1	18.5%	96.3%	0.0%
50yards	2	25.9%		
7.5% didn't answer rank	3	33.3%		
3.7% didn't answer	4	14.8%		
occasional or routine	5	0.0%		
Using Level A Haz-Mat suits & walking	1	14.8%	100%	0.0%
100yards	2	29.6%		
7.5% didn't answer rank	3	33.3%		
	4	11.1%		
	5	3.7%		
Using Level A Haz-Mat suits & walking	1	14.8%	96.3%	0.0%
150yards	2	22.2%		
7.5% didn't answer rank	3	33.3%		
3.7% didn't answer	4	18.5%		
occasional or routine	5	3.7%		
Using Level B Haz-Mat suits & walking	1	18.5%	100%	0.0%
50yards	2	25.9%		
7.5% didn't answer rank	3	33.3%		
	4	14.8%		
	5	0.0%		
Using Level B Haz-Mat suits & walking	1	14.8%	96.3%	0.0%
100yards	2	29.6%		
7.5% didn't answer rank	3	37.0%		
3.7% didn't answer	4	11.1%		
occasional or routine	5	0.0%		

TASK	RANK		OCCASIONAL	ROUTINE
Using Level B Haz-Mat suits & walking	1	14.8%	96.3%	0.0%
150yards	2	22.2%		
7.5% didn't answer rank	3	33.3%		
3.7% didn't answer	4	14.8%		
occasional or routine	5	7.4%		
Using Level C Haz-Mat suits & walking	1	14.8%	100%	0.0%
50yards	2	25.9%		
7.5% didn't answer rank	3	37.0%		
	4	14.8%		
	5	0.0%		
Using Level C Haz-Mat suits & walking	1	11.1%	100%	0.0%
100yards	2	25.9%		
7.5% didn't answer rank	3	37.0%		
	4	18.5%		
	5	0.0%		
Using Level C Haz-Mat suits & walking	1	11.1%	96.3%	0.0%
150yards	2	22.2%		
7.5% didn't answer rank	3	33.3%		
3.7% didn't answer	4	22.2%		
occasional or routine	5	3.7%		
Lifting extinguishers (10-20 lbs.)	1	37.0%	14.8%	85.2%
7.5% didn't answer rank	2	22.2%		
	3	29.6%		
	4	0.0%		
	5	3.7%		
Lifting extinguishers (21-30 lbs.)	1	33.3%	14.8%	85.2%
7.5% didn't answer rank	2	25.9%		
	3	29.6%		
	4	0.0%		
	5	3.7%		
Lifting extinguishers (31-40 lbs.)	1	37.0%	22.2%	74.1%
7.5% didn't answer rank	2	18.5%		
3.7% didn't answer	3	29.6%		
occasional or routine	4	3.7%		
	5	3.7%		
Lifting extinguishers (41-50 lbs.)	1	29.6%	44.4%	55.6%
7.5% didn't answer rank	2	18.5%		
	3	22.2%		

TASK	RANK		OCCASIONAL	ROUTINE
	4	18.5%		
	5	3.7%		
Lifting extinguishers (51-60 lbs.)	1	29.6%	51.9%	44.4%
7.5% didn't answer rank	2	14.8%		
3.7% didn't answer	3	22.2%		
occasional or routine	4	14.8%		
	6	11.1%		
Raise, climb & lower 10-foot ladder	1	25.9%	77.8%	18.5%
7.5% didn't answer rank	2	25.9%		
3.7% didn't answer	3	25.9%		
occasional or routine	4	3.7%		
	5	11.1%		
Raise, climb & lower 24-foot ladder	1	44.4%	77.8%	18.5%
7.5% didn't answer rank	2	25.9%		
3.7% didn't answer	3	22.2%		
occasional or routine	4	0.0%		
	5	0.0%		
Raise, climb & lower 35-foot ladder	1	25.9%	85.2%	7.4%
3.8% didn't answer rank	2	14.8%		
7.4% didn't answer	3	22.2%		
occasional or routine	4	14.8%		
	5	18.5%		
Lift patients onto gurney or truck	1	22.2%	92.6%	3.7%
7.5% didn't answer rank	2	44.4%		
3.7% didn't answer	3	22.2%		
occasional or routine	4	3.7%		
	5	0.0%		
Load gurney onto truck	1	22.2%	92.6%	3.7%
7.5% didn't answer rank	2	37.0%		
3.7% didn't answer	3	25.9%		
occasional or routine	4	7.4%		
	5	0.0%		
Carry patients to gurney or truck	1	22.2%	88.9%	3.7%
7.5% didn't answer rank	2	40.7%		
7.4% didn't answer	3	22.2%		
occasional or routine	4	7.4%		
	5	0.0%		

TASK	RANK		OCCASIONAL	ROUTINE
Drag patients to gurney or truck	1	18.5%	92.6%	0.0%
7.5% didn't answer rank	2	33.3%		
7.4% didn't answer	3	29.6%		
occasional or routine	4	7.4%		
	5	3.7%		
Using Phoenix tool	1	48.1%	74.1%	25.9%
3.8% didn't answer rank	2	44.4%		
	3	3.7%		
	4	0.0%		
	5	0.0%		
Working with SCBA (below ground)	1	22.2%	70.4%	3.7%
14.9% didn't answer rank	2	22.2%		
25.9% didn't answer	3	14.8%		
occasional or routine	4	11.1%		
	5	14.8%		
Working with SCBA (ground-2 stories)	1	29.6%	74.1%	18.5%
7.5% didn't answer rank	2	33.3%		
7.4% didn't answer	3	22.2%		
occasional or routine	4	3.7%		
	5	3.7%		
Working with SCBA (3-5 stories)	1	14.8%	74.1%	0.0%
14.9% didn't answer rank	2	14.8%		
25.9% didn't answer	3	14.8%		
occasional or routine	4	11.1%		
	5	29.6%		
Working with SCBA (6-10 stories)	1	18.5%	70.4%	0.0%
14.9% didn't answer rank	2	14.8%		
29.6% didn't answer	3	11.1%		
occasional or routine	4	7.4%		
	5	33.3%		
Investigation of building fire(below ground)	1	11.1%	70.4%	22.2%
14.9% didn't answer rank	2	14.8%		
7.4% didn't answer	3	3.7%		
occasional or routine	4	22.2%		
	5	33.3%		
Investigation of building fire(ground- 2 stories)	1	22.2%	81.5%	3.7%
7.5% didn't answer rank	2	11.1%		
14.8% didn't answer	3	33.3%		

TASK	RANK		OCCASIONAL	ROUTINE
occasional or routine	4	11.1%		
	5	14.8%		
Investigation of building fire (3-5 stories)	1	14.8%	66.7%	0.0%
14.9% didn't answer rank	2	11.1%		
33.3% didn't answer	3	11.1%		
occasional or routine	4	14.8%		
	5	33.3%		
Investigation of building fire (6-10 stories)	1	11.1%	66.7%	0.0%
14.9% didn't answer rank	2	7.4%		
33.3% didn't answer	3	14.8%		
occasional or routine	4	14.8%		
	5	37.0%		
Operating nozzle	1	44.4%	70.4%	25.9%
7.5% didn't answer rank	2	29.6%		
3.7% didn't answer	3	18.5%		
occasional or routine	4	0.0%		
	5	0.0%		
Climbing steep grades & mountains(<1mile)	1	40.7%	77.8%	18.5%
7.5% didn't answer rank	2	40.7%		
3.7% didn't answer	3	11.1%		
occasional or routine	4	0.0%		
	5	0.0%		
Carrying tools & packs up a grade	1	29.6%	74.1%	18.5%
7.5% didn't answer rank	2	29.6%		
7.4% didn't answer	3	22.2%		
occasional or routine	4	11.1%		
	5	0.0%		
Confined space rescue	1	11.1%	88.9%	7.4%
7.5% didn't answer rank	2	11.1%		
3.7% didn't answer	3	48.1%		
occasional or routine	4	14.8%		
	5	7.4%		
Respond to aircraft incidents	1	25.9%	85.2%	3.7%
26.0% didn't answer rank	2	22.2%		
11.1% didn't answer	3	14.8%		
occasional or routine	4	7.4%		
	5	3.7%		

TASK	RANK		OCCASIONAL	ROUTINE
Respond to Haz-Mat incidents	1	25.9%	85.2%	3.7%
7.5% didn't answer rank	2	25.9%		
11.1% didn't answer	3	33.3%		
occasional or routine	4	3.7%		
	5	3.7%		
Respond to vehicle accidents	1	44.4%	70.4%	29.6%
7.5% didn't answer rank	2	40.7%		
	3	7.4%		
	4	0.0%		
	5	0.0%		
CPR	1	63.0%	88.9%	7.4%
7.4% didn't answer rank	2	11.1%		
3.7% didn't answer	3	14.8%		
occasional or routine	4	3.7%		
	5	0.0%		
Fighting fires (10 - 20 min)	1	59.3%	85.2%	11.1%
7.4% didn't answer rank	2	22.2%		
3.7% didn't answer	3	7.4%		
occasional or routine	4	3.7%		
	5	0.0%		
Fighting fires (21 - 30 min)	1	51.9%	81.5%	11.1%
7.4% didn't answer rank	2	29.6%		
7.4% didn't answer	3	7.4%		
occasional or routine	4	0.0%		
	5	3.7%		
Fighting fires (31 - 40 min)	1	51.9%	85.2%	7.4%
7.4% didn't answer rank	2	25.9%		
7.4% didn't answer	3	11.1%		
occasional or routine	4	0.0%		
	5	3.7%		
Fighting fires (41 - 50 min)	1	51.9%	85.2%	7.4%
7.4% didn't answer rank	2	25.9%		
7.4% didn't answer	3	7.4%		
occasional or routine	4	3.7%		
	5	3.7%		
Fighting fires (51 - 60 min)	1	48.1%	85.2%	7.4%
7.5% didn't answer rank	2	25.9%		
7.4% didn't answer	3	7.4%		

TASK	RANK		OCCASIONAL	ROUTINE
occasional or routine	4	0.0%		
	5	11.1%		
Fighting fires (more than an hour)	1	55.6%	85.2%	7.4%
11.1% didn't answer rank	2	18.5%		
7.4% didn't answer	3	7.4%		
occasional or routine	4	0.0%		
	5	7.4%		

4. Do you have an opinion as to the possible injuries/conditions that can occur while performing the tasks listed above. Rank the following as: 1 = High probability 2 = Low probability
25.9% did not answer this section

Back pain	1	74.1%	Low back strain	1	74.1%
	2	0.0%		2	0.0%
Pulled muscles	1	59.3%	Physical exhaustion	1	74.1%
	2	14.8%		2	0.0%
Heat exhaustion	1	66.7%	Joint pain	1	59.3%
	2	7.4%		2	14.8%
Toxicity (air/fluid)	1	22.2%	AIDS	1	11.1%
	2	51.9%		2	63.0%
Infections	1	14.8%	Heart attack	1	44.4%
	2	59.3%		2	29.6%
Respiratory problems	1	48.1%	Other (please list):		0.0%
	2	25.9%			

Conclusion:
When completed and tabulated, if you would like a summary of the results, copies will be made available through the Wellness director at 295-1819. If you have any questions about this questionnaire or about the study you may call Lawrence Golding or Nickele A'lise Miller at UNLV, Exercise Physiology Laboratory, 895-3766.

APPENDIX D

TABULATION OF EMERGENCY CALLS FROM 1990-1995

1990

DATE	TYPE OF INCIDENT	ARRIVAL TIME TO SCENE	ARIRIVAL TIME BACK TO DEPT.
1/2/90	false alarm	3:03pm	3:30pm
1/3/90	false alarm	9:05am	9:22am
1/3/90	false alarm	10:30am	10:55am
1/4/90	false alarm	6:17am	6:30am
1/5/90	investigation	12:45pm	1:00pm
1/6/90	false alarm	12:30pm	12:50pm
1/7/90	false alarm	12:20pm	12:40pm
1/13/90	false alarm	10:30am	10:55am
1/14/90	false alarm	10:15pm	10:25pm
1/16/90	false alarm	8:15pm	8:24pm
1/17/90	false alarm	1:30pm	1:35pm
1/17/90	false alarm	6:15pm	8:45pm
1/18/90	false alarm	12:08pm	12:25pm
1/18/90	false alarm	4:57pm	5:08pm
1/18/90	false alarm	10:30pm	10:40pm
1/26/90	false alarm	11:31am	"
1/27/90	haz/mat	12:07pm	12:16pm
1/29/90	false alarm	10:25am	"
1/29/90	false alarm	1:11pm	"
1/29/90	false alarm	2:11pm	2:25pm
1/29/90	false alarm	2:37pm	2:50pm
2/1/90	investigation	11:07am	"
2/2/90	medical assist	1:00pm	1:14pm
2/2/90	fire	11:07pm	11:30pm
2/8/90	false alarm	7:25pm	7:50pm
2/13/90	false alarm	2:55pm	3:20pm
2/13/90	false alarm	5:20pm	5:33pm
2/14/90	false alarm	2:35pm	3:15pm
2/15/90	false alarm	2:28pm	3:30pm
2/17/90	false alarm	9:38am	9:45am
2/18/90	false alarm	11:21am	11:33am
2/19/90	false alarm	12:52pm	"
2/19/90	false alarm	5:54pm	6:13pm
2/20/90	false alarm	12:02pm	12:12pm
2/21/90	false alarm	2:15pm	2:25pm
2/23/90	false alarm	7:44pm	7:58pm
2/25/90	fire	2:38pm	4:00pm
2/27/90	false alarm	11:15pm	11:30pm
3/1/90	fire	12:11pm	12:35pm
3/1/90	fire	6:37pm	6:54pm
3/5/90	false alarm	6:36pm	"
3/6/90	false alarm	11:13am	11:24am
3/7/90	false alarm	10:02pm	10:17pm
3/11/90	false alarm	1:55pm	2:15pm
3/11/90	false alarm	8:53am	9:00am
3/11/90	false alarm	12:38pm	12:45pm
3/13/90	false alarm	11:28am	11:40am
3/18/90	false alarm	9:14am	9:30am
3/19/90	false alarm	3:13am	9:25am
3/19/90	false alarm	9:22am	9:35am
3/19/90	false alarm	4:55pm	5:03pm
3/19/90	false alarm	5:41pm	5:50pm
3/21/90	false alarm	10:02pm	10:15pm
3/22/90	false alarm	7:04am	7:19am
3/23/90	fire	3:17pm	3:30pm

1990

DATE	TYPE OF INCIDENT	ARRIVAL TIME TO SCENE	ARIRIVAL TIME BACK TO DEPT
3/23/90	false alarm	11:38pm	11:50pm
3/27/90	investigation	7:20pm	7:55pm
3/28/90	false alarm	11:19pm	11:45pm
3/29/90	false alarm	1:55am	3:07am
3/30/90	false alarm	8:46am	9:00am
3/31/90	invesigation	6:30pm	7:35pm
4/1/90	false alarm	11:25am	11:35am
4/2/90	fire	7:36pm	*
4/2/90	false alarm	10:07am	10:43am
4/4/90	fire	3:39pm	4:25pm
4/4/90	false alarm	4:00pm	5:20pm
4/8/90	false alarm	5:45pm	5:58pm
4/9/90	fire	3:34pm	4:07pm
4/14/90	investigation	8:55pm	9:55pm
4/16/90	false alarm	9:59pm	10:06pm
4/16/90	false alarm	10:06pm	10:16pm
4/17/90	false alarm	6:22am	6:35am
4/17/90	false alarm	3:37am	3:48am
4/17/90	investigation	1:15pm	*
4/18/90	fire	2:35pm	2:57pm
4/19/90	false alarm	5:35pm	6:00pm
4/20/90	investigation	6:58pm	7:18pm
4/20/90	false alarm	7:30pm	8:02pm
4/23/90	false alarm	6:48pm	*
4/23/90	investigation	8:17pm	8:28pm
4/25/90	false alarm	12:32pm	1:00pm
4/25/90	investigation	12:46pm	*
4/25/90	investigation	5:32pm	7:50pm
4/26/90	fire	10:31am	11:0am
4/26/90	investigation	10:25am	10:34am
4/27/90	investigation	11:08am	11:09am
4/30/90	fire	12:00pm	12:10pm
5/3/90	fire	4:40pm	4:54pm
5/5/90	fire	11:20am	11:40am
5/10/90	investigation	11:29am	11:47am
5/14/90	false alarm	5:30am	*
5/15/90	false alarm	9:22pm	9:31pm
5/15/90	false alarm	9:45pm	11:40pm
5/18/90	haz/mat	5:15am	5:35am
5/21/90	investigation	10:55am	12:38am
5/22/90	false alarm	10:25am	10:35am
5/23/90	false alarm	3:52pm	4:11pm
5/29/90	investigation	3:04am	4:00am
5/30/90	false alarm	1:38pm	1:48pm
5/31/90	false alarm	6:28pm	6:40pm
6/1/90	false alarm	1:04pm	1:22pm
6/1/90	false alarm	3:01pm	*
6/5/90	false alarm	9:37am	9:55pm
6/8/90	investigation	7:22pm	7:40pm
6/9/90	investigation	6:34pm	7:06pm
6/13/90	investigation	4:38pm	5:15pm
6/15/90	medical assist	6:33am	7:00am
6/16/90	haz/mat	6:12am	6:54am
6/17/90	false alarm	3:13pm	3:35pm
6/18/90	false alarm	10:44am	11:02am

1990

DATE	TYPE OF INCIDENT	ARRIVAL TIME TO SCENE	ARIRIVAL TIME BACK TO DEPT.
6/20/90	investigation	8:27am	8:50am
6/20/90	fire	6:30pm	8:48pm
6/21/90	false alarm	2:32am	3:02am
6/22/90	false alarm	1:18pm	1:32pm
6/23/90	investigation	1:34pm	2:20pm
6/29/90	false alarm	4:09pm	4:16pm
6/30/90	fire	11:53am	12:04pm
6/30/90	investigation	1:53pm	2:57pm
7/5/90	false alarm	4:27am	4:45am
7/5/90	false alarm	9:09am	9:50am
7/7/90	false alarm	9:00am	9:50am
7/9/90	false alarm	11:00pm	11:10pm
7/10/90	medical assist	1:34pm	2:05pm
7/10/90	false alarm	8:44pm	9:05pm
7/11/90	false alarm	12:25pm	*
7/11/90	fire	1:30pm	*
7/11/90	false alarm	7:26pm	7:45pm
7/13/90	investigation	6:02pm	6:20pm
7/14/90	false alarm	7:55pm	8:10pm
7/14/90	false alarm	8:09pm	8:17pm
7/14/90	false alarm	8:20pm	8:30pm
7/14/90	false alarm	8:32pm	8:45pm
7/14/90	investigation	10:09pm	11:00pm
7/15/90	false alarm	11:05am	11:09am
7/15/90	false alarm	11:20am	11:28am
7/15/90	false alarm	11:30am	11:38am
7/15/90	false alarm	3:39pm	4:52pm
7/16/90	false alarm	1:06am	2:30am
7/16/90	fire	6:54am	7:10am
7/16/90	false alarm	9:17pm	9:28pm
7/19/90	false alarm	7:37pm	8:10pm
7/20/90	false alarm	5:25pm	6:25pm
7/25/90	false alarm	12:20pm	12:45pm
7/27/90	fire	2:04pm	2:20pm
7/31/90	medical assist	10:35am	*
8/3/90	false alarm	9:08am	9:26am
8/3/90	investigation	3:20pm	3:25pm
8/3/90	false alarm	12:45am	1:07am
8/4/90	investigation	6:02pm	7:15pm
8/4/90	investigation	6:28pm	7:15pm
8/7/90	false alarm	12:41pm	12:50pm
8/7/90	investigation	2:09pm	2:20pm
8/7/90	false alarm	9:09pm	9:20pm
8/8/90	fire	10:20pm	10:34pm
8/9/90	false alarm	9:59am	10:20am
8/9/90	fire	8:15pm	8:30pm
8/9/90	investigation	5:06pm	5:35pm
8/14/90	fire	11:52am	1:15pm
8/14/90	false alarm	5:55pm	6:21pm
8/14/90	false alarm	9:55am	10:20am
8/15/90	false alarm	8:07pm	9:10pm
8/15/90	false alarm	9:50pm	*
8/19/90	false alarm	2:20pm	2:30pm
8/20/90	false alarm	6:54am	7:15am
8/23/90	false alarm	10:45am	11:00am

1990

DATE	TYPE OF INCIDENT	ARRIVAL TIME TO SCENE	ARIRIVAL TIME BACK TO DEPT.
8/23/90	false alarm	5:40pm	7:35pm
8/27/90	false alarm	4:45pm	*
8/29/90	false alarm	11:21pm	11:31pm
9/7/90	fire	10:51am	11:15am
9/8/90	false alarm	12:06pm	12:18pm
9/9/90	false alarm	8:03am	8:11am
9/11/90	false alarm	5:50pm	6:04pm
9/11/90	false alarm	8:19pm	8:50pm
9/12/90	false alarm	3:07pm	*
9/13/90	haz/mat	10:45am	11:15am
9/18/90	investigation	1:24pm	2:00pm
9/18/90	false alarm	1:47pm	2:12pm
9/24/90	false alarm	8:20pm	8:30pm
9/26/90	false alarm	2:05am	*
9/26/90	false alarm	2:11am	2:32am
9/26/90	false alarm	7:30am	7:38am
9/26/90	false alarm	8:35am	8:40am
9/27/90	investigation	10:26pm	11:00pm
10/1/90	investigation	1:38pm	1:58pm
10/1/90	investigation	3:20pm	*
10/1/90	false alarm	4:11pm	4:20pm
10/1/90	false alarm	10:18pm	10:31pm
10/4/90	false alarm	11:07am	11:20am
10/8/90	false alarm	3:31pm	3:48pm
10/8/90	false alarm	7:42pm	*
10/12/90	investigation	8:25pm	10:00pm
10/13/90	false alarm	3:37am	3:48am
10/13/90	false alarm	7:33am	7:49am
10/17/90	false alarm	10:34am	10:49am
10/17/90	fire	3:20pm	4:06pm
10/19/90	false alarm	9:44am	9:55am
10/20/90	false alarm	5:14am	5:27am
10/21/90	false alarm	6:04am	6:30am
10/21/90	false alarm	12:00pm	12:06pm
10/23/90	false alarm	4:05am	4:17am
10/28/90	haz/mat	12:40am	1:20am
10/30/90	false alarm	10:34am	10:46am
11/10/90	medical assist	5:50am	6:45am
11/14/90	false alarm	12:20pm	12:37pm
11/19/90	investigation	4:47am	5:45am
11/20/90	false alarm	2:06pm	2:20pm
11/21/90	fire	12:56pm	1:10pm
11/27/90	medical assist	9:25am	9:36am
11/28/90	false alarm	4:55pm	5:05pm
11/30/90	false alarm	2:20pm	2:55pm
12/4/90	medical assist	8:20pm	9:16pm
12/5/90	false alarm	7:32am	7:49am
12/5/90	false alarm	10:04am	10:18am
12/6/90	haz/mat	9:00am	9:30am
12/9/90	false alarm	6:38pm	*
12/10/90	false alarm	10:54am	11:00am
12/10/90	false alarm	3:40pm	3:53pm
12/12/90	false alarm	10:02pm	10:46pm
12/17/90	false alarm	5:56am	6:15am
12/20/90	false alarm	9:15am	10:16am

1990

DATE	TYPE OF INCIDENT	ARRIVAL TIME TO SCENE	ARIRIVAL TIME BACK TO DEPT.
12/22/90	false alarm	8:00am	8:12am
12/22/90	false alarm	8:45am	9:15am
12/23/90	false alarm	2:37am	3:10am
12/23/90	false alarm	10:45am	11:08am
12/23/90	false alarm	1:10pm	2:30pm
12/23/90	investigation	7:45pm	8:00pm
12/24/90	false alarm	2:08pm	2:33pm
12/24/90	false alarm	4:58pm	5:10pm
12/24/90	false alarm	6:20pm	7:17pm
12/27/90	false alarm	10:10am	10:30am
12/27/90	false alarm	10:22am	*
12/30/90	false alarm	8:04am	8:45am
12/30/90	investigation	7:45am	8:40am

Total number of calls is 233

FALSE ALARM	MEDICAL ASSIST	HAZ/MAT	FIRE
196	7	6	24
84.12%	3%	2.58%	10.30%

* time in log book was not documented

1991

DATE	TYPE OF INCIDENT	ARRIVAL TIME TO SCENE	ARRIVAL TIME BACK TO DEPT.
1/5/91	investigation	7:25pm	8:00pm
1/7/91	haz/mat	2:05pm	
1/7/91	haz/mat	2:50pm	3:45pm
1/14/91	false alarm	2:56pm	3:15pm
1/16/91	fire	10:41am	10:55am
1/18/91	false alarm	10:45am	10:58am
1/19/91	investigation	8:25pm	8:41pm
1/25/91	investigation	3:06pm	3:40pm
1/28/91	investigation	8:58am	9:18am
1/28/91	false alarm	11:31pm	11:59pm
1/29/91	investigation	6:20am	7:42am
1/29/91	investigation	8:05am	8:40am
1/29/91	investigation	3:01pm	3:17pm
1/30/91	false alarm	9:53pm	10:05pm
1/31/91	haz/mat	12:25pm	12:37pm
2/2/91	false alarm	9:46am	10:00am
2/2/91	haz/mat	8:01am	8:20am
2/5/91	false alarm	6:05am	6:23am
2/7/91	false alarm	6:11am	6:23am
2/10/91	false alarm	6:42am	6:55am
2/16/91	investigation	1:37pm	2:55pm
2/16/91	false alarm	1:48pm	2:55pm
2/17/91	false alarm	12:02am	12:17am
2/20/91	fire	9:42am	10:10am
2/20/91	false alarm	4:36pm	4:47pm
2/24/91	false alarm	10:22pm	11:36pm
2/25/91	false alarm	7:01am	7:14am
2/27/91	false alarm	6:50am	6:56am
2/28/91	false alarm	3:15am	4:05am
2/28/91	false alarm	12:58pm	1:18pm
2/28/91	false alarm	10:13pm	10:24pm
3/2/91	false alarm	4:39pm	4:51pm
3/2/91	false alarm	4:23pm	4:33pm
3/2/91	false alarm	5:02pm	5:20pm
3/2/91	investigation	11:53pm	12:17am
3/3/91	investigation	12:05pm	12:50pm
3/5/91	false alarm	9:52pm	10:06pm
3/7/91	false alarm	7:13am	7:26am
3/13/91	false alarm	7:53am	8:06am
3/14/91	investigation	12:16pm	1:25pm
3/15/91	false alarm	10:02am	10:17am
3/20/91	false alarm	4:27pm	4:35pm
3/21/91	fire	9:40am	10:00am
3/26/91	false alarm	5:13am	5:30am
3/28/91	false alarm	5:45pm	8:20pm
3/30/91	false alarm	9:38pm	9:49pm
4/4/91	false alarm	10:57am	11:08am
4/5/91	false alarm	1:17pm	1:22pm
4/5/91	false alarm	6:20pm	6:43pm
4/8/91	false alarm	7:35pm	9:16pm
4/9/91	false alarm	10:42am	10:57am
4/10/91	false alarm	7:15am	7:30am

1991

DATE	TYPE OF INCIDENT	ARRIVAL TIME TO SCENE	ARRIVAL TIME BACK TO DEPT.
4/10/91	investigation	3:36pm	*
4/11/91	false alarm	7:38pm	8:33pm
4/15/91	haz/mat	4:17pm	4:40pm
4/18/91	false alarm	6:55pm	7:08pm
5/1/91	false alarm	4:36am	4:56am
5/1/91	investigation	8:48am	9:10am
5/1/91	investigation	10:39am	10:45am
5/1/91	investigation	3:19pm	4:15pm
5/2/91	haz/mat	2:40pm	3:05pm
5/4/91	false alarm	6:36am	6:50pm
5/6/91	fire	7:02am	7:39am
5/6/91	false alarm	9:10pm	9:28pm
5/8/91	false alarm	7:00am	7:35am
5/9/91	fire	4:55pm	5:25pm
5/14/91	false alarm	12:35pm	12:53pm
5/14/91	false alarm	5:23pm	5:40pm
5/14/91	false alarm	6:17pm	6:32pm
5/15/91	false alarm	7:14am	7:20am
5/15/91	false alarm	9:49am	10:05am
5/16/91	false alarm	6:56am	7:10am
5/17/91	false alarm	2:41am	2:45am
5/17/91	false alarm	4:16am	4:25am
5/17/91	false alarm	5:38am	5:46am
5/18/91	false alarm	2:25am	2:37am
5/26/91	false alarm	7:20am	7:45am
5/27/91	false alarm	4:32am	5:04am
5/30/91	fire	1:07pm	1:30pm
5/31/91	false alarm	4:00am	4:20am
5/31/91	false alarm	4:17am	4:25am
5/31/91	false alarm	5:14am	5:22am
5/31/91	false alarm	5:46am	5:58am
6/1/91	investigation	7:55pm	9:10pm
6/3/91	false alarm	6:19pm	6:29m
6/3/91	false alarm	9:01pm	9:55pm
6/3/91	investigation	12:02am	12:15am
6/10/91	medical assist	6:17pm	*
6/11/91	investigation	3:25pm	4:05pm
6/22/91	false alarm	4:44am	5:05am
6/22/91	false alarm	5:34am	5:55am
6/24/91	false alarm	9:32pm	9:57pm
6/27/91	false alarm	9:04am	9:18am
7/1/91	haz/mat	9:10am	10:55am
7/1/91	false alarm	8:40pm	9:15pm
7/2/91	fire	6:25pm	9:10pm
7/4/91	false alarm	12:02pm	12:50pm
7/5/91	false alarm	1:18pm	1:27pm
7/6/91	false alarm	11:34pm	11:59pm
7/7/91	false alarm	4:01am	4:13am
7/7/91	false alarm	9:57am	10:14am
7/7/91	false alarm	2:29pm	3:22pm
7/7/91	false alarm	2:54pm	4:30pm
7/7/91	investigation	5:38pm	6:00pm

1991

DATE	TYPE OF INCIDENT	ARRIVAL TIME TO SCENE	ARRIVAL TIME BACK TO DEPT.
7/9/91	false alarm	3:50pm	4:00pm
7/11/91	false alarm	12:27am	12:50am
7/11/91	false alarm	1:32pm	2:20pm
7/13/91	fire	7:05am	7:50am
7/14/91	false alarm	12:43am	12:54am
7/14/91	false alarm	7:46pm	8:09pm
7/16/91	false alarm	11:10am	11:25am
7/16/91	false alarm	1:24pm	1:35pm
7/17/91	false alarm	3:06pm	3:20pm
7/17/91	false alarm	4:25pm	4:40pm
7/24/91	fire	12:55pm	2:04pm
7/24/91	investigation	9:25pm	10:00pm
7/24/91	false alarm	12:27pm	10:55pm
7/25/91	fire	12:28am	2:30am
7/25/91	false alarm	11:43am	11:59am
7/25/91	false alarm	9:54pm	*
7/30/91	fire	3:03pm	*
7/30/91	fire	3:15pm	*
7/30/91	fire	3:40pm	4:10pm
7/31/91	fire	7:55am	9:45am
8/1/91	fire	10:28am	10:51am
8/1/91	fire	1:22pm	2:30pm
8/1/91	investigation	2:00pm	*
8/5/91	investigation	7:35am	*
8/6/91	fire	4:40pm	5:03pm
8/8/91	false alarm	8:11am	8:25am
8/9/91	false alarm	8:29am	8:43am
8/10/91	medical assist	9:35am	*
8/10/91	false alarm	5:35pm	*
8/10/91	fire	5:42pm	5:59pm
8/11/91	investigation	8:16pm	10:14pm
8/13/91	false alarm	5:43am	5:59am
8/13/91	false alarm	6:16am	6:36am
8/13/91	false alarm	8:40pm	8:50pm
8/14/91	false alarm	12:51pm	1:10pm
8/14/91	false alarm	1:19pm	1:39pm
8/17/91	false alarm	5:08am	6:15am
8/17/91	false alarm	7:00am	7:35am
8/18/91	false alarm	12:03pm	12:45pm
8/19/91	false alarm	3:18pm	3:20pm
8/20/91	false alarm	6:17am	6:25am
8/20/91	false alarm	10:01am	12:40pm
8/20/91	false alarm	9:55am	10:52am
8/22/91	medical assist	6:10am	6:50am
8/22/91	medical assist	4:05pm	4:40pm
8/24/91	investigation	1:21am	2:10am
8/26/91	false alarm	1:31am	1:50am
8/27/91	false alarm	6:27am	6:51am
8/27/91	investigation	3:45pm	4:40pm
8/28/91	false alarm	2:18am	2:38am
8/28/91	false alarm	2:38am	2:51am
8/28/91	medical assist	10:13am	10:50am

1991

DATE	TYPE OF INCIDENT	ARRIVAL TIME TO SCENE	ARRIVAL TIME BACK TO DEPT.
8/31/91	investigation	11:30am	12:30pm
9/2/91	investigation	3:01pm	4:05pm
9/3/91	fire	7:35am	8:24am
9/3/91	false alarm	8:45am	8:53am
9/3/91	false alarm	9:04pm	9:35pm
9/4/91	false alarm	8:51am	9:05am
9/5/91	false alarm	11:33am	12:00pm
9/5/91	false alarm	7:41pm	7:53pm
9/6/91	investigation	9:59am	11:30am
9/6/91	false alarm	10:15am	10:30am
9/6/91	investigation	10:38am	10:51am
9/6/91	false alarm	12:21pm	12:49pm
9/10/91	medical assist	1:35pm	2:35pm
9/11/91	haz/mat	2:23pm	2:40pm
9/12/91	investigation	2:45pm	3:15pm
9/12/91	false alarm	7:02pm	7:54pm
9/17/91	false alarm	1:11pm	1:21pm
9/19/91	investigation	1:25pm	2:10pm
9/23/91	false alarm	11:58pm	1:35am
9/25/91	false alarm	11:04am	11:22am
9/26/91	medical assist	5:10pm	6:20pm
9/30/91	false alarm	8:13pm	8:20pm
10/4/91	medical assist	1:02pm	3:05pm
10/7/91	false alarm	5:37pm	5:59pm
10/8/91	investigation	11:19am	1:05pm
10/13/91	false alarm	9:20pm	9:28pm
10/15/91	false alarm	7:43am	*
10/15/91	medical assist	3:43pm	4:20pm
10/16/91	false alarm	11:48am	12:01pm
10/21/91	false alarm	5:34am	*
10/21/91	false alarm	8:43am	8:58am
10/22/91	false alarm	4:42pm	5:01pm
10/22/91	false alarm	8:13pm	8:45pm
10/24/91	false alarm	5:18am	5:45am
10/24/91	false alarm	8:18am	8:22am
10/24/91	investigation	10:28am	12:28pm
10/24/91	false alarm	8:23pm	8:39pm
10/25/91	false alarm	9:31pm	9:50pm
10/26/91	investigation	8:25pm	9:25pm
10/27/91	false alarm	1:23am	1:38am
10/27/91	false alarm	5:58am	6:18am
10/27/91	false alarm	10:00am	10:25am
10/28/91	false alarm	9:09am	9:19am
10/28/91	false alarm	5:58pm	6:08pm
10/29/91	false alarm	9:49pm	10:05pm
10/31/91	fire	9:33am	9:43am
10/31/91	haz/mat	1:00pm	2:30pm
11/1/91	medical assist	5:48pm	6:25pm
11/4/91	false alarm	3:07pm	3:21pm
11/4/91	false alarm	5:22pm	5:31pm
11/10/91	false alarm	2:05pm	2:50pm
11/12/91	false alarm	3:42am	4:45am

1991

DATE	TYPE OF INCIDENT	ARRIVAL TIME TO SCENE	ARRIVAL TIME BACK TO DEPT.
11/12/91	investigation	3:58am	6:30am
11/12/91	false alarm	11:14am	11:58am
11/12/91	false alarm	8:59pm	9:45pm
11/14/91	false alarm	3:18pm	*
11/15/91	false alarm	9:37am	11:09am
11/18/91	false alarm	2:43am	4:15am
11/19/91	false alarm	12:54pm	*
11/26/91	false alarm	11:43pm	12:45am
11/28/91	false alarm	7:15am	7:28am
11/28/91	false alarm	1:53pm	2:02pm
12/1/91	investigation	7:35am	8:50am
12/2/91	fire	7:32am	7:52am
12/2/91	false alarm	4:00pm	4:15pm
12/3/91	false alarm	3:45pm	4:00pm
12/3/91	fire	5:54pm	6:05pm
12/4/91	fire	10:27am	10:37am
12/5/91	false alarm	7:36pm	7:52pm
12/7/91	false alarm	11:13pm	11:36pm
12/10/91	false alarm	12:29am	1:06am
12/10/91	medical assist	5:50pm	7:00pm
12/13/91	fire	8:39pm	9:56pm
12/14/91	investigation	1:50pm	2:55pm
12/16/91	false alarm	6:24pm	6:37pm
12/22/91	false alarm	8:04am	8:14am
12/26/91	false alarm	8:46am	10:00am
12/30/91	investigation	6:30am	7:30am
12/30/91	false alarm	7:13pm	8:12pm
		Total number of calls is 235	
FALSE ALARM	MEDICAL ASSIST	HAZMAT	FIRE
191	11	9	24
81.30%	4.70%	3.80%	10.20%
	*time was not indicated in the log book		

1992

DATE	TYPE OF INCIDENT	ARRIVAL TIME TO SCENE	ARRIVAL TIME BACK TO DEPT.
1/6/92	false alarm	4:17pm	*
1/7/92	investigation	5:15am	5:47am
1/8/92	false alarm	7:38am	7:56am
1/9/92	false alarm	10:15am	11:00am
1/10/92	false alarm	5:37am	5:48am
1/12/92	medical assist	12:05pm	1:45pm
1/17/92	false alarm	3:02am	3:15am
1/19/92	false alarm	1:16pm	1:34pm
1/21/92	false alarm	10:05am	10:16am
1/21/92	false alarm	10:39am	10:48am
1/21/92	false alarm	10:52am	10:58am
1/21/92	false alarm	10:59am	11:09am
1/21/92	false alarm	11:00am	11:15am
1/23/92	false alarm	4:54am	5:08am
1/28/92	false alarm	6:34am	6:52am
1/29/92	medical assist	8:15am	9:00am
1/31/92	false alarm	12:23am	12:56am
2/4/92	false alarm	1:42am	1:55am
2/4/92	false alarm	7:57am	8:07am
2/8/92	medical assist	6:43pm	7:15pm
2/11/92	fire	8:50am	9:29am
2/15/92	false alarm	9:02pm	9:11pm
2/16/02	false alarm	12:47am	12:57am
2/16/92	false alarm	2:10am	2:30am
2/16/92	false alarm	11:23pm	11:34pm
2/17/92	false alarm	9:41pm	9:55pm
2/18/92	false alarm	12:56am	1:20am
2/18/92	false alarm	11:43am	11:51am
2/21/92	haz/mat	9:56am	11:22am
2/26/92	medical assist	11:50am	2:45pm
2/29/92	false alarm	2:09am	2:23am
3/1/92	false alarm	7:16pm	7:25pm
3/1/92	false alarm	7:31pm	7:43pm
3/5/92	false alarm	3:05pm	3:16pm
3/6/92	false alarm	10:39pm	10:48pm
3/10/92	fire	1:07pm	1:32pm
3/11/92	fire	3:32pm	4:00pm
3/12/92	investigation	3:53pm	3:56pm
3/15/92	investigation	11:56am	12:44pm
3/18/92	false alarm	6:43am	7:00am
3/18/92	fire	6:30pm	6:53pm
3/20/92	haz/mat	6:30pm	7:25pm
3/20/92	false alarm	7:55pm	8:06pm
3/21/92	medical assist	7:10am	7:50am
3/21/92	false alarm	11:47pm	11:57pm
3/22/92	false alarm	2:35am	2:45am
3/22/92	false alarm	7:28am	7:48am
3/22/92	false alarm	8:26pm	8:46pm
3/22/92	false alarm	8:34pm	8:44pm
3/22/92	false alarm	11:14pm	11:22pm

1992

DATE	TYPE OF INCIDENT	ARRIVAL TIME TO SCENE	ARRIVAL TIME BACK TO DEPT.
3/23/92	false alarm	10:00pm	10:12pm
3/25/92	medical assist	6:16pm	7:03pm
3/27/92	investigation	9:42am	*
3/27/92	false alarm	11:18am	11:39am
3/29/92	false alarm	4:00am	5:15am
3/30/92	fire	7:30am	7:50am
3/30/92	investigation	1:20pm	1:59pm
3/31/92	false alarm	9:25am	9:50am
4/4/92	false alarm	4:38am	4:50am
4/4/92	false alarm	5:57am	6:15am
4/5/92	false alarm	12:09am	12:40am
4/6/92	false alarm	6:30am	6:46am
4/6/92	investigation	9:40am	10:15am
4/7/92	false alarm	5:21am	5:45am
4/9/92	haz/mat	12:42am	2:00am
4/14/92	false alarm	9:55am	10:08am
4/16/92	false alarm	8:33am	8:42am
4/16/92	medical assist	9:42am	10:57am
4/16/92	medical assist	4:27pm	5:02pm
4/19/92	false alarm	8:34pm	8:48pm
4/21/92	haz/mat	9:25am	9:35am
4/21/92	false alarm	3:26pm	3:50pm
4/21/92	false alarm	9:51pm	10:42pm
4/25/92	false alarm	3:15am	3:55am
4/26/92	medical assist	7:15pm	8:00pm
4/28/92	medical assist	7:00pm	10:51pm
4/28/92	false alarm	10:40pm	10:45pm
4/29/92	false alarm	7:02pm	8:09pm
5/1/92	investigation	11:41am	12:18pm
5/1/92	false alarm	4:12pm	4:35pm
5/5/92	false alarm	4:55pm	5:06pm
5/6/92	false alarm	7:20am	7:28am
5/6/92	fire	8:24pm	9:38pm
5/6/92	false alarm	10:18pm	10:30pm
5/7/92	false alarm	12:10pm	12:30pm
5/9/92	false alarm	9:28pm	10:12pm
5/10/92	fire	10:20am	11:25am
5/11/92	fire	8:38am	8:53am
5/20/92	false alarm	5:04pm	6:15pm
5/23/92	fire	8:59pm	9:30pm
5/26/92	fire	8:08pm	*
5/26/92	fire	8:23pm	*
5/26/92	fire	9:04pm	9:32pm
5/28/92	investigation	4:20pm	6:20pm
5/28/92	false alarm	6:09pm	6:23pm
5/29/92	fire	7:26pm	8:49pm
5/30/92	investigation	2:25pm	3:25pm
5/30/92	investigation	3:53pm	4:09pm
6/2/92	fire	6:57pm	7:24pm
6/2/92	fire	9:15pm	9:18pm

1992

DATE	TYPE OF INCIDENT	ARRIVAL TIME TO SCENE	ARRIVAL TIME BACK TO DEPT.
6/4/92	false alarm	7:58pm	8:10pm
6/5/92	false alarm	5:16pm	5:38pm
6/5/92	false alarm	10:20am	10:40am
6/8/92	fire	8:07am	8:15am
6/9/92	false alarm	8:47am	9:15am
6/10/92	fire	7:35pm	7:45pm
6/13/92	false alarm	6:40am	7:18am
6/15/92	false alarm	6:15am	6:30am
6/15/92	false alarm	12:13pm	12:30pm
6/15/92	false alarm	11:56pm	12:15am
6/16/92	false alarm	12:38pm	1:20pm
6/17/92	fire	7:35am	7:40am
6/17/92	medical assist	12:30pm	12:48pm
6/18/92	fire	4:37pm	4:55pm
6/18/92	false alarm	6:27pm	6:40pm
6/22/92	investigation	10:15am	10:35am
6/22/92	false alarm	5:08pm	5:35pm
6/22/92	false alarm	6:05pm	6:35pm
6/24/92	investigation	7:32pm	8:30pm
6/26/92	investigation	12:33pm	1:04pm
6/26/92	haz/mat	6:55pm	7:45pm
6/29/92	false alarm	1:47pm	1:55pm
7/3/92	false alarm	12:46pm	1:03pm
7/4/92	fire	2:09am	2:36am
7/6/92	fire	10:43am	9:00pm
7/7/92	false alarm	10:03am	10:13am
7/8/92	false alarm	12:35pm	12:41pm
7/10/92	investigation	5:00pm	5:47pm
7/11/91	false alarm	4:08am	5:00am
7/11/92	false alarm	11:38am	1:00pm
7/11/92	false alarm	1:35pm	1:49pm
7/12/92	false alarm	12:25pm	1:00pm
7/12/92	false alarm	1:04pm	2:40pm
7/14/92	false alarm	12:16am	1:05am
7/14/92	false alarm	6:46pm	7:10pm
7/14/92	false alarm	11:24pm	11:36pm
7/15/92	false alarm	2:36am	3:14am
7/16/92	false alarm	8:40pm	8:47pm
7/17/92	false alarm	12:08am	12:33am
7/17/92	false alarm	7:43pm	8:55pm
7/31/92	fire	8:31pm	8:40pm
8/2/92	fire	6:53pm	10:00pm
8/3/92	fire	1:40pm	2:15pm
8/5/92	medical assist	5:44am	6:19am
8/7/92	investigation	12:49pm	1:00pm
8/11/92	fire	7:35pm	8:30pm
8/11/92	haz/mat	8:55pm	9:12pm
8/12/92	haz/mat	12:04pm	12:15pm
8/12/92	fire	4:21pm	*
8/12/92	investigation	5:35pm	7:00pm

1992

DATE	TYPE OF INCIDENT	ARRIVAL TIME TO SCENE	ARRIVAL TIME BACK TO DEPT.
8/13/92	false alarm	3:06pm	3:15pm
8/14/92	fire	1:00pm	*
8/17/92	fire	9:27am	9:47am
8/18/92	fire	3:24pm	6:30am(8/19)
8/19/92	medical assist	1:58pm	3:30pm
8/19/92	false alarm	9:32pm	9:50pm
8/21/92	fire	12:37pm	1:03pm
8/25/92	false alarm	5:30am	5:45am
8/27/92	medical assist	1:40am	2:24am
8/27/92	medical assist	5:34pm	6:20pm
8/30/92	false alarm	9:24pm	9:34pm
8/31/92	medical assist	8:04am	12:50pm
8/31/92	false alarm	9:48pm	9:54pm
9/1/92	medical assist	7:19pm	7:27pm
9/2/92	false alarm	8:00am	8:10am
9/9/92	false alarm	11:31pm	11:38pm
9/15/92	false alarm	11:24am	11:40am
9/16/92	false alarm	6:27pm	6:40pm
9/16/92	false alarm	7:54pm	8:06pm
9/17/92	false alarm	2:17pm	2:40pm
9/23/92	false alarm	6:08pm	6:37pm
9/23/92	false alarm	5:27pm	5:35pm
9/25/92	false alarm	9:15pm	10:34pm
9/28/92	fire	10:10am	11:05am
9/29/92	false alarm	2:28pm	3:02pm
10/2/92	false alarm	9:57am	10:20am
10/2/92	investigation	12:05am	12:50am
10/2/92	fire	5:05pm	5:20pm
10/7/92	medical assist	9:12am	1:15pm
10/7/92	false alarm	3:06pm	3:16pm
10/12/92	false alarm	7:12am	7:25am
10/15/92	false alarm	8:15am	8:25am
10/15/92	fire	2:18pm	2:30pm
10/21/92	false alarm	7:20am	7:45am
10/21/92	fire	9:22am	9:58am
10/22/92	false alarm	11:56am	12:26pm
10/24/92	false alarm	6:02am	7:05am
10/24/92	false alarm	11:02am	11:20am
10/26/92	false alarm	12:57am	2:16am
10/26/92	false alarm	8:20am	8:32am
10/26/92	false alarm	10:29am	10:40am
10/26/92	false alarm	11:01am	11:19am
10/30/92	haz/mat	2:25pm	*
10/30/92	medical assist	3:15pm	*
11/3/92	false alarm	2:25am	2:43am
11/3/92	false alarm	1:22pm	1:33pm
11/3/92	false alarm	7:10pm	7:25pm
11/3/92	false alarm	7:53pm	8:16pm
11/4/92	false alarm	9:03am	9:17am
11/5/92	false alarm	3:20pm	4:00pm

1992

DATE	TYPE OF INCIDENT	ARRIVAL TIME TO SCENE	ARRIVAL TIME BACK TO DEPT.
11/6/92	investigation	8:00pm	8:45pm
11/8/92	investigation	2:45am	3:40am
11/8/92	investigation	9:35am	10:10am
11/10/92	false alarm	6:41am	6:56am
11/10/92	false alarm	8:09am	8:30am
11/12/92	fire	10:01am	10:17am
11/16/92	haz/mat	1:35am	11:50am
11/17/92	false alarm	8:00pm	8:12pm
11/18/92	investigation	3:45am	4:45am
11/20/92	false alarm	5:42am	6:20am
11/21/92	investigation	10:45pm	10:55pm
11/24/92	investigation	1:39am	1:50am
11/25/92	haz/mat	12:50pm	3:30pm
11/27/92	false alarm	5:18am	6:07am
12/1/92	false alarm	2:02pm	2:08pm
12/1/92	false alarm	4:07pm	4:23pm
12/2/92	false alarm	11:25am	11:37am
12/7/92	medical assist	8:12am	*
12/7/92	medical assist	2:00pm	5:40pm
12/9/92	false alarm	12:01am	12:20am
12/9/92	medical assist	10:45am	11:15am
12/9/92	medical assist	1:23pm	2:00pm
12/9/92	false alarm	4:33pm	6:09pm
12/9/92	haz/mat	4:55pm	4:56pm
12/10/92	investigation	4:33pm	5:11pm
12/11/92	medical assist	4:21pm	5:03pm
12/12/92	false alarm	12:22am	12:45am
12/12/92	investigation	9:39am	10:05am
12/14/92	false alarm	5:29pm	5:36pm
12/17/92	false alarm	4:00pm	4:20pm
12/18/92	medical assist	6:45am	8:05am
12/18/92	false alarm	7:59am	8:55am
12/18/92	medical assist	8:05am	11:00am
12/18/92	investigation	1:30pm	2:00pm
12/18/92	false alarm	11:33pm	12:00am
12/19/92	false alarm	12:27am	12:40am
12/19/92	investigation	11:43pm	2:15am
12/20/92	investigation	5:00pm	5:25pm
12/27/92	false alarm	8:06pm	8:18pm
12/27/92	false alarm	8:22pm	8:50pm
12/29/92	investigation	2:07pm	2:17pm
		Total number of calls is 241	
FALSE ALARM	MEDICAL ASSIST	HAZ/MAT	FIRE
169	26	11	35
70.10%	10.80%	4.60%	14.50%
	*time in log book was not documented		

1993

DATE	TYPE OF INCIDENT	ARRIVAL TIME TO SCENE	ARRIVAL TIME BACK TO DEPT.
1/4/93	false alarm	6:55am	7:20am
1/4/93	false alarm	5:10pm	5:27pm
1/5/93	investigation	6:22pm	7:25pm
1/7/93	investigation	6:15am	7:20am
1/12/93	medical assist	10:57pm	11:47pm
1/13/93	medical assist	8:18am	8:53am
1/15/93	medical assist	10:35am	11:15am
1/17/93	fire	5:34pm	6:37pm
1/24/93	investigation	6:35pm	7:00pm
1/25/93	false alarm	12:13pm	1:28pm
1/28/93	false alarm	7:55am	9:30am
1/29/93	false alarm	11:41am	11:50am
1/29/93	false alarm	11:05am	11:51am
1/31/93	false alarm	7:00pm	8:35pm
2/1/93	false alarm	5:41pm	7:12pm
2/4/93	false alarm	7:06pm	7:14pm
2/4/93	false alarm	11:41pm	11:49pm
2/7/93	false alarm	6:22am	6:36am
2/7/93	false alarm	9:39pm	9:56pm
2/8/93	fire	8:02am	9:24am
2/8/93	investigation	8:42pm	9:00pm
2/16/93	fire	6:43am	7:09am
2/18/93	medical assist	11:17am	11:26am
2/18/93	medical assist	11:45pm	12:01am
2/20/93	investigation	5:30am	5:55am
2/25/93	haz/mat	2:07pm	2:37pm
2/26/93	false alarm	2:04am	2:30am
3/1/93	false alarm	4:27pm	4:39pm
3/2/93	haz/mat	3:12pm	3:36pm
3/3/93	investigation	12:04pm	12:46pm
3/4/93	haz/mat	2:39pm	3:30pm
3/5/93	haz/mat	2:00pm	*
3/8/93	haz/mat	11:56am	*
3/11/93	haz/mat	2:00pm	*
3/12/93	fire	12:00pm	1:24pm
3/14/93	investigation	8:18pm	9:03pm
3/15/93	false alarm	5:50am	6:10am
3/18/93	investigation	3:19am	7:35am
3/18/93	false alarm	1:58pm	2:30pm
3/25/93	haz/mat	4:10pm	*
3/28/93	false alarm	9:58pm	10:23pm
3/29/93	false alarm	2:13pm	2:30pm
3/30/93	false alarm	6:24pm	6:33pm
4/1/93	medical assist	12:51pm	1:40pm
4/2/93	false alarm	9:22am	9:39am
4/6/93	haz/mat	9:00am	10:00am
4/6/93	medical assist	1:42pm	3:30pm
4/11/93	medical assist	5:50pm	6:45pm
4/14/93	false alarm	9:00am	10:10am
4/16/93	false alarm	1:09pm	2:10pm
4/17/93	false alarm	5:16pm	5:32pm
4/19/93	investigation	2:32pm	3:25pm

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DATE	TYPE OF INCIDENT	ARRIVAL TIME TO SCENE	ARRIVAL TIME BACK TO DEPT.
4/19/93	medical assist	5:30pm	6:50pm
4/20/93	false alarm	9:14am	9:27am
4/20/93	medical assist	9:50am	11:00am
4/22/93	false alarm	2:00pm	2:10pm
4/27/93	false alarm	9:59am	10:36am
4/29/93	fire	10:55am	12:40pm
4/29/93	false alarm	11:12am	12:40pm
4/30/93	medical ssist	11:10am	11:30am
5/3/93	false alarm	1:23pm	3:00pm
5/4/93	medical assist	8:43pm	9:44pm
5/5/93	fire	9:15am	9:53am
5/8/93	haz/mat	9:15am	10:00am
5/10/93	false alarm	4:00pm	4:50pm
5/13/93	false alarm	5:45pm	6:07pm
5/19/93	fire	12:17pm	1:04am
5/19/93	false alarm	11:18pm	2:12am
5/20/93	fire	8:08am	9:05am
5/25/93	haz/mat	9:52am	5:45pm
5/25/93	false alarm	2:35pm	3:12pm
5/25/93	false alarm	3:13pm	3:25pm
5/25/93	false alarm	3:57pm	4:06pm
5/27/93	medical assist	4:05pm	4:40pm
5/31/93	medical assist	6:20pm	7:17pm
6/1/93	false alarm	10:18am	10:24am
6/2/93	investigation	10:00am	10:48am
6/3/93	false alarm	8:00am	8:09am
6/8/93	false alarm	10:05am	10:28am
6/10/93	false alarm	1:35pm	2:10pm
6/10/93	false alarm	4:50pm	5:20pm
6/13/93	investigation	7:54am	9:48am
6/14/93	false alarm	11:21am	11:35am
6/15/93	investigation	8:45pm	9:55pm
6/16/93	ivestigation	5:05pm	6:46pm
6/16/93	investigation	5:15pm	8:35pm
6/19/93	investigation	7:00pm	8:35pm
6/21/92	false alarm	12:05pm	12:25pm
6/21/93	false alarm	2:58pm	3:30pm
6/23/93	false alarm	3:17pm	3:40pm
6/25/93	investigation	8:25am	9:50am
6/29/93	haz/mat	9:45am	10:40am
6/30/93	false alarm	1:22pm	1:47pm
7/3/93	false alarm	9:08am	9:20am
7/9/93	investigation	7:30am	8:30am
7/14/93	investigation	8:09am	9:32am
7/18/93	investigation	12:48pm	2:00am
7/18/93	investigation	6:29am	7:20am
7/20/93	haz/mat	3:51pm	4:20pm
7/22/93	false alarm	8:00pm	8:30pm
7/23/93	investigation	6:30pm	7:45pm
7/27/93	false alarm	10:15am	10:45am
7/27/93	false alarm	8:40pm	8:45pm
8/1/93	false alarm	2:43pm	2:50pm

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DATE	TYPE OF INCIDENT	ARRIVAL TIME TO SCENE	ARRIVAL TIME BACK TO DEPT.
8/1/93	false alarm	5:26pm	5:43pm
8/3/93	haz/mat	4:15pm	4:28pm
8/3/93	fire	5:46pm	8:55pm
8/3/93	fire	6:39pm	12:33am
8/4/93	false alarm	6:30am	7:05am
8/4/93	false alarm	12:15pm	12:48pm
8/4/93	fire	12:58pm	*
8/4/93	investigation	12:58pm	*
8/4/93	investigation	4:20pm	4:45pm
8/4/93	false alarm	6:32am	6:55am
8/5/93	fire	1:00am	1:35am
8/5/93	false alarm	6:55am	7:15am
8/7/93	false alarm	7:43pm	8:12pm
8/9/93	false alarm	10:23am	11:36am
8/10/93	false alarm	12:02pm	12:28pm
8/11/93	false alarm	9:39pm	10:56pm
8/11/93	false alarm	1:00pm	1:50pm
8/13/93	false alarm	5:46am	5:52am
8/16/93	fire	1:48pm	2:15pm
8/16/93	fire	1:52pm	2:10pm
8/19/93	false alarm	7:51am	8:05am
8/19/93	false alarm	11:17am	11:56am
8/19/93	false alarm	1:59pm	3:35pm
8/19/93	false alarm	2:26pm	2:56pm
8/19/93	false alarm	6:49pm	7:30pm
8/19/93	haz/mat	5:10pm	*
8/20/93	false alarm	12:40pm	1:15am
8/21/93	false alarm	3:45pm	4:00pm
8/21/93	false alarm	4:08pm	4:25pm
8/22/93	false alarm	11:40am	12:05pm
8/22/93	false alarm	2:14pm	3:20pm
8/23/93	false alarm	3:07pm	3:30pm
8/24/93	false alarm	3:54pm	4:00pm
8/28/93	investigation	1:30pm	2:30m
8/28/93	false alarm	2:35pm	3:22pm
9/4/93	false alarm	2:45pm	5:15pm
9/6/93	investigation	10:55am	11:35am
9/7/93	false alarm	8:04am	10:40am
9/7/93	false alarm	11:50am	12:03am
9/8/93	false alarm	12:43pm	2:20pm
9/16/93	false alarm	2:02am	2:30am
9/17/93	investigation	2:17pm	2:55pm
9/18/93	false alarm	9:35am	11:15am
9/23/93	false alarm	12:12pm	1:17pm
9/24/93	investigation	9:45am	10:10am
9/24/93	false alarm	4:45pm	5:30pm
10/6/93	false alarm	6:40am	6:54am
10/6/93	false alarm	6:55am	7:08am
10/7/93	false alarm	3:28pm	4:20pm
10/8/93	investigation	5:29am	5:31am
10/11/93	investigation	6:00am	6:02am
10/11/93	investigation	6:17am	6:20am

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DATE	TYPE OF INCIDENT	ARRIVAL TIME TO SCENE	ARRIVAL TIME BACK TO DEPT.
10/11/93	false alarm	7:13am	7:16am
10/11/93	medical assist	12:57am	1:57am
10/11/93	haz/mat	12:37pm	1:20pm
10/12/93	false alarm	3:51pm	4:20pm
10/13/93	false alarm	3:28am	3:48am
10/13/93	medical assist	4:00am	4:45pm
10/13/93	false alarm	10:57am	11:18am
10/14/93	false alarm	1:25pm	1:26pm
10/16/93	false alarm	9:01am	9:12am
10/18/93	false alarm	7:33am	8:00am
10/18/93	false alarm	7:40am	8:00am
10/19/93	false alarm	8:49am	9:02am
10/21/93	false alarm	1:19pm	1:26pm
10/21/93	investigation	4:55pm	5:14pm
10/24/93	false alarm	9:00pm	9:09pm
10/25/93	false alarm	7:33am	7:45am
10/25/93	false alarm	12:30am	12:32am
10/26/93	fire	4:01pm	5:25pm
10/27/93	false alarm	7:33am	7:50am
10/31/93	false alarm	8:55am	10:40am
11/2/93	haz/mat	12:31pm	12:42pm
11/3/93	fire	11:55am	12:25pm
11/3/93	false alarm	2:33pm	2:44pm
11/7/93	false alarm	8:17am	11:15pm
11/7/93	false alarm	12:58am	2:00am
11/8/93	false alarm	3:50pm	3:56pm
11/8/93	false alarm	11:43pm	1:48am
11/10/93	false alarm	11:10am	12:25pm
11/10/93	investigation	12:44pm	1:42pm
11/10/93	medical assist	12:53pm	1:15pm
11/13/93	false alarm	5:10am	5:30am
11/13/93	false alarm	2:15pm	*
11/15/93	false alarm	9:48am	9:58am
11/20/93	false alarm	9:03am	9:30am
11/26/93	false alarm	2:00am	*
11/26/93	false alarm	12:30pm	1:45pm
11/26/93	false alarm	9:30am	*
11/26/93	false alarm	11:00pm	12:30am
11/27/93	false alarm	10:21am	10:31am
11/27/93	false alarm	3:24pm	3:28pm
11/30/93	false alarm	9:40am	9:55am
12/5/93	false alarm	11:49pm	12:00am
12/8/93	investigation	7:25am	7:35am
12/8/93	false alarm	12:44am	12:54am
12/8/93	false alarm	9:59pm	10:06pm
12/10/93	false alarm	2:05pm	2:17pm
12/11/93	false alarm	6:23am	6:33am
12/11/93	false alarm	4:15pm	4:30pm
12/12/93	investigation	5:00pm	5:30pm
12/13/93	false alarm	7:18am	10:45am
12/15/93	false alarm	2:26pm	2:50pm
12/17/93	medical assist	6:34am	6:59am

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DATE	TYPE OF INCIDENT	ARRIVAL TIME TO SCENE	ARRIVAL TIME BACK TO DEPT.
12/20/93	medical assist	12:07pm	4:10pm
12/24/93	false alarm	3:25am	4:05am
12/26/93	false alarm	3:55am	5:30am
12/27/93	fire	1:30am	2:50am
12/30/93	false alarm	12:19am	12:32am
		Total number of calls is 212	
FALSE ALARM	MEDICAL ASSIST	HAZ/MAT	FIRE
160	19	16	17
75.50%	9.00%	7.50%	8.00%
	*time in log book was not documented		

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DATE	TYPE OF INCIDENT	ARRIVAL TIME TO SCENE	ARRIVAL TIME BACK TO DEPT.
1/5/94	false alarm	10:12am	10:20am
1/6/94	medical assist	8:10am	8:28am
1/9/94	false alarm	8:08am	8:43am
1/9/94	false alarm	11:08am	11:47am
1/14/94	false alarm	9:02am	10:00am
1/17/94	investigation	12:05pm	3:25pm
1/18/94	investigation	6:41am	6:53am
1/19/94	investigation	1:02pm	2:30am
1/19/94	false alarm	10:53am	11:07am
1/20/94	fire	2:38pm	3:01pm
1/20/94	false alarm	7:49pm	10:02pm
1/25/94	medical assist	9:30am	2:15pm
1/26/94	investigation	4:49pm	6:15pm
1/26/94	investigation	11:35pm	11:50pm
1/27/94	investigation	2:30pm	7:15pm
1/27/94	investigation	9:58am	10:06am
1/28/94	false alarm	10:10am	10:19pm
2/1/94	false alarm	11:09am	11:45am
2/1/94	investigation	4:25pm	4:33pm
2/1/94	false alarm	9:23pm	9:28pm
2/6/94	false alarm	8:44pm	8:51pm
2/7/94	false alarm	3:10pm	3:25pm
2/7/94	false alarm	5:48pm	6:00pm
2/8/94	fire	2:00pm	*
2/10/94	fire	3:05pm	4:50pm
2/13/94	investigation	2:55pm	3:28pm
2/14/94	medical assist	11:00am	*
2/16/94	fire	9:20am	1:25pm
2/16/94	false alarm	1:35pm	2:15pm
2/17/94	false alarm	4:35pm	5:05pm
2/18/94	investigation	5:50am	6:30am
2/19/94	investigation	12:29pm	12:57pm
2/22/94	false alarm	1:03pm	1:20pm
2/23/94	false alarm	6:06pm	6:20pm
2/24/94	false alarm	1:00pm	1:29pm
2/25/94	haz/mat	10:30am	11:18am
2/25/94	false alarm	2:46pm	2:53pm
2/28/94	investigation	7:15am	8:10am
3/2/94	false alarm	1:43pm	1:50am
3/4/94	investigation	8:03am	8:30am
3/5/94	false alarm	8:07pm	8:32pm
3/10/94	false alarm	6:07am	6:13am
3/14/94	investigation	2:25pm	2:50pm
3/16/94	investigation	2:25pm	2:50pm
3/21/94	false alarm	3:18pm	3:36pm
3/21/94	false alarm	4:25pm	4:37pmn
3/23/94	false alarm	8:41am	8:45am
3/24/94	false alarm	11:01pm	12:00pm
3/27/94	false alarm	12:33am	1:33am
3/29/94	false alarm	5:36am	5:44am
3/31/94	investigation	2:50pm	2:50pm
3/31/94	haz/mat	2:55pm	3:35pm

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DATE	TYPE OF INCIDENT	ARRIVAL TIME TO SCENE	ARRIVAL TIME BACK TO DEPT.
4/3/94	fire	3:00pm	3:52pm
4/4/94	investigation	12:15am	1:05am
4/4/94	investigation	10:43pm	11:10pm
4/5/94	investigation	8:09am	8:16am
4/5/94	false alarm	3:56pm	4:13pm
4/6/94	investigation	8:28am	8:37am
4/7/94	investigation	7:53am	8:50am
4/7/94	false alarm	7:23am	7:32am
4/9/94	investigation	7:56am	10:00am
4/9/94	investigation	7:46am	7:55am
4/11/94	investigation	2:07pm	2:15pm
4/12/94	false alarm	1:50pm	2:10pm
4/18/94	false alarm	10:47am	11:09am
4/18/94	medical assist	3:10pm	5:44pm
4/19/94	investigation	7:19am	7:40am
4/20/94	medical assist	5:03pm	6:37pm
4/20/94	medical assist	5:40pm	9:35pm
4/20/94	medical assist	6:24pm	9:10pm
4/24/94	investigation	12:01am	12:17am
4/24/94	investigation	6:37pm	6:45pm
4/26/94	false alarm	4:02pm	4:11pm
4/28/94	investigation	10:22am	10:35am
4/28/94	investigation	8:40pm	10:30pm
4/28/94	investigation	10:00pm	10:43pm
5/1/94	fire	3:08am	3:21am
5/1/94	investigation	9:45pm	*
5/5/94	false alarm	12:19am	12:54am
5/5/94	false alarm	8:24pm	8:53pm
5/5/94	investigation	11:22pm	11:40pm
5/6/94	investigation	12:26am	12:58am
5/11/94	fire	5:00pm	*
5/12/94	investigation	8:10pm	*
5/13/94	medical assist	5:46pm	5:56pm
5/13/94	fire	5:42am	6:10am
5/15/94	investigation	2:38pm	3:20pm
5/16/94	fire	10:40pm	*
5/22/94	investigation	12:45pm	1:20pm
5/24/94	investigation	8:51pm	9:00pm
5/28/94	investigation	5:10pm	5:35pm
5/30/94	investigation	9:23am	9:20am
5/31/94	investigation	4:35am	5:30am
6/1/94	fire	2:21pm	2:48pm
6/2/94	investigation	1:36pm	1:56pm
6/9/94	false alarm	12:53am	1:15am
6/12/94	investigation	8:55am	9:35am
6/13/94	false alarm	9:10am	9:25am
6/13/94	fire	3:10pm	6:40pm
6/13/94	investigation	4:15pm	5:05pm
6/16/94	medical assist	10:49am	11:12am
6/16/94	investigation	9:20am	10:45am
6/19/94	false alarm	1:33pm	2:10pm
6/20/94	fire	10:05am	*

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DATE	TYPE OF INCIDENT	ARRIVAL TIME TO SCENE	ARRIVAL TIME BACK TO DEPT.
6/21/94	fire	8:30am	9:00am
6/22/94	false alarm	5:06pm	5:22pm
6/23/94	fire	5:50pm	8:05pm
6/23/94	false alarm	9:02am	9:15am
6/24/94	false alarm	8:05am	8:15am
6/24/94	false alarm	4:43pm	4:48pm
6/24/94	false alarm	7:04pm	7:23pm
6/24/94	investigation	7:45pm	9:40pm
6/27/94	investigation	3:50pm	4:22pm
6/29/94	false alarm	3:15pm	3:25pm
6/29/94	medical assist	7:43pm	8:18pm
7/1/94	false alarm	6:19am	6:30am
7/7/94	false alarm	9:20am	9:42am
7/7/94	false alarm	2:50pm	3:05pm
7/8/94	false alarm	8:32pm	8:45pm
7/11/94	false alarm	9:37am	2:20pm
7/13/94	fire/vehicle	1:45pm	*
7/13/94	wildland fire	3:28pm	6:00pm
7/16/94	false alarm	9:55am	10:35am
7/16/94	false alarm	4:47pm	5:12pm
7/17/94	false alarm	12:40pm	12:50pm
7/17/94	false alarm	4:05pm	5:20pm
7/17/94	false alarm	4:16pm	5:20pm
7/17/94	false alarm	2:50pm	4:30pm
7/17/94	false alarm	5:52pm	6:38pm
7/18/94	false alarm	2:29pm	4:13pm
7/18/94	false alarm	3:01am	3:11am
7/19/94	medical assist	12:02am	12:40am
7/19/94	false alarm	6:43pm	6:55pm
7/19/94	false alarm	9:13pm	9:36pm
7/20/94	false alarm	1:42pm	3:00pm
7/20/94	false alarm	6:22pm	6:32pm
7/20/94	fire	*	*
7/21/94	false alarm	4:12pm	4:30pm
7/27/94	investigation	5:20pm	5:50pm
7/28/94	investigation	11:51am	12:26pm
7/28/94	false alarm	6:56pm	7:08pm
7/29/94	false alarm	4:32pm	4:43pm
7/31/94	false alarm	5:43pm	5:49pm
8/2/94	false alarm	1:48pm	2:07pm
8/3/94	false alarm	3:14am	3:22am
8/4/94	false alarm	8:52am	8:59am
8/4/94	false alarm	4:18pm	4:31pm
8/5/94	investigation	5:17pm	5:19pm
8/6/94	investigation	10:55pm	11:10pm
8/8/94	investigation	2:10pm	2:35pm
8/9/94	fire	10:18pm	8:34pm
8/13/94	investigation	2:56pm	3:05pm
8/13/94	investigation	3:14pm	3:40pm
8/14/94	investigation	11:16am	11:35am
8/15/94	false alarm	4:19pm	4:25pm
8/16/94	investigation	10:34am	11:07am

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DATE	TYPE OF INCIDENT	ARRIVAL TIME TO SCENE	ARRIVAL TIME BACK TO DEPT.
8/17/94	investigation	4:52am	5:02am
8/17/94	investigation	3:52pm	3:57pm
8/18/94	medical assist	6:47am	7:20am
8/19/94	fire	1:42am	2:30am
8/20/94	investigation	4:47pm	4:55pm
8/20/94	investigation	12:30pm	2:35pm
8/22/94	investigation	9:20am	9:45am
8/22/94	investigation	3:20pm	3:30pm
8/22/94	medical assist	4:53pm	5:05pm
8/22/94	investigation	5:37pm	5:40pm
8/22/94	investigation	8:57pm	9:02pm
8/23/94	fire	4:59pm	5:45pm
8/25/94	fire	1:19pm	1:40pm
8/27/94	investigation	10:01am	10:13am
8/29/94	false alarm	1:08am	1:26am
8/30/94	medical assist	8:28pm	8:41pm
9/1/94	investigation	3:40pm	4:45pm
9/4/94	fire	4:20pm	4:55pm
9/10/94	investigation	3:52pm	4:06pm
9/13/94	false alarm	4:15am	4:24am
9/15/94	haz/mat	2:24pm	3:00pm
9/17/94	false alarm	10:00pm	10:35pm
9/19/94	false alarm	10:57am	11:30am
9/20/94	fire	11:47am	12:15pm
9/21/94	false alarm	3:18am	3:26am
9/21/94	false alarm	7:03am	7:08am
9/21/94	false alarm	2:24pm	3:52pm
9/22/94	investigation	7:35am	7:50am
9/26/94	haz/mat	12:41pm	2:05pm
9/26/94	false alarm	8:56am	9:13am
9/28/94	medical assist	10:37am	10:44am
10/5/94	false alarm	7:48pm	7:58pm
10/6/94	false alarm	8:45pm	8:53pm
10/7/94	investigation	11:59pm	12:33am
10/9/94	investigation	12:51am	3:27am
10/10/94	false alarm	2:49am	2:59am
10/10/94	false alarm	1:32pm	1:41pm
10/11/94	fire	9:20am	9:30am
10/12/94	false alarm	9:20am	9:35am
10/12/94	fire	6:58am	7:05am
10/13/94	false alarm	1:12am	1:26am
10/14/94	false alarm	4:16pm	5:20pm
10/15/94	false alarm	8:30pm	8:48pm
10/15/94	false alarm	7:33am	8:12am
10/15/94	false alarm	11:29am	11:55am
10/17/94	investigation	5:48am	6:25am
10/20/94	haz/mat	9:15am	2:08pm
10/26/94	false alarm	7:19pm	7:51am
10/26/94	medical assist	9:05pm	9:15pm
10/27/94	medical assist	9:05pm	9:15pm
10/27/94	investigation	7:17pm	7:51pm
10/29/94	false alarm	3:50pm	5:09pm

1994

DATE	TYPE OF INCIDENT	ARRIVAL TIME TO SCENE	ARRIVAL TIME BACK TO DEPT.
10/30/94	false alarm	8:58pm	9:19pm
10/31/94	false alarm	3:31am	3:43am
10/31/94	false alarm	1:09pm	1:27pm
10/31/94	false alarm	4:15pm	4:26pm
11/2/94	false alarm	9:15pm	9:30pm
11/2/94	fire	2:25pm	4:43pm
11/3/94	false alarm	5:18am	6:03am
11/3/94	false alarm	12:20am	12:28am
11/3/94	false alarm	1:35am	1:45am
11/3/94	false alarm	10:35am	11:00am
11/7/94	false alarm	7:02am	7:35am
11/10/94	investigation	9:00am	2:55pm
11/25/94	false alarm	12:13pm	12:52pm
11/27/94	false alarm	3:54am	5:18am
11/28/94	false alarm	11:42am	12:06pm
11/29/94	investigation	3:30pm	*
11/30/94	fire	8:30am	10:28am
12/6/94	false alarm	7:55am	8:05am
12/8/94	false alarm	7:20am	8:50am
12/9/94	false alarm	7:53pm	8:13pm
12/12/94	medical assist	3:05pm	9:45pm
12/13/94	false alarm	7:39am	7 53am
12/14/94	investigation	9:23am	9:45am
12/14/94	haz/mat	10:01am	12:03pm
12/15/94	investigation	8:37am	8:55am
12/17/94	false alarm	5:06pm	5:20pm
12/18/94	false alarm	9:49pm	10:05pm
12/19/94	false alarm	4:45am	5:05am
12/21/94	false alarm	7:54pm	10:02pm
12/22/94	false alarm	6:30pm	6:48pm
12/27/94	investigation	8:50am	9:25am
12/28/94	investigation	9:55am	10:25am
		Total number of calls is 240	
FALSE ALARM	MEDICAL ASSIST	HAZ/MAT	FIRE
189	18	7	26
78.80%	7.50%	2.90%	10.80%
	*time in log book was not documented		

1995

DATE	TYPE OF INCIDENT	ARRIVAL TIME TO SCENE	ARRIVAL TIME BACK TO DEPT.
1/2/95	false alarm	2:18am	2:30am
1/2/95	false alarm	8:08am	10:26am
1/5/95	false alarm	5:52pm	5:57pm
1/5/95	fire	9:57am	10:12am
1/6/95	false alarm	10:07pm	10:22pm
1/11/95	haz/mat	8:07am	8:15am
1/12/95	false alarm	10:19am	10:40am
1/12/95	fire	4:33pm	5:30pm
1/15/95	investigation	2:00pm	2:35pm
1/17/95	fire	9:30am	9:49am
1/17/95	fire	1:46pm	2:00pm
1/17/95	false alarm	2:13am	2:24am
1/18/95	false alarm	9:55am	10:07am
1/18/95	false alarm	12:32pm	12:45pm
1/22/95	false alarm	8:57pm	9:06pm
1/23/95	false alarm	9:05am	9:30am
1/24/95	false alarm	7:30am	7:57am
1/25/95	false alarm	4:28am	4:50am
1/25/95	false alarm	5:37am	6:04am
1/25/95	false alarm	6:54am	7:10am
1/25/95	false alarm	8:55am	9:00am
1/25/95	false alarm	10:13am	10:22am
1/26/95	false alarm	10:15am	11:20am
2/6/95	haz/mat	5:55am	6:20am
2/6/95	false alarm	7:25pm	8:03pm
2/10/95	false alarm	12:59pm	1:27pm
2/14/95	false alarm	6:43am	7:20am
2/14/95	false alarm	2:14pm	3:10pm
2/17/95	false alarm	4:01pm	5:08pm
2/25/95	false alarm	1:10pm	1:42pm
2/26/95	false alarm	4:30pm	5:15pm
3/1/95	fire	9:30am	10:12am
3/5/95	fire	6:35pm	8:20pm
3/7/95	false alarm	2:37am	3:39am
3/6/95	false alarm	9:56am	10:10am
3/10/95	false alarm	8:45am	8:49am
3/10/95	false alarm	3:40am	4:38am
3/11/95	medical assist	6:26am	9:10am
3/14/95	false alarm	11:35am	11:45am
3/15/95	medical assist	2:02pm	2:45pm
3/16/95	medical assist	1:34pm	2:15pm
3/19/95	false alarm	6:26pm	8:10pm
3/20/95	false alarm	3:20pm	3:28pm
3/22/95	investigation	3:10pm	3:22pm
3/23/95	medical assist	2:05pm	3:05pm
3/23/95	medical assist	4:45pm	5:03pm
3/24/95	investigation	2:20pm	2:45pm
3/25/95	fire	3:55pm	4:26pm
3/25/95	medical assist	7:10am	7:23am
3/26/95	medical assist	1:07am	1:53am
3/27/95	investigation	3:30pm	4:00pm
3/27/95	investigation	10:38pm	10:46pm

1995

DATE	TYPE OF INCIDENT	ARRIVAL TIME TO SCENE	ARRIVAL TIME BACK TO DEPT.
3/28/95	medical assist	9:50am	10:07am
4/2/95	false alarm	1:55pm	2:06pm
4/3/95	false alarm	4:35pm	4:45pm
4/6/95	fire	2:43pm	3:15pm
4/8/95	medical assist	6:15pm	6:16pm
4/10/95	false alarm	3:53pm	4:05pm
4/10/95	false alarm	6:47pm	7:02pm
4/12/95	fire	1:33pm	1:38pm
4/12/95	fire	4:00pm	6:15pm
4/13/95	haz/mat	2:53pm	2:54pm
4/14/95	investigation	12:09am	2:14am
4/15/95	medical assist	11:55am	12:50pm
4/15/95	medical assist	12:05pm	12:18pm
4/16/95	false alarm	10:26am	11:45am
4/17/95	false alarm	5:15pm	5:35pm
4/17/95	investigation	10:39am	10:58am
4/22/95	investigation	8:00am	9:50am
4/22/95	investigation	1:28pm	2:28pm
4/22/95	false alarm	7:46pm	7:56pm
5/1/95	medical assist	4:51am	6:35am
5/1/95	false alarm	9:08pm	10:10pm
5/9/95	false alarm	7:59am	8:15am
5/9/95	fire	1:23pm	2:42pm
5/9/95	false alarm	1:32pm	1:59pm
5/11/95	investigation	1:30am	1:46am
5/13/95	false alarm	4:52am	5:05am
5/23/95	investigation	11:26am	12:00pm
5/24/95	false alarm	3:37pm	4:01pm
5/24/95	false alarm	5:00am	6:03am
5/24/95	false alarm	12:05pm	12:25pm
5/24/95	false alarm	1:39pm	2:35pm
6/2/95	false alarm	1:16pm	1:42pm
6/10/95	false alarm	1:51pm	2:15pm
6/10/95	false alarm	12:42am	12:53am
6/10/95	false alarm	1:16am	1:31am
6/10/95	false alarm	1:54pm	2:12pm
6/10/95	haz/mat	4:20pm	4:25pm
6/10/95	false alarm	5:45pm	6:25pm
6/13/95	investigation	11:50am	12:03pm
6/13/95	fire	11:15am	2:00pm
6/15/95	false alarm	10:22am	10:45am
6/20/95	medical assist	11:19pm	12:50am
6/21/95	false alarm	1:33pm	1:50pm
6/21/95	fire	4:17pm	5:25pm
6/21/95	false alarm	11:55pm	12:10am
6/23/95	fire	6:53am	8:00am
6/26/95	investigation	12:16pm	12:35pm
6/29/95	fire	12:27pm	12:36pm
6/29/95	false alarm	5:26pm	6:40pm
7/8/95	fire	7:33am	8:05pm
7/10/95	medical assist	9:36am	11:06am
7/14/95	false alarm	10:47pm	10:57pm

1995

DATE	TYPE OF INCIDENT	ARRIVAL TIME TO SCENE	ARRIVAL TIME BACK TO DEPT.
7/20/95	medical assist	3:40pm	4:12pm
7/31/95	haz/mat	12:15pm	12:29pm
7/31/95	investigation	9:48pm	10:03pm
8/8/95	medical assist	2:08am	3:22am
8/9/95	false alarm	3:41pm	4:00pm
8/13/95	medical assist	5:35pm	9:00pm
8/14/95	medical assist	10:41am	11:00am
8/16/95	haz/mat	9:07am	9:17am
8/19/95	false alarm	9:07am	9:15am
8/20/95	investigation	11:12am	12:00pm
8/20/95	investigation	12:00pm	1:53pm
8/20/95	investigation	12:43pm	1:25pm
8/20/95	false alarm	2:22pm	3:55pm
8/21/95	false alarm	12:13pm	1:15pm
8/22/95	false alarm	6:30pm	10:15pm
8/22/95	false alarm	6:10am	7:43am
8/22/95	fire	7:30pm	8:00pm
8/23/95	false alarm	3:23am	3:45am
8/23/95	fire	3:55pm	6:30pm(8/24)
8/28/95	false alarm	1:26am	1:37am
8/28/95	false alarm	10:27pm	10:36pm
8/28/95	medical assist	8:18am	8:28am
8/29/95	fire	10:08pm	11:30pm
8/30/95	false alarm	6:33pm	6:39pm
9/6/95	fire	7:15pm	8:10pm
9/6/95	investigation	6:21pm	6:30pm
9/8/95	fire	1:52pm	2:07pm
9/10/95	false alarm	7:41am	9:00am
9/10/95	false alarm	9:19pm	9:27pm
9/11/95	fire	9:40am	9:47am
9/11/95	investigation	9:47am	10:00am
9/11/95	medical assist	9:50am	10:02am
9/11/95	investigation	12:10pm	12:20pm
9/17/95	false alarm	11:26am	12:27pm
9/18/95	false alarm	6:29am	6:42am
9/22/95	false alarm	11:53pm	12:05am
9/22/95	false alarm	10:49am	11:25am
9/29/95	medical assist	1:10pm	1:40pm
10/3/95	investigation	8:52am	9:44am
10/4/95	fire	9:40am	10:15pm
10/4/95	false alarm	6:54pm	8:59pm
10/6/95	haz/mat	2:33pm	3:11pm
10/7/95	false alarm	2:14am	2:28am
10/11/95	false alarm	6:07pm	6:12pm
10/11/95	false alarm	9:30am	10:32am
10/14/95	false alarm	2:14am	2:32am
10/17/95	medical assist	12:13pm	2:00pm
10/19/95	investigation	2:06pm	2:55pm
10/22/95	false alarm	12:38am	12:50am
11/1/95	false alarm	8:59am	9:26am
11/3/95	medical assist	6:36am	9:15am
11/6/95	medical assist	11:05pm	11:19pm

1995

DATE	TYPE OF INCIDENT	ARRIVAL TIME TO SCENE	ARRIVAL TIME BACK TO DEPT.
11/13/95	fire	4:17pm	5:00pm
11/13/95	false alarm	1:40pm	2:20pm
11/14/95	false alarm	10:12pm	11:10pm
11/15/95	false alarm	6:56am	7:35am
11/20/95	investigation	1:40pm	2:20pm
11/25/95	false alarm	5:40pm	5:50pm
11/27/95	investigation	9:30am	9:41am
11/28/95	investigation	10:36pm	10:51pm
11/30/95	false alarm	8:38am	9:10pm
12/4/95	investigation	3:29pm	3:35pm
12/6/95	investigation	4:49pm	6:30pm
12/9/95	fire	4:59pm	6:30pm
12/16/95	false alarm	1:30am	2:15am
12/16/95	false alarm	11:37pm	12:25am
12/17/95	investigation	4:14am	4:24am
12/26/95	false alarm	2:38pm	2:50pm
12/26/95	fire	4:57pm	5:10pm
12/27/95	fire	3:16pm	3:34pm
12/28/95	false alarm	4:45pm	5:30pm
Total number of calls is 175			
FALSE ALARM	MEDICAL ASSIST	HAZMAT	FIRE
117	24	7	27
66.90%	13.70%	4.00%	15.40%
*time in log book was not documented			

APPENDIX E

LIST OF QUESTIONS

Questions Used for Interviews

100% of incumbent firefighters(excluding chiefs and assistant chiefs) answered these questions.

1. What are the most important physical tasks that you do on a (vehicle extrication/medical assist, Structural/vehicle fire, wildland fire and Hazardous materials) call?

2. What gear is worn at the emergency?

3. What are the pieces of equipment used, which are the most physically demanding on that particular call?

4. How many firefighters use the various pieces of equipment(mentioned in question 3)?

5. What is the duration these pieces of equipment(see question 3) used (total time)? and time per tool?

6. How far is the equipment identified in question 3 carried to scene of an emergency? And how many people carry this piece of equipment?

7. What is the percentage of calls the pieces of equipment in question 3, are used on an actual call?

8. Is this equipment mentioned in question 3, used on any other type of emergency?

APPENDIX F

TASK ANALYSIS

Responses to Interview Questions

Initials	EB	DD	DD	IK	JS	CC	RW	DL	CB	MK	KF	CT	TA
Job Position*	Eng	F/F	F/F	F/F	Eng	Capt	Eng	AC	Eng	F/F	Eng	AC	F/F
Years at Test Site/ Total Years as F/F	14/34	6\31	5\26	9\43	20/24	18/43	11\27	20/30	17\27	8\12	13/33	20/24	8\29
1. ***Vehicle Extication/Medical Assist*** (Full Gear)													
'Phoenix tool- time per tool(min)/ use total(min)	4/ 18	5/ 13	5\ 10	13/ 25	3/ 8	5/ 18	5\ 20	5/ 13	5\ 35	2/ 8	5\ 15	5\ 15	4\ 15
distance carry tool(ft)/ % of calls used(avg)	113/ 50	45/ 25	100/ 90	50/ 50	83/ 50	25/**	38/ **	28/ 78	25/ 25	20/ 5	35/ 25	100/ 30	63/ 50
Generator/Hydrolic Power Unit													
distance carry(ft)./ % calls used(avg)	113/ 50	45/ 25	100/ 90	50/ 50	83/ 50	25/**	38/ **	28/ 78	25/ 25	20/ 5	35/ 25	100/ 30	63/ 50
Carry Individual to Backboard, Gurney or Ambulance													
distance carry/ # of People help carry(avg)	60/ 3	45/ 3	35/ 4	50/ 4	83/ 4	25/ 4	38/ 4	28/ 4	25/ 2	20/ 4	35/ 3	100/ 4	63/ 4
weight of patient(lbs)./ % of calls used(avg)	175/ 85	160/ 90	175/ 90	250/ 85	150/ 85	200/ **	175/ **	200/ 100	200/ 100	200/ 50	150/ 100	165/ 50	218/ 100
'C-Spine -hold head(avg-min)/ % done(avg)	33/ 85	30/ 95	30/ 95	18/ 85	20/ 80	25/ **	30/**	30/ 100	35/ 88	30/**	25/ 90	30/ 100	8/ 100
2. ***Structural/Vehicle Fire(Full Gear w/SCBA 100%)***-Hand Lines													
1 3/4" line- distance carry(avg-ft)/ % time used	200/ 100	200/ 100	125/ 100	175/ 100	200/ 100	200/ 100	200/ **	150/ 100	200/ 25	200/ 5	200/ 100	300/ 100	175/ 100
2 1/2" line- distance carry(avg-ft)/ % time used	175/ 100	200/ 100	240/ 100	200/ 100	200/ 100	175/ 90	20/**	200/ 100	300/ 100	200/ 100	200/ 100	175/ 90	200/ 90
3" line- distance carry (ft)/ % of time used	50/ 100	175/ 100	50/ 100	100/ 90	100/ 90	200/ 100	20/ **	175/ 75	200/ 90	50/ 100	200/ 100	50/ 100	200/ 75
Ventilate Bldg - using exhaust fan %	50	50	75	35	45	60	50	60	40	50	55	50	25
24ft Ladder - distance carry(ft)/ # of people	45/ 2	100/ 2	75/ 2	50/ 2	50/ 2	75/ 2	50/ 2	100/ 2	50/ 2	50/ 2	50/ 2	100/ 2	50/ 2
% (avg)	100	80%	100	55%	75%	75%	100	75%	25%	50%	25%	50%	75%
3. ***Wildland Fire***- Walking-distance(avg-mile)/ % used	1\ 50	2/ 100	2/ 100	2/ 100	2/ 90	2/ 100	75/ 100	5/ 100	5/ 100	1/ 100	4/ 100	2/ 100	2/ 100
terrain walk(avg-degrees)/ total time(avg-hrs)	48/ 8	48/ 12	48/ 9	45/ 6	45/ 12	45/ 8	48/ 16	45/ 8	45/ 12	45/ 20	45/ 16	45/ 15	45/ 2
Bladder Bags													
distance carry(mile)/ % used	1\ 50	2/ 100	2/ 100	2\ 90	1 5/ 90	2/ **	2\ 5	2/ 100	1\ 50	1\ 70	4\ 25	2/ 100	2\ 80
time of work(avg-min)	13	45	30	75	30	60	60	30	60	40	60	75	90
Use of Shovel													
hard work done (avg-min)/ % used	13/ 50	20/ 100	10/ 100	300/ 90	10\ 90	40/ 100	20/ 100	15/ 100	25/ 100	40/ 50	100/ 100	100/ 100	20/ 100
4. ***Haz/Mat***-Wearing Suit													
Level A(hardest) but any level ABC -time in suit (avg-min)	30	20	30	15	13	30	30	30	40	18	45	25	30
distance walk(avg-ft)/ % used (avg)	1000/ 10	400/ 8	500/ 100	1000/ 40	300/ 25	1500/ 10	**/**	1000/ 100	300/ 100	50/ 5	1000/ 10	300/ 20	200/ 25
*Eng-Engineer, F/F-Fire Fighter, Capt.-Captain	**- Did not know (to variable)												
AC-Asst. Chief, FPS-Fire Fighter in Fire Protection Systems													page 1

Initials	JM	RH	RH	TC	JG	RO	KW	BH	JS	CH	HD	JP	DY	CB
Job Position*	F/F	Eng	Capt	Capt	AC	F/F	Eng	F/F	Eng	F/F	Eng	FPS	FPS	FPS
Years at Test Site/ Total Years as F/F	6\12	24/29	20/40	26/ 31	17/21	5\17	10\18	5\9	13/36	5\9	16/20	9\31	6\35	5\12
1. ***Vehicle Extication/Medical Assist*** (Full Gear)														
Phoenix tool- time per tool(min)/ use total(min)	8/ 15	2\ 10	5\ 20	5\ 20	8/ 18	10/ 23	5\ 20	2\ 20	5\ 15	5\ 15	5\ 10	5\ 10	5\ 20	5\18
distance carry tool(ft)/ % of calls used(avg)	30/ 10	38/ 75	28/ 40	28/ 10	20/ 25	43/ 50	150/ 40	330/ 25	100 /50	25/ 25	50/ 20	30/ 35	105 /20	83/ 75
Generator/Hydrolic Power Unit														
distance carry(ft)./ % calls used(avg)	30/ 10	38/ 75	28/ 40	28/ 10	20/ 25	43/ 50	150/ 40	330/ 25	100 /50	25/ 25	50/ 20	30/ 35	105 /20	83/ 75
Carry Individual to Backboard, Gurney or Ambulance														
distance carry/ # of People help carry(avg)	30/ 4	38/ 4	50/ 4	28/ 4	20/ 4	30/ 4	150/ 3	110/ 4	75/ 4	10\4	50/ 4	35/ 4	105/ 4	35/ 4
weight of patient(lbs)./ % of calls used(avg)	175/ 100	178/ 100	200/ 100	170/ 100	175/ 100	238/ 100	250/ 60	190/ 100	200/ 100	150/ 25	180/ 90	200/ 50	200/ 100	200/ 75
C-Spine-hold head(avg-min)/ % done(avg)	15/ 100	25/ 100	30/ 100	18/ 100	20/ 100	20/ 95	20/ 100	30/ 90	25/ 100	20/ 100	30/ 85	13/ 100	35/ 100	15/ 100
2. ***Structural/Vehicle Fire(Full Gear w/SCBA 100%)***-Hand Lines														
1 3/4" line- distance carry(avg-ft)/ % time used	175/ 100	175/ 100	200/ 75	300/ 100	200/ 100	200/ 75	200/ 100	200/ 100	200/ 100	200/ 100	200/ 100	200/ 100	175/ 90	175/ 100
2 1/2" line- distance carry(avg-ft)/ % time used	175/ 100	175/ 100	200/ 75	200/ 90	200/ 100	175/ 75	300/ 100	200/ 100	500/ 100	200/ 100	300/ 100	200/ 100	200/ 90	100/ 100
3" line- distance carry (ft)/ % of time used	175/ 100	100/ 75	200/ 75	200/ 75	250/ 25	175/ 75	200/ 100	200/ 100	100/ 100	50/ 100	75/ 100	100/ 90	200/ 90	100/ 100
Ventilate Bldg.- using exhaust fan %	60	25	25	60	15	45	60	55	50	60	45	60	25	60
24ft Ladder - distance carry(ft)/ # of people	38/ 2	50/ 2	30/ 2	28/ 2	75/ 2	90/ 3	50/ 2	75/ 2	75/ 2	90/ 2	75/ 2	75/ 2	50/ 2	100/ 2
% (avg)	100	100	75%	10%	25%	75%	50%	75%	75%	90%	90%	80%	90%	90%
3. ***Wildland Fire***- Walking-distance(avg-mile)/ % used	12/ 100	1/ 100	5/ 100	1 25/ 100	4/ 100	20/ 90	5/ 100	2/ 100	5\ 90	10/ 100	3 5/ 100	3 5/ 100	2/ 100	3/ 100
Terrain walk(avg-degrees)/ total time(avg-hrs)	45/ 12	45/ 8	45/ 18	45/ 18	40/ 5	45/ 4	50/ 8	50/ 12	45/ 6	45/ 12	45/ 10	45/ 18	45/ 24	45/ 9
Bladder Bags														
distance carry(mile)/ % used	12/ 100	1/ 100	5/ 100	2\ 50	5/ 100	20/ 90	5\ 15	20/ 50	5\ 25	10/ 100	3 5/ 100	3 5/ 100	**/ 100	3/ 100
time of work(avg-min)	60	60	30	20	30	30	30	90	20	30	4	90	**	20
Use of Shovel														
hard work done (avg-min)/ % used	20/ 100	20/ 100	20/ 50	88/ 100	10/ 100	40/ 100	20/ 90	20/ 100	37/ 75	20/ 100	30/ 100	30/ 75	20/ 100	30/ 100
4. ***Haz/Mat***-Wearing Suit														
Level A(hardest) but any level ABC-time in suit (avg-mi	60	30	30	30	30	13	30	60	30	30	45	20	15	15
distance walk(avg-ft)/ % used (avg)	1050/ 75	200/ 50	75/ 100	500/ 20	125/ 5	200/ n/a	500/ 50	225/ 50	300/ 100	150/ 20	150/ 25	250/ 50	500/ 10	600/ 10

*Eng-Engineer, F/F-Fire Fighter, Capt -Captain
AC-Asst. Chief, FPS-Fire Fighter In Fire Protection Systems

APPENDIX G

THE MEANS AND STANDARD DEVIATIONS FROM THE RESPONSES OF THE 27 INDIVIDUALS INTERVIEWED WITH EACH TASK IDENTIFIED

	Pheonix tool				Generator		Carry person				C-spine		Structural fire 1 3/4 line			2 1/2 line			3 1/2 line
	time/tool	total	distance	% calls	distance	% calls	distance ft	# ppl	weight	% calls	hold head	% done	distance	% used	time takes	distance	% used	time takes	distance
	4	18	112.5	50	112.5	50	60	3	175	85	33	85	200	100	0.5	175	100	2	50
	5	13	45	25	45	25	45	3	160	95	30	95	200	100	1	200	100	2	175
	5	10	100	90	100	90	35	4	175	90	30	95	125	100	3	250	100	1	50
	13	25	50	50	50	50	50	4	250	85	18	85	175	100	1	200	100	2	100
	3	8	82.5	50	82.5	50	82.5	4	150	85	20	80	200	100	1	200	100	1	100
	5	18	25	**	25	**	25	4	200	**	25	**	200	100	1	175	90	1.5	200
	5	20	37.5	**	37.5	**	37.5	4	175	**	30	**	200	**	1	20	**	2	20
	5	13	27.5	78	27.5	78	27.5	4	165	100	30	100	150	100	3	200	100	2	175
	5	35	25	25	25	25	25	2	200	100	35	88	200	25	2	300	100	2	200
	2	8	20	5	20	5	20	4	200	50	30	**	200	5	2	200	100	2	50
	5	15	35	25	35	25	35	3	150	100	25	90	200	100	2	200	100	2	200
	5	15	100	30	100	30	100	4	165	50	30	100	300	100	2	175	90	2	50
	4	15	62.5	50	62.5	50	62.5	4	218	100	8	100	175	100	3	200	90	2	200
	8	15	30	10	30	10	30	4	175	100	15	100	175	100	0.25	175	100	1.5	175
	2	10	37.5	75	37.5	75	37.5	4	178	100	25	100	175	100	1	175	100	2	100
	5	20	27.5	40	27.5	40	50	4	200	100	30	100	200	75	1	200	75	2.5	200
	5	20	27.5	10	27.5	10	27.5	4	170	100	18	100	300	100	2	200	90	2	200
	8	18	20	25	20	25	20	4	175	100	20	100	200	100	0.5	200	100	2	250
	10	23	42.5	50	42.5	50	30	4	238	100	20	95	200	75	2	175	75	2.5	175
	5	20	150	40	150	40	150	3	250	60	20	100	200	100	2	300	100	2	200
	2	10	330	25	330	25	110	4	190	100	30	90	200	100	1	200	100	1	200
	5	15	100	50	100	50	75	4	200	100	25	100	200	100	1	500	100	2	100
	5	15	25	25	25	25	10	4	150	25	20	100	200	100	0.25	200	100	2	50
	5	10	50	20	50	20	50	4	180	90	30	85	200	100	1	300	100	2.5	75
	5	10	30	35	30	35	35	4	200	50	13	100	200	100	1	200	100	2	100
	5	20	105	20	105	20	105	4	200	100	35	100	175	90	1	200	90	1.5	200
	5	18	82.5	75	82.5	75	35	4	200	75	15	100	175	100	1	100	100	1	100
mean	5.22	16.19	65.93	39.12	65.93	39.12	50.74	3.78	188.48	85.6	24.44	95.33	197.22	91.15	1.39	208.15	96.15	1.85	136.85
median	5	15	42.5	35	42.5	35	37.5	4	180	100	25	100	200	100	1	200	100	2	175
std	2.31	5.94	63.51	22.62	63.51	22.62	33.25	0.51	27.56	21.47	7.17	6.50	34.90	23.64	0.80	80.11	7.39	0.43	67.33
		**DID NOT KNOW TO VARIABLE																	
																			page 1

3 1/2 line		Exhaust fan	Ladder use 24ft				Wildland fire				Bladder Bags			Shovel		Haz/Mat		
% used	time takes	% use	distance	# ppl	time	% used	dis walk	% done	degrees	total time	distance	% used	time work	avg min	% used	time in suit	dis walk	% used
100	2	50	45	2	3	100	1	50	48	8	1	50	13	13	50	30	1000	10
100	1	50	100	2	1	90	2	100	48	12	2	100	45	20	100	20	400	8
100	1.5	75	75	2	2	100	2	100	48	9	2	100	30	10	100	30	500	100
90	2	35	50	2	1	55	2	100	45	6	2	90	75	300	90	15	1000	40
90	2	45	50	2	3	75	1.5	90	45	12	1.5	90	30	10	90	13	300	25
100	2	60	75	2	1	75	2	100	45	8	2	**	60	40	100	30	1500	10
**	2	50	50	2	2	100	0.75	100	48	16	2	5	60	20	100	30	**	**
75	2	60	100	2	1	75	0.5	100	45	8	2	100	30	15	100	30	1000	100
90	2	40	50	2	2	25	5	100	45	12	1	50	60	25	100	40	300	100
100	2.5	50	50	2	1	50	1	100	45	20	1	70	40	40	50	18	50	5
100	2	55	50	2	1	25	4	100	45	16	4	25	60	40	100	45	1000	10
100	1	50	100	2	2	50	2	100	45	15	2	100	75	100	100	25	300	20
75	1	25	50	2	1	75	2	100	45	2	2	80	90	20	100	30	200	25
100	1.5	60	37.5	2	1	100	12	100	45	12	12	100	60	20	100	60	1050	75
75	1	25	50	2	1.5	100	1	100	45	8	1	100	60	20	100	30	200	50
75	2.5	25	30	2	2.5	75	0.5	100	45	16	0.5	100	30	20	50	30	75	100
75	1	60	27.5	2	3	10	1.25	100	45	16	2	50	20	88	100	30	500	20
25	1	15	75	2	3	25	4	100	40	5	0.5	100	30	10	100	30	125	5
75	2.5	45	90	3	2	75	20	90	45	4	20	90	30	40	100	13	200	**
100	2	60	50	2	1	50	5	100	50	8	5	15	30	20	90	30	500	50
100	0.5	55	75	2	2	75	2	100	50	12	2	50	90	20	100	60	225	50
100	2.5	50	75	2	1	75	5	90	45	6	5	25	20	30	75	30	300	100
100	1	60	90	2	2	90	10	100	45	12	10	100	30	20	100	30	150	20
100	2	45	75	2	2	90	3.5	100	45	10	3.5	100	4	30	100	45	150	25
90	2.5	60	75	2	2	80	3.5	100	45	16	3.5	100	90	30	75	20	250	50
90	1.5	25	50	2	2	90	2	100	45	24	**	100	**	25	100	15	500	10
100	2	60	100	2	2	90	3	100	45	9	3	100	20	30	100	15	600	10
89.42	1.72	47.78	64.63	2.04	1.78	71.11	3.65	97.04	45.63	11.19	3.56	76.54	45.46	39.11	91.48	29.41	475.96	40.72
100	2	50	50	2	2	75	2	100	45	12	2	95	35	20	100	30	300	25
16.69	0.59	14.50	22.26	0.19	0.71	26.21	4.23	9.93	1.96	5.06	4.29	31.49	25.00	56.15	16.51	12.35	381.80	35.04

page 2

APPENDIX H

WEIGHTS OF EQUIPMENT AND CLOTHING

Weights of Equipment and Clothing (gear) at the Nevada Test Site

The Fairbanks Morse Scale, US DOE NV ReeCo. #139639, a large industrial balance scale that sits on the ground was used. Not all of the equipment was weighed just equipment pertinent to my study.

Hydraulic Generator and accessories			97	Lbs.
Phoenix tool	Cutters/Spreaders		40	Lbs.
	Cutters		32	Lbs.
	Ram (large)		51	Lbs.
	Ram (small)		30	Lbs.
Backboard			15	Lbs.
Gurney			75	Lbs.
SCBA/accessories	30 minute tank (full of compresses air)		25	Lbs.
	60 minute tank (full of compressed air)		47	Lbs.
Bunker Gear (turnouts)				
	coat, pants, helmet, gloves, and boots (Weights vary slightly depending on size)		23	Lbs.
Wildland Gear				
	Boots, pants, no-mex pants suit, 2 canteens, fire blanket, gloves and hard hat		15	Lbs.
C-Spine(cervical collar)			1	Lbs.
Fire Hoses				
	50' uncharged	1 ¾"	19	Lbs.
	50' uncharged	2 ½"	31	Lbs.
	50' uncharged	3"	40	Lbs.
	50' charged	1 ¾"	68	Lbs.
	50' charged	2 ½"	141	Lbs.
	50' charged	3"	204	Lbs.
Exhaust fan			71	Lbs.
Bladder Bag	3 gallon (filled)		42	Lbs.
Shovel			6	Lbs.
Chain saw			23	Lbs.
Pike Pole (10ft)			6	Lbs.

Polasky (pick/ax)		6	Lbs.
Ladders			
	12ft (hooks-roof ladder)	28	Lbs.
	24ft extension	71	Lbs.
	35ft	130	Lbs.
Hydrant Pack			
	double female, double male, 5"-3"-2 1/2" span wrench hose straps, hydrant wrench	17	Lbs.
Hazardous Materials Suits			
	Level A	14	Lbs.
	Level B	8	Lbs.
	Level C	7	Lbs.

APPENDIX I

PHYSICAL CHARACTERISTICS OF NTS FIREFIGHTERS

PHYSICAL CHARACTERISTICS OF THE NTS FIREFIGHTERS

Number	Age(yrs)	Height(inches)	Weight (lbs)	BMI (wt(kg)/ht(m^2)
1	48	69	157	23.2
2	55	70	195	28
3	39	75	205	25.5
4	63	69	186	27.6
5	51	75	226	28.1
6	56	73	193	25.6
7	45	73	195	25.9
8	61	72	188	25.5
9	40	71	176	24.7
10	57	67	155	24.4
11	57	70	193	27.7
12	33	67	160	25.2
13	60	71	228	32
14	51	72	213	28.9
15	56	70	205	29.4
16	44	70	189	27.1
17	59	74	220	28.3
18	37	74	248	31.9
19	52	71	192	26.9
20	60	71	185	26
21	37	72	210	28.5
22	59	71	205	28.8
23	39	73	208	27.6
24	26	68	197	29.9
25	38	68	220	33.4
26	28	73	240	31.9
27	25	72	210	28.5
28	38	68	182	27.7
mean	46.93	71.04	199	28
median	49.5	71	196	27.7
range	25 - 63	67 - 75	155 - 248	23.2 - 33.4
std	11.54	2.28	22.72	2.48

APPENDIX J

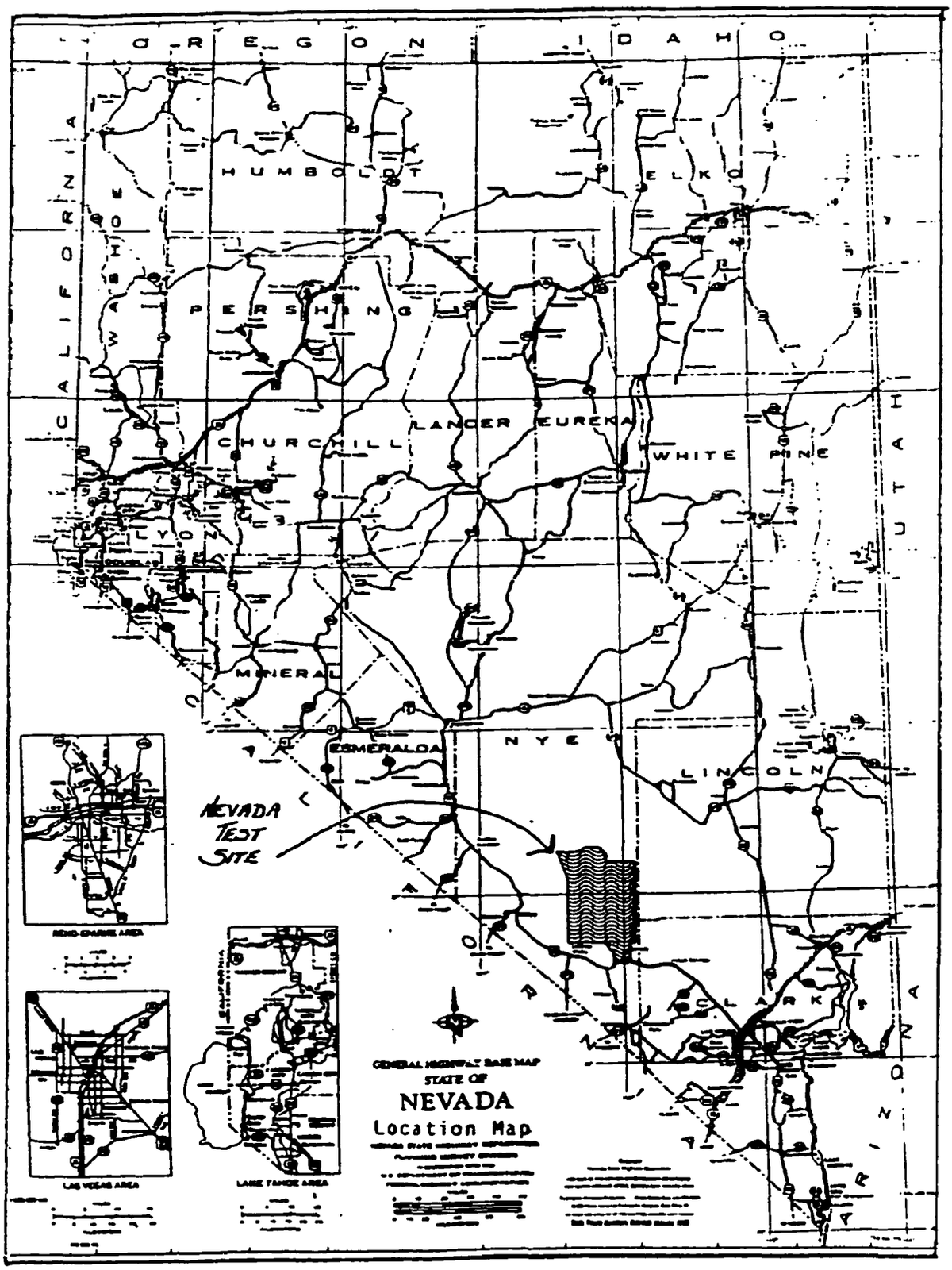
MAPS OF THE NEVADA TEST SITE

1) Location Map of the NTS

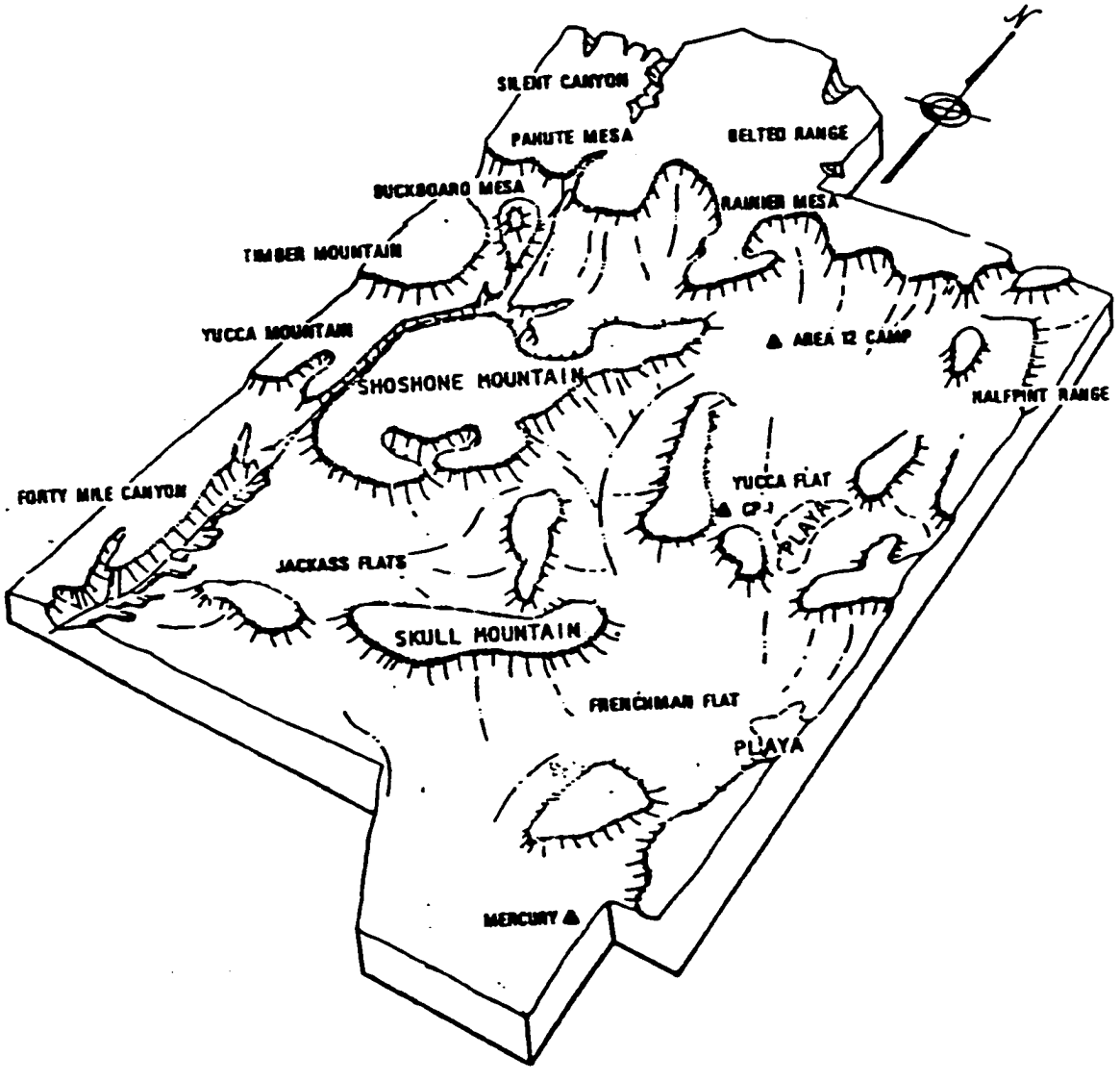
2) Topography Map of the NTS

3) Road and Facility Map of the NTS

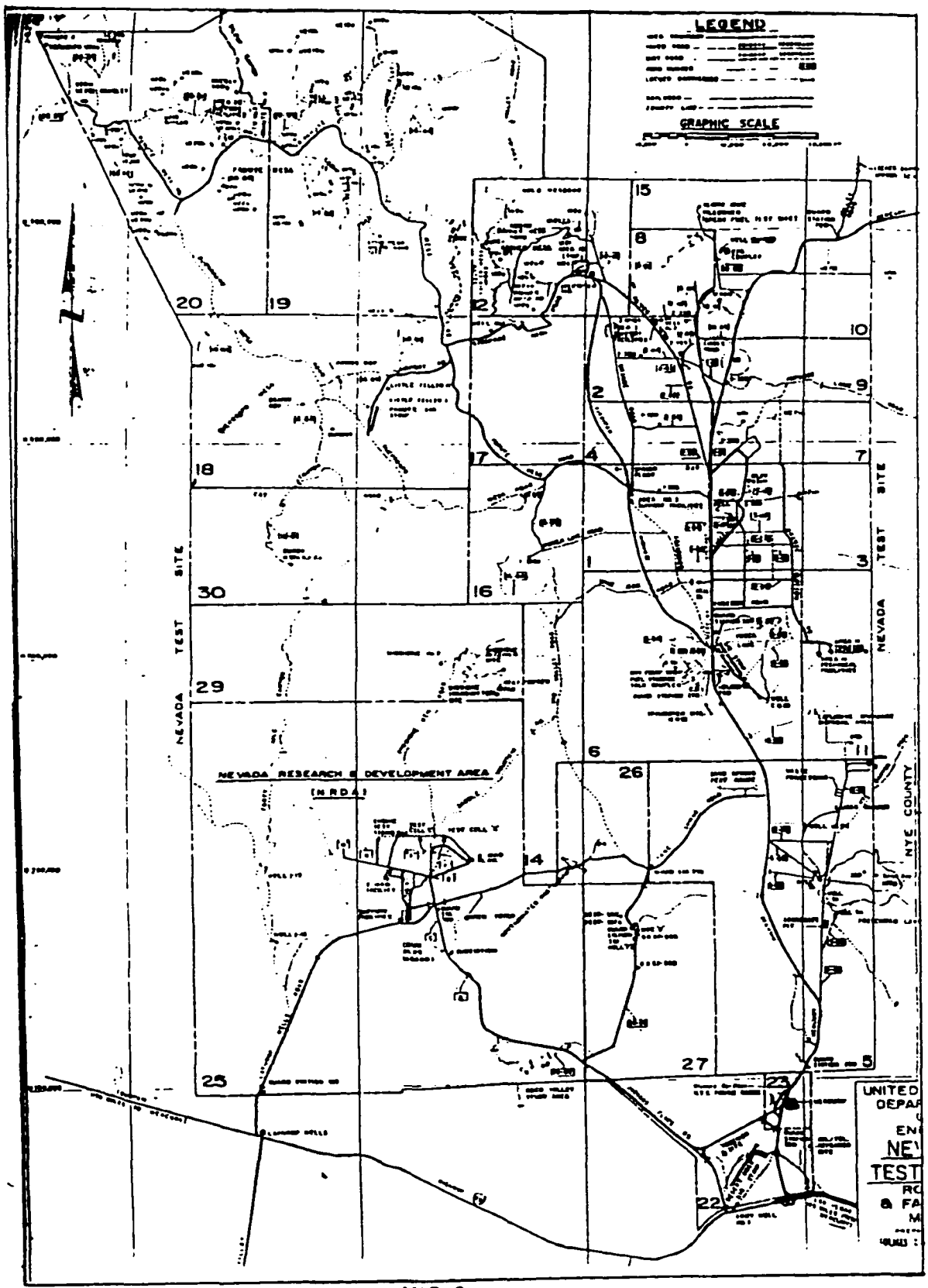
4) Descriptive Map of the NTS



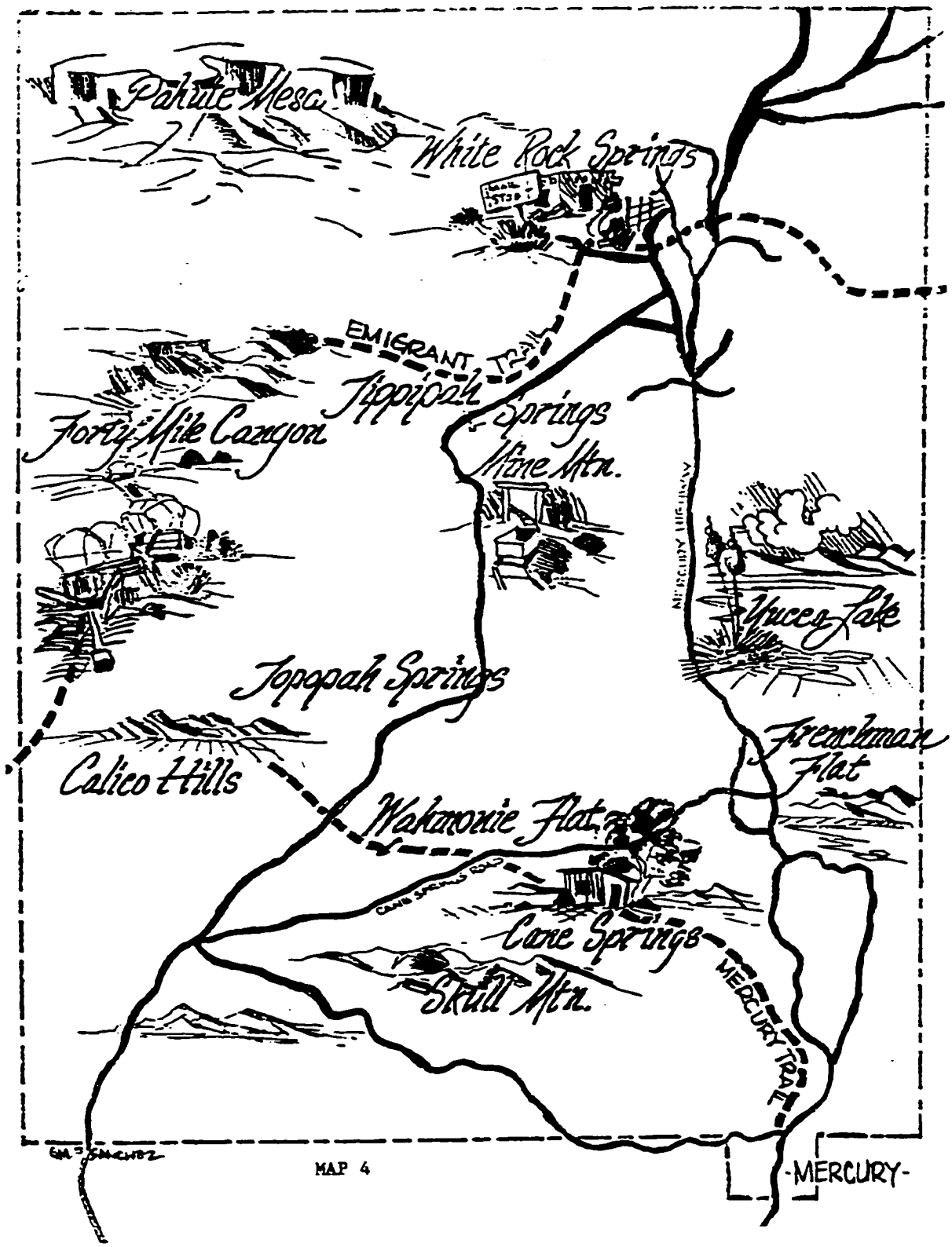
MAP 1



Topography Map - Nevada Test Site
MAP 2



MAP 3



MAP 4

APPENDIX K

CASES LITIGATED INVOLVING PHYSICAL TESTS FOR EMPLOYEE SELECTION

Joyce Hogan & Ann Quigley, Physical Standards for Employment and the Courts. *American Psychologist*, November 1996, 1214-1217.

Appendix K

Cases Litigated Involving Physical Tests for Employee Selection

Case	Claim/Job	Selection battery	Defense	Decision
[illegible] *v. White*	Sex discrimination Title VII Police officer	Physical agility tests: Squat thrusts (25 in 1 min) Sit-ups (25 required) Push-ups (22 required) Squat jumps (27 required) Pull-ups (6 required)	"Synthetic validation" claimed No empirical evidence given	Tests upheld as "not unreasonable" and not non-job related" (8 Empl. Prac. Dec. [CCH] ¶9637)
Officers for Justice v. Civil Service Commission	Sex discrimination and national origin discrimination Title VII Fourteenth Amendment Police officer	Physical agility tests: Primarily upper-body strength Sandbag lift Wall test Dynamometer strength test 63% of men passed 1.2% of women passed	Concurrent study attempted	Job performance not predicted Tests in violation of Title VII Job analysis "not careful" and not done in accordance with guidelines No search for alternatives with less adverse impact Defendants enjoined from further use of tests
Hardy v. Stumpf	Sex discrimination Title VII Fourteenth Amendment Police officer	Physical agility tests: Run 300 ft, scale 6 ft wall Run 300 ft, register 75 lb on grip dynamometer, drag 140 lb dummy 50 ft, and raise it to a 2 ft high platform Complete above in 2.5 min 15% of women passed 85% of men passed	Content validity claimed based on job analysis and concurrent study	Tests found reasonable and supported by job analysis Tests therefore upheld and not in violation of Title VII or Fourteenth Amendment
United States v. City of Buffalo	Sex discrimination Title VII Police officer	MPTC* standards score based on weighted sum of (a) numerical score for height/weight and (b) agility, strength, speed, and endurance test scores	MPTC* standards adopted after abandoning height requirement	Undue advantage given to taller persons Defendants enjoined from further use of tests
Thill v. Cason	Race discrimination Title VII Fourteenth Amendment Fire fighter	Physical agility tests: Dummy carry (up a ladder) Pull-ups (2 required)	No defense presented in text decision	Use of tests upheld: "That an occupational function consumes a *de minimis* proportion of one's workday . . . does not necessarily diminish the need for selecting one who can best perform that function" (18 Fair Empl. Prac. Dec. [BNA] 1930)
[illegible] *v. City of Los Angeles*	Sex discrimination Title VII Fourteenth Amendment Police officer	Physical abilities tests: Run 50 yd, scale 6 ft wall Run 50 yd, 1 min overhand hang from chinning	Concurrent and content validation attempted	Job-relatedness not established Validation studies flawed Prediction of training success insufficient Defendants enjoined from further use of tests

Cases Litigated Involving Physical Tests for Employee Selection

Case	Claim/Job	Selection battery	Defense	Decision
		Run 50 ft, drag 140 lb dead weight 50 ft "Tremor" test—holding a stylus steady for 17 s Endurance run—12 min run on ¼ mi track—scored on number of laps		
United States v. City of Philadelphia	Sex discrimination Police officer	Physical performance test: ½ mi shuttle run Obstacle course Jump reaction time Hand grip 30.9% of women passed 97.2% of men passed	Concurrent validity claimed	Defendants enjoined from further use of tests No showing of job-relatedness
United States v. New York	Race discrimination Sex discrimination Title VII Fourteenth Amendment State trooper	Physical performance test Phase I P/F test: Shotgun aiming Tire change Portable scale lift Pull deer off roadway Physical coordination course Phase II: Competitive combative v. noncombative Attic opening Mile run Police pursuit course Nonweapon physical contact Drag person from vehicle 40.3% of men scored higher than highest scoring woman	Content validity claimed	Defendants enjoined from further use of tests Job analysis inappropriate for content validation Different scoring could have reduced adverse impact
Harless v. Duck	Sex discrimination Title VII Fourteenth Amendment Police officer	Physical agility test: 15 push-ups 25 sit-ups 6 ft standing broad jump 25 ft obstacle course (complete 3 or 4 to pass)	Developed through an "intuitive process"	Tests in violation of Title VII Tests not proved valid or job-related Job did not specify amount of strength or exertion required Test used elsewhere but never validated No justification for tests chosen or scoring used Tests deleted in 1975 with apparently no detrimental effect on police department

Cases Litigated Involving Physical Tests for Employee Selection

Case	Claim/Job	Selection battery	Defense	Decision
Berkman v. City of New York	Sex discrimination Title VII Fourteenth Amendment Fire fighter	Physical agility test: Dummy carry Hand grip Free-style broad jump Flexed arm hang Agility test Ledge walk Mile run 0% of women passed 46% of men passed	Content validity claimed Criterion-related by validity generalization	Defendants enjoined from further test use Validation strategy inappropriate—should have conducted construct or criterion-related validation Job analysis results contradictory "Ex post facto" rationalization of test selection Tests used from other study declared "irrelevant"

• MPTC = Municipal Police Training Council.

APPENDIX L

DATA FROM TEST, RE-TEST RELIABILITY AND VITALS BEFORE AND AFTER EACH TEST

		Test 1	Test 2
Subject 1	1.	33:87	25:79
	2.	13:21	8:21
	3.	12:72	10:47
	4.	23:46	22:09
	5.	12:81	11:19
	6.	1.42:31	1.49:42
	7.	30:41	33:03
	8.	4.26:43	4.11:73

Pre-Test Vitals Before BP: 134/86 Pulse: 84 Respiration: 18
After BP: 162/88 Pulse: 92 Respiration: 22
Post-Test Vitals Before BP: 150/89 Pulse: 117 Respiration: 20
After BP: 167/87 Pulse: 157 Respiration: 38

Subject 2	1.	26:63	27:31
	2.	7:97	12:63
	3.	6:87	11:13
	4.	15:31	21:72
	5.	10:66	11:35
	6.	2.40:00	3.11:97
	7.	28:62	*
	8.	4.47:58	5.55:66

Pre-Test Vitals Before BP: 122/88 Pulse: 82 Respiration: 14
After BP: 172/78 Pulse: 116 Respiration: 26
Post-Test Vitals Before BP: 164/77 Pulse: 74 Respiration: 20
After BP: 167/87 Pulse: 109 Respiration: 24
*stopwatch quit in the middle of timing task was not able to get

Subject 3	1.	37:13	29:00
	2.	11:63	7:97
	3.	10:06	7:18
	4.	19:00	19:22
	5.	11:53	9:44
	6.	2.13:12	1.54:44
	7.	27:38	31:16
	8.	4.42:75	4.09:18

Pre-Test Vitals Before BP: 120/90 Pulse: 68 Respiration: 12
After BP: 158/72 Pulse: 90 Respiration: 18
Post-Test Vitals Before BP: 144/67 Pulse: 60 Respiration: 24
After BP: 154/88 Pulse: 136 Respiration: 30

		Test 1	Test 2
Subject 4	1.	44:00	33:72
	2.	18:03	16:25
	3.	9:87	13:53
	4.	23:56	23:22
	5.	13:34	12:93
	6.	1.57:03	2.09:66
	7.	44:34	45:80
	8.	5.19:83	5.17:55

Pre-Test Vitals Before BP: 138/94 Pulse: 82 Respiration: 14
After BP: 198/94 Pulse: 112 Respiration: 26
Post-Test Vitals Before BP: 146/90 Pulse: 86 Respiration: 24
After BP: 183/96 Pulse: 133 Respiration: 36

Subject 5	1.	44:47	44:15
	2.	17:75	17:10
	3.	34:30	15:94
	4.	27:87	23:56
	5.	13:90	14:00
	6.	2.44:28	4.15:22
	7.	44:15	51:06
	8.	6.25:47	9.21:00

Pre-Test Vitals Before BP: 126/70 Pulse: 68 Respiration: 16
After BP: 160/68 Pulse: 118 Respiration: 24
Post-Test Vitals Before BP: 120/80 Pulse: 100 Respiration: 16
After BP: 162/70 Pulse: 128 Respiration: 22

Subject 6	1.	41:13	40:62
	2.	20:44	17:50
	3.	14:69	21:20
	4.	27:81	20:78
	5.	15:15	13:65
	6.	4.44:82	4.06:50
	7.	56:00	36:13
	8.	8.51:19	8.21:00

Pre-Test Vitals Before BP: 112/70 Pulse: 72 Respiration: 16
After BP: 136/66 Pulse: 118 Respiration: 24
Post-Test Vitals Before BP: 110/64 Pulse: 72 Respiration: 14
After BP: 162/70 Pulse: 120 Respiration: 22

		Test 1	Test 2
Subject 7	1.	40:53	44:41
	2.	18:37	18:97
	3.	14:15	14:65
	4.	23:72	32:41
	5.	13:47	15:19
	6.	2.28:94	2.49:44
	7.	51:34	1.16:00
	8.	6.04:69	6.51:87

Pre-Test Vitals Before BP: 132/80 Pulse: 80 Respiration: 14
After BP: 174/62 Pulse: 120 Respiration: 24
Post-Test Vitals Before BP: 142/82 Pulse: 82 Respiration: 14
After BP: 158/72 Pulse: 120 Respiration: 20

Subject 8	1.	30:28	31:28
	2.	14:80	9:22
	3.	10:10	13:40
	4.	21:75	20:90
	5.	12:10	12:18
	6.	2.25:20	2.12:07
	7.	46:03	36:35
	8.	5.20:20	4.47:78

Pre-Test Vitals Before BP: 134/72 Pulse: 76 Respiration: 18
After BP: 168/80 Pulse: 122 Respiration: 26
Post-Test Vitals Before BP: 138/72 Pulse: 74 Respiration: 18
After BP: 168/70 Pulse: 156 Respiration: 20

Subject 9	1.	29:68	24:63
	2.	9:47	8:75
	3.	10:10	8:69
	4.	13:56	16:41
	5.	10:34	8:44
	6.	2.28:91	2.11:97
	7.	24:59	21:34
	8.	4.47:89	4.11:28

Pre-Test Vitals Before BP: 138/78 Pulse: 84 Respiration: 18
After BP: 180/76 Pulse: 124 Respiration: 28
Post-Test Vitals Before BP: 138/72 Pulse: 100 Respiration: 20
After BP: 162/84 Pulse: 122 Respiration: 32

		Test 1	Test 2
Subject 10	1.	16:75	16:56
	2.	6:82	6:97
	3.	7:56	7:21
	4.	14:19	13:53
	5.	7:18	7:18
	6.	2.07:41	1.54:63
	7.	21:50	21:03
	8.	3.46:35	3.26:22

Pre-Test Vitals Before BP: 148/89 Pulse: 92 Respiration: 20
After BP: 188/88 Pulse: 120 Respiration: 28
Post-Test Vitals Before BP: 130/90 Pulse: 78 Respiration: 18
After BP: 180/70 Pulse: 140 Respiration: 22

Subject 11	1.	20:06	32:13
	2.	8:65	18:17
	3.	11:35	16:44
	4.	23:69	27:65
	5.	13:56	15:44
	6.	2.27:35	2.01:25
	7.	49:68	45:81
	8.	4.59:28	5.18:85

Pre-Test Vitals Before BP: 128/80 Pulse: 60 Respiration: 12
After BP: 170/90 Pulse: 72 Respiration: 16
Post-Test Vitals Before BP: 128/78 Pulse: 54 Respiration: 20
After BP: 198/86 Pulse: 102 Respiration: 24

APPENDIX M

CALCULATION OF RELIABILITIES

The SAS System

---------- TEST=1 ----------

Analysis of Variance Procedure

Dependent Variable: Y

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	21	1634.7712955	77.8462522	.	.
Error	0	.	.		
Corrected Total	21	1634.7712955			

R-Square	C.V.	Root MSE	Y Mean
1.000000	0	0	32.460455

Source	DF	Anova SS	Mean Square	F Value	Pr > F
SUBJ	10	1422.1890455	142.2189045	.	.
SUBJ*TIME	11	212.5822500	19.3256591	.	.

$$R_{ICC} = \frac{MS_{sub} - MS_{sub \times time}}{MS_{sub}} \qquad \frac{142.2189 - 19.325}{142.2189} = .86$$

---------- TEST=2 ----------

Analysis of Variance Procedure

Dependent Variable: Y

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	21	458.80058182	21.84764675	.	.
Error	0	.	.		
Corrected Total	21	458.80058182			

R-Square	C.V.	Root MSE	Y Mean
1.000000	0	0	13.130909

Source	DF	Anova SS	Mean Square	F Value	Pr > F
SUBJ	10	361.29388182	36.12938818	.	.
SUBJ*TIME	11	97.50670000	8.86424545	.	.

$$R_{ICC} = \frac{36.129 - 8.864}{36.129} = .75$$

The SAS System

---------- TEST=3 ----------

Analysis of Variance Procedure

Dependent Variable: Y

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	21	748.97549545	35.66549978	.	.
Error	0	.	.		
Corrected Total	21	748.97549545			

R-Square	C.V.	Root MSE	Y Mean
1.000000	0	0	12.800455

Source	DF	Anova SS	Mean Square	F Value	Pr > F
SUBJ	10	517.21124545	51.72112455	.	.
SUBJ*TIME	11	231.76425000	21.06947727	.	.

$$R_{ICC} = \frac{51.72 - 21.069}{51.72} = .59$$

---------- TEST=4 ----------

Analysis of Variance Procedure

Dependent Variable: Y

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	21	519.00189545	24.71437597	.	.
Error	0	.	.		
Corrected Total	21	519.00189545			

R-Square	C.V.	Root MSE	Y Mean
1.000000	0	0	21.609545

Source	DF	Anova SS	Mean Square	F Value	Pr > F
SUBJ	10	413.19974545	41.31997455	.	.
SUBJ*TIME	11	105.80215000	9.61837727	.	.

$$R_{ICC} = \frac{41.3199 - 9.618}{41.3199} = .77$$

The SAS System

---------- TEST=5 ----------

Analysis of Variance Procedure

Dependent Variable: Y

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	21	121.71267727	5.79584177	.	.
Error	0	.	.		
Corrected Total	21	121.71267727			

R-Square	C.V.	Root MSE	Y Mean
1.000000	0	0	12.046818

Source	DF	Anova SS	Mean Square	F Value	Pr > F
SUBJ	10	111.70972727	11.17097273	.	.
SUBJ*TIME	11	10.00295000	0.90935909	.	.

$$R_{ICC} = \frac{11.17 - .909}{11.17} = .92$$

---------- TEST=6 ----------

Analysis of Variance Procedure

Dependent Variable: Y

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	20	3844.1139810	192.2056990	.	.
Error	0	.	.		
Corrected Total	20	3844.1139810			

R-Square	C.V.	Root MSE	Y Mean
1.000000	0	0	39.130952

Source	DF	Anova SS	Mean Square	F Value	Pr > F
SUBJ	10	3247.4001310	324.7400131	.	.
SUBJ*TIME	10	596.7138500	59.6713850	.	.

$$R_{ICC} = \frac{324.74 - 59.67}{324.74} = .82$$

The SAS System

TOTAL

TEST=7

Analysis of Variance Procedure

Dependent Variable: Y

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	21	192666.33278	9174.58728	.	.
Error	0	.	.		
Corrected Total	21	192666.33278			

R-Square	C.V.	Root MSE	Y Mean
1.000000	0	0	331.08091

Source	DF	Anova SS	Mean Square	F Value	Pr > F
SUBJ	10	171110.91308	17111.09131	.	.
SUBJ*TIME	11	21555.41970	1959.58361	.	.

$$R_{ICC} = \frac{17111.09 - 1959.58}{17111.09} = .89$$

APPENDIX N

ANALYSIS COMPARING TEST 1 AND TEST 2

The SAS System

Pre
TEST=1

Variable	N	Mean	Std Dev	Std Error
T1	11	33.1390909	9.3992739	2.8339877
T2	11	13.3763636	4.8013900	1.4476735
T3	11	12.8881818	7.5030858	2.2622655
T4	11	21.2654545	5.0863137	1.5335813
T5	11	12.1854545	2.1957885	0.6620552
T6	11	38.5490909	12.1984240	3.6779632
TOTAL	11	324.6963636	81.3518559	24.5285075

Post
TEST=2

Variable	N	Mean	Std Dev	Std Error
T1	11	31.7818182	8.6091565	2.5957584
T2	11	12.8854545	4.7638396	1.4363517
T3	11	12.7127273	4.3109537	1.2998014
T4	11	21.9536364	5.0763299	1.5305711
T5	11	11.9081818	2.7032381	0.8150570
T6	10	39.7710000	16.1530103	5.1080304
TOTAL	11	337.4654545	112.0661924	33.7892284

TEST=1

Analysis of Variance Procedure

Dependent Variable: Y

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	21	1634.7712955	77.8462522	.	.
Error	0	.	.		
Corrected Total	21	1634.7712955			

R-Square	C.V.	Root MSE	Y Mean
1.000000	0	0	32.460455

Source	DF	Anova SS	Mean Square	F Value	Pr > F
SUBJ	10	1422.1890455	142.2189045	.	.
TIME	1	10.1320409	10.1320409	.	.
SUBJ*TIME	10	202.4502091	20.2450209	.	.

Tests of Hypotheses using the Anova MS for SUBJ*TIME as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TIME	1	10.13204091	10.13204091	0.50	0.4954

The SAS System

---------- TEST=2 ----------

Analysis of Variance Procedure

Dependent Variable: Y

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	21	458.80058182	21.84764675	.	.
Error	0	.	.		
Corrected Total	21	458.80058182			

R-Square	C.V.	Root MSE	Y Mean
1.000000	0	0	13.130909

Source	DF	Anova SS	Mean Square	F Value	Pr > F
SUBJ	10	361.29388182	36.12938818	.	.
TIME	1	1.32545455	1.32545455	.	.
SUBJ*TIME	10	96.18124545	9.61812455	.	.

Tests of Hypotheses using the Anova MS for SUBJ*TIME as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TIME	1	1.32545455	1.32545455	0.14	0.7182

---------- TEST=3 ----------

Analysis of Variance Procedure

Dependent Variable: Y

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	21	748.97549545	35.66549978	.	.
Error	0	.	.		
Corrected Total	21	748.97549545			

R-Square	C.V.	Root MSE	Y Mean
1.000000	0	0	12.800455

Source	DF	Anova SS	Mean Square	F Value	Pr > F
SUBJ	10	517.21124545	51.72112455	.	.
TIME	1	0.16931364	0.16931364	.	.
SUBJ*TIME	10	231.59493636	23.15949364	.	.

Tests of Hypotheses using the Anova MS for SUBJ*TIME as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TIME	1	0.16931364	0.16931364	0.01	0.9335

The SAS System

---------- TEST=4 ----------

Analysis of Variance Procedure

Dependent Variable: Y

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	21	519.00189545	24.71437597	.	.
Error	0	.	.		
Corrected Total	21	519.00189545			

R-Square	C.V.	Root MSE	Y Mean
1.000000	0	0	21.609545

Source	DF	Anova SS	Mean Square	F Value	Pr > F
SUBJ	10	413.19974545	41.31997455	.	.
TIME	1	2.60476818	2.60476818	.	.
SUBJ*TIME	10	103.19738182	10.31973818	.	.

Tests of Hypotheses using the Anova MS for SUBJ*TIME as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TIME	1	2.60476818	2.60476818	0.25	0.6263

---------- TEST=5 ----------

Analysis of Variance Procedure

Dependent Variable: Y

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	21	121.71267727	5.79584177	.	.
Error	0	.	.		
Corrected Total	21	121.71267727			

R-Square	C.V.	Root MSE	Y Mean
1.000000	0	0	12.046818

Source	DF	Anova SS	Mean Square	F Value	Pr > F
SUBJ	10	111.70972727	11.17097273	.	.
TIME	1	0.42284091	0.42284091	.	.
SUBJ*TIME	10	9.58010909	0.95801091	.	.

Tests of Hypotheses using the Anova MS for SUBJ*TIME as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TIME	1	0.42284091	0.42284091	0.44	0.5215

The SAS System

---------- TEST=6 ----------

Analysis of Variance Procedure

Dependent Variable: Y

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	20	3844.1139810	192.2056990	.	.
Error	0	.	.		
Corrected Total	20	3844.1139810			

R-Square	C.V.	Root MSE	Y Mean
1.000000	0	0	39.130952

Source	DF	Anova SS	Mean Square	F Value	Pr > F
SUBJ	10	3247.4001310	324.7400131	.	.
TIME	1	7.8208000	7.8208000	.	.
SUBJ*TIME	9	588.8930500	65.4325611	.	.

Tests of Hypotheses using the Anova MS for SUBJ*TIME as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TIME	1	7.82080004	7.82080004	0.12	0.7375

---------- TEST=7 ----------

Analysis of Variance Procedure

Dependent Variable: Y

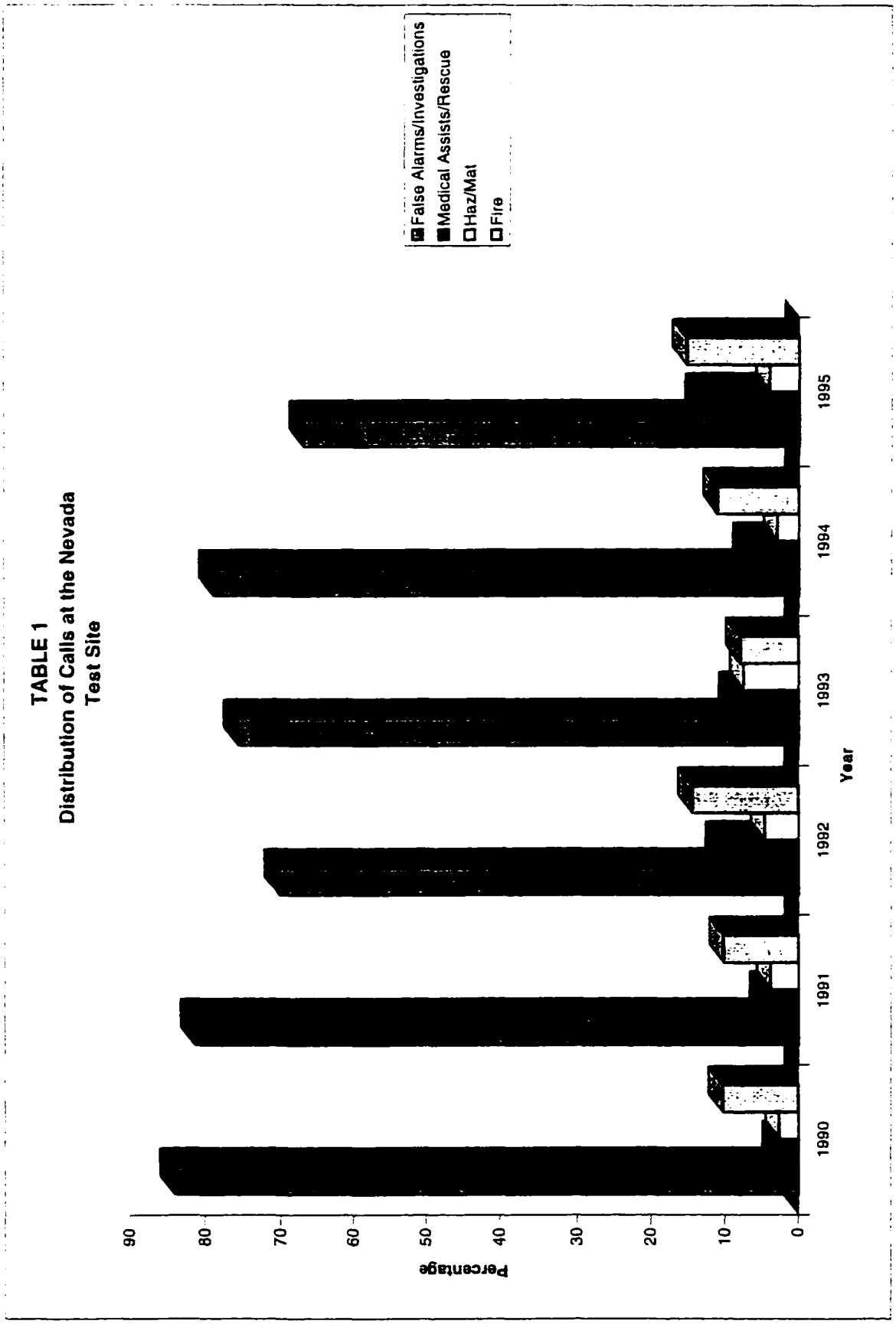
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	21	192666.33278	9174.58728	.	.
Error	0	.	.		
Corrected Total	21	192666.33278			

R-Square	C.V.	Root MSE	Y Mean
1.000000	0	0	331.08091

Source	DF	Anova SS	Mean Square	F Value	Pr > F
SUBJ	10	171110.91308	17111.09131	.	.
TIME	1	896.77325	896.77325	.	.
SUBJ*TIME	10	20658.64645	2065.86464	.	.

Tests of Hypotheses using the Anova MS for SUBJ*TIME as an error term

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TIME	1	896.77325454	896.77325454	0.43	0.5249



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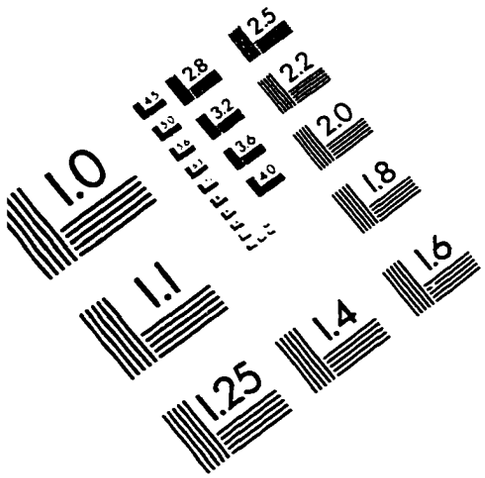
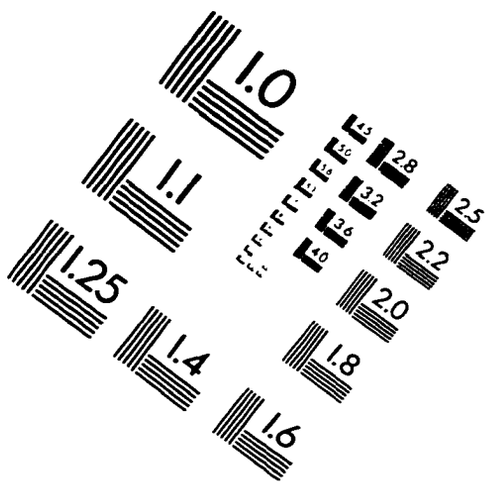
Grant from Graduate Student Association for preparation of the study

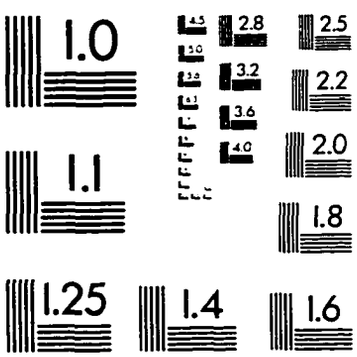
Thesis Title: The Development of a Job-Related Non-Discriminatory Physical Abilities Test for the Firefighters at the Nevada Test Site.

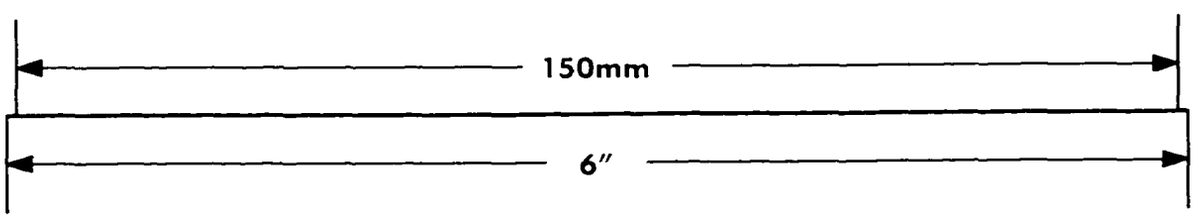
Thesis Examination Committee:
Chairperson, Dr. Lawrence A. Golding, Ph.D.
Committee Member, Dr. John C. Young, Ph.D.
Committee Member, Dr. Richard D. Tandy, Ph.D.
Graduate Faculty Representative, Dr. David James, Ph.D.

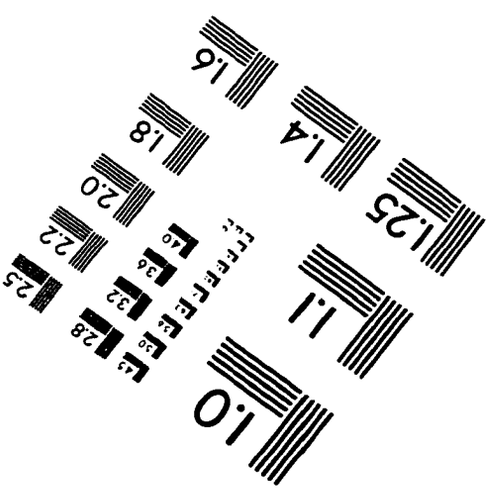
IMAGE EVALUATION
TEST TARGET (QA-3)











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