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The development and testing of a safety training program for arboricultural firms.

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THE DEVELOPMENT AND TESTING OF A SAFETY TRAINING PROGRAM FOR ARBORICULTURAL FIRMS

A Dissertation Presented

By

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University of Massachusetts in partial fulfillment
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School of Education

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DEDICATION

This book is dedicated to my wife,

NORMA JEAN RYAN

without her help, this project would

have been impossible.

ACKNOWLEDGEMENT

No one person is able to carry out all that is required of a dissertation without help. My family and my committee supported me throughout this project and for this I am greatly indebted to them.

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Finally, to Norma, Kelly and Coleen who managed to keep my spirits up throughout the last three years.

ABSTRACT

The Development and Testing of a Safety Training Program for Arboricultural Firms

February 1987

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In 1983, thirteen arborists were killed while working for tree care firms. On-the-job accidents are a major personnel and economic problem for the arborist industry. Many of these accidents could have been prevented with the proper training of new personnel.

The purpose of this research was to develop a production and safety training program that could be used on the job site by industry personnel. The literature review and insurance data analysis revealed that the major accident expense to tree care firms was worker compensation related injuries. A knowledge of required safety and production related competencies could reduce many of these accidents.

A safety competency oriented needs analysis was developed in conjunction with the National Arborist Association (NAA) in order to

guide the curriculum design. Those competencies were transformed into a training program which focused on groundpersons. A Vest Pocket Field Guide program, using a programmed instruction format with individualized learning packages, was the major component.

The Vest Pocket Field Guide was designed to provide an on-the-job production and safety training process for field arborists. In most cases the foreperson acted as the trainer because s/he was the most experienced person on the job site. The Vest Pocket Field Guide establishes training guidelines for the tree care firm.

A sample of convenience consisting of ten arboricultural firms was selected by the researcher from a list supplied by the National Arborist Association. The Vest Pocket Field Guide was field tested by the foreperson and groundpersons of the ten selected firms. A structured interview was administered in order to evaluate the Vest Pocket Field Guide and to determine if the Vest Pocket Field Guide was an effective aid to forepersons in the training of new personnel on the job site. Seventy percent of the forepersons interviewed agreed that most foreperons could train new personnel more effectively using the Vest Pocket Field Guide. Unfortunately, fifty percent of the forepersons also reported that their companies do not adequately train new employees in safety competencies.

Key Words: Accidents, arboriculture, competencies, training, safety.

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CHAPTER I

THE PROBLEM

On-the-job accidents are a major personnel and economic problem of the arborist industry. In 1983 alone, thirteen arborists were killed while on the job. The cost of these accidents is immense, in human terms to workers and their families, and in both human and economic terms to the employing firms. Most arboricultural firms consist of less than 10 persons, with a gross income below $500,000 per year. Taking this into consideration these accidents can be extremely costly. It is not unusual for firms to go out of business as a result of a major accident.

The firm is unable to obtain or afford the required insurance after the accident. The cost of insurance before an accident is often times in excess of 10 percent of the gross income of a firm. Following the accident the rate increases substantially.

Many of these accidents could have been prevented with the proper training of new personnel. An analysis of arboricultural accidents and competencies was conducted in order to develop a safety training program that the arborist industry will use for on-job-training (OJT).

Background

The arborist industry consists of approximately 11,000 tree care firms in the United States. These firms range in size from two-person companies to multi-state corporations with many hundreds of employees.

The commercial tree care industry began around the turn of the century with companies like Davey and Bartlett. Most of the work up through World War II was very labor intensive and much of it was on estates. The source of labor was primarily farm boys and newly arrived immigrants. With the high unemployment rate of the depression, labor was not a serious problem and employers could select the best trained persons.

With the end of World War II, the tree care industry started to change. These changes were brought about by a rapidly changing economy, the breaking up of the old estates, and suburban expansion. Aiding these changes were new methods of pest control, the chain saw, and the aerial lift, all positive additions to the arborist industry. Both the chain saw and the aerial lift made tree work easier, thus extending the length of time that climbers were able to remain working in the field.

The result of these changes was that across the United States tree companies expanded, purchased equipment, and hired workers every spring to fill in manpower gaps.

This all started to change during the 1970s. People started asking questions about pesticide use, the baby boom peaked, gas prices

went up and along came the Occupational Safety and Health Act (OSHA) and the Environmental Protection Agency (EPA). All of these factors were perceived as negative by the tree care industry.

Today, the tree care industry is just beginning to realize that it has a serious labor problem. These problems have been brought about by a number of factors such as the aging of workers, the low unemployment rate, and competition from other industries. As a result of these factors, the industry is experiencing a severe labor shortage and this can be expected to get much worse by the turn of the century.

Statement of the Problem

As a result of the lack of skilled tree workers, the industry is forced to hire many workers who are unskilled and lacking in proper productivity and safety competencies. Adding to this problem of quantity is also quality, workers today must know more in order to do the job correctly and safely. The end result is that employers are being required to do more training. Pressure to train is also being applied by OSHA and the insurance industry in order to reduce the number of accidents.

The Occupational Safety and Health Act became law in 1970. While OSHA does not write regulations for the tree care industry, it does cover tree work under the general duty clause. Section 5A states "The employer shall provide a workplace, free from recognized hazards."

In the tree care industry, the recognized hazards are defined by the American National Standard Institute (6).

Before a tree worker is allowed to work in the vicinity of a recognized hazard, that worker is required by law to be properly trained. It is the employer's responsibility to insure that each employee be properly trained in safety.

The American National Standard Z-133.1-1982 is very explicit about this:

> 3.1.3 Employers shall instruct their employers in the proper use of all equipment provided for them and shall require that safe working practices be observed. A job briefing, work procedure and assignment shall be worked out carefully before any tree job is begun (6).

The Z-133 standard was first approved and printed for distribution in 1972, yet during 1983 twelve tree workers died of electrocution while on the job. An analysis of arboricultural accidents and training curriculum is needed in order to develop an understanding of the problem.

Purpose of the Study

The intent of this research project was to design a safety training program that would be used on-site by the arborist industry. The program's curriculum is based on the National Safety Standards and identified industry competencies, the purpose being to field test a training program that will be relevant to the small firms that make up the arborist industry. It was also the intent of this study to work

with the National Arborist Association (NAA) in order to develop a curriculum that will be valid for today's industry. The NAA is a trade association of more than 460 tree care companies representing 70 percent of the gross tree care sales in the United States.

Questions to be Answered

With the analysis of the data generated from this research, the study will be able to answer the following questions concerning a training curriculum for the arborist industry. The specific questions to be answered are:

1. What kind of accidents are taking place within commercial arboricultural firms?
2. What is the cost of these accidents?
3. What is the cause of these accidents?
4. What safety and production-related competencies are required of a tree worker before s/he is allowed on a job site?
5. What training programs are now being used by the arborist industry?
6. How efficient (safety and production related) are the training programs now being used?
7. Can a competency-based training program be developed that will work and be used by the arborist industry?
8. Is it feasible to develop and field test a training curriculum that can be administered in the field?

9. Can a foreperson be used as a trainer to successfully carry out this program?
10. How effective is the safety and production related training program?

Answers to the above questions may be a major step in the reduction of accidents and could possibly save many lives.

Significance of the Study

The number one killer of tree workers is electric wires! The following two stories are true; they are taken from a talk given by Erik H. Haupt at the National Arborist Association meeting in 1980 (20).

> For 23 year old Luke Smith, Tuesday, October 28, 1975 was a routine day. He left his home at 7:15 heading for his job in Pittsfield, Mass. The weather was crystal clear.
>
> They had been working on a tree removal contract for the town of Pittsfield for the past 2 1/2 weeks and were about through with the job. They had looked at the tree scheduled for removal on the previous night and Luke felt it was going to be a "piece of cake." He had planned a way in which they would do the tree and did not anticipate any problems.
>
> The one thing that Luke had not planned was the fact that less than 12 hours later he would be dead. At 11:00 on that October morning, the tree crane in which Luke was riding came in contact with a 22,000 volt energized line, one of the Electric Company's Pittsfield distribution lines.
>
> Luke died that morning of electrocution, and the tree service went out of business on the day of the accident.

> For Ronald Black, March 30, 1979 was also a routine day. He had been assigned by his employer to trim trees on property belonging to one of the embassies in Washington.
>
> The four-man crew consisted of a foreman, assistant foreman, top climber and Ron Black. Both foremen had worked for a major national tree service firm and had been qualified line clearance tree workers. Although the representative of the company who inspected the job had not detected the 7,000 volt conductor stretched across the property, Black and his foremen were not concerned with the line. They had previously spent time working around energized lines.
>
> At approximately 2:30 p.m. that day, Black came in contact with a primary line that passed through the tree in which he was working. He was knocked unconscious and for the next seven and one-half minutes was clinically dead and all body functions had ceased. The senior climber who was with Black extracted him from the line and lowered him to the ground. Within three minutes CPR was administered and some seven minutes after the accident the first rescue team arrived. Ronald Black returned to work on April 30, apparently recovered from a near fatal accident.

CPR and aerial rescue saved his life. Ron Black's crew had been properly <u>trained</u> and it meant the difference between life and death.

This study documents, in factual terms, the major types of accidents that are taking place in the arborist industry. An analysis of safety training requirements identified by this research permitted the construction and testing of a training curriculum that can be used by the industry to promote safety.

Definition of Terms

Arboriculture -- The art, science, technology, and business of urban tree care.

Arborist -- A person who works in the arborist industry.

Climber -- Arborist who works up in trees, using a climbing rope and saddle.

CPR -- Cardiopulmonary resuscitation.

Groundperson -- Entry level position in arborist industry confined to ground level work.

EPA -- Environmental Protection Agency

Field Trainer -- Foreperson using Vest Pocket Field Guide on job sites.

NAA -- National Arborist Association, A trade association of 460 companies across the United States.

OSHA -- Occupational Safety and Health Act

Tree Care Industry -- Industry that cares for urban/suburban trees (not forests or orchards). Examples: street trees, park trees, residential trees.

Tree Worker -- Arborist

Urban Forestry -- Arboriculture

Utility Wires -- All wires located on utility poles or underground, electric, telephone, cable TV, fire, etc.

Z-133 -- American National Standard for Tree Care Operations, pruning, trimming, repairing, maintaining and removing trees, and cutting brush/safety requirements.

Scope and Delineation of Study

The American arborist industry has a serious problem with safety training. It is this researcher's view that current training programs are not working and that accidents will continue to take place unless change is implemented. While it would be impossible to correct all of the problems, it is foreseeable to identify a major problem area--groundpersons--and to propose a training curriculum that will have an impact on their accident rate.

It was, therefore, proposed that the major causes of accidents be identified and that a training curriculum be developed for groundpersons that could be used as a pilot for other identified training needs of the arborist industry. The specific study sample will be drawn from member companies of the NAA.

CHAPTER II

LITERATURE REVIEW

This chapter will review the literature that pertains to arboricultural accidents, arboricultural safety training programs, arboricultural production competencies, safety competencies, and alternative training methods. Emphasis will be on programs used by commercial arborists. An analysis of the NAA's insurance statistics was used to guide this research along with a review of arboricultural competencies and safety standards.

Arboricultural Accidents

The NAA estimates that there are approximately 11,000 tree care firms in the United States of America producing more than a billion dollars in gross sales during 1984. This large number of companies makes accident investigation extremely difficult because the accident records are not all reported to one agency.

During 1982, the NAA instituted its own tree care insurance program for NAA members. This program was successful with 85 of the 460 member companies participating as of June 1, 1985. This program recorded the accident reports for three years from participating companies. This is the only source of data that involves a significant number of companies; unfortunately, this program was

terminated on July 1, 1985 (15). The reason for this termination was that during 1984/85 the the losses for all casualty and property coverage exceeded premium revenues by 18 percent. The workers' compensation rate was even higher at 23 percent (15).

The tree care industry is a high risk industry with a poor record. Tree care companies now trying to renew policies are finding that premiums have increased as much as 300 percent during 1985.

During the period from January 1984 to January 1985, the total amount paid or reserved for payment for the 85 participating firms was $865,725. How this money was distributed is shown in Table 1.

Table 1. Total Amount of Insurance Money Paid Out or Reserved for the 85 Participating National Arborist Association Firms During 1984 (32).

Accidents	Cost
Auto Liability	$ 66,665.51
Auto Collision	12,431.33
Auto All Other	2,903.53
General Liability	59,749.92
Property	64,862.13
Workers' Compensation	659,113.03
Totals	$865,725.45

Note in Table 1 that the workers' compensation totaled $659,113 or 70 percent. The remainder of this paper will confine itself to accidents involving workers' compensation.

Workers' compensation is a measure of how safe a company or worker is. The more accidents a company has the higher the workers' compensation cost.

The workers' compensation cost has increased steadily during the past three years. This increase has taken place while there has been a decrease in the number of accidents. A review of this decrease is presented in Table 2.

Table 2. A Review of Arboricultural Worker Compensation Accident Numbers and Cost Per Accident Between July 1982 and July 1985.

Date Reported	No. of Accidents	Total Cost	Cost/Accident
07/1984 07/1985	201	$659,113.03	$3,279.16
05/1983 07/1984	261	489,266.21	1,874.58
07/1982 07/1983	216	130,953.67	602.10

This increase in cost per accident, while there was a decrease in the number of accidents, can be explained by either more serious accidents or a higher cost per accident. In either case it becomes clear that a poor safety record is directly related to increased production costs. The exact reason for the increase is difficult to determine without access to the individual accident reports and court records.

Safety is defined as "freedom from danger or harm, any of various devices for preventing an accident" (4). There are many factors that have to be considered: protective clothing, protective gear, and personality factors. But the most important factor is knowledge. Knowledge of the potential danger. A worker's ignorance of safety rules, equipment, or electricity can be the cause of an accident.

The dictionary defines accident as an "unanticipated interruption" (3); and even though one may consider accidents as unanticipated, insurance companies do not. Insurance companies do anticipate and the number of accidents they expect controls the insurance rate.

Table 3 is an analysis of 258 worker compensation claims that were filed during one year. This chart supplies the source, cause, target, result, and cost of these accidents, but it does not supply information that will aid in preventing a reoccurrence of similar accidents. Personal analysis of many arboricultural accidents by this researcher has shown that in many cases the causes of accidents

Table 3. National Arborist Association Loss Control Analysis of Workers Compensation Payments from March 1984 to March 1985, Displaying Source, Cause, and Cost of Arboricultural Accidents (32).

Source	No. of Losses	% of Accidents	Loss Amount in $	% of $
Tree	18	6.2	$ 21,127.78	2.4
Limb	14	5.4	117,128.09	13.8
Branch	12	4.6	941.84	0.1
Chainsaw	11	4.2	12,803.99	1.5
Motor Vehicle	10	3.8	83,405.95	9.8
Truck	7	2.7	11,060.76	1.3
Chainsaw	6	2.3	10,273.95	1.2
Log	6	2.3	7,270.91	0.8
Saw	5	1.9	329.21	0.0
Ladder	5	1.9	4,395.63	0.5
Poison Ivy	5	1.9	159.99	0.0
Other	161	62.4	577,426.11	68.2
Total	258	99.6	$846,332.22	99.6
Cause				
Struck by	67	33.7	198,072.91	23.4
Struck against	35	13.5	47,998.74	5.6
Fell elevation	20	10.0	209,953.07	24.8
Lifted	18	6.9	70,595.07	8.3
Pushing/pulling	15	5.8	70,274.11	8.3
Caught in	11	4.2	11,269.91	1.3
Collision	10	3.8	83,405.95	9.8
Slipped	9	3.4	5.909.21	0.8
Pulled	8	3.1	3,886.30	0.4
Fell on level	6	2.3	1,833.00	0.2
Extreme temp	4	1.5	667.51	0.0
Other	29	11.2	142,485.88	16.8
Total	258	99.4	$846,332.22	99.5

are negligence, and an ignorance of the potential hazards. The proper application of a safety training curriculum could be a method by which the number of accidents could be reduced.

Arboricultural Safety Training Programs

A review of training programs in the United States is in order, with emphasis on exploring commercial training and development.

Arboricultural education was reviewed by Ryan (36) on three levels: high school, college, and industry. In addition, the programs presented by various State Cooperative Extension Services is included (24).

High School and College Programs

High school programs vary from state to state but are primarily located in agricultural or technical schools.

Arboricultural education on the college level can be broken down into two categories: two-year associate degree programs and four-year bachelor degree programs. A review of course outlines from 39 colleges shows that only four programs have safety as part of the curriculum (7). Also Andresen's (7) model course outline for arboriculture does not contain a section on safety. This disregard for safety as part of a program reinforces Hirt's (21) contention that "many teachers who give courses to potential arborists lack experience in arboriculture." Finding qualified instructors can be a problem and industry could be a source of help (10).

The Urban and Community Forestry Act of 1972 established a federal role in arboriculture/urban forestry. As a result of this Act, many forestry schools initiated urban forestry programs during the 1970s. Articles by Andresen and others (8,9) outline this growth. Deneke (13) addresses some of the controversy that has been generated since the Act's inception and suggests that for urban forestry students to be successful they "need interdisciplinary programs." Carlson (11) concurs with Deneke. In the author's opinion, this would be especially true in the area of safety.

Commercial Arborist Training

Industry has traditionally trained the majority of arborists since beginning in 1906 (2). Much of the industry teaching is conducted by experienced forepersons showing the new groundperson or climber how to do the job.

For many years large companies, such as Davey and Bartlett, have conducted training programs. While these programs are not as substantial as they once were, they still fill a need for the large companies. But the small companies, which make up the majority of this industry, need some form of training program.

The National Arborist Association is trying to fill that need. One of the biggest and most successful training aids is the National Arborist Association's Home Study Program. This was first written in 1970 by Dr. James Kielbaso and Dr. Melvin Koelling (37).

The National Arborist Association is also filling a training need in the area of safety. This has been accomplished by the use of a series of slides with accompanying tape recordings. To fill guidelines set up by OSHA, the National Arborist Association has recently published a series of Tailgate Safety Programs (26) and the Electrical Hazards Awareness Program (17). In addition, many companies now have their own "tailgate" versions in order to meet local conditions or needs.

While various government agencies have taught arboriculture courses, most of the work has been accomplished through State Cooperative Extension Services (12). Dr. Stone, of the Massachusetts Agricultural College, started this land-grant college and industry relationship in 1894 (33). Traditionally, much of this extension/ industry training has been oriented toward disease and insect problems such as Dutch elm disease and the gypsy moth (7). Very few of the training programs dealt with safety. This is now changing as industry is becoming increasingly concerned with insurance costs and labor shortages (35).

How successful or valuable these industry programs are can be questioned. Traditionally, most of the safety training has been geared to the employee working in the field. Felix (16) now questions this and states that maybe we should first train the employers. This will be addressed further under Alternative Safety Training Methods.

Gray and Deneke (19) address the necessity of training personnel and separate the reasons into four categories:

1. To meet basic job standards (productivity).
2. To meet requirements of federal, state, and local laws (safety).
3. To apply new technology.
4. To meet standards for certification or licensing.

Item 2 is the category that applies to safety training through the Occupational Safety and Health Act and is an expression of the right of employees to a safe working environment. It is this area that must be improved upon through the identification of competencies and training methodologies.

Identification of Arboricultural Competencies

Competency-based training is designed by identifying what skills are required to do a particular job. The employee is taught by a variety of methods how to perform a task and then is evaluated on his/her ability to complete the task. With this method of training, employees are not compared to others but are evaluated on their ability to perform an occupational skill. Several articles, based primarily on surveys of employers, have identified arboriculture/urban forestry competencies (19, 22, 28, 29, 31, 43, 44). A review and analysis of these tasks indicates that safety is not treated in as much detail as are production tasks. This lack of detail may be due to a lack of safety awareness on the part of the employers and the researchers. A major deficiency of all but one of the competency lists was a failure to break down the competencies based on employment

position or worker category. Thus, it was impossible to determine if a skill was required of both a groundperson and a climber. A much more practical approach was presented in McClay's 1978 study for the U.S. Department of Health, Education and Welfare (27). This study separated the competencies into five worker classes (Appendix A).

Relationship of Identified Competencies to the National Safety Standard

For the purpose of this work only the entry level trainee or groundperson position was studied. Seventeen competencies were identified that would be necessary for a new person to know in order to work on a tree removal site safely. These competencies must be correlated with the Z-133 safety standards.

The American National Standard (Z-133.1 - 1982) is the standard used in the United States. This standard is accepted by the industry, government agencies, and involved insurance companies (Appendix B).

Arboriculture competencies are required for groundpersons in three tree work situations:

1. Pruning and removal sites.
2. Spraying and fertilizing sites.
3. Transplanting sites.

These competencies are required for the safety of the worker, fellow workers, and the general public. In addition, many of these competencies are required for the proper completion of the work.

The groundperson's production and safety competencies should be based on the three work situations. Field training should be

organized in a similar manner and should combine the production competencies along with the safety training required by the Z-133. At the present time, the literature does not contain a competency list that contains both production and safety.

For the remainder of this paper, only the information required for a pruning or removal site will be discussed.

Alternative Safety Training Methods for Commercial Arborist

Safety training programs are available for commercial arborists (Appendix C) yet accidents continue to take place. Why? The reason could be that although some good programs have been developed, they either are not being used or they are not taken seriously. Robert Felix, Executive Vice President of the NAA, feels that perhaps we have been training the wrong people. We have been training employees because they are in production and are having the accidents, Felix continues by stating that while "employees are trainable, employers are not" (16).

Many employers view safety training as infringing upon production (43). For this reason, safety and production competencies must be presented at the same time.

Safety starts with management and one of the best ways to boost profits is to maintain a safe working environment. Every accident results in two kinds of cost: increased insurance costs and uninsured costs, the latter are probably five times greater (25). Examples of

uninsured costs are lost time, damaged equipment, and lost customers. Employers have to realize these costs and start supporting effective training programs.

Bill Frey is a loss control consultant who has been working with the NAA and feels that any safety program that is implemented must have the full support of management. Frey outlines seven methods of reducing accidents (18):

1. Inspections.

   Must be conducted in an atmosphere of advocacy rather than adversity in order to seek out and correct error provocative situations.

2. Accident Investigation.

   It is an after-the-fact procedure which is not truly preventive, but it can be used to prevent future accidents.

3. Critical Incident Technique.

   Involves taking a randomly selected group of employees and asking them about their accidents.

4. Safety Training.

   "Historically, the problem with safety training has been that it is conducted over too infrequent intervals, under the worst possible conditions, and usually by the wrong people. The best safety training is utilizing the methods, standards and discussions that the NAA has provided" (18).

5. Emergency Planning.

   Employees must be taught what to do in the event of an emergency.

6. Job Safety Analysis (JSA).

   Frey considers JSA one of the best preventative methods for the control of worker accidents. JSA gets both the worker and the supervisor involved in establishing and maintaining a safe work procedure that is both mutually agreed upon and readily attainable by the worker.

7. Presite Planning.

   Basically a JSA of each worksite.

Please note that Frey's seven steps involve both employers and employees with employers leading the way. Stanley (40) presented a paper emphasizing the same point.

> If the supervisor will devote the same effort to the prevention of production interruptions caused by accidents as he does to be elimination of all other difficulties. . .he will find that his job becomes easier. Success in the prevention of accidents is not easily gained. It requires the same kind of persistent effort that is needed in any worthwhile line of endeavor (40).

In order to reduce accidents employers must want to have a safe and productive company and then they must get employees involved. When a worker knowingly chooses a risky shortcut to accomplish a task, it means that he is not convinced that the precautionary measure is necessary (25).

Job Safety Analysis (JSA) Methodology

The JSA appears to be a method that requires management to lead and for employees to take an active part. Wright Tree Service of Des Moines, Iowa, is a company that is actively involved with JSA. Wright became involved with JSA in 1978 (42). Wright's accident statistics show decreased numbers of accidents and employee attitude has improved. The JSA is a continuing program with high employee participation that appears to be working.

There are four basic steps in making a JSA:

1. Select the job to be analyzed.
2. Break the job down into successive steps (competencies).
3. Identify the hazards and potential accidents (safety standards).
4. Develop ways to eliminate the hazards and prevent the potential accidents (training).

Wright's safety training program is impressive because it involves production and safety competencies, broken down by job title, and also a field training program (45). Management has definitely taken a lead in this program but it very much involves the field workers. As a result, it is working. Wright is a very large, multi-state company and could afford to develop this program. The question is can this be used by other companies, especially small ones, with the same amount of success.

With a JSA, many of the employee-employer approved working methods would be the same for any arboricultural firm; for example,

the task of starting a chainsaw -- but some jobs will vary depending on equipment, location, or tree species.

The goal of this work was to develop a production-safety training curriculum that could and would be used by both employers and employees of small NAA member firms on job sites (32).

Arboriculture safety will continue to be a major problem until managers realize the cost of accidents and become actively involved in reducing the problem. In the development of a production-safety curriculum, both employers and employees must be actively involved. Because of the nature of the arborist industry, an on-site curriculum that is in an individualized programmed instructional format would be preferred.

CHAPTER III

RESEARCH METHODOLOGY

The research design for this project was broken down into four steps: (a) data sources, (b) competency identification, (c) curriculum development, and (d) field applications. The goal of this research was to develop an arboricultural curriculum based on both productivity and safety competencies that could be used by the tree care industry.

Data Sources

Three major sources of data were used to carry out this research. Data from the first two sources, the literature search and the insurance data analysis, were reviewed in Chapter II. The third source of data was a structured interview of forepersons and the structured interview was conducted using a sample of convenience supplied by the NAA.

Interview Population

The test population consisted of member firms of the NAA or the Massachusetts Arborist Association. For the purpose of this research, companies consisting of less than twenty full-time persons were used. This sample of convenience was identified in consulting with Mr. Robert Felix, Executive Vice President of the NAA, in order to select

ten firms that would form the basis of the study and meet the twenty-person limit from the New York/New England region. Ten crews were used in the data collection process. Each crew consisted of a trainer and at least one trainee. The participating companies are identified in Appendix D.

A composite of the ten tree companies involved in this study outline of a typical New York/New England tree care firm that is principally involved in residential work. The education of the owner is surprisingly high with the minimum being an Associate degree and the maximum a Master's degree in Horticulture. The mean was three years of college, six owners had Associate degrees, three had Bachelor's degrees, and one has a Master's degree of Science in Horticulture. Ninety percent of the owners had degrees in arboriculture, the remainder had a degree in business. It should be pointed out here that this was a selected sample of convenience and since a new training methodology was being tested, the researcher wanted to use the most cooperative companies available.

The companies have been in business from one to fifty-four years. The mean was 19.3 years with a median of 16 years. Data relative to the type of business being conducted by the ten sample companies are presented in Table 4. Note that tree pruning and removal make up the majority of work conducted by these firms. This type of work is also the most hazardous in the tree care industry.

The number of employees by job description for the ten sample companies are shown in Table 5. Note that the major seasonal increase

in employees is for the groundperson and climber positions. These two positions are the least experienced and have the most accidents.

The data presented in both Table 4 and Table 5 typify small tree care firms. Most of the responding companies did not disclose their gross income for 1985.

Table 4. Description of Arborists Business, Based on Type of Arboricultural Work Performed. Percentages are based on man-hours of work performed in a small tree care firm.

Work Type	Mean %	Median %	High %	Low %
Tree pruning and removal	59.70	62.50	85	35
Spraying and fertilizing	26.80	30.00	45	10
Transplanting and landscaping	12.10	7.50	30	0
Utility	.20	0	2	0
Other	1.20	0	10	0
Total	100			

Table 5. Number of Arboricultural Employees by Position Typical of a Small Tree Care Firm.

Position	Year-round		Seasonal	
	Mean	Median	Mean	Median
Salespersons	1.35	1	0	0
Forepersons	2.30	2	.40	0
Climbers	2.10	2	2.00	2
Groundpersons	1.20	2	2.10	2
Office	1.30	1	.4	0
Total	8.25	8	4.9	4

This research was concerned with two key positions in the tree care industry, groundpersons and forepersons. The actual test subject population/persons were the entry level position/persons of the tree care firm. The exact title varies by firm; examples of titles used are: trainee, groundperson, brushee, and hose dragger. For the purpose of this study the researcher will use the title groundperson.

The exact duties of a groundperson vary from firm to firm and between job sites. Three arboricultural job situations requiring special competencies were identified in Chapter II. For the purpose of this study, the competencies required of a groundperson on a pruning or removal job site will be applied.

An average groundperson is 22.3 years old, has 12.4 years of education and is being paid $7.33 per hour. Six of these people have had no formal training in arboriculture, while four have received training on the college or high school level. The groundpersons have been working for a tree care firm a mean of 1.45 years with a median of .75 years.

The foreperson's position is also one that varies tremendously in the tree care industry. While the job title will vary by firm, in general the position is one of an experienced arborist whose duties may involve not only crew management but also sales. In many cases, especially in small companies, the owner of the company is also the salesperson and general foreperson. In summary, the foreperson is the most experienced member of a crew and the groundperson the least

experienced; as a result, most forepersons act as the primary trainer of new groundpersons/trainees.

The average foreperson, from the study's sample, was extremely well trained. The formal education varied from a high school diploma to a Bachelor of Science degree in Arboriculture. All had received formal training in arboriculture. Important to note is that all of the forepersons had arboricultural work experience with a mean of 4.02 years and a median of 4 years. Income varied from $18,000 to $30,000 with a mean of $23,640, based on two thousand hours. A general job description of a foreperson and groundperson is given in Appendix E. A major aim of this research was to channel the training so that both production and safety competencies are taught at the same time to the groundperson/trainee by the experienced foreperson/trainer.

The interview data were collected by an interview team.

Interview Team

The interviews were administered by three Arboriculture/Urban Forestry seniors from the University of Massachusetts in Amherst who completed two college courses that addressed arboricultural safety. Leisure Studies and Resources 332, is a junior level course at the University that teaches basic arboriculture, including the study of the Z-133 Safety Standard. Arboriculture S-08, Utility and Municipal Arboriculture, contains a section dealing with the teaching of safety to employees. Each student had also worked for the researcher as a teaching assistant. This position involved teaching basic climbing, chainsaw, and rope safety competencies.

In addition to the college training, each interviewer had also completed the NAA Electrical Hazards Awareness Program. Each interviewer will receive one special project credit for his/her work on this project.

Training the Interview Team

The interviewers participated in a two-part training workshop in order to establish a protocol for the on-site interview process. The interview instructions are in Appendix F. The group interview training consisted of a complete review of the instrument. In addition, observation techniques and processes to record the data were discussed in order to insure that all of the data would be collected in a like manner. This training was required in order to assure a common system of repetition.

In addition to the group meeting, the researcher met with each of the individual interviewers in order to review any concerns. The individual tree companies were also discussed at this time.

Competency Identification

The existing production and safety-related competency lists were reviewed and analyzed in detail in Chapter II. A major finding was that no competency list has both production and safety tasks on it. This deficiency is compounded by the fact that only one list breaks the competencies into worker classifications.

In order to develop a curriculum that had both safety and production competencies, it was first necessary to develop a combined competency list.

McClay's 1978 competency list developed for the U.S. Department of Health, Education and Welfare (Appendix A), was the best production related list because it separated the competencies by job title. Therefore McClay's list was used as a basis for the production competencies.

The safety competencies were constructed from the American National Safety Standard Z-133.1-1982 (See Appendix B). It was necessary to combine both of these in order to have a competency list that could be used to construct an on-site curriculum. As discussed in Chapter II, the competency list was divided into three work situations. For the purpose of this study, only the competencies required of a groundperson on a pruning or removal site will be presented.

The identified competencies that are required of a groundperson on a pruning site are contained in Table 6. This table has both production and safety competencies listed and contains the competencies that can be taught by a foreperson while on the job site.

Therefore, Table 6 in effect, becomes a field site training outline for the foreperson. Table 6 was used to guide the curriculum development for this project.

Table 6. Field Site Training Outline for Groundpersons Based on Production and Safety Competencies (6, 27).

Identified Competencies References (27)	Z-133 Safety Standards References (6)
1. General Safety	
A. 7.E Administer First Aid	3.3.1 3.3.2
B. 7.F Aerial Rescue	4.2.9
C. Personal Protective Equipment (mandated by law)	3.2.1 3.2.2 3.2.4 3.2.5 4.1.1 4.2.5 4.2.6 4.2.9
D. Gasoline Chain Saw (not identified as a required competency--but results in many injuries)	6.2.1 6.2.3 6.2.5 6.2.6 6.2.8 3.5.1 3.5.2
2. Traffic Control A. 7B Flag person B. 7J Sign placement C. 7K Control traffic	3.4
3. Pruning and removing trees A. 4B tie appropriate knots B. 4G hoisting tools to climbers	3.2.10 7.9.2 7.9.3 7.9.4 7.9.5 7.9.6
C. 12B Lowering lines	8.2.4 8.2.5 8.5.6
4. Ladders A. 7A Lowering lines	8.2.8 7.11.3 7.11.4 7.11.5 7.11.6

Table 6. (continued)

Identified Competencies	Z-133 Safety Standards
5. Disease Control	
A. 6A Disinfect pruning tools	NAA-Pruning Standard
6. Brush chipper	
A. 121 Chipping	5.3.1
	5.3.5
B. 136 Refueling	5.3.6-8.6.2
	8.6.3
	8.6.4
	8.6.5
	8.6.6
	8.6.7
	3.5.1
	3.5.2
C. Towing	5.3.7
7. Trucks	
A. 12M Loading brush	5.6.2

Curriculum Development

The major focus of this research was the development of an arboricultural safety training curriculum that could be used by a foreperson in the field to train groundpersons. The major guidelines for the development of this material was twofold:

1. Competency based on productivity and safety.
2. Individualized learning packages for field use.

Each competency listed from Table 6 was transferred to a 3x5 inch Vest Pocket Field Guide, the assumption being that the foreperson

is an experienced arborist who knows how to do the job. Therefore, a long description of tasks is not required and would, in fact, reduce the effectiveness of the curriculum. When the interviewers supplied the foreperson with a list of task items that the groundperson needed to know in order to work in a safe and productive manner, the foreperson went through the list not forgetting to convey some important safety information. Figure 1 is an example of a field card.

Trainee

SKILL: Starting a Chainsaw

	Z-133 Ref.
Chainsaw	6.2.1
	6.2.3
Gas, Oil, Chain, Starting Rope	6.4.4
Starting	6.2.5
Start in Clear Area	6.2.6
Two Hands on Saw	6.2.7
Avoid Kick-Back	6.2.8
Avoid "drop" Starting	

Figure 1. Example of a 3x5 inch Vest Pocket Field Guide card used by a foreperson as an aid to training a groundperson on How Safely Start a Chainsaw, the Z-133 reference can be used by the foreperson to guide the trainee.

A field card was developed for each task that a groundperson needed to know in order to be productive and safe on a pruning or tree removal job site. It is important to note here that this is the first time the safety standards from the Z-133 were incorporated into an on-site training program. The Z-133 is the national standard and tree workers are required to know and follow it.

Each task was broken down into steps that were not too detailed nor too general. The key item with this curriculum was its simplicity and the ability of the foreperson to go through the cards on the job site. Most of these workers were outdoor people and did not like the structured classroom environment, but were able to adapt and learn quickly in the field.

In summary, the Vest Pocket Field Guide was developed as a training aid for field use by field personnel. Since it is able to fit into a shirt pocket or lunch box there is no reason to leave it back at the shop with the other training programs. A complete set of the Vest Pocket Field Guide appears in Chapter IV. This was developed for the foreperson/trainer and is based on Table 6. The Vest Pocket Field Guide has been divided into seven parts or training sessions, taking into consideration the safety and production competencies required on a pruning site.

Field Application

The field trial was divided into three major steps or stages in order to test the workability of this program.

Stage I--Training of the Foreperson/Trainer

The training of the forepersons actually required that some time be spent showing the forepersons that it was to their advantage to do a thorough job training the groundpersons. They often had to be convinced that they should have a training program and that it would

make their job safer and easier. This form of training must be considered because many "older" forepersons fear that the "young" climber may take over his/her job. The experienced foreperson must be shown that s/he is of value to the company, especially if s/he can train new people.

The forepersons were taught the basic military four-step training methodology that many forepersons used while in military service.

Step 1. Tell them what you're going to show them.

Step 2. Show them how to do it.

Step 3. Let them try it.

Step 4. Check and follow up.

The training program for groundpersons was reviewed with the field trainers/forepersons. Some background educational materials containing additional training information was also given to the forepersons, as it was required for clarification on a particular subject--for example, chainsaw safety. The training of the foreperson was conducted one-on-one by the interviewer in order to explain the program and reduce any training fear. The interviewer followed the interview instructions (See Appendix F).

Stage II--Application of Curriculum: Field Trial

The actual field trial took place between May 15, 1986 and July 1, 1986. The reason for these dates was that most of the temporary seasonal hiring takes place at this time by the tree care industry.

Each of the field trainers/forepersons had the opportunity during this period to use the Vest Pocket Field Guide with at least one new groundperson.

Stage III--Data Collection Process

The primary objective of Stage III was to collect variable data that would be used to evaluate the program in order to determine if the intended objectives and goals were met.

Primary Objectives:

1. To determine the adequacy of the Vest Pocket Field Guide in training safety and production competencies to groundpersons.
2. To determine if a foreperson can be used as a trainer to carry out this program in the field.

Subordinate Objectives:

1. To determine if the program is effective as a safety and production training program.
2. To determine if the program content is consonant with the job requirements of a groundperson.
3. To identify strengths of the program.
4. To identify weaknesses of the program.

In order to collect the required data, a three-part instrument was developed and administered (See Appendix G).

Part I--Questionnaire/Opinionnaire
of Foreperson

The first step was to interview the foreperson/trainer during the training session in order to obtain the necessary information and the foreperson's attitudes/opinions of the program. This questionnaire was used to draw the biographical sketch of the interview population, presented earlier in this chapter of both the foreperson and the company. At the conclusion of the month-long trial, the questionnaire was completed by the interviewer in person or by phone. Appendix G contains an example of the interview questionnaire used.

Part II--Field Observation

There is no substitute for direct observation of a crew in order to measure and assess performance. An observer checklist was used to determine the positive or negative behavior being displayed by the crew concerning production and safety items.

This checklist was used by the interviewer on the job site, spending a minimum of four hours with each crew between May 15, 1986 and July 1, 1986. This on-site evaluation by an experienced arborist, the interviewer, allowed the recording of data on-site without interfering with the normal routine of the crew. While visiting the work site, the interviewer dressed in work clothes and worked along with the crew. While this relaxed the crew and they worked in their "normal routine," the researcher assumed there may have been some

upgrading of worker safety habits during the visit. The checklist appears in Appendix G.

Part III--Exit Interview
of Groundperson/Trainee

While the field observation supplied most of the information required from the groundperson, an exit interview was used to expand this information. The earlier biographical composite of the groundperson was constructed from the exit interview. The exit interview instrument is included in Appendix G and consists of ten questions that were administered by the interview team.

The field data was collected, correlated, and analyzed during the summer of 1986. The findings are presented in Chapter IV.

CHAPTER IV

FINDINGS

The findings of the study are presented in three segments: (a) Development of a Combined Competency List, (b) Development of the Vest Pocket Field Guide, and (c) Analysis of the Structured Interviews.

Combined Competencies

A major finding of the research was that of the eight competency lists analyzed not one contained safety competencies. In order to carry out this project, a safety competency list had to be developed. This list was developed by using the Z-133.1-1982 as a benchmark. The safety competencies were then combined with the production competencies developed by McClay (27).

The data from these two lists was then combined to form Table 6; which was in turn used to develop the Vest Pocket Field Guide curriculum.

Vest Pocket Field Guide

The Vest Pocket Field Guide presented herein was developed to meet the two guidelines presented in Chapter III concerning an acceptable arboricultural curriculum:

1. Curriculum would be based on production and safety competencies.
2. Individualized learning packages for field use would be developed.

The Vest Pocket Field Guide meets both criteria. As a result of the field trial, the cards have been modified to meet concerns and omissions that were in the original cards. As discussed earlier, the Vest Pocket Field Guide will have to be modified for regional differences. The Vest Pocket Field Guide presented on the following 25 pages is a base to work from and improve upon.

All of the persons that have used the Vest Pocket Field Guide received instructions before using it on how to put the Vest Pocket Field Guide to best use. Each foreperson/trainer had a copy of the Z-133 safety standard and knew how to use it.

In summary, the Vest Pocket Field Guide was developed to provide an on the job safety training process for field persons. In most cases the foreperson was the trainer because s/he was the most experienced person on the job site.

Training takes place on the job site because most of the work cannot be taught in a classroom and must be taught in the field. In addition, teaching on site is more cost efficient. The Vest Pocket Field Guide is an individualized safety and production learning package for field use by arborists.

VEST POCKET FIELD GUIDE

FOR

ARBORISTS

by

H. Dennis P. Ryan III

INTRODUCTION

Many tree workers are injured because they lack good training. We believe that forepersons are the most knowledgeable persons about job safety and therefore should be the best trainers.

This guide has been designed for quick and easy reference and outlines what we think every groundperson needs to know in order to work safely and to make his/her job easier and more productive.

The small size is designed to fit into your pocket or lunch pail for easy access. Please try it--if you have any suggestions--GOOD or BAD--please give me a call. Thank you.

If you have any questions
or comments concerning
the Vest Pocket Field Guide
you may contact

H. Dennis P. Ryan, III
Arboriculture and Urban Forestry
(413) 545-2255

Department of Landscape Architecture and Regional Planning
University of Massachusetts
Amherst, Massachusetts 01003

The Z-133 Reference on the right side of each card refers to Z-133 safety standard that you received with this Guide. For additional training aids contact:

National Arborist Association
174 Rt. 101
Bedford Station, Box 238
Bedford, NH 03102

INTRO

EMERGENCY PHONE NUMBERS

Tree Company Office _____

Police/Fire _____

TRAINING GUIDELINES

This Vest Pocket Field Guide was developed for you so that training of new groundpersons can take place on the job site. This guide was designed to make your training job easier. Please follow the guidelines for best use of this Vest Pocket Field Guide:

1. Read each unit before using.

2. Look over your copy of the Z-133 as a reference.

3. Teach the groundperson the training unit using the military four-step method that you are familiar with.
   a. tell them
   b. show them
   c. let them try
   d. check them

4. When you are satisfied that they know the unit, have them sign the signature card and then you sign it.

5. Have a signature card for each person and keep the card in a safe place for reference.

Trainee SKILL: Groundperson Personal Protection Unit To be taught the first day on the job	Z-133 Ref.

Trainee SKILL: Groundperson Personal Protection <u>Proper Clothing</u> No loose clothing Proper boots	Z-133 Ref. 3.2.1 3.2.5 CARD 1-1

Trainee Groundperson SKILL: Personal Protection Property Safety Equipment Hard Hats - always Eye Protection during chipping during sawing Hearing Protection during chipping during extended use of chain saw	Z-133 Ref. 3.2.2 3.2.4 3.6
	CARD 1-2

Trainee Groundperson SKILL: Personal Protection Electrical Hazards All overhead and underground wires are to be considered energized with potentially fatal voltages and should never be touched either directly or indirectly	Z-133 Ref.
	CARD 1-3

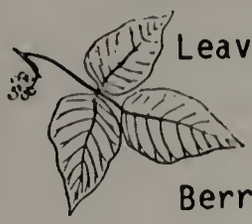
Trainee Groundperson SKILL: Personal Protection Electrical Hazards Direct Contact Put hand on wire Indirect Contact Touch wire with tool, brush or through truck, etc.	Z-133 Ref. 4.1.1
	CARD 1-4

Trainee Groundperson SKILL: Personal Protection Electrical Hazards All groundpersons will maintain a distance of 10 feet from wires either directly or indirectly	Z-133 Ref. 4.3.5
	CARD 1-5

Trainee SKILL: Groundperson Personal Protection Electrical Hazards When a bucket truck or crane is near the wires, the groundperson will stay at least 10 feet from the truck and chipper.	Z-133 Ref. 4.2.9 CARD 1-6

Trainee SKILL: Groundperson Crew Safety Unit	Z-133 Ref.

Trainee Groundperson SKILL: Crew Safety	Z-133 Ref.
<u>First Aid</u> Location of truck first aid box Contents of box How to obtain a first aid card and CPR card	3.3.1
	CARD 2-1

Trainee Groundperson SKILL: Crew Safety	Z-133 Ref.
<u>Poison Ivy</u>  Leaves: Grow in groups of three. Leaflets are not lobed. Dark green in summer; scarlet and orange in fall. Berries: White and waxy in appearance. Growth Form: Woody wine is most typical form; also grows as trailing shrubs. Habitat: Grows in, on, or near trees and is often found along fence rows.	CARD 2.2

Trainee Groundperson
SKILL: Crew Safety

Z-133 Ref.

Poison Sumac

Leaves: Divided into 7 to 13 leaflets arranged in pairs with one at the end of the midrib. Bright orange in spring; dark green with scarlet midribs in summer; red-orange in fall.

Berries: Ivory or green in color; hang in loose, long cluster

Growth Form: Coarse, woody shrubs.

Habitat: Swamps or bogs.

CARD 2-3

Trainee Groundperson
SKILL: Crew Safety

Z-133 Ref.

Fire Protection

Location of Fire Extinguisher on Truck 3.5

Demonstrate Proper use of Fire Extinguisher

CARD 2-4

Trainee Groundperson SKILL: Crew Safety	Z-133 Ref.
<u>Refueling</u> No smoking Stop engine Let engine cool Do not restart within 10 feet of refueling spot Do not refuel on lawn or driveway	3.5.2 3.5.1.1 3.5.1.2
	CARD 2.5

Trainee Groundperson SKILL:	Z-133 Ref.
Rope Unit	

Trainee Groundperson
SKILL: Rope

Knots

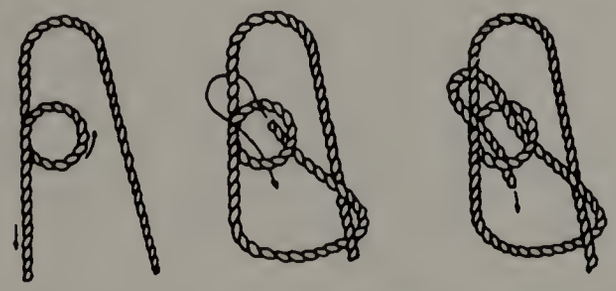
☐ SINGLE BOWLINE

Z-133 Ref.

CARD
3-1

Trainee Groundperson
SKILL: Rope

Knots



☐ RUNNING BOWLINE

Z-133 Ref.

CARD
3-2

Trainee Groundperson
SKILL: Rope

Knots

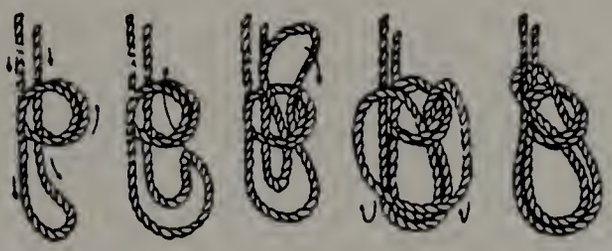
☐ CLOVE HITCH

Z-133 Ref.

CARD
3-3

Trainee Groundperson
SKILL: Rope

Knots



☐ BOWLINE ON A BIGHT

Z-133 Ref.

CARD
3-4

Trainee Groundperson SKILL: Rope	Z-133 Ref.
Knots Show the groundperson any other knots that you think s/he should know to make your job easier	
	CARD 3-5

Trainee Groundperson SKILL: Rope	Z-133 Ref.
Rope Safety	
Never use a climbing rope to lower limbs	3.2.10
Never use unsafe ropes	7.9.2
Store rope properly	7.9.3
	CARD 3-6

Trainee Groundperson SKILL: Rope Lowering Show groundperson how to take a "wrap" when lowering heavy work	Z-133 Ref. 8.2.4
	CARD 3-7

Trainee Groundperson SKILL: Rope Coiling Rope Show groundperson how to coil a line Show groundperson how to store rope properly	Z-133 Ref. 7.9.4
	CARD 3-8

Trainee Groundperson
SKILL:

Brush Control Unit

Z-133 Ref.

Trainee Groundperson
SKILL: Brush Control

Clean/Safe Work Site

Keep site clean
Pile brush with butt ends in one direction
Keep street and sidewalk clear
Do not walk under trees when climbers are in trees-falling objects

Z-133 Ref.

8.6.1

CARD
4-1

Trainee Groundperson SKILL: Brush Control	Z-133 Ref.
<u>Chipping</u> No loose clothing, rings, etc. Wear eye protection Wear hearing protection	8.6.6 8.6.2 5.3.6
	CARD 4-2

Trainee Groundperson SKILL: Brush Control	Z-133 Ref.
<u>Chipper Maintenance</u> Check Gas Oil Water Proper start up Proper clutch engagement Keep all safety panels in place	5.3.1
	CARD 4-3

Trainee Groundperson SKILL: Brush Control	Z-133 Ref.
Feeding Chipper Always and only from side Keep hands out of chute Feed from curbside whenever possible Keep tools, stones out of chute	8.6.3
	CARD 4-4

Trainee Groundperson SKILL: Brush Control	Z-133 Ref.
Towing Chippers Unlocked chippers will always be chocked When towing check to see if hitch is secure When towing safety chains shall be crossed under tongue	5.3.5 5.3.7
	CARD 4-5

Trainee Groundperson
SKILL: Brush Control

Loading Brush by Hand

Pack properly
Tie down load
Do not block taillights
Do not overhang side

Z-133 Ref.

5.6.2

CARD
4-6

Trainee Groundperson
SKILL:

Chainsaw Unit

Z-133 Ref.

Trainee Groundperson SKILL: Chainsaws	Z-133 Ref.
Safety Instructions Before using saw have groundperson read manufacturer's book	6.2.1
	CARD 5-1

Trainee Groundperson SKILL: Chainsaws	Z-133 Ref.
Maintenance	6.2.6
Gas mix Chain oil Air filter Chain tension Keep saw clean	6.2.8
	CARD 5-2

Trainee Groundperson SKILL: Chainsaws	Z-133 Ref.
<u>Starting</u>	
Secure footing	6.2.3
Proper hand hold thumb under top bar	6.2.4
Are co-workers clear?	6.2.5
Keep chain off of ground	
	CARD 5-3

Trainee Groundperson SKILL: Chainsaws	Z-133 Ref.
<u>Bucking</u>	8.7.1
Stand uphill when cutting	8.7.2
Careful of branches under tension	8.7.3
Block log to prevent rolling	8.7.4
Use of wedges to prevent chain binding	8.7.5
Never cut with one hand	
	CARD 5-4

Trainee Groundperson SKILL: Ladder Safety Unit	Z-133 Ref.

Trainee Groundperson SKILL: Ladders <u>Safety</u> Electrical hazard exists with metal ladders Inspect before use Do not use to load logs	Z-133 Ref. 7.11.1 7.11.3 7.11.6
	CARD 6-1

Trainee Groundperson
SKILL: Ladders

Proper Placement

Check footing of ladder
Set ladder 1/4 total height
distance from base of tree
Tie ladder off if necessary

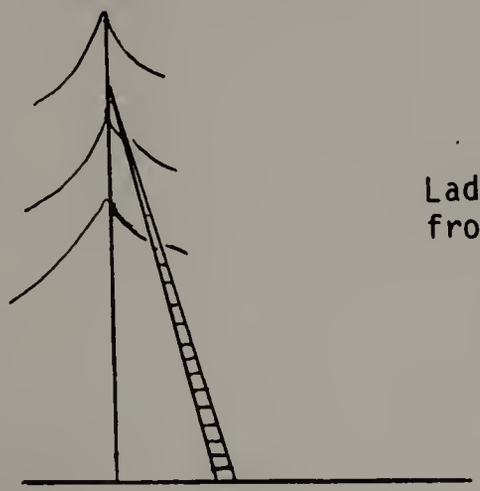
Z-133 Ref.

7.11.4

CARD
6-2

Trainee Groundperson
SKILL: Ladders

Proper Placement



Ladder 1/4 distance
from tree base

Z-133 Ref.

CARD
6-3

Trainee Groundperson SKILL: Traffic Safety Unit	Z-133 Ref.

Trainee Groundperson SKILL: Traffic Control Show groundperson how to place Signs Traffic cones Stress importance of keeping alert for cars, children, etc.	Z-133 Ref. 3.4.1
	CARD 7-1

Signature Card

Trainee Groundperson--Competion Check List
Groundperson--John Doe

	Groundperson	Foreperson	Date
Unit 1 Personal Protection			
Unit 2 Crew Safety			
Unit 3 Rope			
Unit 4 Brush Control			
Unit 5 Chainsaw			
Unit 6 Ladders			
Unit 7 Traffic Control			

Analysis of Structured Interviews

The interviews consisted of three sections: (a) Foreperson Questionnnaire, (b) Field Observation, and (c) Exit Interview.

Foreperson Questionnaire

The foreperson's questionnaire consisted of 15 questions. The questions were grouped into three categories: (a) training opinion, (b) usefulness of Vest Pocket Field Guide, and (c) attitude toward safety. The set of 15 questions were grouped as follows: (a) five questions related to training, (b) six questions related to the Vest Pocket Field Guide, and (c) four questions related to safety.

A Likert-type rating scale was developed to measure the attitude of the foreperson in response to the three categories. There were five possible responses to the fifteen questions: Strongly Disagree (SD), Disagree (D), Neutral or Undecided (N), Agree (A), and Strongly Agree (SA). The foreperson questionnaire is summarized in Tables 7, 8, and 9. The complete questionnaire is in Appendix G. Since the foreperson is the crew leader, his/her attitude could set the tone for the entire crew.

Table 7. Summarization of the Forepersons' Responses to the Five Questions Relating to Training Attitude Derived from the Forepersons Questionnaire.

Question		SA n	SA %	A n	A %	N n	N %	D n	D %	SD * n	SD * %
F1.+	Part of a foreman's job is to train new people.	2	20	8	80	--	--	--	--	--	--
F2.+	Most training takes place on the job site.	3	30	7	70	--	--	--	--	--	--
F3.+	Safety training should be required of all ground-persons.	6	60	4	40	--	--	--	--	--	--
F4.-	My company does not adequately train its new employees in safety.	1	10	4	40	--	--	5	50	--	--
F5.-	Most new ground-persons are use-less.	1	10	2	20	3	30	4	40	--	--

* (SA) Strongly Agree
(A) Agree
(N) Neutral or Undecided
(D) Disagree
(SD) Strongly Disagree
n Total number of responses by scale
% Percentage of responses by scale

Table 8. Summarization of the Forepersons' Attitude Responses to the Six Questions relating to the Vest Pocket Field Guide.

Question		SA n	SA %	A n	A %	N n	N %	D n	D %	SD * n	SD * %
F6.+	The Vest Pocket Field Guide makes my job of training easier.	--	--	3	30	7	70	--	--	--	--
F7.-	The Vest Pocket Field Guide does not contain all of the groundperson's tasks.	--	--	4	40	5	50	1	10	--	--
F8.+	Most forepersons could train new groundpersons if they used the Vest Pocket Field Guide.	--	--	7	70	3	30	--	--	--	--
F9.+	The Vest Pocket Field Guide outlines safety skills necessary for a groundperson.	1	10	8	80	1	10	--	--	--	--
F10.+	The Vest Pocket Field Guide outlines production skills necessary for a groundperson.	--	--	7	70	3	30	--	--	--	--
F15.-	This project was a complete waste of time.	--	--	--	--	3	30	5	50	2	20

* (SA) Strongly Agree
(A) Agree
(N) Neutral or Undecided
(D) Disagree
(SD) Strongly Disagree
n Total number of responses by scale
% Percentage of responses by scale

Table 9. Summarization of the Forepersons' Responses to the Four Questions Related to His/Her Attitude Toward Safety on the Job Site.

Question	SA		A		N		D		SD *	
	n	%	n	%	n	%	n	%	n	%
F11.+ All tree workers should wear hard hats at all times while on the job site.	1	10	4	40	3	30	2	20	--	--
F12.+ When feeding a chipper safety glasses should always be worn.	5	50	3	30	2	20	--	--	--	--
F13.- A groundperson can feed a chipper while the aerial lift is working in the electrical lines.	--	--	1	10	1	10	4	40	4	40
F14.- A climbing line can be used to lower light limbs.	--	--	1	10	3	30	5	50	1	10

* (SA) Strongly Agree
(A) Agree
(N) Neutral or Undecided
(D) Disagree
(SD) Strongly Disagree
n Total number of responses by scale
% Percentage of responses by scale

Field Observation Checklist

The Field Observation Checklist consisted of 15 questions designed to measure observed safety behavior. The data were collected for foreperson, climber, and groundperson by the interviewer. The checklist is a methodology to estimate the degree of safety being followed on the job site by the observed crews. The complete Observation Checklist is shown in Appendix G. The observations recorded by the interviewer are summarized in Table 10.

Table 10. Summarization of Safety Observation Checklist*

	Mean	Median
Foreperson	8.66	9.23
Climber	8.54	9.10
Groundperson	8.24	8.93
Combined Total	8.48	9.03

*Each observation was rated on a scale of 1 to 10, one being the lowest and ten the highest rating. If a person was following accepted safety behavior 70% of the time s/he was given a 7.

Exit Interview

Ten questions were grouped into three categories: (a) training opinion, (b) attitude toward safety, and (c) attitude to the work experience. The set of questions was grouped as follows: (a) three Likert-type questions relating to training, (b) four Likert-type questions relating to safety, and (c) three open questions relating to attitude.

A Likert-type scale was developed to measure the response of the groundperson in relation to training and safety. There were five possible responses to the questions: Strongly Disagree (SD), Disagree (D), Neutral or Undecided (N), Agree (A), and Strongly Agree (SA). The questions were formulated as either a negative or a positive response. The exit interview is summarized in Tables 11 and 12. The last three work experience questions were open-ended and are as follows:

G8. What do you like best about this job?

G9. What do you like least about this job?

G10. Do you wish to stay in this business and become a climber?

The open questions answered by the groundpersons revealed no startling information. On the positive side, they generally liked working out-of-doors, working on a new site every day, the excitement, and lastly the crew. Negative responses primarily were aimed at the brush cleanup which is a hot, dirty, and monotonous process.

A surprisingly high percentage (70%) of the groundpersons wished to stay in the tree care business and become climbers.

Table 11. Summarization of the Groundpersons' Responses to the Three Questions Relative to Training Attitude.

Question		SA n	SA %	A n	A %	N n	N %	D n	D %	SD * n	SD * %
F1.+	Part of a foreman's job is to train me.	4	40	6	60	--	--	--	--	--	--
F2.-	My company does not adequately train its new employees in safety.	--	--	--	--	2	20	7	70	1	10
F7.+	The foreperson has been teaching me how to do my job.	1	10	9	90	--	--	--	--	--	--

* (SA) Strongly Agree
(A) Agree
(N) Neutral or Undecided
(D) Disagree
(SD) Strongly Disagree
n Total number of responses by scale
% Percentage of responses by scale

Table 12. Summarization of the Groundpersons' Responses to the Four Questions Related to the Attitude Toward Safety on the Job Site

Question		SA n	SA %	A n	A %	N n	N %	D n	D %	SD * n	SD * %
F3.+	All tree workers should wear hard hats at all times while on the job site.	1	10	3	30	3	30	3	30	--	--
F4.+	When feeding a chipper safety glasses should always be worn.	2	20	6	60	1	10	1	10	--	--
F5.-	A groundperson can feed a chipper while the aerial lift is working on line clearing.	--	--	--	00	1	10	6	60	3	30
F6.-	A climbing line can be used to lower light limbs.	--	--	3	30	2	20	3	30	2	20

* (SA) Strongly Agree
(A) Agree
(N) Neutral or Undecided
(D) Disagree
(SD) Strongly Disagree
n Total number of responses by scale
% Percentage of responses by scale

Appendix G contains the complete exit interview. The findings presented in this chapter will be discussed in Chapter V and recommendations presented.

C H A P T E R V

DISCUSSION AND RECOMMENDATIONS

Summary

On-the-job accidents are a major personnel and economic problem of the arborist industry. Many of the accidents could be prevented with the proper training of new personnel. Analysis of arboricultural accidents and competencies was conducted in order to develop a training curriculum that the industry would use on the job site.

As a result of the shortage of adequately skilled tree workers, the industry is forced to hire many who are unskilled and lacking in proper productivity and safety competencies. The end result is that employers are required to do more training. Pressure to train is also being applied by OSHA and the insurance industry in order to reduce the accident rate.

The purpose of this research was to develop a safety training program that can be used by industry personnel on the job site. A competency oriented needs analysis was developed in conjunction with the National Arborist Association in order to guide the curriculum design. The training program focused on groundpersons, but the methodology is applicable for other identified training requirements. A programmed, Vest Pocket Field Guide instructional format with

individualized learning packages is the major component of the learning system. Units are based on the National Safety Standard and were field tested. The effectiveness of the training program will require an additional long-term study.

This two and one-half year study was divided into two distinct parts. The first part involved an extensive computerized literature review and an analysis of NAA insurance statistics. This information was used to evaluate the competency lists that are presently available and to evaluate training systems used by commercial arborists. These data were then compared with arboricultural accidents for a three-year period.

The second part of this study was the development of the competency based Vest Pocket Field Guide and a structured interview. The structured interview was administered to forepersons and groundpersons in order to evaluate the new training program.

Discussion

Literature Review

The literature review and insurance data analysis revealed that the major accident expense to tree care firms is workers' compensation-related injuries. The cost of these injuries has been rising steadily since 1983, resulting in premium increases of as much as 300 percent. The cause of these accidents is difficult to pinpoint, but separate analyses of individual accidents indicate that in many cases the cause is ignorance.

A knowledge of required safety and production-related competencies could reduce many of these accidents. Unfortunately, at the present time, there is no competency listing that contains safety tasks. This poses a major problem in the establishment of training programs that will reduce accidents.

There are several training programs currently on the market--most are produced and sold by the NAA. A review of these programs shows that they contain most of the safety competencies that have been discussed. These training aids are produced as audiovisual slide programs, take-home self-teach workbooks, and as video cassettes. These programs would be excellent if they were used.

During this project, a major concern was brought to light--employer attitude. All of the training programs have been aimed at the employees because they are having the accidents. But is it employer attitude that is the cause of the accidents? This employer attitude was first exposed by Felix (16) during the literature review. This assessment was confirmed in the foreperson's structured interview.

Employees are not going to follow safety programs if their "boss" is putting pressure on them to complete a job. Employees are not going to use training programs at the shop if the employer will not give them the time to conduct a training program. As a result, most training is conducted informally on the job site. At the present time, there is no training program on the market that can be used on

site. As a result, important competencies are omitted and accidents continue to take place.

Vest Pocket Field Guide and Interviews

The Vest Pocket Field Guide was developed to eliminate some of these training problems. Since the Vest Pocket Field Guide is used on site by the foreperson, necessary safety competencies should not be overlooked. While there is insufficient data available to positively state that this program would work, it is the opinion of the researcher that it would if it were used. This opinion is derived from analysis of the forepersons' responses on the structured interview. An assessment of this data is in order. The research questions presented in Chapter I will be used to guide this analysis.

Research Question 1: What kind of accidents are taking place within commercial arboricultural firms?

The kind of accidents that are taking place within the arborist industry were outlined in Table 1. Without question the major problem is the cost of workers' compensation. An analysis of workers' compensation-related injuries from March 1984 to March 1985 was presented in Table 2.

Research Question 2: What is the cost of these accidents?

The high cost of these accidents for the 1984/85 year was reviewed in Tables 1 and 2. The 1985/86 year showed a dramatic insurance cost increase for the tree care industry of 200 to 800 percent, depending on the individual firm (16). As a result of this

increase, some companies have curtailed services and others are looking for new investment opportunities (16).

Research Question 3: What is the cause of these accidents?

The causes of these accidents, were listed in Table 3. However, the accident reports supplied by the NAA did not go into sufficient depth to answer why those accidents occurred. A separate analysis of several fatal accidents that have taken place in Massachusetts, by the researcher, has shown that in many cases it is a lack of knowledge that predisposes the worker to the accident; in other cases, negligence.

Research Question 4: What safety and production-related competencies are required of a tree worker before s/he is allowed on a job site?

The safety and production-related competencies that are required of a tree worker were shown in Table 4. Prior to this study, there had been no research conducted that investigated both the production and safety competency needs of the tree industry. This deficiency is a major blockage to the construction of an adequate training curriculum that could be used by the tree care industry.

Research Question 5: What training curricula are now being used by the arborist industry?

With the exception of the large multi-state tree care firms, the NAA supplies the majority of the on-site training programs (See Appendix C). In addition, the State Cooperative Extension Services that have historically concerned themselves with plant pest problems are now presenting limited training programs and safety competencies.

Research Question 6: How efficient (safety and production related) are the training curricula now being used?

This question cannot be answered in factual terms because sufficient data are not available. Training programs are available to commercial arborists, yet problems that seemingly could be controlled persist. Felix (16) has raised a very legitimate question "Are we training the right people?" While it is true that field personnel continue to have accidents, is this a result of employer pressure to complete the job on schedule?

The following unsolicited comments were returned by two foremen and support the above "employer" problem.

> Pressure to produce on-the-job forces you to work unsafely at times, also this pressure to get the work completed results in poor training of new personnel.
>
> For the most part safety methods are practiced but the fast pace of company often gets in the way of proper practices.

These comments are frightening because they highlight that safety is right as long as it does not conflict with production. This finding was confirmed in Table 2. The sample companies followed accepted safety practices 85 percent of the time. More importantly, 15 percent of the time they did not. This indicates that the crews are not always following proper procedures; therefore, the training is not working in many cases.

Research Question 7: Can a competency-based training program be developed that will work and be used by the arborist industry?

This question must be answered in three phases. First, can a competency-based training program be developed? The Vest Pocket Field Guide, a production and safety-based competency-based curriculum, was developed and tested for this project. As discussed in Research Question 4, a complete list of both production and safety competencies was not available. While a list was compiled for this project, this deficiency is a major problem in the construction of any further training programs.

The second part of this question asks whether or not a competency-based training program will work. Quite frankly, there is insufficient data available to draw a conclusion. What is required to answer this is a long-term project that compares companies receiving training as opposed to those that continue using present practices.

Foreperson's Questions 9 and 10 refer to safety and production skills and indicate that the program does address necessary skills. Ninety percent of the forepersons' responses were either "strongly agree" or "agree" in reference to the Vest Pocket Field Guide containing necessary safety tasks, 70 percent in reference to production skills.

Production skills that forepersons felt should be added included: driving and backing a trailer, emergency phone numbers, and walking beneath trees when a climber is working. Overall, the Vest

Pocket Field Guide covered the necessary skills; however, some refinement is needed on the local level in order to meet individual company needs. The researcher feels this type of safety training approach will work if it is used. This "IF" leads to the last part of the question, will this training program be used by the arborist industry? Part of this answer can be found in Table 8. All of the forepersons sampled responded that training was part of their job and that most training takes place on the job site. While this foreperson response is encouraging, it returns to the problem of the employers discussed in Research Question 6. Will the employers sacrifice production in order to have a safe work environment?

> Research Question 8: Is it feasible to develop and field test a training program that can be administered in the field?

Yes. A training curriculum was developed from the McClay's (27) competency study and the Z-133 safety standard (6).

The field test was limited to ten tree care firms. This sample of convenience was drawn from member companies of the NAA and the Massachusetts Arborist Association (See Appendix C). These companies were not a random sample but were picked in consultation with the Executive Vice President of the NAA. The objective was to pick ten firms that would support the goal of having employees well trained in production and safety competencies. A selected sample of convenience had to be used, because most tree care firms do not conduct any formal training.

Could this training program be administered in the field? Seventy percent of the forepersons agreed that most forepersons could train new groundpersons if they used the Vest Pocket Field Guide. Unfortunately, fifty percent also reported that their companies do not adequately train their new employees in safety. Again we are dealing with the employer's priorities, production over safety.

Research Question 9: Can a foreperson be used as a trainer to successfully carry out this program?

A review of Tables 8 and 12 supports the conclusion that a foreperson can be used as a trainer. Forepersons agree unanimously that part of their job is training, that most training takes place on the job site, and that safety training should be required of all groundpersons.

The groundpersons also support the use of a foreperson as a trainer. One hundred percent agree that part of the foreperson's job is training. All of the groundpersons also reported that the foreperson has been teaching them how to do their job.

The second part of the question with reference to using the foreperson/trainer to successfully carry out this program is more difficult to answer. Referring back to Research Question 7, a long-term comparison study is in order, but 70 percent of the forepersons agree that forepersons could train new groundpersons if they used the Vest Pocket Field Guide. Thirty percent of the forepersons agreed that the Vest Pocket Field Guide makes the job of training easier, 70 percent had a neutral response.

Research Question 10: How effective is the safety and production related training program?

In short, this question could not be answered, but was discussed in Research Questions 6, 7, and 9. A long-term study will be required to answer this question, which was beyond the scope of this study.

Conclusion

The data produced from this study must be analyzed in the context of the tree care industry. The industry primarily consists of very hard working persons, who are successful because of their independence and drive. Something that does not show an immediate profit is ignored. Most of the safety advances of the industry have been forced upon the owners by OSHA and the EPA. Unfortunately, in order to reduce accidents, most companies will have to be coerced into proper training. When this training is required it is the opinion of this researcher that the Vest Pocket Field Guide could play an important role in on-site training.

The major focus of this project was the development of a production and safety competency-based training program that could be used by the arborist industry on site. The Vest Pocket Field Guide meets this goal. Further refinement of this training aid will require an in-depth analysis of competency needs and individualized programming for each local or company.

Recommendations

Based on the findings of this study, it is apparent that while the study produced an on site competency-based curriculum, it has also raised several important questions. These questions could be used to form the basis for the following recommendations for further research.

A survey of arboricultural employers is necessary in order to analyze their attitudes towards production, safety, education, and employee rights. Further research in arboricultural safety related training will be questionable unless a methodology can be constructed that incorporates employer priorities as they relate to production and safety.

Arboricultural accident data are not compiled by any one national agency, as a result arboricultural accident analysis is difficult. A collection and analysis of individual accidents is necessary. While the collection process would be difficult, the data collected would help to determine the cause of these accidents. Cooperation by major companies or associations would be necessary in order to collect the accident reports for analysis. The establishment of a national central clearing house, for example through the NAA, should be a priority.

It is imperative that a competency list be developed that includes all aspects of arboriculture. This listing should include production and safety competencies based on job title. Any further training programs must include both safety and production as a means of producing a profitable company in a safe work environment.

A comparative analysis that reviews companies that are receiving competency training against those that are following standard practices is required. This would require a large sample that is studied for several years. A state-wide or association membership sample would be necessary.

Lastly, while the Vest Pocket Field Guide is still unproven, it should be utilized to train new persons on site. It's use may reduce accidents and improve production, thus proving its worth.

In summary, arboricultural accidents will continue to take place until employer priorities and competency training take safety into consideration. The use of the Vest Pocket Field Guide could be a help, but further study is required.

A P P E N D I X A

ARBORICULTURAL COMPETENCIES

A review of eight competencies lists was undertaken in order to establish what tasks were necessary for new groundpersons (19, 22, 27, 28, 29, 31, 43, 44). None of the competency lists contained safety tasks and only one list broke down the competencies into job titles. McClay's 1978 competency list for the U.S. Department of Health, Education, and Welfare (27) did separate the tasks by title.

A select portion of the McClay Competency List is appended because it was used in combination with the National Safety Standard in order to produce Table 6. This table of required competencies was used to guide the development of the Vest Pocket Field Guide. This guide contains both production and safety competencies.

The production competency list is divided into five occupations or job titles* and identifies which tasks are essential** by job title.

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*Trainer (T), Groundperson (G), Climber (C), Foreperson (F), and Manager/Superintendent (S).

**4.0 = Essential; 3.0 = Important; 2.0 = Of Some Importance; 1.0 = Not Important; 0 = Does Not Apply.

Competencies Identified and Validated

Competencies	(T)	(G)	(C)	(F)	(S)
1. Interview and select prospective employees.	.2	.3	.5	2.5	3.6
a. Interview and select prospective employees.	.2	.3	.5	2.5	3.6
2. Work with customers and prepare estimates and bills.	.4	.7	1.0	2.8	3.5
a. Handle customer or public complaints before and after tree work.	.4	.8	1.3	3.5	3.9
b. Work with tree wardens, police, and representatives of utilities in planning work.	.3	.5	.9	3.0	3.8
c. Prepare estimates for competitive bidding and private work.	.2	.3	.5	2.1	3.5
d. Prepare bills for work performed.	.2	.3	.4	1.6	3.5
e. Advise property owners of tree work and obtain permission for work.	.4	.9	1.5	3.5	3.5
f. Post signs or distribute circulars announcing future.	.8	1.1	1.1	2.8	2.7
3. Plan work schedules.	.3	.5	1.0	3.3	3.6
a. Prepare daily work assignment sheets.	.2	.4	.8	3.2	3.6
b. Prepare work report forms.	.3	.6	1.2	3.3	3.5
4. Inspect work in progress.	.3	.4	.9	3.3	3.8
a. Check crew production and performance.	.3	.4	.9	3.3	3.8
b. Tie appropriate knots for tree climbing and limb lowering operations.	2.2	2.9	4.0	3.7	2.0
c. Prune trees in accordance with industry standards.	2.0	2.0	4.0	3.7	2.0
d. Handle rope for lowering limbs.	2.5	3.7	3.7	3.5	1.7
e. Operate aerial lift device.	1.5	1.9	3.6	3.6	1.8
f. Position outriggers on aerial life equipment.	1.7	2.6	3.5	3.6	1.7
g. Hoist tools to climbers using rope and bucket.	2.3	3.6	2.8	3.1	1.3
h. Prune and shear shrubs for form and compactness.	1.6	2.6	2.7	3.0	1.7

Competencies	(T)	(G)	(C)	(F)	(S)
6. Prevent and control diseases and other tree enemies.	1.3	1.8	2.0	3.0	2.7
a. Disinfect pruning tools to prevent spread of disease.	2.2	2.7	3.2	3.0	1.7
b. Identify insect damage to trees and shrubs, and insect causing damage.	1.1	1.4	2.1	3.3	3.8
c. Identify fruiting body of fungus.	.9	1.1	1.7	2.9	3.5
d. Identify pollution damage to trees.	.8	1.0	1.6	2.8	3.6
e. Identify lightning damage to trees.	1.0	1.2	2.3	3.3	3.6
f. Identify and report girdling roots.	1.0	1.6	2.4	3.2	3.3
g. Mix chemicals for spray applications.	1.1	2.0	2.0	3.6	2.4
h. Select pesticides, fungicides, surfactants, and thickners for spray operations.	.5	.9	1.1	2.9	3.6
i. Select appropriate nozzles and pump pressures for spray operations.	.6	1.1	1.4	3.3	3.2
j. Determine when conditions are suitable for spray operations.	.5	1.0	1.3	3.6	3.5
k. Check for open windows and doors and cover pools, toys, pet dishes, etc.	1.8	2.7	2.4	3.4	2.1
l. Operate power spray equipment.	1.2	2.2	2.5	3.3	1.6
m. Handle spray hose for spray applicator.	2.1	3.0	2.3	2.6	1.2
n. Clean sprayer and truck after spray operations.	2.4	3.0	2.2	2.5	1.2
o. Dispose of spray containers and excess spray materials in approved manner.	1.7	2.5	2.2	3.2	1.8
7. Practice safe work habits.	1.7	2.5	2.2	3.2	1.8
a. Position and steady ladders for climbers.	2.6	3.4	2.6	3.0	1.3
b. Act as flagman on major traffic arteries.	2.9	3.5	2.4	2.8	1.4
c. Raise balloons or place signals for aerial spray operations.	1.4	2.1	1.4	2.2	1.1

Competencies	(T)	(G)	(C)	(F)	(S)
d. Operate two-way radio.	1.3	2.0	2.2	3.0	2.8
e. Administer first aid.	2.2	3.1	3.3	2.8	3.2
f. Participate in tree accident rescue operations.	2.0	2.9	3.6	3.7	2.8
g. Develop training and safety programs for employees.	.3	.6	1.1	2.8	3.9
h. Fill out accident report forms.	.7	1.0	1.5	3.6	3.6
i. Notify power companies and police of downed wires.	1.3	1.6	2.2	3.6	3.5
j. Place sign and barrier for pedestrian and traffic control.	2.1	3.1	2.5	3.3	1.9
k. Direct and control pedestrian and vehicular traffic in work area.	2.4	3.2	2.2	3.2	1.8
8. Identify trees and shrubs.	1.2	1.6	2.3	3.2	3.6
a. Identify common species of trees for the geographical area.	1.4	2.0	3.0	3.7	3.7
b. Use dichotomous key in the process of identifying uncommon trees.	.9	1.1	1.6	2.7	3.4
9. Fertilize trees and shrubs.	1.4	2.0	1.9	2.7	1.8
a. Collect and package soil samples.	1.1	1.5	1.4	2.9	2.5
b. Determine type and amounts of fertilizer required for fertilization of trees and shrubs.	.7	1.0	1.3	2.9	3.3
c. Punch or drill holes in root zone for fertilization.	2.0	2.8	2.4	2.6	1.2
d. Spray soluable fertilizer for foliar feeding of trees.	1.3	2.2	2.2	2.8	1.2
e. Apply fertilizer or lime by hand or spreader.	1.8	2.6	2.1	2.4	1.0
10. Protect trees and shrubs.	1.3	2.0	2.4	2.6	1.4
a. Determine method or type of lightning protection system to be installed.	.5	.8	1.4	2.6	3.1
b. Attach tree air terminals or points and connect down conductors.	.7	1.1	2.7	2.7	1.3
c. Measure and cut cable for lightning protection system.	1.2	2.0	2.3	2.6	1.2

Competencies	(T)	(G)	(C)	(F)	(S)
d. Dig trenches to extend down conductors beyond root area.	1.8	2.5	1.9	1.9	2.0
e. Drive grounding rods into ground.	1.8	2.6	1.9	2.1	1.0
f. Clean, treat, and fill cavities in trees above ground level.	1.1	1.6	2.9	3.0	1.4
g. Clean, treat and fill basal cavities at ground level.	1.2	2.3	2.5	2.9	1.4
h. Mix mortar or commercial preparations for filling cavities.	1.7	2.6	2.2	2.5	1.8
i. Brace cavities with bolts or rods.	1.2	2.0	2.9	3.0	1.4
j. Cut and prepare sheet metal for covering cavities.	1.3	2.2	2.3	2.4	1.2
k. Drill holes and install drains in cavities as required.	1.2	2.0	2.7	2.7	1.2
l. Brace or cable established trees above ground level.	1.1	1.5	3.1	3.0	1.4
m. Measure and cut cable for cable operations.	1.4	2.0	2.8	2.9	1.3
n. Insert screw rods for separating parallel branches.	1.4	1.7	3.0	2.8	1.2
o. Cut pipe for use in covering bracing bolts.	1.4	2.3	2.3	2.4	1.1
p. Construct stone dry-wells around trees for raising grade.	1.6	2.6	1.9	2.5	1.4
q. Remove girdling roots with appropriate tools.	1.3	2.1	2.5	2.9	2.1
11. Transplant trees and shrubs.	1.7	2.6	2.1	2.5	1.3
a. Root prune trees to be transplanted.	1.5	2.7	2.3	2.8	1.5
b. Dig and comb soil from roots of trees to be transplanted bareroot.	1.7	2.6	2.0	2.5	1.2
c. Dig, ball, and burlap trees to be transplanted.	1.9	2.7	2.3	2.6	1.4
d. Tie back branches of trees to be transported.	1.9	2.7	2.3	2.6	1.4
e. Dig holes to receive transplanted trees.	2.2	2.9	2.2	2.3	1.3
f. Backfill soil around transplanted trees.	2.3	2.9	2.1	2.4	1.2
g. Operate tree spade in transplanting operations.	1.0	2.0	2.0	2.7	1.3

Competencies	(T)	(G)	(C)	(F)	(S)
h. Operate back-hoe in transplanting operations.	.9	2.0	1.8	2.5	1.1
i. Guy newly transplanted trees.	1.8	2.7	2.4	2.8	1.4
k. Cut deadman anchors from cedar or locust for guying.	1.7	2.4	1.9	2.1	1.0
l. Dig trenches for installing deadman anchors.	2.0	2.6	1.8	2.0	1.0
m. Drive or bury posts or stakes for guying.	2.1	2.7	2.0	2.1	1.1
n. Operate front-end loader for moving soil in grading operations.	1.1	2.3	1.9	2.5	1.2
o. Install drainage tiles around tree when grade is raised.	1.5	2.6	2.0	2.6	1.4
p. Construct wall around tree when grade is lowered.	1.4	2.5	1.8	2.5	1.3
q. Remove soil with hand or power equipment in grade lowering.	1.6	2.5	1.8	2.3	1.2
r. Treat, prune, and repair roots damaged in grade lowering or excavation.	1.4	2.5	2.3	2.8	1.5
12. Fell and dispose of unwanted trees.	1.6	2.8	2.4	2.6	1.3
a. Fell and cut up trees using power chain saw.	1.7	3.1	3.5	3.4	1.6
b. Handle ropes for pull-lines and lowering limbs and sections.	2.0	3.5	3.2	1.5	
c. Operate tree crane for removing sections in tree removal process.	.8	1.8	2.2	3.0	1.3
d. Operate hydraulic log splitter.	1.3	2.5	1.9	2.3	1.1
e. Operate stump cutter.	1.1	2.5	2.1	2.7	1.3
f. Cut up stumps using power or hand tools.	1.5	2.8	2.2	2.4	1.2
g. Fill depressions resulting from stump removal operations with chips and soil.	2.2	2.9	2.1	2.2	1.2
h. Control brush by application of foliar, basal, dormant stem, or stump sprays.	1.4	2.5	2.1	2.8	1.7
i. Feed limbs or brush into chipper.	2.3	3.6	2.7	2.6	1.3

Competencies	(T)	(G)	(C)	(F)	(S)
j. Operate grapple loader.	.9	2.0	2.0	2.5	1.1
k. Operate log chipper.	1.0	2.0	1.7	2.1	1.0
l. Load and unload logs from flat-bed truck.	1.8	2.8	2.2	2.5	1.2
m. Load limbs and debris on dump truck.	2.5	3.4	2.5	2.5	1.2
n. Drive and operate dump truck for disposal of brush and debris.	2.0	3.2	2.5	2.8	1.3
13. Maintain equipment.	1.6	2.5	2.5	2.9	1.6
a. Inspect, service and repair aerial lift equipment.	1.0	1.5	2.7	3.4	2.1
b. Submit periodic equipment status reports.	.6	1.1	1.8	3.5	3.4
c. Fuel, service, and replace worn teeth on stump cutter.	1.2	2.3	1.9	2.6	1.3
d. Operate and maintain rotary brush saw.	1.4	2.5	2.1	2.3	1.1
e. Lubricate moving parts and check hydraulic system on power equipment.	1.5	2.7	2.7	3.3	1.5
f. Inspect, coil, pile, or suspend rope for storage.	1.7	2.8	3.2	3.4	1.6
g. Refuel gasoline engines.	2.4	3.2	2.7	2.7	1.3
h. Drain and change oil and filters.	1.7	2.5	2.1	2.4	1.3
i. Change and repair tires on equipment.	1.6	2.2	1.8	2.1	1.2
j. Replace and/or repair chains on chain saw.	1.6	2.8	3.0	3.3	1.5
k. Sharpen blades for chain or hand saws.	1.4	2.6	3.1	3.2	1.5
l. Keep tool storage area on truck clean and orderly.	2.5	3.2	3.0	3.1	1.5

APPENDIX B

NATIONAL SAFETY STANDARD

In order to develop Table 6, it was necessary to have a list of safety competencies. The Safety Competency List was selected and developed from the National Safety Standard Z-133-1-1982 (6).

This standard was developed under the procedures of the American National Standards Institute by the American National Standards Committee on Safety in Tree Trimming Operation, Z-133. The secretariate of the Z-133 Committee is held by the International Society of Arboriculture.

On September 24, 1986, this researcher was appointed to the Z-133 Committee.

AMERICAN NATIONAL STANDARD FOR TREE CARE OPRATIONS PRUNING, TRIMMING, REPAIRING, MAINTAINING, AND REMOVING TREES, AND CUTTING BRUSH SAFETY REQUIREMENTS (6)

1. General

1.1 Scope. This standard presents safety requirements for pruning, trimming, repairing, maintaining and removing trees and for cutting brush and for the equipment used in such operations.

1.2 Purpose. The purpose of this standard is to provide safety criteria for workers and the public. It is intended as a guide to federal, state, and municipal authorities in teh drafting of their regulations and may be adopted by them in whole in part.

1.3 Application. This standard is intended to apply to any employer engaged in teh business, trade, or performance of tree pruning, trimming, repairing, maintaining, removal, or brush cutting who hires one or more persons to perform such work. It is also intended, through the voluntary use, as a standard reference for safety requirements for those engaged in pruning, trimming, repairing, maintaining, or removing trees or cutting brush.

2. Definitions

Aerial Lift. One of the following types of vehicle-mounted aerial devices used to elevate personnel to job sites above ground:

(1) extensible boom platforms

(2) aerial ladders

(3) articulating boom platforms

(4) vertical towers

(5) a combination of any of the above-defined in American National Standard for Vehicle-Mounted Elevating and Rotating Aerial Devices, ANSIA 92.2-1979.

These devices are made of metal, wood, fiberglass reinforced plastic (FRP), or other material; are powered or manually operated; and are deemed to be aerial lifts whether or not they are capable of rotating about a substantially vertical axis.

These devices are made of metal, wood, fiberglass, reinforced plastic (FRP), or other material; are powered or manually operated; and are deemed to be aerial lifts whether or not they are capable of rotating about a substantially vertical axis.

Approved. Acceptable to the federal, state, or local enforcing authority having jurisdiction.

Electrical Conductor. Any overhead or underground electrical device, including communications wires and cables, power lines, and other such facilities.

Line Clearance Tree Trimming. The pruning, trimming, or removal of trees or brush growing or existing in proximity to electrical conductors (as defined above) for the purpose of preventing such growth from interfering with the facilities involved.

Qualified Line-Clearance Tree Trimmer. A tree worker who, through related training or on-the-job experience, or both, is familiar with the hazards in line clearance and has demonstrated his/her ability in the performance of the special techniques involved.

This qualified person may or may not be currently employed by a line clearance contractor.

Qualified Line Clearance Tree Trimmer Trainee. Any worker undergoing line-clearance tree trimming training, who, in the course of such training, is familiar with the hazards in line clearance and has demonstrated his/her ability in the performance of the special techniques involved. Such trainees shall be under the direct supervision of qualified personnel.

Qualified Personnel. Any worker who by reason of his/her training and experience has demonstrated the ability to safely perform his/her duties and, where required, is properly licensed in accordance with federal, state, or local laws and regulations.

Qualified Tree Worker. A worker who, through related training or on-the-job experience, or both, is familiar with the hazards of pruning, trimming, repairing, maintaining or removing trees, and with the equipment used in such operations, and has demonstrated his/her ability in the performance of the special techniques involved.

Qualified Tree Worker Trainee. Any worker undergoing on-the-job training who, in the course of such training, is familiar with the hazards of pruning, trimming, repairing, maintaining, or removing trees, and with the equipment used in such operations, and has demonstrated his/her ability in the performance of the special techniques involved. Such trainees shall be under the direct supervision of qualified personnel.

Shall. As used in this standard, denotes a mandatory requirement.

Should. As used in this standard, denotes an advisory recommendation.

System Operator/Owner. The person or organization that operates or controls the electrical conductors involved.

Taut-Line Hitch. A know used for securing all workers aloft to their climbing rope, and consisting of either one or two wraps over two wraps.

3. Genreal Safety Requirements

3.1 General

3.1.1 Employers and employees shall observe all provisions of applicable federal, state, and local laws for persons engaged in the occupations covered by this standard.

3.1.2 Safety equipment and devices shall conform with the requirements of this standard and shall be maintained in safe condition.

3.1.3 Employers shall instruct their employees in the proper use of all equipment provided for them and shall require that safe working practices be observed. A job briefing, work procedure, and assignment shall be worked out carefully before any tree job is begun.

3.1.4 All equipment, including ropes and lines upon which the worker must rely for his/her safety, shall be inspected by the worker each day before use.

3.2 Personal Protective Equipment

3.2.1 Personal protective equipment as outlined in 3.2 shall be required where there is a reasonable probability of injury or illness that can be prevented by such protection. Employees shall use such protection.

3.2.2 Head protection shall be worn by workers engaged in tree operations. It shall conform to the applicable provisions of American National Standard Requirements for Protective Headware for Industrial Workers, ANSI Z-89.1-1981. Class B helmets only shall be worn when working in proximity to an electrical conductor, in accordance with ANSI Z-89.1-1981. The tree worker shall not place reliance on the dielectric capabilities of such helmets.

3.2.3 Respiratory protection shall be worn as required in this standard and shall conform to the applicable provisions of American National Standard Practices for Respiratory Protection, ANSI Z-88.2-1980.

3.2.4 Eye and face protection shall be worn as required in this standard and shall conform to the applicable provisions of American National Standard Practice for Occupational and Educational Eye and Face Protection, ANSI Z-87.1-1979.

3.25 Employees shall wear clothing and footwear appropriate to the work location and condition.

3.2.6 Safety belts or tree-trimming saddle belts as specified in American National Standard Requirements for Safety Belts, Harnesses, Lanyards, Lifelines and Drop Lines for Construction and

Industrial Use, ANSI A-10.14-1975, or a saddle formed by a double bowline on a bight shall be worn to protect workers above ground level.

3.2.7 Saddle belts or safety belts used for climbing operations shall have forged support rings. Snaps used in climbing ropes or in safety straps, for attachment to the forged support ring, shall be of a self-closing safety type. Forged support rings shall be designed so that the snaps will not become disengaged (roll off) accidentally.

3.2.8 Climbing ropes shall be used when working aloft in trees. These ropes should have minimum diameter of 1/2 inch (12 mm) and should be 3- or 4-strand first-grade manila, with a nominal breaking strength of 2,385 pounds (10.6 kg) or equivalent strength and durability. Synthetic rope shall have a maximum elasticity of not more than 7%.

3.2.9 Saddle belts or safety belts shall not be spliced or weakened by punching extra holes in them.

3.2.10 Climbing ropes shall not be used to lower limbs or other parts of trees, or to raise or lower equipment.

3.3 First Aid

3.3.1 An approved first-aid kit adequately stocked and maintained shall be provided by the employer when and where operations are being carried on. Each employee shall be instructed in its use.

3.3.2 All employees shall be instructed in identification of, and preventive measures relating to, common poisonous plants such as poison ivy, poison oak, and poison sumac.

3.4 Traffic Control

3.4.1 Effective means for control of pedestrian and vehicular traffic shall be instituted on every job site where necessary.

3.4.2 Traffic-control devices used in tree operations shall conform to the applicable federal and state regulations or to applicable sections of American National Standard Manual on Uniform Traffic Control Devices for Streets and Highways, ANSI D-6.1-1978.

3.5 Fire Protection

3.5.1 The requirements of the federal, state and local enforcing authorities shall be compiled with in providing the necessary fire protection for tree operations.

3.5.1.1 Gasoline-powered equipment shall be refueld only after it has been stopped. Any spilled fuel shall be removed from the equipment before restarting.

3.5.1.2 Gasoline-powered equipment shall not be operated within 10 feet (3 m) of (1) any refueling operations or (2) any area in which refueling has recently taken place.

3.5.1.3 Flammable liquids shall be stored, handled and dispensed only from metal containers or approved safety cans.

3.5.1 Smoking shall be prohibited when handling or working around any flammable liquid.

3.6 Noise. When employees are required to work in areas in which the noise levels exceed acceptable standards as established by federal regulations, the employer shall take appropriate measures to suppress the noise to safe levels. When it is not practicable to decrease the noise or isolate the workers from it, the workers shall wear effective hearing-protective equipment as provided by the employer.

3.7 Rescue. Rescue procedures for employees working above ground shall be established by the employer, and the employees trained accordingly.

4. Electrical Hazards

4.1 General. All overhead and underground electrical conductors and all communication wires and cables shall be considered to be energized with potentially fatal voltages and shall never be touched either directly or indirectly.

4.1.1 Every tree worker shall be instructed that : (1) A direct contact is made when any part of the body touches or contacts an energized conductor or other energized electrical fixture or apparatus. (2) An indirect contact is made when any part of the body touches any object in contact with an energized electrical conductor or other energized fixture or apparatus. (3) An indirect contact can be made through conductive tools, tree branches, trucks, equipment, or other objectives or as a result of communication wires and cables, fences, or guy wires being accidentally energized. (4) Electric shock

will occur when a tree worker, by either direct or indirect contact with an energized conductor, energized tree limb, tool, equipment, or other object, provides a path for the flow of electricity to a grounded object or to the ground itself. Simultaneous contact with two energized conductors will also cause electric shock that may result in serious or fatal injury.

4.1.2 The system operator/owner shall be advised before any work is performed in proximity to energized conductors. This rule shall not apply to persons working on behalf of, or employed by, the system operator/owner.

4.2 Working in Proximity to Electrical Hazards

4.2.1 A close inspection shall be made by the tree worker and by the supervisor (see Section A3) to determine whether an electrical conductor passes within reaching distance of the tree worker before climbing, entering, or working around any tree.

4.2.2 Only a qualified line-clearance tree trimmer or qualified line-clearance tree-trimmer trainee shall be assigned to the work if it is found that an electrical hazard exists. A trainee shall be under the direct supervision of qualified personnel.

4.2.3 There shall be a second qualified line-clearance tree trimmer or line-clearance tree-trimmer trainee within normal voice communication during the line-clearing operations aloft when the line-clearance tree trimmer or line-clearance tree-trimmer trainee must approach more closely than 10 feet (3 m) to any conductor or

electrical apparatus energized in excess of 750 volts or: (1) when branches or limbs being removed cannot first be cut (with a pole pruner/pole saw) sufficiently clear of the primary conductors and apparatus as to avoid contact, or (2) when roping is required to remove branches or limbs from such conductors or apparatus. This does not apply to utility worker engaged in tree trimming incidental to their normal occupation.

4.2.4 Line clearance tree trimmers and line-clearance tree-trimmer trainees shall maintain the clearances from energized conductors given in Table 1.

Voltage Range (phase to phase) (kV)	Minimum Working Distance
2.1 to 15.0	2 ft. 0 in. (0.6 m)
15.1 to 35.0	2 ft. 4 in. (0.7 m)
35.1 to 46.0	2 ft. 6 in. (0.75 m)
46.1 to 72.5	3 ft. 0 in. (0.9 m)
72.6 to 121.0	3 ft. 4 in. (1.0 m)
138.0 to 145.0	3 ft. 6 in. (1.05 m)
161.0 to 169.0	3 ft. 8 in. (1.1 m)
230.0 to 242.0	5 ft. 0 in. (1.5 m)
345.0 to 362.0	7 ft. 0 in. (2.1 m)
500.0 to 552.0	11 ft. 0 in. (3.35 m)
700.0 to 765.0	15 ft. 0 in. (4.55 m)

Table 1. Minimum working distances from energized conductors for line-clearance tree trimmers and line-clearance tree trimmer trainees.

4.2.5 All other tree workers shall maintain a minimum clearance of 10 feet (3 m) from energized conductors rated 50 kV phase-to-phase or less; for conductors rated over 50 kV phase-to-phase the minimum clearance shall be 10 feet plus 4/10 inch (3 m plus 10 mm) for each kilovolt over 50 kV.

4.2.6 Branches hanging on a conductor may be removed using appropriately insulated equipment.

4.2.7 Rubber footwear, including lineman's overshoes, shall not be considered as providing any measure of safety from electrical hazards.

4.2.8 Ladders, platforms, and aerial devices, including insulated aerial devices, shall not be brought in contact with an electrical conductor.

4.2.9 When a aerial lift device contacts an electrical conductor, the truck supporting the aerial lift device shall be considered as energized, and contact with the truck shall be avoided except where emergency rescue procedures are being carried out. Emergency rescue should only be attempted by properly trained persons familiar with electrical hazards.

4.3 Storm Work and Emergency Conditions

4.3.1 Storm work and emergency conditions create special hazards; only authorized representatives of the system operator/owner shall perform tree work under such conditions.

4.3.2 When, during tree operations, an emergency condition develops that involves electrical conductors, work shall be suspended and the system operator/owner shall be notified immediately.

5. Mobile Equipment

5.1 General

5.1.1 All vehicles and equipment, regardless of type, shall be equipped and operated in compliance with applicable federal, state and local laws and regulations, and with manufacturer's operating instructions.

5.1.2 All equipment shall be turned off and at rest when repairs or adjustments are made, except where manufacturer's procedures require otherwise. All defects or malfunctions affecting the safe operation of any equipment shall be corrected before placing each equipment into use.

5.1.3 Trucks with obscured rear vision, particularly those with trailed vehicles, should be backed up only when absolutely necessary and then only with outside guidance.

5.1.4 All equipment shall be operated by qualified personnel.

5.1.5 All material and equipment carried on vehicles shall be stored so as to prevent them from falling off the truck during transit.

5.1.6 Workers shall not be permitted to ride outside of, or on top of, the vehicle or its load unless they are riding in a

designated place or places required by the nature of the operation, such as roadside spraying.

5.1.7 No hoisting or manlifting equipment shall be used to lift more than its rated capacity as stated by the manufacturer's plate or specification.

5.1.8 Pads shall be set under outrigger feet when they are put on a soft surface. Traction for outrigger feet shall be ensured when ice or snow is present.

5.1.9 The manufacturer's instructions shall be followed in detecting hydraulic leaks. Workers shall not attempt to locate hydraulic leaks by feeling for them with their hands.

5.1.10 All step surfaces on equipment shall be skid-resistant.

5.1.11 The manufacturer's recommended maintenance and parts replacement procedures should be followed.

5.1.12 All ignition keys shall be removed when the equipment is left unattended to prevent unauthorized starting.

5.1 Aerial Lifts

5.2.1 All aerial-lift equipment used for operations within the scope of this standard shall be in accordance and ANSI A-92.1-1979.

5.2.2 Prior to the daily use of an aerial-lift device, a visual inspection and operational check shall be made in accordance with the manufacturer's and owner's instructions.

5.2.3 Bucket's platforms, or booms of aerial-lift equipment shall be provided with some means of anchorage to which a safety belt or lanyard can be secured.

5.2.4 The combined load, including workers, material, and tools, shall not exceed the rated lift capacity as stated by the manufacturer. Such rated lift capacity (load rating) shall be conspicuously and permanently posted on the lift in accordance with ANSI A-92.2-1979.

5.2.5 An aerial lift or ladder shall not be used as a crane or hoist to lift or lower materials unless specifically designed to perform such operations.

5.2.6 Wheel checks shall be installed before using an aerial lift on an incline.

5.2.7 Pneumatic tools, when being serviced or adjusted or when not in use, shall be disconnected, except where manufacturer's procedures require otherwise.

5.2.8 When hydraulic tools are being serviced or adjusted, they shall be disconnected, except where manufacturer's procedures require otherwise.

5.2.9 When operating an aerial-lift device, the operator shall look in the direction of travel of the bucket and be aware of the booms in relation to all other objects and hazards.

5.2.10 When booms are operated over roads, safe clearances from passing vehicles shall be maintained on traffic control shall be provided.

5.2.11 A one-man bucket shall not have more than one person riding in it during work operations.

5.2.12 Except where quick-acting connectors are used, pressure shall be released before connections are broken to avoid the hazards of flying particles or the whipping of hydraulic or pneumatic hoses. Hydraulic or pneumatic hoses shall never be kinked in order to cut off pressure prior to disconnecting.

5.2.13 No part of the body shall be used to either locate or attempt to stop a hydraulic leak: A hydraulic puncture wound will probably cause a generalized infection and result in amputation; wounds permitting hydraulic fluid to get into the circulatory system have caused death.

5.2.14 All hoses affecting the dielectric characteristics of equipment shall be made of nonconductive material. Hydraulic fluids for insulated equipment shall be of the insulating type.

5.2.15 Booms or buckets shall not be run into conductors, cables, poles, trees, and similar objects.

5.2.16 Electric cables (as for an electric saw), lights, or other conductive material shall not be run from the truck to the bucket on insulated equipment.

5.2.17 An aerial-lift truck shall not be moved when the boom is elevated in a working position with men in the basket, except for equipment that is specifically designed for this type of operation. The booms of a fully articulated aerial device shall not be considered elevated in a working position when the basket is

"landed" directly in front of or behind the truck with the booms held as low as feasible and low enough so that the operator's head is below the highest point of the vehicle.

5.2.18 Booms shall not be operated unless outriggers, where required, are down.

5.2.19 Workers shall not drill holes which may reduce dielectric integrity in aerial-lift buckets.

5.2.20 During aerial-lift operations, tree workers not engaged in line clearance shall maintain a minimum clearance of 10 feet (3 m) from energized conductors rated 50 kV phase-to-phase or less; for lines rated over 50 kV phase-to-phase the minimum clearance shall be 10 feet plus 4/10 inch (3 m plus 10 mm) for each kilovolt over 50 kV phase-to-phase. Qualified line-clearance tree trimmers or qualified line-clearance tree-trimmer trainees using an insulated aerial bucket may operate in accordance with the clearance given in Table 1.

5.2.21 Worker shall be instructed that even fully insulated buckets do not protect them from other electric paths to the ground such as those through trees, through the guy wire, or the path from one phase wire to the second phase wire, any one of which can be fatal.

5.3 Brush Chippers

5.3.1 Access panels for maintenance an adjustment shall be closed and secured prior to operation of brush chippers.

5.3.2 Each rotary drum tree or brush chipper or disk-type tree or brush chipper not equipped with a mechanical infeed system shall be equipped with an infeed hopper not less than 85 inches (2.15 m), measured from the blades or knives to ground level over the centerline of the hopper, and shall have sufficient height on its side members so as to prevent personnel from contacting the blades or knives of the machine during normal operations.

5.3.3 Each rotary drum tree or brush chipper or disk-type tree or brush chipper not equipped with a mechanical infeed system shall have a flexible anti-kickback device installed in the infeed hopper for the purpose of protecting the operator and other persons in the machine area from the hazards of flying chips and debris.

5.3.4 Each disk type tree or brush chipper equipped with a mechanical infeed system shall have a quick stop and reversing device on the infeed. The activating level for the quick stop and reversing device shall be located across the top, along each side of, and as close to the feed end of the infeed hopper as practicable and within easy reach of the operator.

5.3.5 Trailer chippers detached from trucks shall be chocked or otherwise secured.

5.3.6 The operator and workers in the immediate area shall wear eye protection in accordance with 3.2.4.

5.3.7 When in tow position, the chipper safety chains shall be crossed under the tongue of the chipper and affixed securely to the towing vehicle.

5.4

5.4.1 Working and walking surfaces of all srayers and related equipment shall be covered with skid-resistant material.

5.4.2 Equipment on which workers stand and spray while the vehicle is in motion shall be equipped with guardrailing around the working area. The guardrailings shall be constructed in accordance with American National Safety Requirements for Floor and Wall Openings, Rail-ings, and Toeboards, ANSI A-12.1-1973.

5.4.3 Workers wearing clothing soaked with combustible liquid has been spilled shall avoid open flame.

5.5 Stump Cutters

5.5.1 Stump cutters shall be equipped with enclosures or guards that effectively protect the operator.

5.5.2 The operators and workers in the immediate area shall wear eye protectors in accordance with 3.2.4.

5.6 Trucks

5.6.1 A steel bulkhead or equivalent protection shall be provided to protect the occupants of vehicles form load shifts.

5.6.2 Logs or brush shall be securely loaded onto trucks in such a manner as not to obscure taillights or brake lights and vision, or to overhang the side.

5.6.3 In order to avoid the hazard of spontaneous combustion, wood chips should not be left in trucks for extended periods.

5.7 Log Loaders, Tree Cranes, and Related Hoists

5.7.1 Tree cranes operated by qualified line-clearance personnel working with the knowledge and approval of the system operator/owner shall be operated to maintain a minimum clearance of 10 feet (3 m) from energized conductors rated 50 kV or less. The minimum clearance shall be 10 feet plus 4/10 inch (3 m plus 10 mm) for each kilovolt voer 50 kV; however, a nonconductive drop line of a crane may be operated within the clearance set forth in Table 1.

5.7.2 A boom-angle indicator shall be provided on all cranes.

5.7.3 All cranes and rigging shall be in compliance with American National Standard Safety Code for Crawler, Locomotive, and Truck Cranes, ANSI B-30.5-1968.

5.7.4 An operator of hoisting equipment shall remain at the controls while a load is suspended.

5.7.5 Riding the load line is prohibited. However, a qualified tree worker may be hoisted into position utilizing the hook, provided that he/she is tied in with an approved type of climbing rope and safety saddle that is independently secured to the boom--and not to the hook.

5.7.6 A daily visual inspection of wire ropes, gears, chain drives, and other parts shall be made by the operator, in accordance with the manufacturer's recommendations.

5.7.7 A durable and legible sign shall be placed conspicuously and shall contain the following wording or its

equivalent: "Warning--Keep Clear of This Equipment When in Operation."

5.8 Off-the-Highway Equipment and Tracked Vehicles

5.8.1 Vehicles shall not be operated at speeds which will endanger the driver, workers, or traffic. Equipment shall be under control at all times and shall be kept in gear when descending grades.

5.8.2 Towing equipment for brush hogs and similar implements shall be equipped with a deadman control. If a deadman control is not available, the operator shall disengage the power source to the rotary or cutter head before alighting.

5.9 Digging and Ditching Operations. The location of any underground utilities shall be determined before digging or ditching operations are begun.

6. Portable Power-Hand-Tools

6.1 Portable Electric Power Tools

6.1.1 Electric tools (except those that are self powered) shall never be used in trees near an energized electrical conductor where there is a possibility of the supply cord or tool contacting the conductor, whether in an aerial lift or not.

6.1.2 All portable electric hand tools shall: (1) be equipped with three-wire cord having the ground wire permanently connected to the tool frame and means for grounding the other end; or (2) be of the double insulated type and permanently labeled as "Double

Insulated"; or (3) be connected to the power supply by means of an isolating transformer, or other isolated power supply.

6.1.3 Extension cords shall be maintained in safe condition. Exposed metal sockets shall not be used.

6.1.4 Tool operators shall: (1) use electric hand tools in accordance with the manufacturer's instructions; (2) prevent cords from becoming entangled, damaged or cut by blades and bits; (3) avoid laying extension cord in water; (4) support an electrical tool and its power supply cord by a line, independent of the worker when the tool is used aloft.

6.2 Gasoline-Driven Power Saws

6.2.1 The manufacturer's operating and safety instructions shall be followed unless modified by this standard.

6.2.2 Power saws weighing more than 15 pounds (6.8 kg) (service weight) that are used in trees shall be supported by a separate line, except when used from an aerial lift device.

Where there are not lateral branches on which to crotch a separate line for power saws weighing over 15 pounds (6.8 kg), a false crotch shall be used. A false crotch is one that can hold power saw lines without slipping or coming untied.

6.2.3 The operator shall have secure footing when starting the saw. Power saws weighing less than 15 pounds (6.8 kg) (service weight) may be drop started. Drop starting of saws over 15 pounds (6.8 kg) is permitted outside of the basket of an aerial lift only after ensuring that the area below the lift is clear of personnel.

6.2.4 The engine shall be started and operated only when all co-workers are clear of the saw.

6.2.5 The engine shall ordinarily be stopped when power saws are being carried. The saw need not be stopped between cuts during consecutive felling, bucking, or limbing or cutting operations on reasonably level ground. The chain shall not be turning and the operator's hand shall be off the throttle lever while operators move between work locations. One-man saws shall be carried by the worker on his/her side with the guide bar of the saw pointed to the rear; two workers shall carry a two-man saw.

6.2.6 The engine shall be stopped for all cleaning, refueling, adjustments, and repairs to the saw or motor where practical, except where manufacturer's procedures require otherwise.

6.2.7 The saw muffler should be maintained in good condition.

6.2.8 The saw should be clean of sawdust and flammable material.

6.3 Backpack Power Units (for use in pruning, clearing, etc.)

6.3.1 The manufacturer's operating and safety instructions shall be followed unless modified by the standard.

6.3.2 No one except the operator shall be within 10 feet (3 m) of the curring head of the brush saw.

6.3.3 The power unit shall be equipped with a quick shutoff switch readily accessible to the operator.

6.3.4 The operator shall observe the position of all personnel while the unit is running.

6.3.5 The engine shall be stopped for all cleaning, refueling, adjustments, and repairs to the saw or motor where practical, except where manufacturer's procedures require otherwise.

7. Hand Tools

7.1 General

7.1.1 The correct tool shall be selected for the job.

7.1.2 Tools that have been made unsafe by damage or defect shall not be used.

7.1.3 When climbing a tree, workers shall not carry tools in their hands other than tools that are used to assist them in climbing, such as pole pruners or pole saws.

7.1.4 Workers shall maintain a safe working distance from other workers when using hand tools.

7.1.5 Tools shall be properly stored or placed in plain sight out of the immediate work area when not in use.

7.1.6 Workers shall not throw or drop tools from trees unless warning has been given and the ground area is clear, and the act of dropping will not endanger personnel.

7.2 Chopping Tools - Axes, Brush Hooks, Machetes, and Others

7.2.1 Chopping tools that have loose or cracked heads or splintered handles shall not be used.

7.2.2 Chopping tools shall never be used while working aloft.

7.2.3 Chopping tools shall be swung away from the feet, legs, and body, using the minimum power practical for control.

7.2.4 Chopping tools shall not be driven as wedges or used to drive metal wedges.

7.3 Pruners and Saws

7.3.1 Pole pruners, pole saws, and other similar tools shall be equipped with wood or nonmetallic poles. The actuating cord shall be of nonconducting materials.

7.3.2 When inserting a blade in a bow-saw frame, workers shall keep their hands and fingers in the clear when the tension level snaps into or against the saw frame. When removing a bow-saw blade from the frame, the operator shall stay clear of the blade.

7.4 Injector Tools for Applying Herbicides

7.4.1 The bit of injector tools shall be covered with a shield when not in use.

7.4.2 Injectors shall be laid flat on the ground when not in use.

7.4.3 Injectors shall not be carried on the shoulders but shall be carried by the loop handle on the downhill side, with the bit properly shielded and facing to the rear.

7.4.4 The manufacturer's recommendations shall be used in handling chemical mixtures.

7.4.5 Workers shall have firm footing and shall clear all interferring limbs away before using the tool.

7.5 Grub Hoes, Mattocks, and Picks

7.5.1 The blade eye shall be tight-fitting and wedged so that it cannot slide down the handle.

7.5.2 When swinging grub hoes, mattocks, and picks, the worker shall have a secure grip and firm footing.

7.6 Cant Hooks, Cant Dogs, Tongs, and Carrying Bags

7.6.1 Hooks should be firmly set before applying pressure.

7.6.2 Tools with cracked, splintered, or weakened handles should not be used.

7.6.3 Workers shall be warned and shall be in the clear before logs are moved.

7.6.4 The points of hooks shall be at least 2 inches (51 mm) long and shall be kept sharp.

7.6.5 Workers shall stand to the rear and uphill when rolling logs.

7.7 Wedges, Chisels, and Gouges

7.7.1 Wedges, chisels, and gouges shall be inspected for cracks and flaws before use.

7.7.2 Wedges and chisels shall be properly pointed and tempered. Tools with mushroomed heads shall not be used.

7.7.3 Only wood, plastic, or soft-metal wedges shall be used with power saws.

7.7.4 Wood-handled chisels should be protected with a ferrule on the striking end.

7.8 Hammers, Mauls, and Sledges. Wood, rubber, or high impact plastic mauls, sledges, or hammers should be used when striking wood-handled chissels or gouges.

7.9 Ropes

7.9.1 Climbing ropes shall be used when working aloft in trees. These ropes should have a minimum diameter of 1/2 inch (12 mm) and should be a 3- or 4-strand, first-grade manila, with a nominal breaking strength and durability. Synthetic rope shall have a maximum elasticity of not more than 7%.

7.9.2 Rope made unsafe by damage or defect, or for any other reason, shall not be used.

7.9.3 Rope shall be stored away from all cutting edges and sharp tools. Corrosive chemicals, gas and oil shall be kept away from rope.

7.9.4 When stored, rope shall be coiled and piled, or suspended, so that air can circulate through the coils.

7.9.5 Rope ends shall be secured to prevent unraveling.

7.9.6 Climbing and safety rope shall not be spliced to effect repair.

7.9.7 Safety snaps shall be rotated from one end of the rope to the other, as needed, and the worn end cut off.

7.10 Tackle Blocks and Pulleys. Tackle blocks and pulleys shall be inspected immediately before use and shall be condemned if

defective, accordance with procedures given in American National Standard Safety Standard for Slings, ANSI B-30.9-1971.

7.11 Ladders

7.11.1 Ladders made of metal or other conductive material shall not be used where an electrical hazard exists. Only approved wood ladderse (constructed in accordance with American National Standard for Ladders--Portable Wood--Safety Requirements, ANSI A-14.1-1982 or nonconductive ladders made of synthetic material equal to or exceeding the strength of approved wood ladders shall be used.

7.11.2 Metal ladders used where no electrical hazard exists shall conform to American National Standard for Ladders--Portable Metal--Safety Requirements, ANSI A-14.2-1982.

7.11.3 All ladders shall be inspected daily before use. Unsafe ladders shall not be used.

7.11.4 The attaching of cleats, metal points, and safety feet; lashing or other effective means of securing the ladder shall be used if there is danger of its slipping.

7.11.5 Ladders shall be supported while in storage so they will not sag. Except when on mobile equipment, ladders shall be stored under suitable cover, protected from the weather, and kept in a dry location away from excessive heat.

7.11.6 Ladders shall not be used as bridges or inclined planes to load or handle logs or other material.

7.12 Climbing Spurs. Climbing Spurs shall be of the tree-climbing type and shall have gaffs of the type and length suitable for the tree being climbed.

8.0 Safe Work Procedures

8.1 Climbing

8.1.1 A tree worker shall be tied in with an approved type of climbing rope and safety saddle when working above the ground. The climbing rope shall always be used even when work is performed from a ladder or scaffold. A safety strap or rope with snaps may be used for additional protection.

8.1.2 During climbing operations, tree limbs should be inspected before weight is applied to them. The climber should not trust the capability of a dead branch to support his/her weight. Dead branches should be broken off on the way up, if possible. Hands and feet should be placed on separate limbs, if possible.

8.1.3 It is recommended that a worker never shin a tree for a distance greater than 15 feet (4.55 m) or shin for any distance behond his/her demonstrated physical capabilities.

When the climbing distance is greater than 25 (7.6 m), or is beyond the worker's physical capabilities, the worker should not climb (footlock) the rope, but should use a safety saddle or a sling instead.

8.1.4 The climbing rope should be passed around the trunk of the tree as high above the ground as possible using branches with a wide crotch to prevent any binding or the safety rope.

The crotch selected for tying in should be directly above the work area, or as close to such a position as possible, but located in such a way that a slip or fall would swing the worker away from any electrical conductor. The rope should also be passed around the main leader or an upright branch, using the limb as a stop. Feet, hands, and ropes should be kept out of tight V-shaped crotches.

8.1.5 While climbing, the location of all electrical conductors should be noted and the worker should climb on the sie of the tree that is away from electrical conductors, if possible.

8.1.6 A figure-eight knot should be tied in the end of the rope, particularly when climbing high trees. This will prevent pulling the rope accidentally through the taut line-hitch and possible serious injury from a fall.

8.1.7 The climbing line shall be crotched as soon as practicable after the worker is aloft and then a taut line-hitch shall be tied and checked.

8.1.8 The worker shall be completely secured with the climbing line before starting his/her operation.

8.1.9 The worker shall remain tied in until the work is completed and he/she has returned to the ground. If it is necessary to recrotch the rope in the tree, the worker shall re-tie in or use the safety strap before releasing the previous tie.

8.2 Pruning and Trimming

8.2.1 Pole pruners and pole saws shall be hung securely in a vertical position to prevent dislodgement. Pole pruners or pole saws shall not be hung on utility wires or cables and shall not be left in the tree overnight. Pole saws shall be hung so that the sharp edge is away from the worker, if possible.

8.2.2 A scabbard or sheath should be hooked to the belt or safety saddle to carry the handsaw when it is not in use.

8.2.3 Warnings, when necessary, shall be given by the worker in the tree before a limb is dropped. "Timber" or "heads up" are common terms used for this purpose.

8.2.4 A separate line should be attached to limbs that cannot be dropped safely or are too heavy to be controlled by hand. The line should be held by workers on the ground end of the rope. Use of the same crotch for both the safety rope and the work rope should be avoided.

8.2.5 The safety line or climbing rope shall never be used for any purpose but climbing.

8.2.6 Cut branches should not be left in trees overnight.

8.2.7 A climbing rope shall never be left in a tree overnight. A service line should be put up for operations lasting overnight or longer and should be used to bring the climbing rope back into position at the start of the next day's work operation.

8.2.8 The tree climber shall inspect his/her rope for cuts or abrasions before starting work. If any cuts or serious abrasions

are found, the rope should be discarded or used for some other purpose or the defective section should be cut off.

8.2.9 During all tree-working operations above a height of 12 feet (3.65 m) that are not subject to the requirements of 4.2.3, there shall be a second worker in the vicinity.

8.3 Cabling

8.3.1 In cabling operations, branches that are to be cabled should be brought together to the proper distance by means of a block and tackle, a hand winch, a rope, or a rope with a come-along.

8.3.2 Not more than two persons should be in a tree working at opposite ends during cabling installation.

8.3.3 When the block and tackle are released, workers in trees should be positioned off to one side in order to avoid injury in case the lag hooks pull out under the strain.

8.3.4 Groundmen should not stand under the tree when cable is being installed.

8.3.5 Tools used for cabling, bark tracing, cavity work, etc., shall be carried in a bag or belt designed to hold tools and not put in the pockets or stuck in the top of a boot.

8.3.6 A handline shall be used for raising or lowering tools.

8.4 Topping/Lowering Limbs

8.4.1 Workers performing topping operation should make sure the trees are able to strain of a topping procedures. If not,

some other means of lowering the branches should be provided, such as a tree crane.

8.4.2 If large limbs are lowered in sections, the worker in the tree should be above the limb being lowered.

8.4.3 Guidelines, handlines, or tag lines shall be used when conditions warrant their use.

8.5 Felling

8.5.1 Before beginning any felling operation, the worker shall carefully consider: (1) the tree and the surrounding area for anything that may cause trouble when the tree falls; (2) the shape of the tree; (3) the lean of the tree; (4) wind force and direction; (5) decayed or other weak spots; (6) the location of other persons.

8.5.2 The work area shall be cleared to permit safe working conditions, and an escape route shall be planned before any cutting is started.

8.5.3 Each tree worker shall be instructed as to exactly what he/she is to do. All workers not directly involved in an operation shall be kept clear of the work area.

8.5.4 A notch or backcut shall be used in felling trees over 5 inches (127 mm) diameter, measured at breast height. No tree shall be felled by "ripping" or "slicing" cuts.

8.5.4.1 The depth or penetration of the notch shall be about one-third the diameter of the tree.

8.5.4.2 The opening or height of the notch shall be about 2 1/2 inches (63.5 mm) for each foot (0.3 m) of the tree's diameter.

8.5.4.3 The backcut shall be made higher than the point or apex of the notch to prevent kickback.

8.5.5 Just before the tree is ready to fall, an audible warning shall be given to those in the area. All personnel in the vicinity shall be safely out of range when the tree falls.

8.5.6 If there is danger that the trees being felled may fall in the wrong direction or damage property, wedges, block and tackle, rope, or wire cable (except where an electrical hazard exists) shall be used. All limbs shall be removed from trees to a height and width sufficient to allow the tree to fall clear of any wires and other objects in the vicinity.

8.5.7 Special precautions in roping rotten or split trees are important because they may fall in an unexpected direction even though the cut is made on the proper side.

8.5.8 Persons shall be kept back from the butt of a tree that is starting to fall.

8.6 Brush Removal and Chipping

8.6.1 Brush and logs should not be allowed to create a hazard at the work site.

8.6.2 All worker feeding brush into chippers shall wear eye protectors.

8.6.3 Brush chippers shall be fed from the side of the centerline and the operator shall immediately turn away from the feed table when the brush is taken into the rotor. Chippers shall be fed from the curbside whenever practical.

8.6.4 The chipper chute shall not be raised or removed while the rotor is turning. The chipper shall not be used unless an exhaust chute of sufficient length or design to prevent contact with the blade is in place.

8.6.5 Foreign material such as stones, nails, sweepings, etc., shall not be fed into the chipper.

8.6.7 The feed chute or feed table of a chipper shall have sufficient height on it side members to prevent operator contact with the blades or knives during normal operations.

8.7 Limbing and Bucking

8.7.1 Whenever it is possible to do so, the tree worker shall work on the side opposite the side on which the limb is being cut.

8.7.2 The tree worker should stand on the uphill side of the work wherever possible.

8.7.3 Branches bent under tension shall be considered hazardous.

8.7.4 The tree worker shall block the log to prevent rolling, when necessary.

8.7.5 When bucking up trunks of trees, wedges shall be used as necessary to prevent binding of the guide bar or chain.

GENERAL SAFETY PROCEDURES THAT APPLY TO ALL TREE WORK

A.1 Lifting

Before lifting any weight, the tree worker should: (1) be sure clear ground is available if the weight is to be carried from one place to another; (2) decide exactly how the object should be grasped to avoid sharp edges, slivers, splinters, or other things that might cause injury; (3) make a preliminary lift to be sure the load can be safely handled; (4) place feet solidly; (5) crouch as close to the load as possible with legs bent at an angle of about 90 degrees; (6) keep back as straight as possible (it may be far from vertical but should not be arched); (7) lift with legs, not the back.

A.2 Load Handling

Loads should be handled by the use of skids and winch equipment; cutting logs into shorter lengths should be considered.

A.3 Direct Supervision

Direct supervision is when a qualified line-clearance tree trimmer or a qualified supervisor is present on the job site.

A P P E N D I X C

SAFETY TRAINING PROGRAMS AVAILABLE TO COMMERCIAL ARBORIST

The National Arborist Association (NAA) is the only organization that currently supplies safety training materials to arborists. The following materials were available as of 6/86:

1. Four-part slide/cassette program on tree care safety
   - General Safety
   - Personal Safety
   - Equipment Safety
   - Operational Safety
2. Slide/cassette program on chain saw use and safety
3. Slide/cassette program on aerial rescue
4. Tail gate safety program
5. Two-part slide/cassette program on electrical hazards
6. Notice of employee safety violation
7. Emergency phone number decals
8. NAA safety decals
9. Electrical hazards awareness program

For more information:

Safety Programs - NAA
174 Rt. 101
Bedford Station, Box 238
Bedford, NH 03102
(603) 472-2255

APPENDIX D

SAMPLE OF CONVENIENCE

The sample of convenience was arranged in consultation with Mr. Robert Felix, Executive Vice-President of the National Arborist Association. All of the participating companies are members of the NAA or the Massachusetts Arborist Association.

Company	Interviewer
1. Allenby Tree Inc. Falmouth, Massachusetts	Mark DiBiase
2. American Tree Care, Inc. Southampton, New York	Tony Medeiros
3. Collins Tree Service Hookset, New Hampshire	James Cohen
4. Gilbert & Simpson Assoc. Hingham, Massachusetts	James Cohen
5. Hall Tree and Spray Needham, Massachusetts	James Cohen
6. G. B. Knowles & Co., Inc. Fairhaven, Massachusetts	Mark DiBiase
7. Parr & Hanson Tree Service Hicksville, New York	Tony Medeiros
8. RichMar Tree Service East Hampton, New York	Tony Medeiros
9. Treesmith Duxbury, Massachusetts	Mark DiBiase
10. Tree Specialists Holliston, Massachusetts	Mark DiBiase

APPENDIX E

VEST POCKET FIELD GUIDE

Interview Instructions

On-the-job accidents are a major personnel and economic problem of the arborist industry. Many of the accidents could be prevented with the proper training of new personnel.

The major focus of this research is the development of arboricultural safety training materials that can be used by a foreperson in the field to train groundpersons. The major guidelines for the development of this material are two-fold:

1. Competency based on productivity and safety.
2. Individualized learning packages for field use.

Each competency listed has been transferred to a 3x5 inch Vest Pocket Field Guide which is enclosed. The assumption is that the foreperson is an experienced arborist who knows how to do the job. Therefore, a long description of tasks is not required and would in fact, reduce the effectiveness of the curriculum. If we supply the foreperson with a list of task items that the groundperson needs to know in order to work in a safe and productive manner, the foreperson will go through the list and not forget to convey some important safety information.

As an interviewer, your task will be to carry out six steps by July 1, 1986. For this you will receive 1 (one) Special Project Credit (LS&R 396).

Instructions

Step 1. Interview Training

A. Group Meeting. Each interviewer will receive the project documents. D. Ryan will review each page and will answer all questions. Steps 2 through 6 will be discussed, including interview and observation techniques (group meeting May 5, 1986).

B. Individual Interview Meeting. Review any concerns and discuss the tree companies from which the interviewer will collect data.

Step 2. All companies will be contacted by D. Ryan before being interviewed.

Company Profile (Green). First visit.

Before filling out the Green Form each supervisor will be given a copy of the confidentiality letter.

The interviewer should then fill out the Green Form for each company.

The only question that may be of concern to the owner is the one about gross income. This question is optional.

We are using a structured interview format for asking the questions and for the recording of responses.

Directions:

1. Read the question exactly from the form .
2. Print in the response .

Step 3. Company Foreperson/Trainer (Yellow)

Before filling out the Yellow Form, each foreperson will be given a copy of the confidentiality letter. The interviewer should then fill out the top of the Yellow Form for each foreperson. (First visit.) After filling out the top of the Yellow Form each foreperson should be given a copy of the Vest Pocket Field Guide. Review and explain the guide.

The training of the forepersons will actually require that some time be spent by the interviewer showing the forepersons that it is to their advantage to do a thorough job in training the groundpersons. They may have to be convinced that they should have a training program and that it will make their jobs safer and easier. This encouragement of training must be considered because many "older" forepersons fear that the "young" climbers may take over their jobs. The experienced foreperson must be shown that s/he is of value to the company, especially if s/he can train new people.

The foreperson will then be taught the basic military four-step training methodology that many forepersons used while in the service, using the Vest Pocket Field Guide as an outline:

Step 1. Tell them what you are going to show them.

Step 2. Show them how to do it.

Step 3. Let them try to.

Step 4. Check and follow up.

The training of the foreperson will be a one-on-one with the interviewer in order to explain the program and reduce any training fear.

On the second visit to the company the Yellow Rating Scale should be answered by the foreperson. Circle the foreperson's one response.

Step 4. Groundperson Exit Interview (Orange Form) (Second Visit)

Before filling out the Orange Form each groundperson will be given a copy of the confidentiality letter. The interviewer should then fill out the Orange Form with the groundperson using the standardized techniques.

There is no substitute for direct observation of a crew in order to measure and assess performance. The observer checklist (Blue) will be used to determine the positive or negative behavior being displayed by the crew concerning production and safety items.

As an experienced arborist who has been trained in safety, your on-site evaluation will be used to confirm the company's work habits. Is the company working and training in a safe manner or do their actions show that they only "talk" safety?

The Blue Observer Checklist contains a list of behaviors that reflect a positive or negative effect toward safety. A numerical scale is used to rate each question: 1 being low and 10, high.

Example: #6 Proper Feeding of Chipper

Does the person feed the chipper from the side all of the time or just occasionally?

If he feeds from the side 70% of the time and from the front 30%, rate him a "7".

When visiting the work side to fill out the Blue Form, the observer should dress in work clothes and work along with the crew. This will relax the workers and allow recording more accurate information.

Step 6. Return to D. Ryan

The data sheets for each company are in a stamped, self-addressed envelope. After collecting the data and finishing Step 5, please post the data.

Please return all data by: July 1, 1986

"Hot Line"

If you have any questions or problems call me immediately (collect):

(413) 545-2255 - Office

(413) 253-3769 - Home

Thank You

APPENDIX F

QUALIFICATIONS AND JOB DESCRIPTIONS

I. Qualifications for Crew Foreperson, Job Description

1. Have a total of three years experience working on a tree trimming crew.
2. Know and understand all approved work methods that apply to the climber's job description.

A. NATURE OF DUTIES

1. Supervises a tree trimming crew and is responsible for the proper administration, informing and enforcement of supervisory practices and economic work practices such as training, employee induction and follow-up, disciplinary action, absence policy, informing employees, quantity and quality of work production, adherence to and enforcement of safety practices and other employee relations responsibilities.
2. Is responsible, with approval of the Supervisor, for the hiring, firing, promotion, disciplinary action and training of all employees assigned to his crew. Is subject to intermittent supervision by his supervisor according to the size of company operations in the area and therefore, must be

capable of responsible, independent action that will mutually benefit both the client and the company.

B. DIRECTS the crew in the field in the performance of the following functions:

1. Trim trees, involving climbing and working in trees (maybe near energized lines).
2. Remove trees and brush, clean-up and dispose of all debris. Secure appropriate permits for disposal, when necessary.
3. Operate power equipment such as truck, power saws, power winch, trim lift, chipper, sprayer, pneumatic tools; use ladders and hand tools such as axes, hand lines, saws, block and tackle, pruners, etc.
4. Disinfect tools used in diseased trees, where necessary.

C. PLANS and LAYS OUT daily work for crew. CONSIDERS such factors as ability to get power equipment to locations, time required to complete work, clean-up time, equipment available, weather conditions, customer permission, etc.; and the need for close supervision and proper rigging to avoid accident or property damage when removing large trees in cramped space.

D. ASSIGNS work to individual crew members and supervise crew in carrying out work according to good tree practices. Must be capable of adjusting to field requirements without direction from his supervisor.

E. ENFORCES safe practices such as using life lines, etc., or arranges via Overhead Lines Dispatcher for rubber hose protection

on energized wire, or requests shutdowns of high voltage lines. RECOGNIZES poisonous plants and uses proper safeguard against them. ADMINISTERS first aid and obtains professional help if required. Is responsible for the conduct of safety training of assigned personnel in accordance with good safety training procedures.

F. RESPONSIBLE for the maintenance and accuracy of all records and reports related to the performance of crew's operation. Furnishes supervisor with reports of orders completed, units of work completed, crew time and distribution, etc.

G. SAFEGUARDS employees and public (especially children) from hazards in and around work area. COOPERATES with customers, police and fire departments when blocking streets or driveways. SETS UP barriers, warning signs, flags, markers, etc., to protect employees and public. FOLLOWS and ENFORCES safe work practices, rules and policies.

H. RESPONSIBLE for inspection, proper working conditions, and necessary repairs to tools, truck and other work equipment. Requests major repairs or replacements when necessary. Maintains good housekeeping on truck and at work locations. Responsible for the respectable appearance of personnel on his crew.

I. In addition to above, performs other duties as required or assigned.

II. Qualifications for Groundman/Driver, Job Description

1. Have a valid chauffer's or driver's license as applicable by state law.

Nature of Duties

1. Loads and unloads trucks with logs, brush and debris, and/or feeds brush into brush chipper.
2. Uses hand lines to lower limbs and equipment.
3. Keeps work area picked up and orderly.
4. Carries and lays out material, tools and equipment at work site.
5. Works from ground using gasoline-powered chain saws.
6. Drives a truck with attached brush chipper.
7. Services truck and equipment. Keeps truck and other assigned equipment in a neat, orderly fashion. Reports the need for repairs to trucks and equipment to crew foremen.
8. Safeguards employees and public from hazards in and around the working area.
9. Helps enforce on-the-job safety practices.
10. Performs other related work as assigned.

Note:

All employees engaged in tree work shall consider the American National Standard Safety Requirements for Pruning, Trimming, Repairing, Maintaining and Removing Trees, and for Cutting Brush (Z-133.1-1982), as incorporated safety requirements for their work procedures.

APPENDIX G

DATA COLLECTION QUESTIONNAIRES*

I. Questionnaire/Opinionnaire of Foreperson/Trainer

Name of Company _____ Phone #_____

Address _____

Owner of Company _____

Education of Owner _____

H.S. _____ College _____ OJT _____

Major _____ CPR _____ Certified _____

Years in Business _____ Gross Income 1985 _____

Type of Business by Percent

Tree Pruning & Removal	_____%
Spraying & Fertilizing	_____%
Transplanting & Landscaping	_____%
Utility	_____%
Other _____	

Number of Employees	Year Round	Seasonal
Salespersons	_____	_____
Forepersons	_____	_____
Climbers	_____	_____
Groundpersons	_____	_____
Office	_____	_____

Comments: _____

_____

_____

*Structured interviews were collected by a trained arborist interviewer, interviewer listed the responses.

Name of Foreperson _____

Date of Birth _____ Home Phone # _____

Training: HS _____ College _____ Major _____
OJT _____ Certified _____ CPR _____
Years in Business _____ Years with Company _____
Years as Foreperson _____ Income 1985 _____

Comments: _____
_____

Rating Scale

For each of the following statements you are requested to give the answer that most expresses your opinion. There are five possible responses: Strongly Disagree (SD), Disagree (D), Neutral or Undecided (N), Agree (A) and Strongly Agree (SA). All answers and persons will be kept confidential. Circle your answer.

F. 1. Part of a foreperson's job is to train new people.

SA A N D SD

F. 2. Most training takes place on the job site.

SA A N D SD

F 3. Safety training should be required of all groundpersons.

SA A N D SD

F 4. My company does not adequately train its new employees in safety.

SA A N D SD

F 5. Most new groundpersons are useless.

SA A N D SD

F 6. The Vest Pocket Field Guide makes my job training easier.

SA A N D SD

F 7. The Vest Pocket Field Guide does not contain all of the groundperson's tasks.

SA A N D SD

What should be added? _____
_____

F 8. Most forepersons could train new groundpersons if they used the Vest Pocket Field Guide.

SA A N D SD

F 9. The Vest Pocket Field Guide outlines safety skills necessary for a groundperson.

SA A N D SD

F 10. The Vest Pocket Field Guide outlines production (job) skills necessary for a groundperson.

SA A N D SD

F 11. All tree workers should wear hardhats at all times while on the job site.

SA A N D SD

F 12. When feeding a chipper safety glasses should always be worn.

SA A N D SD

F 13. A groundperson can feed a chipper while the aerial lift is working on line in electric lines.

SA A N D SD

F 14. A climbing line can be used to lower light limbs.

SA A N D SD

F 15. This project was a complete waste of time.

SA A N D SD

II. Field Site Observation Check List

Each observation is rated on a scale of 1 to 10, one being the lowest and ten the highest grade. The same observation will be made for all persons on the job site.

	Question	Foreperson	Climber	Groundperson
S	1. proper clothing	_____	_____	_____
S	2. proper booths	_____	_____	_____
S	3. hard hats	_____	_____	_____
S	4. safety glasses	_____	_____	_____
S	5. proper hand holds on chain saws	_____	_____	_____
S	6. proper feeding of chipper	_____	_____	_____
S	7. proper use of climbing lines	_____	_____	_____
S	8. personnel maintain safe practices near energized conductors	_____	_____	_____
S	9. proper fueling of saws	_____	_____	_____
S	10. proper knots used to tie on tools	_____	_____	_____
S	11. proper lowering of limbs	_____	_____	_____
S	12. tools are stored properly	_____	_____	_____
S	13. work site is kept clean	_____	_____	_____
S	14. traffic control was established	_____	_____	_____
S	15. crew enjoyed having researcher on site	_____	_____	_____

Comments: _____

III. Exit Interview - Groundperson

Name of Groundperson _____

Date of Birth _____ Home Phone # _____

Training: HS _____ College _____ Major _____

OJT _____ Certified _____ CPR _____

Years in Business _____ Time with Company _____

Wage Rate _____

Comments: _____

_____

Rating Scale

For each of the following statements you are requested to give the answer that most expresses your opinion. There are five possible responses: Strongly Disagree (SD), Disagree (D), Neutral or Undecided (N), Agree (A) and Strongly Agree (SA). All answers and persons will be kept confidential. Circle your answer.

G 1. Part of the foreperson's job is to train me.

SA A N D SD

G 2. My company does not adequately train its new employees in safety.

SA A N D SD

G 3. All treeworkers should wear hardhats at all times while on the job site.

SA A N D SD

G 4. When feeding a chipper safety glasses should always be worn.

SA A N D SD

G 5. A groundperson can feed a chipper while the aerial lift is working on line clearing.

SA A N D SD

G 6. A climbing line can be used to lower light limbs.

SA A N D SD

G 7. The foreperson has been teaching me how to do my job.

SA A N D SD

G 8. What do you like best about this job?

_____

_____

G 9. What do you like least about this job?

_____

_____

G 10. Do you wish to say in this business and become a climber?

Yes _____ No _____

Comments: _____

_____

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