TAB D

CPSC Memorandum from Carolyn Meiers, Directorate for Engineering Sciences, to DeWane Ray, Directorate for Engineering Sciences, entitled "Petition Requesting Standard for Hunting Tree Stands and a Ban of Waist Belt Restraints Used with Hunting Tree Stands (Petition CP 02-3)," October 30, 2003.

UNITED STATES
CONSUMER PRODUCT SAFETY COMMISSION
WASHINGTON, DC 20207

Memorandum

Date: October 30, 2003

TO : DeWane Ray, Project Manager, Tree Stand Petition
Division of Mechanical Engineering
Directorate for Engineering Sciences

THROUGH : Hugh McLaurin, Associate Executive Director
Directorate for Engineering Sciences

Mark Kumagai, Acting Division Director
Division of Mechanical Engineering
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FROM : Carolyn Meiers, Engineering Psychologist
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SUBJECT : Petition Requesting Standard for Hunting Tree Stands and Ban of Waist Belt Restraints Used with Hunting Tree Stands, CP 02-3

This memo discusses human factor issues associated with petition CP 02-3 that requests a mandatory standard for tree stands and a ban of safety belt restraints used with these stands.

I. BACKGROUND

In March 2002, the U.S. Consumer Product Safety Commission (CPSC) received a petition from Dr. Carol Pollack-Nelson, an independent safety consultant, requesting 1) a mandatory standard for hunting tree stands to address mechanical hazards and 2) a ban of safety belt restraints,[1] used with the stands, to address asphyxiation fatalities.

The petition further states that CPSC incident data indicate that falls from tree stands are often associated with severe injuries or deaths when stands suddenly and unexpectedly collapse. Several mechanical failures involving latching mechanisms, securing straps, and gripping hardware that contributed to the falls are cited from the data. Further, the petition states that significant cognitive, perceptual, and behavioral demands are placed upon hunters as they interact with tree stands. Hunters must understand where and how to properly set up a tree stand,

[1] During a telephone conversation with Dr. Pollack-Nelson, she clarified that the term "waist belts," as originally used in the petition request, is intended to be an inclusive term for single-strap restraint designs that include chest belts. Therefore, this memo uses the term "safety belt," rather than "waist belt," to refer to single-strap restraint designs.

have the physical capability to execute the necessary tasks properly, and be able to perceive if the set-up has been successfully completed. The petition also states that safety belts present "a serious risk of death, and a false sense of security to consumers" because they can fatally constrict the chest or abdomen when arresting a fall.

II. DISCUSSION

This section discusses human factors issues associated with tree stand and fall protection device failures. Included for discussion are descriptions of the various types of tree stands and fall protection devices available to hunters, results of tree stand surveys and studies, an analysis of in-depth investigations (IDIs) of concomitant failures of tree stands and fall protection devices, post-fall suspension and self-rescue issues and research, and an evaluation of current voluntary standards for fall protection devices and tree stands.

1. TREE STANDS and FALL PROTECTION DEVICES

A. Tree Stands. Tree stands are used by hunters who prefer to hunt from elevated positions to increase their field of vision and to decrease the likelihood of detection by prey on the ground. A tree stand is basically a seat and footrest unit that is either strapped to a tree or is part of a freestanding-tower design. Several styles of tree stands are available, such as ladder stands, fixed-position stands, and climbing stands. Unique features distinguish each style.

1) Ladder Stands. A ladder stand consists of a seating platform and a footrest platform that strap to a tree and are accessed by a ladder constructed from individual ladder sections; a ladder is integral to the design of this type of tree stand. Ladder stands can be positioned at various heights depending on the length and number of ladder sections used. According to hunting supply catalogues, most ladder stands have the capability to reach heights ranging from 12 to 17 feet with 20 feet appearing to be the height of the tallest ladder stand marketed.

Ladder tripod stands provide the same benefits as tree stands but are freestanding and can be erected in open areas away from trees. Commercial tripod stands appear to be involved in fewer tree stand-fall incidents than other types of tree stands according to safety ratings[2] devised by Deer & Deer Hunting Magazine[3] and a survey of hunters conducted in Vermont and North Carolina.[4]

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[2] The safety ratings were calculated by dividing the accident frequency by the amount of reported use by responders to the survey.

[3] Tree Stand Safety Survey Results '99 Part 1: The Homemade Stand, If You Build It They Will Fall. (October 1998). *Deer & Deer Hunting Magazine.*

[4] Safety Issues Related to Hunting in Tree Stands. Survey of Hunters in North Carolina and Vermont. (August 2002). Conducted by Responsive Management for the International Hunter Education Association in conjunction with the North Carolina Wildlife Resources Commission and the Vermont Fish and Wildlife Department.

2) Fixed-Position or Hang-On Stands. Fixed-position tree stands, which can also be referred to as hang-on stands, are metal folding seats that require accessory climbing equipment, such as tree steps or climbing sticks, to gain access to the stand. The height at which fixed-positioned tree stands can be set relies on the judgment of the hunter and the preset lengths of accessory climbing equipment.

Of manufactured tree stands, fixed-position tree stands and the climbing stands, described below, appear to be involved in more tree stand incidents than other types of stands.[5]

3) Climbing Stands. A climbing stand is "walked" or "inched" up a tree by alternately raising the seating platform and the standing platform in a stand up, sit down pattern. The climbing function is integral to the design of the tree stand making additional climbing equipment (ladders, tree steps, climbing sticks) unnecessary.

4) Homemade Stands. Hunters can elect to build their own stands as an alternative to commercially manufactured stands. A reader survey conducted by *Deer & Deer Hunting Magazine* in 1999 found that homemade stands are more hazardous than commercial stands and account for a wide variety of structural failures. However, a survey conducted by the International Hunter Education Association (IHEA) in 2002 found that tree stand incidents occurred more frequently with manufactured stands (68%) than with homemade stands (32%).

Features. Hunters have a variety of features to choose from when selecting tree stands. These features include portability, bars and rails that ring the seating compartment, gun rests, outward facing stands, tree-facing stands, and multiple-occupancy stands that include a tree stand with a seating capacity for a family of four.

The petitioner contends that there are psychological and physical factors that interact to influence human performance in installing tree stands. Video demonstrations of the tree stand installation process and the proper use of tree stands and fall protection devices affirm that several cognitive and perceptual processes are required to correctly follow and execute the detailed procedures and that agility, coordination, balance, and strength are necessary to set up, climb, and descend tree stands. If the required psychomotor skills are lacking or impaired, falls may occur.

While instructions on how to set up and use tree stands are necessary, behavioral and psychological processes, and design flaws can diminish their effectiveness. For instance, convenience and ease-of-use of the product can be a determinant of how diligently the instructions are followed. If procedures are viewed as cumbersome, hunters may shortcut critical safety measures in the interest of time and effort. In addition, without feedback to confirm proper set up of the tree stand, unintentional errors can occur – the hunter may not recognize when instructions have been improperly followed.

[5] Ibid.

B. Fall protection devices. Hunters are encouraged through informational and educational campaigns to use fall protection devices to prevent death and injuries from falls while hunting from tree stands. A fall protection device is comprised of various components such as, straps, belts, buckles, and other hardware configured for the purpose of arresting a fall.

Fall protection devices are also referred to as fall restraint systems and fall arrest systems (FAS). Fall protection devices work as a system because each component of the device is dependent on other components for operational integrity. The terms "restraint " and "arrest" can carry nuances of meaning. Instructions supplied by one tree stand manufacturer have a warning that states that the full-body harness that is included with the purchase of the tree stand is not intended to *arrest* a fall but is designed to *restrain* a fall. For the purposes of this memo, "fall protection device" is used as an inclusive term for the various types of straps and harnesses worn by hunters to arrest, or stop, a fall. Furthermore, the purpose of a fall protection device is understood to be the stoppage of a fall, not the prevention of a fall.

There are three common types of fall protection devices available to hunters: safety belts, chest-and-shoulder harnesses, and full-body harnesses.

1) Safety Belts. Safety belts are among the simplest and least expensive of fall protection devices. A safety belt is a single strap, which can be worn either around the waist or chest, with a lanyard that secures the belt to an anchor on the tree. While a number of manufacturers include full-body harnesses with the purchase of their tree stands, a few still provide safety belts with their tree stands. Safety belts can also be purchased separately as an accessory item.

2) Chest-and-Shoulder Harnesses. A chest-and-shoulder harness is basically a safety belt with shoulder straps.

3) Full-Body Harnesses. Full-body harnesses include straps for the pelvic and thigh areas in addition to the shoulder straps. Full-body harnesses are the more expensive of the fall protection devices.

Although full-body harnesses are currently being promoted by some industry members as the preferred type of fall protection device for hunters, recent surveys found that safety belts are the primary fall restraint system in use. The *1999 Deer & Deer Hunting Magazine* survey found that of those who responded and who stated that they wore fall restraint systems, 66 percent used a commercial waist belt, 25 percent used a commercial chest harness, and 10.5 percent used a commercial full-body harness. According to the survey, respondents were six times more likely to use a waist belt than a full-body harness. The 2002 IHEA survey also found that the most common type of fall protection device used by responders was a simple safety belt, and a full-body harness was the least used.

A number of factors may account for the widespread use of safety belts compared to full-body harnesses. These include the price differential between the products, ease-of-use, and comfort.

A video on safe tree stand hunting produced by the National Bowhunter Education Foundation and the Treestand Manufacturers Association features hunters wearing all three types of fall protection devices. A segment of the video is dedicated to a discussion on the correct use of a safety belt. The video directs hunters that 1) the single-strap fall restraint system should be worn snugly around the chest and under the arms and, 2) there should be no slack in the lanyard that anchors the strap to the tree while the hunter is in a sitting position.

Most of the respondents in the 1999 *Deer & Deer Hunting Magazine* survey who had on fall protection devices at the time of their falls reported satisfactory results when rating the devices based on their capability to reduce or prevent injury after the fall. However, most of the respondents who wore single belts or homemade fall protection devices at the time of their fall, rated these devices as "ineffective." [6] The survey report did not explain why the responders thought the devices were not effective.

The majority of hunters who hunt from tree stands do not wear fall protection devices. In the 1999 survey of hunters conducted by *Deer & Deer Hunting Magazine*, 88% of the respondents stated that they were not wearing a fall protection device at the time of their fall. More recently, the IHEA surveyed hunters in Vermont and North Carolina and found that 58% were not using a fall protection device when their falls occurred.

Hunters who responded to the 1999 *Deer & Deer Hunting M*agazine survey pointed out the inconvenience of wearing fall protection devices. They stated it was "difficult and possibly hazardous to maneuver their restraints around branches and other obstacles while climbing to and entering the stand, or departing and descending from the stand. Until they find equipment that is easy to use for climbing and descending, they believe they have little choice but to ignore pleas to buckle up."[7]

2. TREE STAND SURVEYS AND STUDIES

A complete, detailed, accurate database of tree stand incidents does not exist. Researchers in the field are working to establish an incident-reporting system similar to those used to report hunter-related shooting incidents.[8] Until a more comprehensive database is developed, self-report surveys of hunters and retrospective analyses of tree stand injury data can provide insight into the circumstances and trends surrounding tree stand falls. Highlights from data collected by four of these sources – IHEA, *Deer & Deer Hunting Magazine*, the *Journal of Trauma*, and the *Morbidity and Mortality Weekly Report* follow.

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[6] Tree Stand Survey Results '99 Part 2: Unhappy Landings: One Fall Can Change Your Life. (November 1998). *Deer & Deer Hunting Magazine.*

[7] Tree Stand Survey Results '99 Part 3: Vigilant Care, Only You Can Make Your Stand Hunts Safe. (December 1998). *Deer & Deer Hunting Magazine.*

[8] Ibid.

A. International Hunter Education Association (IHEA) 2002 Survey. IHEA conducted a telephone survey of 1056 hunters in Vermont and North Carolina and found the following:

- 7% of the hunters interviewed experienced an incident in a tree stand in the previous 10 years.
- In the entire sample, 1.5% of all hunters interviewed had a tree stand incident and needed medical attention.
- 74% of all tree stand incidents reported by hunters occurred while they were transitioning into or out of the stand.
- 32% of tree stand incidents occurred while climbing into a hunting position.
- 29% of tree stand incidents occurred while climbing down from the tree stand .
- The direct causes of injury were reported as fell to the ground (24%), caught on step while falling (13%), injured by fall protection device (1%).
- Climbing stands (43%) and fixed-position stands (34%) were involved in most of the reported incidents. Ladder stands accounted for 18% of the incidents and tripod/quad stands accounted for 4% of the incidents.
- 21% of the tree stands involved in the incidents were reported by the hunters to be defective.
- Of the 21% of stands deemed defective, 35% were said to be homemade and 16% were said to be manufactured, the remaining types of tree stands were not known.
- 58% of those who had experienced a tree stand incident had not used a fall protection device at the time of the incident.
- 78% of those who experienced a tree stand incident had not used a fall protection device while climbing into a stand.
- 57% of those who experienced a tree stand incident had not used a fall protection device while in the stand.
- A simple safety belt was the most common type of fall protection device used by those who had experienced a tree stand incident in the past 10 years (16%). Chest harnesses were used by 8% of the responders. A full-body harness was the least used fall protection device (7%).

B. *Deer & Deer Hunting Magazine* 1993 and 1999 Surveys. In 1993 and 1999, *Deer & Deer Hunting Magazine* surveyed their readers regarding tree stand falls. In 1993, the magazine received over 2,300 completed surveys. The number of responses to the 1999 survey was not available. Among the findings from the anecdotal data are the following:

- Each style of tree stand has hazards unique to that style. For instance, ladder stands were responsible for falls when one side of the ladder sunk into the ground as hunters either climbed into or out of the stand. Climbing stands either slipped or collapsed.
- Most falls occur while hunters are climbing up or down, while they are installing the stand and while they are getting into or getting out of the stand rather than when they are positioned on the stand.
- Structural failures, slips, and other types of movement caused hunters to fall while they were on the stand.
- Interactions of several variables, such as type of stand, type of tree (and bark), and weather conditions (rain, drizzle, snow, sleet, ice), increases the risk of falls.
- Boots caked with mud or wet with moisture caused slips off the tree stand platforms.

- In the 1993 survey, almost half of the responders reported that they wear a fall protection device while in the stand. However, only 20 % wear them when they are most likely to fall, while they are ascending, descending, or transitioning into or out of the tree stand.

C. *Journal of Trauma*, October 2002. Deer Stand-Related Trauma in West Virginia: 1994 through 1999. This study analyzed data from hospital and state trauma registries and patient charts, and Department of Natural Resources (DNR) logs. Some of the findings of the analysis are listed below.

- Hospital data identified 90 deer stand-related injury incidents that occurred during the study period. These included 7 deaths.
- Most of the incidents identified through hospital data occurred with homemade tree stands.
- Hospital data indicated that most of the hunters involved in falls were not using a fall protection device.
- DNR data indicated that there were 29 reported falls from deer stands during the study period.
- About 15% of the hunters listed in the DNR reports were using a safety belt at the time of their fall.
- Most patients had multiple injuries. The majority of injuries involved long bone fractures of the extremities and spinal cord injuries.
- The authors concluded that injuries from tree stands were a significant cause of morbidity and mortality in West Virginia.

D. *Morbidity and Mortality Weekly Report (MMWR) October 20, 1989: Current Trends: Tree Stand-Related Injuries Among Deer Hunters – Georgia, 1979-1989.* All tree stand-related deer hunting injuries reported on Georgia's mandatory Uniform Hunter Casualty Report for ten hunting seasons were analyzed to obtain injury data. This study did not distinguish between homemade and commercial tree stands. Some of the findings relevant to this petition are given below.

- Of 594 deer hunting-related injuries, 214 (36%) injuries were related to tree stands.
- 17 (8%) of these 214 injuries resulted in fatalities.
- 111 (52%) of the 214 tree stand-related injuries were from falls.
- 49 (23%) of the 214 injuries occurred while descending from a tree stand.
- 40 (19%) of the 214 injuries occurred while climbing a tree stand.
- 68 (32%) of the 214 injuries occurred because of mechanical failure (i.e., collapse of the tree stand or its steps).
- 11 (5%) of the hunters reported they had fallen asleep in their tree stand immediately before falling.
- 8 (4%) of the hunters admitted to or were suspected of being intoxicated at the time of the incident.
- None of the tree stand-related injured hunters were wearing fall protection devices at the time of injury.
- Fractures and sprains were the most commonly reported injuries: 73% of those injured sustained fractures, including fractures of the cervical or lumbar vertebrae.
- Cervical spine fractures accounted for 16 (10%) of the fractures.

Although the above studies and surveys differed in methodologies, findings often coincided. Some general findings derived from the research are given below.

- Most falls occurred when hunters ascended and descended trees and when they climbed into or out of stands.
- Some hunters will wear fall protection devices while in stands, but not wear them when ascending or descending stands.
- Climbing stands and fixed-position stands were the types of stands most often involved in tree stand incidents.
- Single belt systems were the most commonly used fall protection devices.
- A majority of the hunters who hunted from tree stands did not wear fall protection devices.

3. CPSC IN-DEPTH INVESTIGATIONS OF TREE STAND AND FALL RESTRAINT SYSTEM INCIDENTS

CPSC databases provide limited information on tree stand falls. Many reports do not identify the type of tree stand involved or state whether fall protection devices were implicated in the incidents. However, five CPSC in-depth investigations (IDIs), conducted into fatalities that occurred from the concomitant failures of tree stands and fall protection devices, provide some knowledge of the circumstances surrounding the deaths of the hunters. [9] These investigations are summarized below.

A. IDI # 960207CCN0546: In December 1995, a 30-year-old man was asphyxiated when the bottom of a climbing deer stand he was using collapsed and he was suspended by his neck from his chest harness. The victim was able to remove his left arm from the harness and this caused the harness to slip up and under his neck pinning his right arm in a position over his head. Reportedly, this prevented or severely retarded his ability to breathe. The victim was said to be a licensed hunter with 16 years experience. It was reported that the evidence showed the victim attempted to free himself from the fall protection device by cutting the straps, but according to the IDI "it appeared that the victim was unable to maintain his consciousness long enough" to be successful.

B. IDI #991214CCC0190: In October 1999, a 12-year-old male was found hanging from a tree stand by his fall protection device. Reportedly, the tubular armrest on the tree stand broke causing the victim to fall forward off the stand. Ligature marks were found on the victim's throat. Death was due to asphyxiation. The fall protection device was described as a "safety strap." The CPSC investigator stated in a later transmission that the tree stand involved in the incident was a climbing tree stand and that the fall protection device consisted of a single strap and loop. Photographs of the device were not available.

C. IDI 000609HCC0742: In December 1999, a 14-year-old male was hunting from a climbing tree stand when one of the straps used to attach the stand's platform to the tree broke and the platform fell from underneath the victim's feet. The victim was found hanging by his safety

[9] The Human Factors analysis of tree stand incidents focuses on IDIs that include failures of the fall protection devices that resulted in deaths. Other tree stand-related IDIs in the CPSC databases involve possible mechanical failures, homemade tree stands, or non-use of fall protection devices and are not relevant to this discussion.

belt, facing away from the tree. The Sheriff's Office report stated that the safety belt was "around his chest and lower rib cage." The autopsy stated that the weight of the victim hanging from the safety belt compressed his chest and limited his ability to breathe. The autopsy report further stated that scratch marks found on the victim's chest indicated the victim most likely tried to disengage himself from the fall protection device.

It was reported that the young man had hunted many times before, but it is not known if he used a tree stand on any of these occasions. The tree stand involved in the incident was new and the incident occurred on the first day the stand was used. The safety belt worn by the victim was included with the purchase of the tree stand. A copy of the owner's manual for the tree stand, included with the IDI, illustrates the safety belt being worn around the waist and the upper torso. The instructions state, "The Personal Safety Belt (PSB) provided should be worn around the waist so that it is snug but not tight."

D. IDI 010111CNE6050: In September 2000, a 59-year-old male died from asphyxia due to manual compression of the chest when his climbing tree stand dislodged and he became suspended by his safety belt. The victim was reported to be an avid, experienced hunter and a certified hunter safety instructor. According to the IDI, it appeared that the victim had reached his chosen height on the tree and was initiating the process of securing the stand around the tree when the stand collapsed and fell to the ground suspending the victim from the fall protection device. The tree stand was found collapsed at the foot of the tree with no obvious broken parts.

One part of the safety belt webbing was attached to the tree and the other part was around the thoracic chest area of the victim. The IDI stated that the particular style of fall protection device worn by the victim functioned similarly to that of a noose. The victim was found facing the tree and, from the photographs taken at the scene, appeared to be hanging close to the tree. Minimal scuffing on the instep of the victim's new boots coincided with the smoothing of tree bark in the area of the victim's feet.

Apparently, when the tree stand fell, the impact of the victim's body on the fall protection device put tension of the restraint system and cinched the webbing tight against the chest. Cause of death is listed as asphyxia secondary to manual compression of the chest. According to the investigation report, the safety belt was included with the purchase of the tree stand.

E. IDI 021212CNE7628: In October 2002, a 34-year-old male died as a result of asphyxiation due to hanging when the chest strap on the full-body harness he was wearing slipped up around his neck while he was trying to disengage himself from the harness. The platform of his climbing tree stand collapsed precipitating his fall. This was the first time the victim had used this stand. It was reported that the victim had not used a harness prior to this episode. The victim had injuries to his fingers that reportedly indicated he was struggling to free himself from the full-body harness.

The autopsy report stated that the motor abilities of the victim diminished "in a rapidly, accelerating fashion" once the strap constricted the neck. The autopsy report further stated

that the victim became unconscious in seconds and that death ensued within minutes of the injury.

All the above incidents involved the collapse or other mechanical failure of climbing tree stands. Two incidents involved safety belts, one incident mentioned a safety belt (photographs or details of the product were not available to verify the type of product), one incident involved a chest harness, and one incident involved a full-body harness. Two victims were adolescents (12 and 14 years of age). In two incidents, the victims were using the tree stands for the first time.

In three incidents, straps on the fall protection devices slipped up and around the neck of the victims and in two incidents the safety belt was found around the thoracic area of the victims. There is some evidence that while suspended some of the victims attempted to free themselves from the fall protection devices.

4. POST-FALL SUSPENSION AND SELF-RESCUE

The IDIs identify two types of fall protection-related hazards associated with the incidents. One hazard occurs during the fall sequence at the time of the arrest when the straps on the device exert pressure on the upper body that results in asphyxiation; asphyxiation can occur fairly rapidly under these circumstances.

The second hazard is a hidden hazard resulting from post-fall suspension in the restraints. The fall protection device successfully arrests the fall without incident and the hunter is left suspended from the tree. Because a hunter could be suspended from a fall protection device for a long period of time before help arrives (one source estimates between 14 and 16 hours[10]), it is expected that attempts will be made to get free of the device. The IDIs indicate that during some of the escape attempts the straps of the device shifted up to the neck, leading to the hanging death of the victim.

A. Post-Fall Suspension. Studies have been conducted to determine human tolerance to motionless suspension. These static suspension studies with human volunteers have shown that tolerance of a fall protection device varies considerably among individuals and among the various types of devices.[11]

A review of the literature on fall arrest and post-fall suspension found "that the risk of fall arrest injury with a waist belt is probably greater than the risk of fall arrest injury with a full body harness assuming a dorsal attachment in both cases... Despite the limited data available on

[10] June 19, 2002 letter from Nigel Ellis, specialist in fall protection, to the U.S. Consumer Product Safety Commission concerning Petition CP 02-3.

[11] Noel, G. et al. (1978). Some Aspects of Fall Protection Equipment Employed in Construction and Public Works Industries. In Fundamentals of Fall Protection. (1991), pp. 1-32. Ed. Sulowski, A.C. Toronto, Canada: International Society for Fall Protection.

human suspension, it appears that the waist belt and thoracic harness are not useful for prolonged motionless suspension." [12]

The U.S. Air Force conducted a study with 13 human subjects for the Occupational Safety and Health Administration (OSHA) of tolerable, motionless suspension times for a safety belt, chest harness, and full-body harness. [13] As in the findings of the literature review discussed previously, the study showed that the safety belt was the least tolerable of the fall protection devices tested. The following table shows the median times of suspension for each fall restraint. Volunteers exhibited a range of tolerance times for suspension and these times are also given in the table. Because the study was conducted on fit and healthy volunteers, tolerance for suspension may be less for the general population.

Type of Fall Restraint	Median Times	Range of Times
Safety Belt	1 ½ minutes	Approx. ½ minute – 4 ¾ minutes
Chest Harness	5 ½ minutes	Approx. 1 minute to 13 minutes
Full-Body Harness	14 ½ minutes	Approx. 5 min to 30 minutes

Volunteers were least able to tolerate the safety belt because of abdominal pressure and difficulty in breathing. The chest harness exerted pressure at the armpit and caused physiological distress in the upper extremities. The study found duration times could vary among full-body harnesses depending on the configuration of the harness. A general finding relating to full-body harnesses was that "the suspension loads should be distributed as much as possible and concentration of the loads in the groin area should be minimized."[14]

It was also discovered that survival times increase if the user can reposition within the fall restraint system; however, it is unknown what time limits can be applied to these situations. Survival times can depend on the physical condition of the hunter, strap configuration of the fall restraint system, load distribution in the fall restraint system, and a person's position in suspension. [15]

B. Post-Fall Self-Rescue. Tree stand manufacturers have provided some guidance on post-fall self-rescue maneuvers. The following step-by-step procedures for self-rescue from post-fall suspension are included in the instructions provided with one manufacturer's tree stand. These same procedures are described in a safety video produced by the National Bowhunter Education Foundation and the Treestand Manufacturers Association (TMA) included with some manufacturer's tree stands. The video also suggests that hunters carry a knife to cut themselves out of the restraint straps when suspended in a fall protection device.

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[12] Hearon, B.F. and Brinkley, J.W. (1984). Fall Arrest and Post-Fall Suspension: Literature Review and Directions for Further Research. In Fundamentals of Fall Protection. (1991), pp. 123-137. Ed. Sulowski, A.C. Toronto, Canada: International Society for Fall Protection.

[13] Brinkley, J.W. (1988). Experimental Studies of Fall Protection Equipment. In Fundamentals of Fall Protection. (1991), pp. 139-153. Ed. Sulowski, A. Toronto, Canada: International Society for Fall Protection.

[14] Ibid.

[15] Ibid.

In case of fall:

1. Most important: Do not panic
2. Second most important: Determine the quickest way possible to remove your weight from the safety belt. This may be done by climbing back onto either section of the tree stand or by installing and standing on a screw-in or strap-on-step (If available).
3. Once your weight is off the safety belt, if you can not use the tree stand to climb back down the tree, hold onto the tree with one arm, remove the safety belt with the other, then "bear hug" the tree and carefully climb down.
4. Replace harness.

Note: It is highly recommended that you hunt with a companion and that you carry a cell phone or a two-way radio at all times when using treestands.

The maneuvers described above require physical coordination and strength that may not be possessed by the hunters. In addition, hunters may not be able to act quickly enough to affect a rescue, as in the instance of a tree stand collapse where handholds may not be available. Photographs accompanying some of the IDIs show that some victims were found hanging closely to trees yet could not rescue themselves.

Advising hunters to cut themselves out of a fall protection device may not be adequate to address the issue of post-fall rescue. Cutting or loosening the straps or trying to slip out of fall protection devices introduces a hidden hazard; the straps can slip up the torso and either incapacitate the hunter by pinning the arms against the body or cause asphyxiation by exerting pressure on the chest or neck region. This is evidenced by the investigations of fatalities, discussed above, incurred in tree stand incidents involving asphyxiation by fall protection devices.

5. VOLUNTARY STANDARDS

The Treestand Manufacturers Association (TMA) was formed in 1995. The TMA issues certification stickers for tree stands that meet requirements for load, stability, adherence to trees, and, in the case of climbing stands, repetitive loading.[16] Ten standard practices and methods developed by TMA are published as ASTM International Standards. The TMA standard for testing tree stand fall protection devices, TMS 06-02 (previously TMS 08), was recently balloted and adopted as an ASTM International Standard.

[16] Tree stand Survey Results '99 Part 3: Vigilant Care, Only You Can Make Your Stand Hunts Safe. (December 1998). *Deer & Deer Hunting Magazine.*

A review of the ASTM and TMA standards identified the following major human factors issues.

A. TMS 06-02: Standard Test Method for Treestand Arrest System

TMS 06-02, the Standard Test Method for Treestand Arrest System, refers to a fall protection device as a "fall arrest system" or FAS. It defines a FAS as follows:

> "a system, which is assembled for the purpose of arresting an accidental fall of its user. FAS consist of a Full Body Harness, lanyard, anchorage means, and connecting hardware."

The standard defines a full-body harness as follows.

> "A component with a design of straps which is fastened about the person in a manner so as to contain the torso and distribute the fall arrest forces over at least the upper thighs, pelvis, chest and shoulders with means for attaching it to other components and subsystems."

Use of safety belts and chest harnesses is not addressed in the standard. This suggests that the TMA is recognizing only full-body harnesses as acceptable fall protection for use with tree stands. However, the following ASTM standards do not define fall protection devices as full-body harnesses.

> ASTM F 2121 – 01 Standard Practice for Treestand Labels
> ASTM F 2122 – 01 Standard Practice for Treestand Safety Devices
> ASTM F 2123 – 01 Standard Practice for Treestand Instructions

Without providing definitions for the terms, these standards use "safety belt" and "harness" to refer to fall protection devices. Section 6.2.3 of ASTM F 2122 - 01, Standard Practice for Treestand Safety Devices, appears to contradict the requirements of TMS 06-02 by providing the manufacturer with an option as to the type of fall protection device to include with a tree stand. This section states the following:

> "A fall protection device, such as a safety belt or harness, shall be provided with each tree stand as standard equipment. The type of fall protection device is an option of the manufacturer."

While this standard would permit the inclusion of a safety belt as a fall protection device, as of January 1998, the Occupational Safety and Health Association (OSHA) banned the use of such belts as part of a personal fall protection system in the construction industry (29 CFR 1926.502 (d)). The decision was based on studies that indicated the hazardous effects of fall impact and pressure exerted by safety belts.

This standard does not provide methods or procedures to verify that a suspended hunter can safely disengage from the fall protection device.

B. ASTM F 2127-01 Standard Test Method for Treestand Adherence

This standard permits climbing and fixed-position tree stands to be tested for adherence on a wooden or metal pole 10" in diameter. Adherence performance conducted on a textured, wooden pole is likely to differ from adherence performance on a smooth, metal pole. Permitting the use of optional testing surfaces may affect the reliability of the test findings by producing inconsistent performance results between the two types of surfaces.

Adherence is tested in a laboratory setting and may not be representative of foreseeable use situations. Various types of tree barks, angularity of the tree, and weather conditions may affect adhesion performance.

C. ASTM F 2121 – 01 Standard Practice for Treestand Labels

This standard provides requirements for label formatting. Use of the guidelines in the American National Standard for Product Safety Signs and Labels, ANSI Z535.4 – 2002, would improve label formatting, particularly the sections referring to choice of a signal word and the use of the safety alert symbol. While the ASTM standard recommends using "Danger" as a signal word for a label on fall protection use, "Warning" would be more appropriate. The ASTM standard does not require a safety alert symbol for warnings which is part of the recognized format for labels and safety information.

D. ASTM F 2123 – 01 Standard Practice for Treestand Instructions

Requirements in this standard apply solely to instructions for tree stands. Although ASTM 2122 – 01, Standard Practice for Treestand Safety Devices, provides that a fall protection device be included with the purchase of a tree stand, there are no requirements in this standard that pertain to instructions for fall protection devices.

III. SUMMARY and CONCLUSIONS

CPSC data on tree stand falls is largely nonspecific. It is not always reported if falls occurred from homemade or manufactured stands or whether fall protection devices were in use at the time of the incidents. A few CPSC in-depth-investigations provide details on the concomitant failures of climbing stands and fall protection devices. Survey data from hunters who experienced falls are useful in the identification of contributory factors. However, survey data does not address fatalities resulting from tree stand falls. Retrospective analyses of injury and death data can provide some insight into the risks. Research on the suspension limitations of fall protection devices also provides a basis on which to evaluate hazards inherent in fall protection devices. Integration of the findings from the various available data and research sources helps to profile tree stand incidents.

Based on five in-depth investigations, two types of fall protection device-related hazards were identified. These are hidden and unexpected hazards. One hazard occurs during the fall sequence at the time of the arrest when the straps on the fall protection device exert pressure on the upper body or neck causing asphyxiation. The other hazard occurs during post-fall suspension when

self-rescue attempts cause the straps on the fall protection device to slip around the neck and throat resulting in strangulation.

ES does not believe that the current ASTM or TMA standards adequately address the fall protection devices for tree stands. In-depth investigations reported the user being asphyxiated by their safety belt, chest harness, or full-body harness. CPSC staff is concerned that a fall protection device intended to prevent deaths and injuries due to falls from tree stands may, in fact, result in death or serious injury due to its use.

The TMA standard for fall protection devices requires the use of a full-body harness rather than a safety belt or chest harness. The full-body harness is an improvement over the other two types of fall protection devices because it distributes arrest forces over more of the body and allows a hunter more time to react to the situation. However, as the asphyxiation death involving a full-body harness demonstrates, there is a need for additional standard requirements to address the issue of post-fall self-rescue.

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TAB E

CPSC Memorandum from Jason Goldsmith, Ph.D., Directorate for Health Sciences, to DeWane Ray, Directorate for Engineering Sciences, entitled "Petition CP 02-3," October 29, 2003

UNITED STATES
CONSUMER PRODUCT SAFETY COMMISSION
WASHINGTON, DC 20207

Memorandum

Date: October 29, 2003

TO : DeWane Ray, ESME,
Project Manager, Petition CP 02-3

THROUGH: Mary Ann Danello, Ph.D., Associate Executive Director,
Directorate for Health Sciences
Lori E. Saltzman, M.S., Director,
Division of Health Sciences

FROM : Jason R. Goldsmith, Ph.D., Physiologist,
Division of Health Sciences

SUBJECT : Petition CP 02-3

This memorandum has been prepared in response to Petition CP 02-3, which requests that the Commission 1) establish a mandatory standard for hunting tree stands to address the risk of falling, and 2) ban the waist-belt restraints (also referred to as waist straps) commonly used with these stands, which pose a serious threat to the safety of the users.

BACKGROUND:

Based on a search of the medical literature and CPSC databases, the petitioner, Carol Pollack-Nelson, Ph.D., concluded that many injuries and fatalities have resulted from falls from tree stands subsequent to their collapse. The petitioner cited two articles that were found in her search of the medical literature (Crites et al., 1998, Price and Mallonee, 1994), both of which report an association between falls from tree stands and severe and permanent injuries. Furthermore, for the 10-year period that the CPSC data was searched (ending in November 2000), the petitioner stated that "...19 deaths and hundreds of injuries..." were revealed and that "...many of the injuries and fatalities resulted from falls when the tree stand suddenly and unexpectedly collapsed." The petitioner highlighted four fatalities that were found in the CPSC data that "...occurred when the hunter was wearing, and became asphyxiated by, a waist belt." These incidents led the petitioner to conclude that the waist belt restraints that are included with some tree stands and/or which manufacturers have encouraged consumers to use as a fall-protection device, can present a serious risk of death.

The Division of Hazard Analysis (HA) staff (N. Marcy, December 17, 2002 Briefing Package Memo) examined CPSC databases for incidents involving tree stands. In the most recent year for

which complete NEISS data is available, 2001, an estimated 6,000 injuries attributed to the use of tree stands were treated in U.S. hospital emergency rooms. Of these injuries, 5,200 were associated with falls from a tree stand (5080) and/or collapse of the tree stand (120). Twenty-six percent of these injuries were of such severity to warrant hospitalization or transfer to another medical facility. Fractures were the most common injury type, representing 44% of all injuries.

Among the additional tree stand-related incidents found by HA in a search of the remaining databases (Injury or Potential Injury Database (IPII), In-depth Investigation Database (INDP), and Death Certificate Database (DTHS)) for the period from 1980 to 2001, there were 62 deaths and 55 injuries. Fifty-nine of the 62 deaths and 53 of the 55 injuries resulted from a fall from the tree stand. Although a reason for the fall is unknown in many of these cases, 44 falls were associated with tree stand failures; of these failures, 37 (4 deaths and 33 injuries) involved a stand known to be commercially manufactured. Eight incidents were identified where a fall-protection device was involved in, or directly responsible for, the injury or death. In four of these incidents, death resulted from suspension of the hunter from his fall-protection device subsequent to the tree stand failing in some manner. In three additional deaths and one injury, a fall-protection device was involved in the incident; in these incidents, there was no specific mention of a failure of the tree stand.

Based on a review of the materials provided by the petitioner, the HA analysis, a review of the medical literature involving falls and asphyxial deaths due to various forms of suspension, and the secondary literature concerning suspension from fall-protection devices, Health Sciences (HS) staff has provided a discussion on the types of injuries that may occur as a result of consumer use of hunting tree stands and fall-protection devices. For purposes of this discussion, safety belts shall refer to both waist belts and chest belts; both waist and chest belts consist of a single strap that encircles the body. Other fall-protection devices exist, which include chest harnesses and full-body harnesses; both of these devices consist of multiple elements. These devices will be discussed further below in the context of a general discussion related to fall-protection devices.

DISCUSSION:

The fact that tree stands place the hunter some distance above the ground exposes them to an increased risk of injury due to their potential to fall from an elevated height (i.e., from the tree stand). As summarized in the HA analysis, there are a number of falls that occur each year associated with the use of tree stands; in 2001, over 5,000 hunters are estimated to have been treated in U.S. hospital emergency rooms for fall-related injuries related to tree stands.

The types of injury that may result from a fall from a tree stand are dependent on a number of factors, including the height of the fall, the presence or absence of a fall-protection device, collisions with other objects during the fall, the surface on to which the individual ultimately falls, the impact duration, and the anatomical region(s) of the body that is impacted during the fall. Depending on the fall-protection device employed during use of a tree stand and whether it is used properly by the hunter in conjunction with the tree stand, the injury potential from a fall from a tree stand can be minimized or made considerably worse. Falls from tree stands in the

absence and presence of fall-protection devices and their respective injury potential will be discussed separately below, followed by a general discussion of fall-protection devices.

Falls from tree stands - without fall-protection devices

Hunters who elect not to wear a fall-protection device have no option but to fall toward the ground subsequent to a fall from a tree stand. In the hunting environment, the surface that is ultimately impacted can range from a soft forest floor that is heavily covered with decaying matter, to a much harder surface, such as that created by exposed primary roots or rocky substrate. Hunters can also collide with branches or other tree limbs during the fall, which can produce secondary injury. Such secondary impacts can also affect the body orientation at final impact as well as reduce the velocity of final impact with the ground (Crites et al., 1998).

Consequently, the injury potential may range from abrasions, contusions, and lacerations to more serious lacerations, fractures, and internal organ injuries, some of which can lead to permanent disability or death. As detailed in the HA analysis of fall-related incidents involving tree stands, many of the reported injuries involve spinal fractures and internal organ injuries, some of which led to the death of the hunter.

Several recent medical reports have examined the injuries associated with tree stands (in most cases, it is unknown whether the tree stand was manufactured or homemade). A subset of these reports has specifically focused on spinal injuries since these are severe injuries that often have permanent consequences. In all but one study where the use of a fall-protection device was investigated, researchers found that none of the injured hunters had been wearing such a device.

Crites et al. (1998) examined 27 cases of spinal injury subsequent to a fall from a tree stand that were reported to Duke University Medical Center over 16 consecutive hunting seasons (1981 - 1997). The average fall height was approximately 20 feet. Forty-four percent of the patients sustained some form of neurological deficit, with paraplegia the most common outcome. Fifty-nine percent of the patients had associated injuries as well, such as fractures of the arm, leg, shoulder, and collar bone. Lumbar segmental injury (injury to the vertebrae in the lower back, between the ribs and pelvis) was the most common injury and burst fractures (vertical fracture of a vertebra) the most common fracture type. Use of a fall-protection device was not investigated in this study.

In an examination of the 41 tree-stand related spinal cord injuries reported to Louisiana's Spinal Cord Injuries Registry from 1985 to 1994, Lawrence et al. (1996) report that 28 falls resulted in permanent paralysis and 13 in temporary neurological deficit. Two of these falls were reported to have been associated with collapse of the tree stand. In this study, none of the patients reported having used a fall-protection device at the time of their injury.

Price and Mallonee (1994) examined hunting-related spinal cord injuries that were suffered by Oklahoma residents and reported to the Injury Prevention Service of the Oklahoma State Department of Health during a five and one-half year period between 1987 and 1993. They found 10 fall-related injuries; seven were from a tree stand, one was from a deer blind and in two

others the involvement of a tree stand was unknown. Based on state licensing of hunters in this state, this resulted in an annual rate of 0.5 spinal cord injuries per 100,000 licenses sold. The injured reported having fallen from heights of 15 to 30 feet. Eight of the injured suffered paraplegia/paresis due to thoracic or lumbar spine injuries, whereas two suffered quadriplegia/paresis subsequent to injuries at the cervical spine level. Four of the injuries resulted in neurological damage that was severe enough to result in permanent paralysis and one in death. None of the injured reported that they were wearing a fall-protection device at the time of their fall.

The Georgia Department of Human Resources and the Georgia Department of Natural Resources (Brown et al., 1989) studied all tree stand-related deer hunting injuries for a 10 hunting-season period, 1979-1989. Two hundred and fourteen injuries were found, 17 of which were fatal. This figure translates to an annual injury rate associated with tree stands of 8.9 hunters per 100,000 hunting licenses sold. Failure of the tree stand occurred in 32% of the incidents. Fractures (73%) and strains or sprains (10%) were the most commonly reported injuries, with cervical spine fractures accounting for 10% of the fractures. Of the 214 injuries, 111 were received as a result of the hunter falling from a tree stand; 49 fell while descending from the stand and 40 fell while ascending to the stand. None of the 214 injured was wearing a fall-protection device at the time of their injury.

Urquhart et al., (1991) examined admission records of the Medical College of Georgia Hospital and Clinics for the period of 1982 to 1989 for injuries that resulted from falls from tree stands. One death and 18 injuries were found. The majority of the injuries involved fracture of the spine and long bones. Six of the injured are permanently paralyzed and eight were debilitated for various lengths of time as a result of their fall. More than 60% of the patients required hospitalization for more than two weeks and four required rehabilitation lasting up to five months. Three of the falls involved commercially-manufactured stands (2 climbing stands, 1 ladder stand). Seven of the falls were caused by structural failure of the stand, only one of which was commercially manufactured. Of the seventeen survivors contacted by Urquhart et al., none reported wearing a fall-protection device at the time of their fall.

Finally, in a retrospective study of hospital trauma registry data from the six largest trauma centers in West Virginia for injuries resulting from tree stand-related incidents over the 6-year period, 1994 through 1999, Gates et al. (2002) identified 90 incidents where injuries were sustained due to falls, seven of which proved fatal. The majority of injuries were fractures of the extremities (47%) and spinal cord injuries (36%). On average, 3.4 days of hospitalization were required. An examination of the West Virginia Department of Natural Resources incident reports for this same time period, revealed 22 injuries and 7 deaths involving falls from tree stands. The average height of the fall was 17.5 feet. Eighty-five percent of the hunters were not wearing a fall-protection device at the time of their fall. Approximately 33% of these incidents involved commercially-manufactured stands.

Falls from tree stands - with fall-protection devices

The injuries that a hunter who is wearing a waist belt may experience subsequent to a fall from a tree stand range from bruises and abrasions to more severe injuries, such as internal organ injuries, bone fractures and death by asphyxiation. Transmission of the forces associated with a fall to the organs of the abdomen, over which the waist belt is positioned, can lead to severe injury of the internal organs as well as injury to the spine and other skeletal elements. The production of these injuries will depend on the amount of force conveyed to the body during arrest of the fall and the duration over which these forces are applied. Crawford (1989) states that waist belts have produced severe injury and even death to men that have fallen while wearing such devices. In addition to producing various internal, spinal and ribcage injuries as a result of forces being applied to the abdomen, he points out that tests performed with anthropometrically designed dummies have shown that some belts can slide over the buttocks of an inverted faller, allowing him to fall to the ground.

The potential for a waist belt to asphyxiate the user is perhaps the greatest hazard associated with its use, yet this hazard may not be well recognized. Respiration in humans is dependent upon exchange of gases occurring in the lungs. This exchange is dependent upon the availability of the proper gases in the environment, the existence of a clear pathway between the environment and the lungs, and the mechanical movement of the muscles and skeletal system, which allow ventilation of the lungs to take place. Waist belts can compromise this system in several ways.

Hanging can occur if the waist belt becomes positioned around the neck subsequent to a fall. Pressure exerted on the front of the neck by a belt that is bearing the weight of the individual can occlude the airway, depriving the lungs of their oxygen supply. Similarly, pressure applied to the sides of the neck can occlude blood vessels that are crucial for maintenance of the oxygen supply to the brain.

Traumatic asphyxia (postural or positional asphyxia) can occur if the body's position in some way interferes with normal respiration. Typically, this occurs when an individual is unable to breathe because of an inability to ventilate (move one's chest), or the airway is compressed against the face or neck. Compression of the chest or upper abdomen by a waist belt that is bearing the full weight of the hunter's body can compromise an individual's ability to ventilate the lungs by exerting pressure on the diaphragm, the muscles of the rib cage, and/or the abdominal muscles. Under such compression, the resultant impaired breathing would lead to physical exhaustion and fatigue of the respiratory muscles, producing an increasingly hypoxic (oxygen-depleted) state that eventuates in unconsciousness and death (Busuttil and Obafunwa, 1993).

Additionally, suspension by a waist belt may leave the hunter hanging upside down. This position would impair respiratory movements, as the diaphragm will be pushed into the thoracic cavity by the abdominal organs, eventuating in respiratory fatigue and the consequent asphyxiation of the hunter. In this position, an impaired ability to breathe would be compounded by pooling of blood in the head and impaired venous return to the heart (Lawler, 1993; Purdue, 1992; Uchigasaki et al., 1999).

Six cases of hanging or traumatic asphyxiation by a fall-protection device were found by HA in the CPSC databases. In four of these six fatalities, death occurred due to suspension by the fall-protection device subsequent to failure of the tree stand. In the first such incident (IDI 000609HCC0742), a 14-year-old male was hunting from the platform of a portable stand when one of the straps that holds the stand's platform broke and caused the platform to fall from underneath his feet. This caused the young man to be suspended by his waist belt, which was found around his chest and bearing the full weight of his body. According to the medical examiner, the resulting compression of the chest compromised his ability to breathe and led to his death from traumatic compression asphyxia. In another compression asphyxiation incident (IDI 010111CNE6050), a 59-year-old man was left suspended by his "safety belt" after his climbing tree stand dislodged from the tree. Although the term safety belt is used, it is unknown what type of fall-protection device was actually involved in this incident. Two other fatalities were both hangings. In the first (IDI 991214CCC0190), a 12-year-old boy was found hanging from his "safety strap", presumably after his tree stand's tubular arm rest broke and caused him to fall forward. It is unknown what type of fall-protection device was involved in this incident, despite it being referred to as a safety strap. In the second hanging (IDI 960207CCN0546), a 30-year-old man was hung by the chest harness that he was wearing subsequent to the bottom of his tree stand falling.

In two other fatalities in which a fall-protection device was involved, there was no specific mention of a failure of the tree stand. The narrative from the Injury and Potential Injury Incident (IPII) report for one of the fatalities (IPII X96C0727A) states that a 58-year-old man died of asphyxia and shock after he became suspended by a "waist safety belt" while hunting from a tree stand. There is insufficient detail (e.g., no product information or medical report) to determine whether the fall-protection device was actually a waist belt and by what manner it led to the asphyxiation of the man. In another fatality, the death certificate (DTHS 9842123822) states that a 42-year-old man fell off a tree stand and became entangled in his "safety harness", which led to his death by positional asphyxiation.

The petitioner cited four of the above fatalities (IDI 000609HCC0742, IDI 010111CNE6050, IPII X96C0727A, and DTHS 9842123822) in support of a ban on waist-belt restraints; however, in only one (IDI 000609HCC0742) is it known with any certainty that a waist belt was involved.

One additional fatality involved a fall-protection device. The death certificate (DTHS 0021032750) in this case states that a 58-year-old man was found hanging from a "safety strap" at a deer stand. However, it was concluded by the certifying physician that the hunter died from natural causes (intracerebral hemorrhaging as a consequence of chronic anticoagulation), rather than from asphyxiation caused by his "safety strap".

Fall-protection devices – general discussion

Whereas, the petitioner has specifically raised concern with waist belts, it is important to note that wearing a chest belt or chest harness around the chest subjects the user to the same risk of asphyxiation as previously described for waist belts.

An alternative fall-protection device, the full-body harness, is a device that is better able to distribute the forces associated with a fall across the body. It does so by using multiple elements, including straps that wrap around the thighs. In so doing, it largely spares sensitive areas of the body, such as the chest and abdomen, from fall-arrest forces; instead, they are directed toward less sensitive areas of the body. Additionally, breathing is not impaired in the manner described for waist belts, chest belts, and chest harnesses. However, there is some evidence that suggests that full-body harnesses, along with waist belts, chest belts, and chest harnesses, can only be tolerated for a short period of time by individuals who remain relatively motionless, as might be the case with someone who falls and is injured or unconscious.

The U.S. military and others have performed limited studies on suspension in various fall-protection devices. The most scientific of these studies, performed by the U.S. Air Force (Brinkley, 1991), and in agreement with other studies, suggests that passive suspension is tolerated by young, healthy (and noninjured) subjects for only a finite amount of time. Tolerance was determined by medical personnel using physiological monitoring and observation of symptoms such as light-headedness, decreased heart rate, nausea, flushing of skin, and drowsiness. Tolerance was also established by the volunteers based on their report of losing sensation in the extremities, experiencing nausea, pressure from the straps or a difficulty in breathing. Tolerance, in general, appeared to be dependent on the individual, the fall-protection device type and the manner in which the device was adjusted. On average, safety belts could be tolerated for only approximately 1.5 minutes, due primarily to difficulty in breathing and abdominal pressure from the belt that developed in that time period. Chest harnesses were tolerated for approximately 6 minutes; testing of these devices was terminated primarily due to the development of cardiovascular symptoms and the report by volunteers of pressure on the arms from the shoulder straps. A variety of full-body harnesses were tested as well. Although better tolerated than safety belts and chest harnesses, tolerance to these devices was still limited to only approximately 30 minutes. Tolerance limits to the full-body harnesses were determined, in large part, by the appearance of cardiovascular symptoms and nausea. This study suggests that for similar individuals, suspension in a motionless state for periods of time that approach these tolerance times may result in difficulty in breathing as well as potentially adverse cardiovascular responses that include tachycardia and bradycardia (rapid and reduced heart rates, respectively) and the subsequent loss of consciousness, eventuating in death. Individuals who are less fit and/or injured or otherwise incapacitated can be expected to fare less well.

CONCLUSION:

Injuries due to falls from tree stands can be severe, with permanent debilitation or death likely outcomes. Some of these fall injuries and deaths potentially could be prevented by addressing the failures of tree stands that led to their occurrence. Other falls may be due to circumstances that do not include failure of the tree stands. Whereas, it appears that many falls occurred in the absence of a fall-protection device, seeking to prevent such falls may involve strategies that are more complex than simply suggesting that hunters wear a fall-protection device. Safety belts, (waist or chest belts) or chest harnesses have the potential to hang or traumatically asphyxiate (by compressing the abdomen or chest in such a manner as to restrict breathing) the hunter that

wears such a device. Those devices and their alternatives (e.g., full-body harnesses) may also produce fatal outcomes if suspension subsequent to a fall is for a prolonged period of time.

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TAB F

CPSC Memorandum from Thomas E. Caton, Directorate for Engineering Sciences, to DeWane Ray, Directorate for Engineering Sciences, entitled "Petition Requesting Standard for Hunting Tree Stands and a Ban of Safety Belts Used with Hunting Tree Stands (Petition CP 02-3)," October 29, 2003.

UNITED STATES
CONSUMER PRODUCT SAFETY COMMISSION
WASHINGTON, DC 20207

Memorandum

Date: October 29, 2003

TO : DeWane Ray, ESME
Project Manager, Tree stands

THROUGH: Hugh M. McLaurin, Associate Executive Director
Directorate for Engineering Sciences

Mark Kumagai, Acting Director
Division of Mechanical Engineering

FROM : Thomas E. Caton
General Engineer
Division of Mechanical Engineering

SUBJECT : Petition Requesting Standard for Hunting Tree Stands and a Ban of Safety Belts Used With Hunting Tree Stands (Petition CP 02-3)

Petition CP 02-3

The United States Consumer Product Safety Commission (Commission) received a letter, dated March 20, 2002, that petitioned the Commission "...to promulgate regulations that (1) establish a mandatory standard for hunting tree stands to address the risk of falling; and (2) ban waist belt restraints in tree stands, as they pose a serious threat to the safety of users." The petitioner "...believes the tree stand waist belt may pose a greater risk of injury or fatality than the fall itself."

Engineering Sciences staff is aware of two organizations, the Treestand Manufacturers Association (TMA) and ASTM International, that have standards and test methods for tree stands. The TMA developed eleven tree stand standard practices and methods. Ten of these eleven standard practices and methods have been balloted and published as ASTM standard practices and methods by ASTM International. Nine of the ten ASTM standards are identical to the TMA standards and the tenth is less stringent than the original TMA standard. TMS 06, the only TMA standard not published as an ASTM standard, was balloted by ASTM on July 9, 2003. The ten ASTM International standards for tree stands are published in the Annual Book of ASTM Standards 2002, Vol. 15.07: End Use Products.

The ASTM International standards for fall protection devices for tree stands (ASTM F 2121-01, F 2122-01, and F 2123-01) address the safety belt or waist belt restraints mentioned in Petition CP 02-3. The ASTM International standards addressing structural integrity of tree stands (ASTM F 2120-01, F 2124-01, F 2125, F 2126, F 2127, and F 2128) provide test methods to verify the tree stand's load capacity rating assigned by the manufacturer. TMA standard TMS 06 was balloted on July 9, 2003 by ASTM contains requirements for the use of a full body

harness. TMA standard TMS 09 has been balloted and approved as ASTM F 2275 and contains the engineering specifications for the manufacture of a tree stand. The TMA standards and the ASTM International standards are summarized in the Appendix Table 1.

Discussion of Standards

The terminology associated with these practices and standards includes climbing tree stands, non-climbing, fixed position or hang-on tree stands, and tripod or tower tree stands.

Structural Integrity:

ASTM F 2120-01 *Standard Practice for Testing Treestand Load Capacity* is a general standard that provides guidance to the user about when to apply the load test methods specified in ASTM standards, F 2125, F 2126, F 2127 and F 2128. The original TMA standard is TMS 01-96 *Standard Practice for Testing Treestand Load.* Both standards provide for uniformity in the testing of tree stand load capacity.

ASTM F 2124-01 *Standard Practice for Testing Ladder Treestand, Tripod Treestand and Climbing Stick Load Capacity* was balloted from the original TMA standard, TMS 05-00 *Standard Practice for Testing Ladder Treestand, Tripod Treestand and Climbing Stick Load Capacity*. This standard is essentially the same as ASTM F 2120 with the exception of the testing order. These standards provide guidelines for the test selection for evaluating the load capacity of ladder tree stands, ladder, tripod tree stands and climbing sticks in accordance with the manufacturer's capacity rating. The ASTM standard only tests ladder tree stands with the load applied to the top platform use condition such as when the user is at the top of the stand. The ASTM standard does not consider the effect of the user's weight as the user climbs up the ladder to the platform. Ladder industry standards published by the American National Standards Institute provide for various tests along a ladder's length to simulate use conditions and more fully evaluate a ladder.

ASTM F 2125-01 *Standard Test Method for Treestand Static Stability* and the original TMA standard, TMS 12-98 *Standard Test Method for Treestand Static Stability*, contain the procedure for determining the static stability of tree stands relative to the manufacturer's rated capacity. These standards provide requirements for the testing of a tree stand at 80% and 100% of its rated capacity. This standard test method does not provide for testing tree stands with no-load or minimum-load conditions such as when the user is entering or exiting a tree stand. It is ES's opinion that these conditions should be addressed by a standard because a tree stand can suffer slippage under these conditions. ASTM F 2125 is similar to ASTM F 2127 with the exception of the description of how to apply a test load to a climbing stand.

ASTM F 2126-01 *Standard Test Method for Treestand Static Load Capacity* and the original TMA standard, TMS 11-98 *Standard Test Method for Treestand Static Load Capacity*, define the static load capacity of tree stands in terms of a factor of safety relative to the manufacturer's rated capacity. These test methods use static loads ranging from 25% to 200% of the tree stand's manufacturer's rated capacity to test a tree stand. Tree stand performance is evaluated by inspecting the tested tree stand for permanent deformation due to yielding.

ASTM F 2127-01 *Standard Test Method for Treestand Adherence* and the original TMA standard, TMS 13-96 *Standard Test Method for Treestand Adherence*, contain requirements for adherence of tree stands to the tree. These standards provide methods for deflection tests for climbing tree stands and fixed tree stands with test loads at 80% and 100% of the tree stand manufacturer's rated capacity but do not consider no-added load, minimal-load applied test conditions, or how a no-load condition affects the adherence of a tree stand to the mounting tree. These conditions can occur when the hunter transfers in and out of the tree stand. ASTM F 2127 is similar to ASTM F 2125 with the exception of the description of how to apply a test load to a climbing stand.

ASTM F 2128-01 *Standard Test Method for Treestand Repetitive Loading Capability* and the original TMA standard, TMS 15-96 *Standard Test Method for Repetitive Loading Capacity*, contain requirements to determine the capacity of climbing tree stands to withstand repeated loading relative to the manufacturer's rated capacity.

ASTM F 2275 *Standard Practice for Treestand Manufacturer Quality Assurance Program* and the original TMA standard, TMS 09 *Standard Practice for Treestand Manufacturer Quality Assurance Program*, provide the minimum requirements necessary for a quality assurance program. TMA standard TMS 09 requires that the welding of metal components shall be done by certified welders following American Welding Society, American Society of Mechanical Engineers, or equivalent standards and that tree stand parts shall meet the manufacturer's engineering specifications. ASTM F 2275 is less stringent than TMA standard TMS 09 because it does not include the certified welder provisions that are in TMS 09. The Treestand Manufacturers Association and ASTM standards have requirements for metallic components but the fabric components of tree stands, such as seating and straps, do not have direct standard requirements. Staff believes that there is a need for standards for the fabric components used with tree stands.

Fall Protection Devices

ASTM F 2122-01 *Standard Practice for Treestand Safety Devices* and the original TMA standard, TMS 03-98 *Standard Practice for Treestand Safety Devices*, provide guidelines for the selection, availability and placement of user safety devices. The standard states that fall protection devices shall include safety belts and/or chest harnesses, and that the chest or full body harness provided for fall protection device is at the option of the manufacturer. It requires that the user shall be able to secure the fall protection device to the tree being climbed, and that the fall protection device shall be adjustable by the user so the user can minimize their free-fall distance. A review of a sporting goods catalog suggests that various manufacturers have included safety belts, chest harnesses, or full body harnesses with their tree stands.

TMA standard TMS 06 *Standard Test Method for Treestand Fall Arrest System* was adopted by the TMA on January 16, 2003. This standard is being balloted as an ASTM standard. TMA standard TMS 06 provides a method for the determination of tree stand fall-arrest-system and sub-system-component load-capacities. It also specifies a full body harness, a lanyard anchorage, and hardware to connect the fall arrest system components to create a linear linkage along which the maximum arrest force acts. TMA standard TMS 06 also provides for the testing

of a climbing belt with a full body harness only if the tree stand fall arrest system includes an integral-climbing belt.

The approval of TMA standard TMS 06 suggests that the TMA has moved away from the use of safety belts or unspecified chest harnesses to only specifying full body harnesses as an acceptable fall arrest system in their standards. The staff believes that it is worthwhile to limit fall protection devices to full body harnesses because it provides a suspended user with more opportunity to safely free themselves from the suspended state should it occur. However, TMA standard TMS 06 does not provide test methods to verify that a suspended user can safely free themselves should they become suspended after falling from a tree stand. The ability of a suspended user to safely free themselves after becoming suspended needs to be addressed.

Labeling and Instructions

ASTM F 2121-01 *Standard Practice for Treestand Labels* provides guidelines for the design and placement of user labels and warnings. This ASTM standard states that the label must contain a phrase to 'not use without safety belt' or 'always wear a safety belt'. The original TMA standard, TMS 02-98 *Standard Practice for Treestand Labels*, provides guidance for user labels on tree stands. According to the standard, the label should include a phrase to not use without a safety belt. These two standards provide for uniform user labels on a tree stand but do not define a safety belt or chest harness.

ASTM F 2123-01 *Standard Practice for Treestand Instructions* and the original TMA standard, TMS 04-98 *Standard Practice for Treestand Instructions*, provide guidelines for the selection, content and placement of user instructions and for the use of a safety belt or chest harness for fall protection. These standards mention the use of a safety belt or chest harness but do not define the safety belt or chest harness nor specify the use of a full body harness as TMS 06 does.

Conclusions/Recommendations

It is the staff's opinion that the Treestand Manufacturers Association and corresponding ASTM International standards address structural integrity, stability, and adherence to the mounting tree and provide an adequate assessment for the use of metal tree stands under load. However, these load-based tests do not consider when a tree stand is used without an applied load such as when the user is entering or exiting a tree stand. The tree stand tests should be extended to include no-load/reduced load conditions that exist when entering and exiting a tree stand. American National Standards Institute A14 standards should be consulted for guidance about ladder tests to consider for additional requirements to the tree stand standards. In addition, the existing standards do not evaluate the strength of a tree stand's seats made from fabric even though fabrics are used with some tree stands.

It is the staff's opinion that TMA standard TMS 06 requiring a fall arrest system to include a full body harness is an improvement compared to safety belts and chest harnesses. The full body harness distributes the arrest forces over the body, provides for upright suspension, and reduces the possibility of asphyxiation from chest compression. Staff believes these improvements will provide the user with more time to safely free themselves from the suspended

state should it occur. However, TMA standard TMS 06 does not provide test requirements to verify that a suspended user can safely free themselves while being suspended after falling from a tree stand.

Voluntary standards governing tree stands should be updated to: (a) reflect all known hazards, (b) emphasize the benefits of a full body harness, (c) arrest falls by safely distributing arrest forces to the body, (d) provide upright suspension of the user after falling that does not restrict breathing or have the potential to restrict breathing, (e) afford the user a safe escape from suspended state after falling and becoming suspended, (f) evaluate the structural integrity of all components such as fabric seats and test for dynamic load conditions to simulate normal use such as entering and exiting the tree stand, and (g) develop additional tests for tree stand ladders that consider the effect of loads along the length and not just those applied at the top platform. These issues should be addressed by the industry voluntary-standards-development process.

APPENDIX

TABLE 1 – COMPARISON OF TMA STANDARDS TO ASTM STANDARDS

Original Treestand Manufacturers Association Standard	Corresponding ASTM International Standard	Description of ASTM or TMS Standard
TMS 01-96 *Standard Practice for Testing Treestand Load Capacity*	F 2120-01 *Standard Practice for Testing Treestand Load Capacity*	Specifies the test sequence to verify the rated load carrying capacity and considers structural failures such as yielding, deformation, or cracking.
TMS 02-98 *Standard Practice for Treestand Labels*	ASTM F 2121-01 *Standard Practice for Treestand Labels*	Provides guidelines for labels and warnings and says that the label must contain a phrase to: 'not use without safety belt' or 'always wear a safety belt.' Does not define a safety belt.
TMS 03-98 *Standard Practice for Treestand Safety Devices*	ASTM F 2122-01 *Standard Practice for Treestand Safety Devices*	Provides guidelines for the selection, availability and placement of safety devices; fall protection devices are at the option of the manufacturer.
TMS 04-98 *Standard Practice for Treestand Instructions*	ASTM F 2123-01 *Standard Practice for Treestand Instructions*	Provides guidelines for the selection, content and placement of instructions and for fall protection.
TMS 05-00 *Standard Practice for Testing Ladder Treestand, Tripod Treestand and Climbing Stick Load Capacity*	ASTM F 2124-01 *Standard Practice for Testing Ladder Treestand, Tripod Treestand and Climbing Stick Load Capacity*	Provides guidelines for load capacity evaluation of ladder tree stands, tripod tree stands and climbing sticks per the manufacturer's capacity rating.
TMS 12-98 *Standard Test Method for Treestand Static Stability*	ASTM F 2125-01 *Standard Test Method for Treestand Static Stability*	For quality assurance and production control but not as an independent material and product acceptance test.
TMS 11-98 *Standard Test Method for Treestand Static Load Capacity*	ASTM F 2126-01 *Standard Test Method for Treestand Static Load Capacity*	For quality assurance, production control purposes, and determination of static load capacity relative to the manufacturer's rated capacity.
TMS 13-96 *Standard Test Method for Treestand Adherence*	ASTM F 2127-01 *Standard Test Method for Treestand Adherence*	For quality assurance and production control purposes but not as an independent

		material or product-acceptance test. These methods do not consider test conditions of no-added load, minimal-load applied test conditions, or how a no-added load condition affects the adherence of a tree stand to the mounting tree.
TMS 15-96 *Standard Test Method for Repetitive Loading*	ASTM F 2128-01 *Standard Test Method for Treestand Repetitive Loading Capability*	For quality assurance and production control purposes recognizing that individual usage will vary and not as an independent material or product-acceptance test.
TMS 06 *Standard Test Method for Treestand Fall Arrest System*	Balloted by ASTM on July 9, 2003	For the determination of the load capacities for tree stand fall arrest systems and the subsystem components. Provides for the testing of a climbing belt with a full body harness only if the fall arrest system includes an integral climbing belt suggesting that non-full body harnesses would not be specified by the Treestand Manufacturers Association in future standards.
TMS 09 *Standard Practice for Treestand Manufacturer Quality Assurance Program*	ASTM F 2275 *Standard Practice for Treestand Manufacturer Quality Assurance Program*	Provides the minimum requirements necessary for a quality assurance program. However, TMS 09 says that the welding of metal components shall be done by certified welders following American Welding Society, American Society of Mechanical Engineers or equivalent standards and that tree stand parts shall meet the manufacturer's engineering specifications and ASTM F 2275 does not include the certified welder provision.

Tab G

CPSC/ASTM Correspondence to F08.16 Subcommittee:

Letter
From: DeWane Ray, CPSC
To: James Olshefsy, ASTM F08 Staff Manager,
Re: Letter Ballot F08.16 (03-01) Item 1, July 31, 2003

Email
From: John Woller, Sr., TMA/ASTM Technical Contact
To: to DeWane Ray, CPSC,
Subject: Response to CPSC Comments to Letter Ballot F08.16 (03-01) Item 1, August 12, 2003.

Letter from Mark Kumagai, CPSC staff to James Olshefksy ASTM F08 Staff Manager,
Re: F08.16 Standards Development, March 19, 2004.

U.S. CONSUMER PRODUCT SAFETY COMMISSION
WASHINGTON, DC 20207

DeWane Ray, P.E.
Project Manager
Engineering Sciences Directorate
Division of Mechanical Engineering

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Email: jray@cpsc.gov

July 31, 2003

Mr. James Olshefsky
ASTM F08 Staff Manager
ASTM International
100 Barr Harbor Drive
West Conshohocken, PA, 19428-2959
Re: Letter Ballot F08.16 (03-01) Item 1

Dear Mr. Olshefsky:

This is my abstaining vote with comments for the F08.16 (03-01) Item 1 letter ballot on "Treestand Fall Arrest System." The U.S. Consumer Product Safety Commission (CPSC) staff is prohibited by CPSC policy from casting affirmative or negative votes on issues related to voluntary standards.

CPSC staff recommends that the standard provide specifications to ensure that a user can safely escape from a fall arrest system (FAS) after falling from a tree stand. In a recent incident involving a death by asphyxiation (see enclosed investigation report 021212CNE7628), a hunter fell and was suspended by his full body harness. The hunter attempted to escape by removing the harness, which resulted in a harness strap compressing the hunter's neck and asphyxiating him. Many hunters hunt alone in secluded areas and would most likely be required to rescue themselves if suspended by a FAS. Staff is aware of seven deaths that involved a person being asphyxiated by a safety belt, chest harness, or full body harness (see-enclosed investigation and incident reports). CPSC staff recommends the formation of a task group to address this issue; CPSC staff would like to participate on this task group.

CPSC staff also notes that the title of the proposed standard is "Standard Test Method for Treestand Fall Arrest System." Since section 11 of the proposed standard provides pass/fail criteria, it seems appropriate that the title identify the standard as a test method and specification and that the scope section should also identify that the standard includes requirements.

These staff comments have not been reviewed or approved by the Commission. If you have any questions or comments please feel free to contact me at the above numbers.

Sincerely

DeWane Ray, P.E.
Engineering Sciences Directorate
Division of Mechanical Engineering

Enclosures

-----Original Message-----
From: John Woller Sr. [mailto:jwoller@summitstands.com]
Sent: Tuesday, August 26, 2003 3:45 PM
To: Ray, Dewane J
Cc: NFMBOW@aol.com; jolshefs@astm.org; mark@huntersview.com; Jmlp356@aol.com; lrezmer@thegametracker.com; meek36@bellsouth.net; jengstrom@ardisam.com; tom.gallagher@cabelas.com; Bruce Navarro
Subject: Response to CPSC Comments to Letter Ballot F08.16 (03-01) Item 1
Mr. DeWane Ray August 26, 2003
Project Manager
Engineering Sciences Directorate
Division of Mechanical Engineering
CPSC

DeWane:

Per our conversation this AM please consider the following as response to your 7/31 letter to Jim Olshefsky at ASTM. This reiterates most of the thoughts already sent to the TMA Board and you on 8/25. ASTM requires that all comments to proposed standards be addressed. (Also, as I explained, there were 7 incident reports attached with your letter rather than the 5 cited. Two were short one-page reports that had minimal data).

This proposed ASTM standard adopted by the TMA is a test method to determine the load capacities by measuring the maximum arrest force and dynamic strength of components or sub systems. It does not purport to address all of the safety concerns, if any, associated with its use. The pass/fail criteria are given to assure the product will function for its intended use i.e., safely arrest the users fall from a treestand.

There are no specifications in the current standard because it is a test method. For compliance to this standard, manufacturers must design, analyze and identify the material and construction specifications necessary to meet the pass/fail criteria of this test method. Specifications in general, and especially one to ensure that a user can escape, are beyond the scope of this test method standard.

In other applications involving the use of full body harnesses such as commercial, industrial, mountain climbing, etc. there are no known specifications for escape. (Users are predominantly in contact with rescue personnel.) Since treestand users are alone, cutting straps or otherwise attempting to escape can lead to either 1) a fall resulting in serious injury or death or, 2) entanglement and strangulation or asphyxiation death from the remaining support straps (as shown in the CPSC incident reports sent).

In March of 2001 a special Treestand Manufacturer's Association (TMA) fall extraction committee composed of two harness manufacturers, a prominent hunter/writer (PhD) and the National Bowhunting Education Foundation (NBEF) Director released their findings concerning harness self-extraction. The Extraction Committee decided NOT to include any examples or other extraction explanation because:

a. Difficulty of trying to include all extraction procedures for every "situation"
b. Difficulty of explaining when and how to use any one extraction procedure
c. Potential of increasing their (NBEF and TMA Manufacturers) exposure to liability is ever present.

From this decision the NBEF concluded to use the disclaimer in their "Safe Treestand Hunting" video: It is the user's responsibility to follow the manufacturer's directions, use the stand as it was designed and to always wear a properly fitted fall restraint system from the point of leaving the ground to returning again to the ground.

There were three major premises leading to the Fall Extraction Committee's conclusion:

1. The single most prevalent reason for falls to occur is due diligence by the user. Other reasons are a lack of knowledge of a specific product (users not following manufacturers instructions) or (least common and rare) they occur from equipment malfunction. Falls ONLY occur because the users do

not connect themselves to the tree until reaching the hunting height, and disconnect it before descending. If a properly designed (TMA certified) harness is used continuously, injury from a fall CANNOT occur.

2. If the user is properly informed as to the use and set-up of their particular climbing apparatus- and the stand is utilized according to manufacturers instructions (including fall-restraint use and operation) then there is no need for further instruction on self-extraction.
3. The user must have fall recovery item(s) available and accessible, be familiar in their use and be able to use them effectively under extremely difficult conditions.

Although a study was completed by the TMA, by copy of this note to Norb Mullaney is it requested that his F08.16 Sub-Committee form a Task Force to again investigate self-extraction from a full body harness to comply with your recommendation. The formation of this task force was discussed with Jim Olshefsky today and members would not necessarily have to be ASTM members. You will are certainly welcome and encouraged to participate. I'm sure the TMA Board agrees that the TMA is most willing to cooperate in any way that we can.

Since the CPSC can participate in ASTM Task Force activities, as opposed to industry associations, your involvement is assured. If you are in agreement with the above explanation and believe that the CPSC issues have been addressed, your indication of satisfactory response to the issues raised in your comments would be appreciated. (An e-mail note is preferred) If not, please contact me.

Sincerely,

John Woller, Sr., TMA Technical Contact to ASTM

U.S. CONSUMER PRODUCT SAFETY COMMISSION
WASHINGTON, DC 20207

Mark Kumagai, P.E.
Director
Division of Mechanical Engineering
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March 19, 2004

Mr. James Olshefsky
ASTM F08 Staff Manager
ASTM International
100 Barr Harbor Drive
West Conshohocken, PA 19428-2959
re: F08.16 Standards Development

Dear Mr. Olshefsky:

The U. S. Consumer Product Safety Commission staff has reviewed available incident data pertaining to injuries and deaths associated with hunting tree stands and has the following comments and recommendations for consideration by the ASTM F08.16 subcommittee. Please note that these comments have not been reviewed or approved by, and may not necessarily reflect the views of, the Commission.

Our incident data review shows that most injuries and deaths involving tree stands are due to hunters falling out of the tree stand. In addition, staff is aware of one death associated with a full body harness. Staff also reviewed the following ASTM standards to determine the safety requirements and criteria that are related to the structure and use of tree stands and their components: F 2120, F 2122, F 2124, F 2125, F 2126, F 2127, F 2128 and F 2337.

The available data often lack sufficient details to determine the exact cause of an incident. However, based on engineering and human factors judgment applied to what we could learn from the incident data and the standards, CPSC staff recommends that the F08.16 subcommittee assign task groups to work on the following:

- Investigate self-rescue from a full body harness in the event of a fall and suspension.
- Determine whether ASTM F2337 should apply to aftermarket safety harnesses marketed for use with tree stands.
- Consider load requirements to include dynamic loads to simulate realistic use conditions when a user is entering, exiting, ascending or descending a tree stand.
- Consider load requirements for ladder stands to apply along the length of the ladder and not just at the top, since the load varies as the user ascends or descends the ladder.
- Consider load requirements for fabric seats.

Thank you for considering these comments and recommendations. CPSC staff is prepared to participate in the consideration of requirements pertaining to these issues. If you have any questions or comments please feel free to contact me or Patricia Hackett, the staff engineer who is handling hunting tree stands. Ms. Hackett can be contacted at 301-504-7577, phackett@cpsc.gov.

Sincerely,

Mark E. Kumagai, P.E.

cc: John Woller, Sr.,
TMA Technical Contact to ASTM