UNITED STATES
CONSUMER PRODUCT SAFETY COMMISSION
WASHINGTON, DC 20207

OFFICE OF THE SECRETARY

2000 OCT 17 P 12:52

VOTE SHEET

Date: OCT 16 2000

TO : The Commission
Sadye E. Dunn, Secretary

FROM : Michael S. Solender, General Counsel M.S.S
Stephen Lemberg, Assistant General Counsel SL
Patricia M. Pollitzer, Attorney PMP

SUBJECT : Petition CP 99-2 requesting a standard for bleachers and grandstands

Attached is a briefing package from the staff concerning a petition submitted by Representatives Bill Luther and Jim Ramstad. The petition requests that the Commission develop a safety standard for bleachers and grandstands. The staff recommends that the Commission deny the petition.

Please indicate your vote on the following options.

I. Grant Petition CP 99-2 and direct the staff to begin developing a draft advance notice of proposed rulemaking.

_____ _____
Signature Date

II. Deny Petition CP 99-2 and direct the staff to prepare a letter of denial to the petitioners.

_____ _____
Signature Date

NOTE: This document has not been reviewed or accepted by the Commission.
Initial rcl Date 10/16/00

CPSA 6 (b)(1) Cleared
No Mfrs/PrvtLblrs or Products Identified
Excepted
Firms Notified,
Comments Processed.

III. Defer decision on Petition CP 99-2.

_____ _____

Signature Date

IV. Take other action (please specify):

_____

_____

_____

_____ _____

Signature Date

Bleacher Petition (CP 99-2)
Briefing Package

October 2000

For additional information, contact:
Janet Buyer
Directorate for Engineering Sciences
(301) 504-0508 ext 1413

Table of Contents

EXECUTIVE SUMMARY

In July 1999, U.S. Representative Bill Luther and U.S. Representative Jim Ramstad petitioned the U.S. Consumer Product Safety Commission (CPSC) for the development of a national safety standard for bleachers and grandstands. The Congressmen requested that the standard include "minimum spacing requirements for gaps between bleacher guardrails and between seats and footboards for new construction, side and back safety features, and guidelines for retrofitting older facilities" in order to prevent falls from bleachers. The Congressmen's request was docketed as a petition on August 10, 1999, and a Federal Register notice was published on August 26, 1999. The request for guidelines, however, could not be considered as part of the petition because the Commission does not have the authority to issue guidelines through rulemaking. As a separate effort, CPSC staff drafted retrofit guidelines and they were released for public comment on July 14, 2000. The guidelines have subsequently been revised to reflect comments received and the final draft version of the document, "Guidelines for Retrofitting Bleachers", is being provided to the Commission for consideration under separate memorandum.

This briefing package provides the Commission with the available information about the hazard of falls from bleachers. CPSC is aware of four deaths to children under age 15 years that resulted from falls off of bleachers. In 1988, a 4-year-old male was found at the bottom of bleachers from which he was thought to have fallen. He suffered a fractured skull and died. Also in 1988, a 4-year-old girl died when she fell from bleachers and suffered craniocerebral injuries. Two deaths occurred in 1999. In one case, a 6-year-old boy fell through a 13-inch opening between a bleacher footboard and seatboard. In the other case, a 3-year-old child fell off bleachers through an opening in the guardrail. From 1991 through 1999, there was an annual average of 19,100 bleacher-associated injuries requiring emergency room (ER) visits. In 1999, there were an estimated 22,100 bleacher-associated injuries treated in ERs. Approximately 6,100 of these injuries were a result of the person falling from the bleachers onto the surface below. Approximately 4,910, or about 80%, of these falls involved children under the age of 15. Children who fell from bleachers were 50% more likely to incur a head injury than an injury to any other body region.

There are four model codes and two standards with provisions that address the prevention of falls from bleachers. Staff believes that falls from bleachers are occurring on older bleachers with hazardous spacing that were built and installed before these provisions were incorporated into the codes and standards. A mandatory standard would not affect these older bleachers. Also, because many bleachers are constructed on site as opposed to the manufacturing location, inspection and enforcement of a mandatory standard would be difficult and staff believes these functions are best accomplished by the governing state and local officials.

Based on the above conclusions, the staff recommends that the Commission deny the petition. Furthermore, if the Commission approves the draft "Guidelines for Retrofitting Bleachers", existing bleachers that are not in compliance with the bleacher

provisions in the most recent edition of the codes and standards will likely be retrofitted such that the hazard of falls from these non-compliant bleachers will be significantly reduced.

UNITED STATES
CONSUMER PRODUCT SAFETY COMMISSION
WASHINGTON, DC 20207

Memorandum

Date: OCT 16 2000

TO : The Commission
Sadye E. Dunn, Secretary

THROUGH: Michael S. Solender, General Counsel M.S.S
Thomas W. Murr, Acting Executive Director TM

FROM : Ronald L. Medford, Assistant Executive Director, RLM
Office of Hazard Identification and Reduction
Janet Buyer, Project Manager, JB
Directorate for Engineering Sciences

SUBJECT : Petition for Development of a National Safety Standard for Bleachers and Grandstand Facilities (CP 99-2)

I. BACKGROUND

In a letter dated July 23, 1999, U.S. Representative Bill Luther and U.S. Representative Jim Ramstad petitioned the U.S. Consumer Product Safety Commission (CPSC) for the development of a national safety standard for bleachers and grandstands (TAB A). The Congressmen requested that the standard include minimum spacing requirements for gaps between bleacher guardrails and between seats and footboards for new construction, side and back safety features, and guidelines for retrofitting older facilities. The Congressmen's request was docketed as a petition on August 10, 1999. The Office of the General Counsel for CPSC, however, determined that the request for guidelines could not be considered as part of the petition because the Commission does not have the authority to issue guidelines through rulemaking. As a separate effort, the Commission staff drafted retrofit guidelines and they were released for public comment on July 14, 2000. The guidelines have subsequently been revised to reflect comments received and the final draft version of the document, "Guidelines for Retrofitting Bleachers", is being provided to the Commission for consideration under separate memorandum.

II. DISCUSSION

A. Public Comments

CPSC solicited public comments on this petition in a Federal Register notice published on August 26, 1999. Seven comments were received (TAB B). Six respondents recommended granting the petition as requested by Congressmen Luther and Ramstad and one respondent recommended denial. The six responses in favor of a national standard were submitted by consumers, students, a safety consultant, and a parent of a child injured on bleachers. In general,

their position was based upon the observation that many facilities are equipped with bleachers that lack the safety features that are requested in the petition. The National Fire Protection Association (NFPA) recommended denial of the petition on the basis that NFPA 102, *Standard for Grandstands, Folding and Telescoping Seating, Tents, and Membrane Structures*, addresses the concerns of the petitioners, and that the CPSC should encourage nationwide compliance with NFPA 102 rather than develop a separate national standard.[1]

B. CPSC's Roundtable on Bleachers and Grandstands

In order to seek additional public comment and to gain further insight on bleacher safety issues, the CPSC hosted a Roundtable on Bleachers and Grandstands on December 8, 1999. This Roundtable included consumers as well as representatives from industry and government. The Congressmen who petitioned the Commission, parents, safety advocates, code officials, and manufacturers attended. Presentations were given by several of the attendees and an open discussion followed.[2]

C. Product Description and Potential Hazards

Bleachers are structures that provide tiered or stepped seating. They are available in various configurations and sizes. They generally fall into one of four categories: permanent (or stationary), portable (or movable), telescopic (or folding), and temporary. Figures 1, 2, and 3, are photos of permanent, portable, and telescopic bleachers, respectively. Temporary bleachers are typically stored in pieces and only set up for specific uses, such as circuses, golf tournaments, and parades.

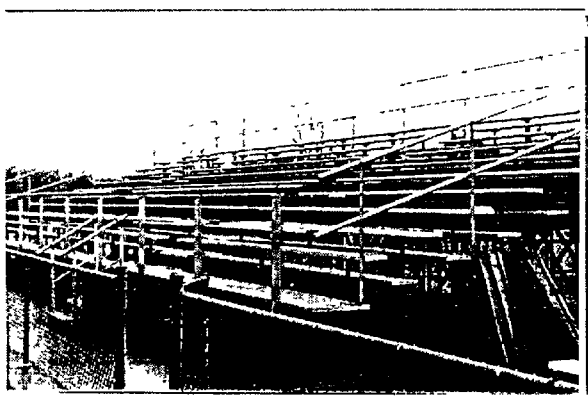


Figure 1: Permanent bleachers

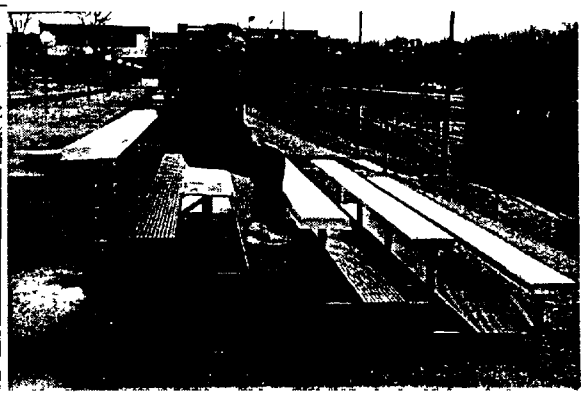


Figure 2: Portable bleachers

[1] This comment applies for NFPA 101, *Life Safety Code*, as well as NFPA 102. NFPA 101 and NFPA 102 both have provisions for bleachers and grandstands that apply to new construction as well as existing installations. NFPA 101 was revised in 2000 and NFPA 102 was revised in 1995. Per R. Cote of NFPA, NFPA 101 is more widely adopted than, and generally supersedes, NFPA 102.

[2] Video tape of "CPSC Chairman's Roundtable on Bleachers and Grandstands, December 8, 1999," available upon request from CPSC, Office of Secretary.

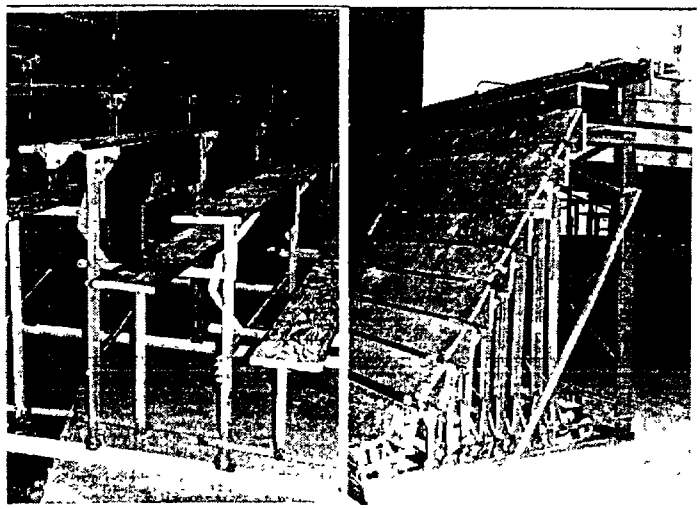


Figure 3: Telescopic bleachers (open and closed positions)

Bleachers can pose several potential hazards. Falls from bleachers can occur when guardrails are absent from the backs or open sides of the bleachers. Falls from bleachers can also occur when there are openings between components in the seating and guardrails that are large enough to permit a person to pass through them. These openings can exist in the following areas, shown in Figure 4: (1) between components of the guardrail, (2) between components of the seating, such as between the footboard and seatboard, and (3) between the bottom rail of the guardrail and the footboard or seatboard. Falls onto bleachers can occur when there are missing or inadequate components that assist in access and egress, such as aisles, handrails, and non-skid surfaces. Collapse of bleachers, particularly manually-operated telescopic bleachers, can occur if the bleachers are not operated properly. The focus of this package is on the hazard of falls from bleachers, either from open sides or the back of bleachers, or through spaces between bleacher components, as described above.

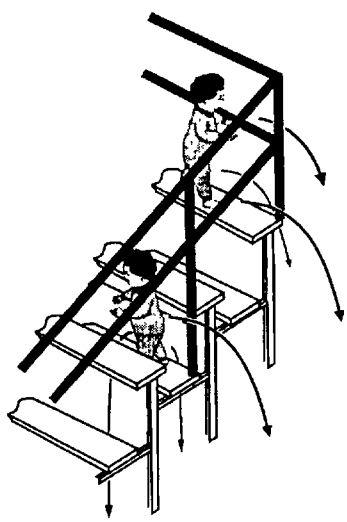


Figure 4: Inadequate guardrails and openings that permit falls from bleachers

D. Incident Data

1. Deaths

The CPSC is aware of 10 deaths involving falls from bleachers from January 1980 through December 1999 (TAB C). Of these 10 deaths, four involved children under the age of 15. In 1988, a 4-year-old male was found at the bottom of bleachers from which he was thought to have fallen. He suffered a fractured skull and died. Also in 1988, a 4-year-old girl died when she fell from bleachers and suffered craniocerebral injuries. Two of the fatalities occurred in 1999. In the first incident, a 6-year-old child fell from the bleachers through a 13-inch opening between the footboard and seatboard. In the other case, a 3-year-old child fell through an opening in the guardrail.

2. Injuries

Information on injuries associated with bleachers was obtained from CPSC's National Electronic Injury Surveillance System (NEISS). From reported NEISS cases, national estimates of annual bleacher-related injuries requiring emergency room (ER) visits were developed. From 1991 through 1999, there was an annual average of 19,100 bleacher-associated injuries treated in ERs. Because injuries incurred by children falling from bleachers are the injuries the petition is primarily concerned with, data concerning such incidents from the latest year, 1999, were examined in more detail. In 1999, there were an estimated 22,100 bleacher-associated injuries treated in ERs. Approximately 6,100 of these injuries were a result of the person falling from the bleachers onto the surface below. Approximately 4,910, or about 80%, of these falls involved children under the age of 15. Children who fell from bleachers were 50% more likely to incur a head injury than an injury to any other body region.

The information available in the NEISS database generally does not give enough detail to determine how the person fell from the bleachers, whether between the seat and footboard, off the side, or through a guardrail. Therefore, further conclusions regarding the relationship between bleacher characteristics and injuries and deaths can not be made based on the available epidemiological data. To obtain more incident data with these details, a special injury study would be needed.

E. Product and Market Information

There are no available data on the number of facilities with bleachers in the U.S. However, given estimates of the types of facilities that are likely to have bleachers, staff estimates that there are at least 60,000 facilities with bleachers in the U.S. (TAB D). This estimation is based on the assumption that there are 37,500 school facilities and 4,000 sports facilities with bleachers, and that 10% of the 180,000 state and local parks and fitness and recreation sports centers have bleachers. Staff also estimates that, in 1997, the number of bleacher seats installed in the U.S. may have ranged from about 0.75 million to about 2 million. Some of these installations were likely for the replacement or rehabilitation of existing bleachers.

Staff has identified over 70 firms involved in bleacher manufacture, distribution, design, or installation. Of these, about 17 are manufacturers. The remainder provide bleacher installation and sales services. Although Roundtable attendees indicated that bleachers being manufactured today are designed to meet the model codes and standards (discussed below), many bleachers are constructed on site as opposed to the manufacturing location. In these situations, local code authorities inspect and certify that the bleachers are built and installed in accordance with the local building codes.

F. Model Codes and Standards

There are several model codes and standards that have provisions for bleacher design and construction. Each has specifications for means of egress, which includes specifications for permissible opening sizes and guardrails. These model codes and standards are periodically revised. State and local governments decide whether to adopt them, in part or in entirety or at all, as their building codes. Compliance of bleachers with the applicable provisions is generally determined by the governing jurisdiction's enforcement of its building codes.

Staff reviewed the most recent editions of the model codes and standards for the provisions pertaining to bleachers. There are four model building codes and two standards, and each has varying degrees of coverage to prevent falls from bleachers. The model building codes currently have provisions that apply only to new construction, not existing structures. Therefore, when a governing jurisdiction adopts a later edition of one of these building codes, existing structures are not required to be retrofitted to comply with the updated code. Only when an existing facility is rehabilitated, reconstructed, or altered are the currently-adopted governing building codes applied to the entire structure, including the bleachers, if there are any. In addition to the model codes, the National Fire Protection Association (NFPA) has two standards accredited by the American National Standards Institute (ANSI) that similarly address bleachers; however, the NFPA has provisions for existing bleacher installations as well as new construction. Descriptions of these provisions in these codes and standards are described below and they are also summarized in Table 1.

The 2000 International Building Code (IBC), published by the International Code Council (ICC), is a relatively new code that is a product of merging the code development efforts by the other three model building code organizations (see below). The IBC is intended to replace these other three model codes. The IBC specifies that, where bleacher footboards are more than 30 inches above grade, the vertical openings between the seatboards and footboards must prevent passage of a 4-inch diameter sphere. The horizontal openings between the seatboards and footboards, when projected on a horizontal plane, must be less than 1/4 inch. The IBC also specifies that guardrails are required along open sides of bleachers which are located more than 30 inches above the floor or grade below. This includes the back of the bleachers. The guardrails are to measure 42 inches vertically in height above the leading edge of the footboard or seatboard, whichever is adjacent. Guardrails with openings must not permit passage of a 4-inch diameter sphere from 0 to 34 inches in height. From a height of 34 inches to 42 inches, a sphere of 8 inches in diameter cannot pass through the openings.

The 1999 National Building Code (NBC), published by Building Officials and Code Administrators (BOCA), has the same requirements as the 2000 IBC with the exception that openings in guardrails up to the full height of at least 42 inches must prevent passage of a 4-inch diameter sphere. Also, it specifies that guardrails shall not have an ornamental pattern that would provide a ladder effect and that guardrails are required along open sides located more than 15.5 inches above grade.

The 1997 Standard Building Code (SBC), published by Southern Building Code Congress International (SBCCI), is similar to the IBC; however, the SBC does not address the vertical opening limitation between footboards and seatboards and it states that openings in guardrails up to the full height of at least 42 inches must prevent passage of a 4-inch diameter sphere.

The 1997 Uniform Building Code (UBC), published by the International Conference of Building Officials (ICBO), is also similar to the IBC; however, the UBC limits the vertical opening between footboards and seatboards to not permit passage of a 9-inch sphere as opposed to a 4-inch sphere and it states that openings in guardrails up to the full height of at least 42 inches must prevent passage of a 4-inch diameter sphere.

The 2000 Edition of NFPA 101 Life Safety Code has provisions for both new and existing grandstands and folding and telescopic seating. This code states that guardrails are required along those portions of the backs and ends of these types of assembly seating where the seats are more than 48 inches above the floor or ground. The guardrails are required to be at least 42 inches above the aisle surface or footrest or at least 36 inches vertically above the center of the seat or seatboard surface, whichever is adjacent. The guardrail is exempted where an adjacent wall or fence affords an equivalent safeguard. The vertical openings between guardrails and footboards or seatboards must not permit a 4-inch diameter sphere to pass through the opening. It also states that openings between the seatboard and footboard located more than 30 inches above grade must not permit a 4-inch diameter sphere to pass through the opening. This standard also has a provision for annual inspections and maintenance by the owner to ensure safe conditions. Biennially, the inspection is to be performed by a professional engineer, registered architect, or individual certified by the manufacturer.

The 1995 edition of NFPA 102 Standard for Grandstands, Folding and Telescopic Seating, Tents, and Membrane Structures also has provisions for grandstands and folding and telescopic seating. The requirements are similar to those stated above with the exception that grandstand guardrails must be at least 42 inches vertically above either the aisle surface or footrest or the center of the seat board surface, whichever is adjacent. This standard also has a provision for biennial inspections.

The staff examined the code provisions described above and concludes that the majority are sufficient to prevent falls from bleachers (see Table 1).

Table 1: Codes and Standards Provisions Relating to Prevention of Falls Off Bleachers *

Provision	IBC 2000	NBC 1999	SBC 1997	UBC 1997	2000 NFPA 101	1995 NFPA 102
Minimum ht of surface above floor requiring guardrail and limiting opening size	30"	15.5"	30"	30"	48"	48"
Minimum height of guardrail	42" above footboard or seatboard, whichever is adjacent	42" above footboard	42" above footboard or seatboard, whichever is adjacent	42" high	42" above footboard or 26" above seatboard, whichever is adjacent	42" above footboard or seatboard, whichever is adjacent
Diameter of sphere to not pass through openings in the guardrail	• 4" up to 34" high • 8" from 34" to 42" high	4"	4"	4"	4"	4"
Diameter of sphere to not pass through vertical openings between footboard and seatboard at ht of 30" above grade	4"	4"	Not addressed	Not addressed	4"	4"
Inspections	Not addressed	Not addressed	Not addressed	Not addressed	Every one years	Every two years

*The shaded items in Table 1 are those specific provisions that the staff believes do not fully address this hazard. CPSC staff believes that bleachers should have guardrails on all open sides, including the back, where the bleacher surface is 30 inches or more above the ground, and that all openings at these heights should prevent passage of a 4-inch sphere (TABS E and F) The 4-inch limitation should apply to openings between the footboard and seatboard, between the components in the guardrails, and between the guardrails and footboard and seatboard CPSC staff believes that the top surface of the guardrail should be at least 42 inches above the adjacent footboard or seatboard As for inspections of bleachers, staff believes that thorough inspections should be conducted at least quarterly by trained personnel and by a licensed design professional at least every two years

CPSC staff is aware of an activity to develop a new code. In March 2000, the NFPA announced that they will develop a separate set of building codes, to be issued in 2002. Also in March 2000, the ICC announced the formation of a consensus committee to develop retrofit provisions for existing bleacher installations for inclusion in the IBC.

Concerning the extent of building code adoption, at the state level of government the majority of states adopt codes for assembly occupancies that are likely to contain bleachers, such as schools, auditoriums, and public buildings.[3] A majority of these states have adopted an edition of the code that reflects the provisions presented in Table 1. There are 16 states that have a state-mandated building code that covers all buildings and occupancy classifications. CPSC staff does not have data on how many states permit local amendments for assembly occupancies when the amendments are less stringent than the state-mandated building code. However, Roundtable attendees were of the opinion that jurisdictions do not likely make amendments to

[3] "Summary of State-Mandated Building Codes," by the Institute for Business and Home Safety, November 1999

the provisions for bleachers. Although there are 13 states that do not have a state-mandated building code for any building and occupancy classification, several of these states permit jurisdictions within their state to adopt building codes at the local level.

G. CPSC Staff's Assessment of the Need for a Standard

The information available in the NEISS database does not provide enough description of the bleachers involved or detail about how the fall occurred to determine if the deaths and injuries are occurring on bleachers that are compliant with the most recent editions of the codes or standards. However, the staff believes it is reasonable to assume that the falls are likely occurring from bleachers that were built and installed before these most recent code provisions were adopted and are not compliant with any of these provisions. The draft guidelines for retrofitting bleachers that have been developed by the CPSC staff are intended to address the older bleachers that are believed to be responsible for the deaths and injuries from the hazard of falls from the bleachers. If the Commission were to issue a mandatory standard for bleachers, it would only apply to bleachers manufactured after issuance of the standard and not to existing bleachers.

As stated earlier, many bleachers are constructed on site rather than where the components are manufactured. In these situations, local code authorities inspect and certify that the bleachers are built and installed in accordance with the local building codes. If a national standard for bleachers were to be developed, the inspection, certification, and enforcement on a federal level would be very difficult to conduct. The staff is of the opinion that these actions are best achieved by the state and local code authorities. Therefore, the staff believes that approval of the guidelines for retrofitting bleachers, in conjunction with allowing state and local officials to continue to enforce code compliance, is a better solution for this hazard than issuing a mandatory standard.

III. OPTIONS

1. Grant the Petition

If the Commission determines that a mandatory action is reasonably necessary to eliminate or reduce an unreasonable risk of injury associated with falls from bleachers, the Commission may grant the petition and direct the staff to develop an advance notice of proposed rulemaking (ANPR).

2. Deny

If the Commission determines that a mandatory standard is not the best solution to address falls from bleachers because older bleachers with hazardous spacing will not be affected by such a standard and that inspection and enforcement on a federal level will be difficult to achieve, then the Commission may deny the petition.

3. Defer

If the Commission determines that more information is needed before a decision can be made to grant or deny the petition, the Commission could defer a decision and direct the staff to collect additional information.

IV. CONCLUSIONS AND STAFF RECOMMENDATION

People fall from bleachers when guardrails are absent from the backs or open sides of the bleachers and when there are openings between components in the seating and guardrails that are large enough to permit a person to pass through them. Staff believes it is reasonable to assume that falls from bleachers occur on those that are not compliant with model codes and standards and, in particular, are occurring on bleachers that were built and installed before these provisions were incorporated into the applicable code or standard. The draft guidelines for retrofitting bleachers that have been developed by the staff are intended to address the older bleachers that are believed to be responsible for the deaths and injuries from the hazard of falls from the bleachers.

Because many bleachers are built and installed on site, a mandatory standard would pose problems for inspection and enforcement. It is staff's opinion that local code authorities would be the most appropriate individuals to inspect and certify that the bleachers are built and installed in accordance with local building codes.

Based on the above conclusions, the staff recommends that the Commission deny the petition. The staff believes that a mandatory standard is not the most effective way to address bleacher safety. To address existing bleachers, the staff has developed draft "Guidelines for Retrofitting Bleachers". If approved, this document will be made available to state and local officials, including inspectors and regulatory officials throughout the country as well as facility owners and operators, school officials and parks and recreation personnel, manufacturers, and designers. Furthermore, we have no information to indicate that current or future bleacher construction built to the current codes and standards has hazardous spacing. There is not enough information in the death and injury data to determine the age of the bleacher involved in the incident and information is not available on how many bleachers meet current building code requirements.

TAB A

Congress of the United States

Washington, DC 20515

CP9:-2-

PETITION

July 23, 1999

CPSC/OFFICE OF THE SECRETARY

1999 JUL 30 P 2:27

Office of the Secretary
Consumer Product Safety Commission (CPSC)
Washington, DC 20207

Dear CPSC Members:

We are writing to petition the Consumer Product Safety Commission to issue national safety standards for bleacher and grandstand facilities.

As you may know, in Minnesota there have been numerous recent injuries to children at basketball and hockey arenas resulting from falls between the gaps of bleacher seats and guardrails. In January 1999, a 6-year-old boy was fatally injured when he fell through a 13-inch gap between the footboard and seat at a community sports arena. Safety officials have recently indicated that they are aware of over 50 recent bleacher accidents in the Minnesota and Wisconsin area.

There is no accurate inventory of how many older, potentially dangerous bleachers are in use throughout the country. Most of these facilities were built years ago before building codes adopted standards for bleacher construction. Many state and local governments have begun to address this issue by strengthening existing building codes and creating programs that allow schools and communities to access funds to retrofit older facilities to minimize accidents. However, many communities are either not bound by building code standards or are legally able to opt out of any standards proposed at the state level. Uniform national standards would help efforts at the state and local level to prevent children and adults from being injured or killed due to poorly designed or out of date bleacher facilities. We believe that any national standard should include minimum spacing requirements for gaps between bleacher guardrails and between the seats and footboards for new construction, side and back safety features, and guidelines for the retrofitting of older facilities.

Sporting events are central to so many family and community activities. We all agree that parents need to be watchful of their kids whether at an arena or playing in the park. But there are further things we can do to help keep kids safe by making sure that sporting facilities are not dangerous places for children.

Along with this petition for rulemaking, we have introduced legislation in the House, H.R. 836, The Bleacher Safety Act, asking the CPSC to promulgate bleacher safety standards within 6 months of the bill's passage. While we will continue to pursue strengthening safety

standards legislatively we believe it is within the jurisdiction of the CPSC to act expeditiously to establish safe bleacher standards.

For your information, we have enclosed numerous news articles describing recent bleacher accidents and highlighting the need for these facilities to be modernized and a copy of a recent law enacted by the Minnesota legislature. If you have any questions about our rulemaking petition, please contact Steven Heuer in Rep. Luther's office at 202/225-2271. Thank you for your consideration of this request.

Sincerely,

Bill Luther
Member of Congress

Jim Ramstad
Member of Congress

TAB B

United States
CONSUMER PRODUCT SAFETY COMMISSION
Washington, D.C. 20207

MEMORANDUM

DATE : October 26, 1999

TO : ES

Through: Sadye E. Dunn, Secretary

FROM : Martha Kosh

SUBJECT: Petition CP 99-2, Petition for Development of a Safety Standard for Bleachers and Grandstands

ATTACHED ARE COMMENTS ON THE CC99-2

COMMENT	DATE	SIGNED BY	AFFILIATION
CC99-2-1	8/17/99	Deane Downey	474 Elm St. Eminence,KY 40019
CC99-2-2	10/22/99	Sara C. Yerkes Director Government Affairs	The National Fire Protection Association 1 Batterymarch Park P.O. Box 9101 Quincy, MA 02269
CC99-2-3	10/24/99	Edwin Jaramillo & Esther Lester	11601 SW 106 Terrace Miami, FL 33176
CC99-2-4	10/24/99	David Brendel Safety Engineer	P.O. Box 130935 Birmingham, AL 35213
CC99-2-5	10/24/99	Kristen Stiller & Emilio Lopez	Florida International University Miami, FL 33157
CC99-2-6	10/25/99	J. Castillo & Isela Zaldivar	Florida International University Miami, FL

Petition CP 99-2, Petition for Development of a Safety Standard for Bleachers and Grandstands

CC99-2-7	10/25/99	Gabriela Monnier	11503 SW 172 Terrace Miami, FL 33157
		&	
		Juliette DeGrace	16303 Malibu Dr. Weston, FL 33326

TAB C

UNITED STATES
CONSUMER PRODUCT SAFETY COMMISSION
WASHINGTON, DC 20207

Memorandum

DATE: July 21, 2000

TO: Janet Buyer, ES
Project Manager, Bleacher Petition

THROUGH: Susan Ahmed, Ph.D.
AED, Directorate for Epidemiology
Russell Roegner, Ph.D.
Director, Division of Hazard Analysis, EP

FROM: Susan Kyle, Ph.D.
Division of Hazard Analysis

SUBJECT: Injury and Death Data Related to the Bleacher Petition (CP99-2): 1991-1999

On July 23, 1999, Mr. Bill Luther and Mr. Jim Ramstad, Members of the Congress of the United States, petitioned the U.S. Consumer Product Safety Commission (CPSC) to "issue national safety standards for bleacher and grandstand facilities." The petition included a copy of a bill they had introduced on February 24, 1999, into the U.S. House of Representatives, H.R. 836 "Bleacher Safety Act of 1999", which would require the CPSC to "by rule issue a bleacher safety standard for the production, erection, and retrofitting of bleacher and grandstand facilities to reduce the risk of children falling between guardrails and gaps in the seats of bleachers and grandstand facilities."

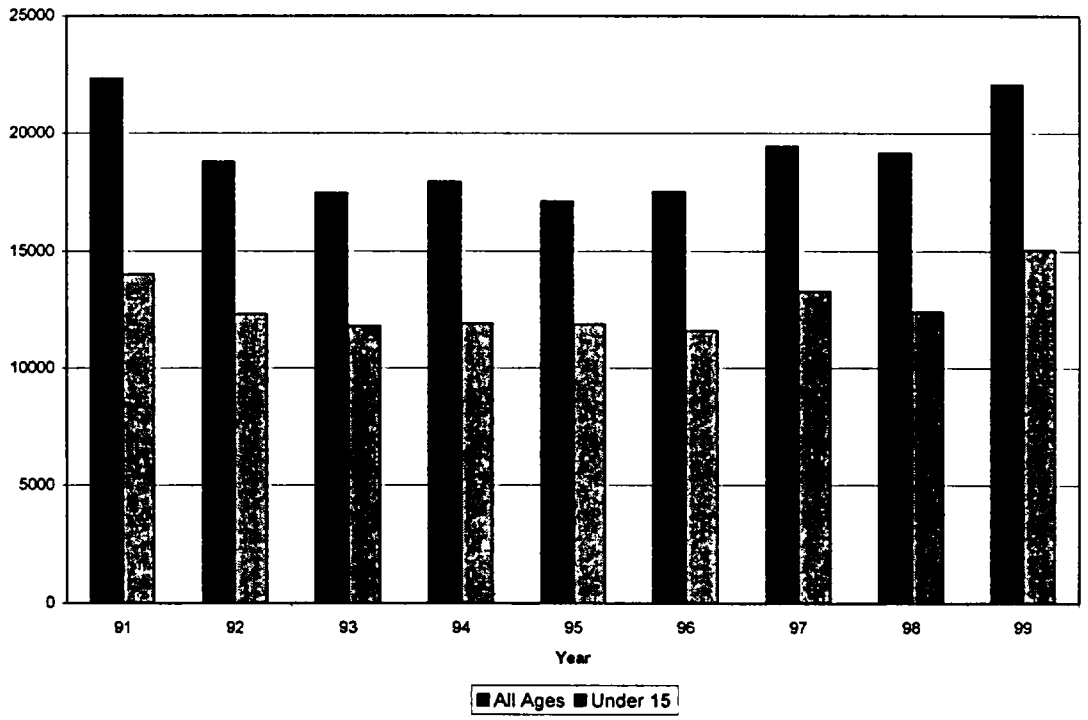
This memorandum provides information on the deaths and injuries associated with bleachers, particularly fall injuries and deaths incurred by children for the time period 1991-1999.

Injury Data

Information on injuries associated with bleachers was obtained from CPSC's National Electronic Injury Surveillance System (NEISS). NEISS is a probability sample of hospital emergency departments (EDs) in the U.S. Descriptive data about the patient and the injury (age, sex, body part injured, diagnosis, whether treated and released, transferred, or hospitalized) were extracted from the ED medical record, including a brief narrative describing the circumstances of the injury which was taken verbatim from the medical record. From reported NEISS cases, national estimates of annual bleacher-related injuries were developed which incorporated sampling frame weighting factors and adjustment factors for changes in the sampling frame over the 9-year time period.

Figure 1 presents the annual estimated number of emergency department-treated injuries associated with bleachers to people of all ages for the years 1991-1999. During that time period, the number of injuries ranged from 22,300 to 17,100 with an annual average of 19,100. Figure 1 also shows the number of injuries to children under 15. On average, 67% of bleacher-associated injuries occurred to children under the age of 15.

Figure 1.
Bleacher-Associated
Emergency-Department-Treated Injuries
1991-1999



Source: National Electronic Injury Surveillance System

Data from 1999 were examined in more detail for information concerning falls from bleachers, particularly those by children under age 15. NEISS comments were inspected to determine whether or not the injury involved a fall. Of the estimated 22,100 (c.v.=0.087) total bleacher-associated injuries in 1999, 9,100 (41%) were reported as non-fall-related, resulting from various scenarios such as running into the bleachers while playing basketball or some other activity in the gym, hitting the head, chin, finger, etc. on the bleachers while playing or crawling under them, jumping off the bleachers, cutting oneself on the bleachers, etc. An estimated 13,000 (59%) injuries were reported to have involved a fall.

Falls Compared to Non-Falls

The injuries resulting from falls were compared to the injuries resulting from other scenarios to determine whether there was any difference in the type of injury – either a difference in diagnoses or a difference in body parts injured. Results are presented here.

Table 1
Percent of Bleacher-Associated Injuries by Diagnosis
Fall-Related Compared to Non-Fall-Related Scenarios

	Percent of Bleacher-Associated Injuries		
	All Scenarios All Ages estimate=22,100	Fall-Related All Ages estimate=13,000	Non-Fall-Related All Ages estimate=9,100
Diagnosis	100% (591)	100% (355)	100% (236)
Laceration	37% (206)	33% (113)	42% (93)
Contusion/abrasion	26% (143)	29% (92)	21% (51)
Strain/sprain	17% (84)	15% (45)	20% (39)
Fracture	10% (63)	12% (45)	7% (18)
All Other Diagnoses	11% (95)	11% (60)	11% (35)

Source: National Electronic Injury Surveillance System, U.S. Consumer Product Safety Commission
Note: Number in parentheses indicates the sample size upon which the national estimate was based.
Note: Column percents may not add to 100 due to rounding.

The distribution of diagnoses was significantly different when fall-related scenarios were compared to non-fall-related scenarios (p-value chisq = 0.0362). However, when individual diagnoses were inspected, only the risk of laceration was found to be significantly lower in fall cases than in non-fall-related cases (p=0.0486, relative risk = 0.80; 95% confidence limits 0.65-0.99). The significantly greater risk of incurring a fracture from a fall-related scenario which was seen in 1998 was not observed in the 1999 data.

To compare fall and non-fall scenarios by body region injured, five body regions were defined as follows:

head region – head, face, ears, eyes, mouth, nose, neck;
trunk region – upper trunk, lower trunk, pubic area;
upper limb region – shoulder, upper arm, elbow, lower arm, wrist, hand, fingers;
lower limb region – upper leg, knee, lower leg, ankle, foot, toes;
other – ingestion, aspiration, whole body, 25-50% of body, not recorded.

Results of the comparison by body region are presented below.

Table 2
Percent of Bleacher-Associated Injuries by Body Region
Fall-Related Compared to Non-Fall-Related Scenarios

	Percent of Bleacher-Associated Injuries		
	All Scenarios All Ages estimate=22,100	Fall-Related All Ages estimate=13,000	Non-Fall-Related All Ages Estimate=9,100
Body Region	100% (591)	100% (355)	100% (236)
Head	41% (255)	48% (177)	32% (78)
Trunk	10% (57)	10% (36)	10% (21)
Upper Limb	15% (92)	17% (59)	11% (33)
Lower Limb	33% (181)	25% (81)	45% (100)
Other	1% (6)	1% (2)	2% (4)

Source: National Electronic Injury Surveillance System, U.S. Consumer Product Safety Commission
Note: Number in parentheses indicates the sample size upon which the national estimate was based.
Note: Column totals may not add to 100 due to rounding.

There were significant differences in the body regions injured when fall-related scenarios were compared to non-fall-related scenarios (p-value chisq = 0.0001). The head region was more likely to be injured in a fall than in a non-fall scenario (p=0.0021, relative risk = 1.47; 95% confidence limits 1.13-1.93), while the lower limb region was less likely to be injured (p=0.0001, relative risk = 0.56; 95% confidence limits 0.43-0.73). These results were similar to those seen in 1998.

Types of Fall-Related Scenarios

The fall-related scenarios were divided according to the way in which the fall was described in the NEISS comments: fell off of, fell from, fell through, fell into, fell against, etc.

An estimated 6,100 injuries involved falls that were described as fell off of, fell from, fell between, fell through or fell out of. Of the descriptions used in the NEISS comments, these were the ones considered to be most likely to describe an incident where the person was on the bleachers and fell off of them, as opposed to falling while on the bleachers and remaining on the bleachers, or falling into the bleachers while on the basketball floor, etc. These 6,100 injuries were 47% of the bleacher-associated fall injuries and 28% of all bleacher-associated injuries.

The information in the NEISS comments generally does not give enough detail to determine how the person fell off, whether between the seat and the footboard, off the side, or through a handrail, etc. Very few of these falls were described as falls between or through the bleachers. However, there is no required standardization for the NEISS comments, so "fell off of" or "fell from" might have been used to describe a fall through the bleachers.

Injuries Involving Fall-Related Scenarios Pertinent to the Petition

Injuries incurred by children are of particular concern. As shown in Table 3 below, 68% (15,080/22,100) of the bleacher-associated injuries which occurred in 1999 were incurred by children under age 15. Of the injuries which resulted from all types of bleacher-associated falls, 73% (9,540/13,000) were incurred by children. Of the falls which were falls off of bleachers, 80% (4,910/6,100) were children. Children under 15 were about 1.5 times more likely to have fallen off of bleachers than were adults (p=0.0103, relative risk=1.46; 95% confidence limits 1.06-2.01).

Injuries incurred by children falling off of bleachers are the injuries with which the petition is primarily concerned. These injuries accounted for approximately one-fifth (22%: 4,910/22,100) of all bleacher-associated injuries in 1999.

Table 3
Estimated Number of Bleacher-Associated Injuries
by Age Group and Scenario

	Estimated Number of Bleacher-Associated Injuries		
	All Ages	Children < 15	Adults
All Scenarios	22,100	15,080	6,990
Not Fall-Related	9,070	5,540	3,530
Fall-Related	13,000	9,540	3,460
Falls Off Of	6,100	4,910	1,220
Other Falls	6,900	4,630	2,240

Source: National Electronic Injury Surveillance System, U.S. Consumer Product Safety Commission
Note: Estimated numbers may not add to totals due to rounding.

Falls off of bleachers by children under 15 were further investigated to determine how the injuries resulting from this scenario differed from injuries resulting from all other scenarios. The results for differences in injury diagnoses are presented in Table 4 and for differences in body region injured in Table 5.

Table 4
Percent of Bleacher-Associated Injuries by Diagnosis
Children Under 15 Who Fell Off Bleacher Compared to All Other Scenarios

	Percent of Bleacher-Associated Injuries		
	All Scenarios All Ages estimate=22,100	Fall Off Of Under Age 15 estimate=4,910	All Other Scenarios* All Ages estimate=17,150
Diagnosis	100% (591)	100 % (136)	100% (455)
Laceration	37% (206)	26% (31)	40% (175)
Contusion/abrasion	26% (143)	30% (34)	25% (109)
Strain/sprain	17% (84)	21% (19)	16% (65)
Fracture	10% (63)	13% (22)	8% (41)
All Other Diagnoses	11% (95)	10% (30)	11% (65)

Source: National Electronic Injury Surveillance System, U.S. Consumer Product Safety Commission
Note: Number in parentheses indicates the sample size upon which the national estimate was based.
*All Other Scenarios includes non-fall scenarios for children < 15, fall-related scenarios where the child did not fall off of the bleachers, and all scenarios for persons 15 and older.

Although the distribution of diagnoses for children under age 15 who fell off the bleacher differred somewhat from the distribution of diagnoses for all other scenarios this difference was only marginally significant (p= 0.0621). Lacerations were less likely to occur in children who fell off the bleachers than in other injury scenarios (p=0.0050, relative risk=0.65; 95% confidence limits=0.47-0.88).

Table 5 on the following page presents the differences in body region injured for children who fell off of the bleachers compared to all other scenarios.

Table 5
Percent of Bleacher-Associated Injuries by Body Region
Children Under 15 Who Fell Off Bleacher Compared to All Other Scenarios

	Percent of Bleacher-Associated Injuries		
	All Scenarios All Ages estimate=22,100	Fall Off Of Under Age 15 estimate=4,910	All Other Scenarios* All Ages estimate=17,150
Body Region	100% (591)	100 % (136)	100% (455)
Head	41% (255)	53% (74)	38% (181)
Trunk	10% (57)	9% (10)	10% (47)
Upper Limb	15% (92)	23% (31)	12% (61)
Lower Limb	33% (181)	14% (19)	39% (162)
Other	1% (6)	2% (2)	1% (4)

Source: National Electronic Injury Surveillance System, U.S. Consumer Product Safety Commission
Note: Number in parentheses indicates the sample size upon which the national estimate was based.
*All Other Scenarios includes non-fall scenarios for children < 15, fall-related scenarios where the child did not fall off of the bleachers, and all scenarios for persons 15 and older.

The distribution of injuries across the body regions differed significantly for children who fell off the bleacher as compared to all other scenarios (p-value chisq=0.0002). Children who fell off the bleachers were almost one-and-a-half times more likely to incur an injury to the head region than were other injury scenarios (p=0.0178, relative risk=1.38; 95% confidence limits=1.09-1.75). The risk of incurring an injury to the upper limb region was almost twice as high for children who fell off (p=0.0400, relative risk=1.91; 95% confidence limits=1.10-3.32). Children who fell off the bleachers were less likely to incur an injury to the lower limb (p=0.0000, relative risk=0.36; 95% confidence limits=0.22-0.60).

Other Injuries

In addition to the injuries reported through NEISS, the petitioners reported four serious injuries in the 1998-1999 time period, and CPSC staff is aware of one other serious incident in that time period. These incidents are reported below.

Year	Age/Sex	City/State	Injury	Scenario
1999	5M	St. Paul, MN	skull fracture	fell 10 feet off back of bleachers
1999	2F	Bimidji, MN	concussion	fell from bleachers at university
1999	3F	Louisville, KY	skull fracture	fell through bleachers in indoor gym
1998	4M	Eminence, KY	skull fracture	fell backwards off bleachers
1998	5M	Louisville, KY	multiple	fell through bleacher floorboards

Bleacher-Associated Deaths Potentially Addressed by the Petition

CPSC staff is aware of 15 bleacher-associated deaths since 1980 which involved hazards which might be addressed by the petition, including falls from bleachers or closing or collapsing bleachers. Of these, 7 were to children under the age of 15 and 4 of these involved falls. Table 6 on the following page presents information on the bleacher-associated deaths of which CPSC is aware.

Table 6
Bleacher-Associated Deaths Potentially Addressed by the Petition

Year	*City*	*State*	*Age*	*Sex*	*Brief Narrative*
1999	San Antonio	TX	3 yr	F	Fell from unsafe bleachers
1999	Hutchinson	MN	6 yr	M	Fell 8 - 10 feet (Inadvertent therapeutic toxicity also contributed)
1998	Miami	FL	66 yr	M	Fell from bleachers in 1982, died of complications in 1998
1998	Fayetteville	NC	7 yr	F	Crushed when caught in bleachers being closed at high school
1995	LasVegas	NV	Unk	Unk	Closed head injury received in a fall from bleachers at boxing match
1994	Baytown	TX	5 yr	F	5 year old died and 17 others injured when bleachers collapsed
1991	Richmond IN	IN	33 yr	M	Fell, hit chest on bleacher at ball game
1989	Wheeling	WV	15 yr	M	Jumped from bleachers
1988	Portage	IN	4 yr	M	Found at bottom of bleachers, thought to have fallen, fractured skull
1988	Hartford	CT	25 yr	M	Died after fall from stadium bleachers
1988	Chicago	IL	4 yr	M	Fell from bleachers, craniocerebral injuries
1987	Salina	KS	10 yr	M	Struck by portable bleachers that were blown over by wind
1983	Union Twp.	PA	46 yr	M	Lost control, hit rear of bleachers, no other description
1981	Madison	WI	67 yr	M	Fell off bleachers
1980	Phoenix	AZ	50 yr	M	Fracture of cervical spine, fall off bleachers

Source:U.S. Consumer Product Safety Commission
In-Depth Investigation Files, Death Certificate Files, Incident and Potential Incident Files

Summary

There were an estimated 22,100 bleacher-associated emergency-department-treated injuries in 1999. Of these, an estimated 13,000 (59%) were reported to have involved a fall. About 47% (6,100) of these fall injuries may have been falls off of bleachers, and 80% (4,910) of these involved children under the age of 15. Injuries incurred by children falling off of bleachers were almost one-and-a-half times more likely to be head region injuries than were injuries resulting from other hazard scenarios.

CPSC is aware of 10 fall-related bleacher-associated deaths since 1980. Of these fall-related deaths, 4 were to children under the age of 15.

TAB D

UNITED STATES
CONSUMER PRODUCT SAFETY COMMISSION
WASHINGTON, DC 20207

Memorandum

Date: August 8, 2000

TO : Scott Heh, ES
Janet Buyer, ES
Project Managers, Bleacher Petition

THROUGH: Warren J. Prunella, AED, EC

FROM: Mary F. Donaldson, EC

SUBJECT : Economic Input to Bleacher Petition Package

Attached is the economic input to the petition requesting development of safety standards for bleachers and grandstands.

Attachment

The Market for Bleachers and Grandstands

Background

The Consumer Product Safety Commission is considering a petition from Congressmen Luther and Ramstead to develop national safety standards for bleachers and grandstands to prevent falls from gaps in their structures. This paper presents a preliminary discussion of the market for bleachers and grandstands.

The product

Bleachers and grandstands are tiered or stepped spectator seating structures commonly used during sporting and other events. According to *Webster's II New Riverside University Dictionary*, grandstands have roofs whereas bleachers do not. Throughout this paper, however, we use the term "bleacher" to refer to both types of seating.

There are four major types of bleachers: *stationary (or permanent); telescopic (or folding); portable (or movable);* and *temporary.* Stationary bleachers are used mainly for sporting arenas and school athletic fields. Generally, bleachers of this type have concrete foundations, steel understructures, and aluminum or wood decks and seating, although some use composite or plastic seating.

Stationary bleachers are assembled and installed on site. According to a representative of a major bleacher firm, prices for permanent bleachers range from $100 to $225 per seat, averaging about $145 per seat.

Telescopic or folding bleachers are used in gymnasiums. They may be opened manually or with power assistance. These bleachers are commonly made of wood decking and seating with steel understructures. Including installation, average prices for telescopic bleachers range from about $75 to $200 per seat. If they are power operated, the price per seat increases by $30 to $45 per seat (3).

Portable bleachers are found on small playing fields such as those used by youth sports leagues. They can be moved without being disassembled but many remain on site. They seat relatively few people, with capacities of up to about 100 persons. According to a major bleacher manufacturer, these bleachers are not produced by the major bleacher firms. They are manufactured by companies that produce outdoor equipment, such as playground equipment, for parks and recreation facilities.

Temporary bleachers are used for special events such as circuses, golf tournaments and parades. These bleachers are typically stored in pieces and then set-up for specific uses. They are then broken down and stored again for reuse. Sometimes temporary bleachers are prefabricated on a flatbed with wheels, requiring minimal labor

for set-up. In general, temporary bleachers are made of lower cost materials than other types of bleachers. They are often supplied by companies that provide other similarly produced structures such as temporary construction scaffolding. On a per seat basis, the average price of outdoor temporary bleachers, not including set-up costs, ranges from $30 per seat to about $60 per seat (3).

Codes and Statutes

Currently, there are several building codes that address bleacher design and construction safety. One is the National Fire Protection Association (NFPA) National Fire Codes 101 and 102. Others include the Building Officials and Code Administrators (BOCA) Code, the International Building Code (IBC) 2000, and the Southern Building Code Congress International (SBCCI) 1999. These codes address requirements for construction, including accessible gaps, seating arrangements, and egress.

The IBC, BOCA, and SBCCI are identical in their specifications of maximum openings of ¼ inch in the horizontal gap between footboards and seatboards. These codes also address requirements for guardrails, although their specifications are different. Various provisions of the building codes are discussed further in the engineering analysis paper accompanying this briefing package. It is unknown to what extent current and past bleacher construction meets these various codes.

At the state level, Minnesota recently required all bleachers greater than 30 inches in height (both existing and new construction) to conform to a regulation that prohibits gaps greater than 4 inches (Minnesota Statutes 1999, 16B.616 Bleacher Safety). This requirement goes into effect on January 1, 2001.

Firms and Sales

We have identified over 70 firms involved in bleacher manufacture, distribution, design or installation. Of these, about 17 are manufacturers. The remainder provides bleacher installation and sales services.

The estimate of 17 firms is consistent with information provided at the Chairman's *Roundtable on Bleachers and Grandstands*, held at CPSC headquarters on December 8, 1999. According to presentations delivered during the roundtable, there are at least 10 manufacturers of stationary bleachers. There also may be as many as 5 firms that manufacture indoor telescopic bleachers. Local rental equipment firms supply temporary bleachers for occasional uses. The number of firms manufacturing portable bleachers is unknown.

Most of the bleacher manufacturers, although national in presence, would be considered small businesses, based on the Small Business Administration's guidelines, because they have fewer than 500 employees (5). We were able to identify only one

manufacturer with more than 500 employees, based on an InfoUSA database search (6). It is also likely that the great majority of the firms involved in the distribution and installation of bleachers are small businesses.

Every five years, the *Census of Manufactures* provides information on factory shipments and number of firms manufacturing bleachers. Information from the past three reports is summarized in Table 1. The 1997 report provides the most recently available national statistics on bleacher shipments and firms. There were 14 firms reported to have over $100,000 in annual sales. Aggregate bleacher factory shipments were valued at $147.75 million, almost double that of shipments reported in 1987. However, in real dollar terms (adjusting for inflation), actual factory shipments may have increased about 50 percent.

Table 1: Bleacher and Grandstand Shipments, 1987-1997

Year	No. of firms with at least $100K in shipments	Shipments
1987	13	$ 76.1
1992	18	$ 130.6
1997	14	$ 147.7

Source: U.S. Bureau of the Census

Information on aggregate shipments and the reported per seat prices for bleachers detailed above allows us to make a rough estimate of the number of seats installed on an annual basis. In general, if bleachers cost between $75 to $200[1] per seat installed, then the number of bleacher seats installed in the U.S. in 1997 may have ranged from about 0.75 million to about 2 million. Some of these installations would be for the replacement and/or the rehabilitation of existing bleachers.

We are aware of several Canadian firms that market bleachers to the U.S. In addition, The International Trade Commission tracks shipments of imported aluminum structures to the U.S., under which bleachers may fall. Canada and Mexico are the top two suppliers of these items (4). However, we are not aware of specific Mexican firms that export bleachers to the U.S.

Trade and Professional Associations

There is no national trade organization of bleacher manufacturers. There are however, a large number of organizations that represent bleacher owners. There also are organizations representing individuals involved in bleacher design and acquisition, such as the American Institute of Architects and the National Recreation and Park Association.

[1] We excluded the lower cost temporary bleachers in this calculation, because most of these bleachers probably are not captured by the bleacher shipments census figures.

Facilities with Bleachers

The number of facilities with bleachers in the U.S. is unknown. However, we can make a rough approximation to the number given estimates of types of facilities that are likely to have bleachers.

There are approximately 14,500 public school districts in the United States consisting of about 61,000 elementary schools, and 21,000 secondary schools. There also are about 17,000 private elementary schools and 2,500 private secondary schools (1) (2).

Based on data from *American School and University Magazine*, approximately 23% of elementary schools and 66% of secondary schools built during the 1995-1997 time period had installed bleachers. Applying these percentages to all the elementary and secondary schools in the U.S., there may be on the order of 33,500 elementary and secondary schools with bleacher installations.

In addition, there are approximately 4,000 public and private colleges in the United States. If all of these schools have bleacher installations, then there may be about 37,500 schools and colleges with bleacher installations.

Other facilities likely to have bleachers for spectator seating include recreation centers, ice rinks and sports arenas. According to the *1997 Economic Census, Arts, Entertainment and Recreation, Geographic Area Series*, there were 21,283 fitness and recreational sports centers in the U.S. (These types of facilities include ice skating and roller skating rinks.) There are also about 3,900 spectator sports firms reported in the same economic census that are likely to have bleachers. These sports firms include football and baseball clubs, and dog, auto and horse racetrack operations.

The National Recreation & Parks Association estimates that there are about 158,000 local park and recreation sites in the U.S. These facilities are a part of 4,992 park systems throughout the country. At the state level, according to the National Association of State Park Directors, there are 789 state parks with recreational areas in the U.S. Some of these state and local sites undoubtedly have bleachers.

Based on the information available, it seems reasonable to assume that there are at least 60,000 facilities with bleachers in the U.S. This assumes that there are 37,500 school facilities and 4,000 sports firm facilities with bleachers, and that 10 percent of the 180,000[2] state and local parks and fitness and recreation sports centers have bleachers.

[2] 180,000 is the rounded sum of 158,000 local parks + 789 state parks +21,283 fitness & recreational sports centers.

Cost of Injuries to Children under 15 From Falls off Bleachers

In 1999, there were approximately 11,200 medically treated injuries to children under 15 associated with *falls off* bleachers. Of these, about 4,900 were treated in hospital emergency departments and 6,300 were treated in other medical settings.[3] Based on injury costs provided by CPSC's Injury Cost Model, the societal costs for these injuries are estimated to have been approximately $170.5 million in 1999.

According to information provided by the CPSC Directorate for Epidemiology, there were four deaths since 1988 involving falls from bleachers to children under 15 years old. This is about one death every three years. If we assign a cost of $5 million per death, then societal costs of deaths average about $1.67 million per year. Combining the average fatal and nonfatal costs of these injuries, the societal costs of falls off bleachers to children under 15 were an estimated $172 million in 1999.

With a minimum of 60,000 facilities with bleachers in the U.S., the annual societal costs of falls off bleachers involving children under 15 may be as high as $2,800[4] per facility.

[3] Hospital emergency department figures based on estimates of falls off bleacher provided by the Directorate for Epidemiology. Other medically attended injuries are based on estimates generated by CPSC's Injury Cost Model using NEISS data.

[4] If falls off bleachers for persons 15 and older were included, then societal costs per facility rise to as high as $3,500.

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TAB E

UNITED STATES
CONSUMER PRODUCT SAFETY COMMISSION
WASHINGTON, DC 20207

MEMORANDUM

August 8, 2000

To: Janet L. Buyer,
Project Manager, Bleacher Petition CP 99-2
Division of Electrical Engineering, Directorate for Engineering Sciences

Through: Jacqueline Elder
Deputy Assistant Executive Director
Office of Hazard Identification and Reduction

Robert B. Ochsman, Ph.D.,
Director, Division of Human Factors

From: Timothy P. Smith,
Engineering Psychologist, Division of Human Factors

Subject: Human Factors Assessment for Petition CP 99–2,
Petition for Development of a Safety Standard for Bleachers and Grandstands

Introduction

The U.S. Consumer Product Safety Commission (CPSC) has received a petition (CP 99-2) from Representatives Bill Luther (D-MN) and Jim Ramstad (R-MN) of the United States Congress requesting that CPSC develop safety standards for bleachers and grandstands. The petitioners remark that there have been several recent incidents involving children falling through gaps in bleachers at basketball and hockey arenas, and that a six-year-old boy died in one such incident. They request that CPSC develop a national standard, which would include spacing requirements for gaps in new bleachers, and issue guidelines for retrofitting older facilities. This memorandum discusses the extent to which falls through gaps in bleachers could be prevented by restricting gap size to no more than four inches.[1]

Discussion

The bleachers to which the petitioners refer are defined as any tiered or stepped seating facility used in a "public or privately owned sports or entertainment arena, gymnasium, auditorium,

[1] This four-inch dimension is based on the Minnesota Bleacher Safety Act, which states that the "open space between bleacher footboards, seats, and guardrails must not exceed four inches" for bleachers over 30 inches above grade (Office of Revisor of Statutes, 1999). This is also consistent with Section 1008.14 of the final draft of the 2000 International Building Code, which states that openings between the seat and footboards "shall not allow passage of a sphere greater than 4 inches" when footboards are more than 30 inches above grade, the 1999 National Building Code of the Building Officials and Code Administrators, and the 1998 Uniform Building Code of the International Conference of Building Officials.

stadium, hall, special event center in a public park, or other facility for public assembly" (Office of Revisor of Statutes, 1999). Based on this definition, children of virtually all ages could be exposed to bleachers. Due to growth-rate differences among various parts of the body during physical development, the heads of children are proportionally larger than those of adults when compared to total body size (Haywood, 1993 & Pheasant, 1996). For this reason, head breadth is often the dimension that determines whether a child can pass completely through an opening. The following table displays the 5th percentile maximum head breadths for children up to two years old (Schneider, Lehman, Pflug, & Owings, 1986):

Age (months)	5th Percentile Maximum Head Breadth (inches)
0-3	3.9
4-6	4.1
7-9	4.6
10-12	4.5
13-18	4.7
19-24	4.8

Based on the above data, only the youngest infants (i.e., those under four months old) are likely to include any significant percentage with head breadths narrow enough to pass through a four-inch gap. These children, however, are not yet capable of walking on their own and are unlikely to have access to the gaps in bleachers. In addition, based on 1998 NEISS data virtually no fall-related injuries on bleachers occur to children under four months old; those that have occurred involve children in a car seat or infant seat, which would be incapable of fitting through a four-inch gap. Therefore, HF staff believes that a maximum permissible gap size of four inches is likely to protect virtually all users from falling completely through the gaps in bleachers.

While a maximum permissible gap size of four inches could prevent nearly all falls through the gaps in bleachers, a gap that is large enough to permit passage of a child's body yet small enough to prevent passage of a child's head could pose an entrapment hazard. To prevent entrapments, CPSC's *Handbook for Public Playground Safety* recommends that openings in protective barriers on elevated platforms be small enough to prevent passage of the small torso template (CPSC, 1997).[2] If this were applied to bleachers, it would essentially require a maximum permissible gap size of 3 ½ inches—the 5th percentile buttock depth of a child 23 to 24 months old (CPSC, 1997). There are, however, differences between children's use of playground equipment and their use of bleachers.

Much of the available injury data do not make clear distinctions between falls through gaps and other kinds of falls off or from bleachers, nor do they precisely describe the scenarios leading up to these falls. Still, HF staff expects that most young children who are injured as a result of

[2] To prevent the possibility of entrapment, CPSC's *Handbook for Public Playground Safety* typically recommends that completely bounded openings either be too small to permit passage of the small torso template or large enough to permit passage of the large head template. However, openings that permit passage of the large head template would not prevent a child from passing through it. Therefore, the Handbook recommends that openings in and around protective barriers on elevated surfaces—the purpose of which is to prevent inadvertent or unintentional falls off elevated platforms—not permit passage of the either the small torso template or the large head template (CPSC, 1997).

falling through the gaps in bleachers become exposed to those gaps unintentionally due to slipping, misstepping, or falling while on the bleachers. These differ from scenarios in which children are purposefully performing actions that are likely to result in entrapment, such as climbing on, around, and through playground equipment (e.g., climbers and other climbing equipment). Although it is foreseeable that children will climb on and around bleachers, HF staff does not believe children's exposure to the gaps and to entrapment-initiating situations on bleachers is as great as with playground equipment having similar gap sizes. Therefore, limiting the maximum permissible gap size to 3 ½ inches on bleachers may be unnecessarily stringent.

Conclusions

A maximum permissible gap size of four inches would be effective at keeping virtually all children from falling completely through the gaps in bleachers. While this gap size makes it physically possible for the youngest and smallest child users to become entrapped, the ways in which bleachers are most commonly used indicate that they are unlikely to present the same degree of entrapment potential as playground equipment. Therefore, limiting the maximum permissible gap size to 3 ½ inches on bleachers may be unnecessarily stringent.

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TAB F

UNITED STATES
CONSUMER PRODUCT SAFETY COMMISSION
WASHINGTON, DC 20207

Memorandum

Date: August 10, 2000

TO : Janet L. Buyer
Project Manager, Bleacher Retrofit Guidelines
Directorate for Engineering Sciences

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, x-1387

SUBJECT : Minimum heights for the initiation of protective barriers on bleachers

This memorandum describes the Health Sciences evaluation of the minimum height of the elevated bleacher surface that should have a full protective barrier. The discussion focuses on children ages 5 and under, who are the most vulnerable to fall injuries.

There are a number of existing guidelines and codes that provide some direction about the appropriate minimum height for protective guardrails. The guidelines contained in the CPSC Handbook for Public Playground Safety[1], for example, require guardrails or protective barriers for elevated surfaces greater than 20 inches in height for preschool-aged children and 30 inches in height for school-aged children. These heights take into account the way in which children interact with the playground equipment and the types of hazard scenarios that are likely to exist. The 20- and 30-inch height requirements for guardrails on playground equipment also take into account the presence of shock-absorbing surfacing material placed under the play equipment. These materials are designed to absorb the energy of an impact and reduce the severity of head injuries or reduce the chances that they would occur. Many building codes, including existing code requirements for bleachers, also require guardrails or protective barriers for elevated surfaces greater than 30 inches in height.

DISCUSSION:

The types and severity of injuries associated with falls from bleachers are dependent on several factors, including body orientation, the surface onto which the individual falls, and the distance the individual falls. Many bleachers have been constructed over/upon nonshock-absorbing surfacing materials, such as wood or linoleum flooring, soil, turf, cement and asphalt. These surfaces, unlike those that incorporate unitary materials or loose-fill materials, significantly increase the potential for fall-associated injuries, including life-threatening head injuries. The

distance an individual falls prior to impacting one of these unprotected surfaces compounds the risk of significant injury. Young children (age 5 and under) are particularly vulnerable to fall-related head injuries. It is important to note that incidents that result in injury of the head require professional medical treatment, and, due to their nature may result in permanent injury or death.[2,3] Given that children's cognitive, social, and motor function change with age, it may take considerably longer (months or years) for the full effects of a head injury to manifest themselves.[4] This necessitates that in all cases involving head injury of a child, follow-up visits with a physician should take place over the course of a child's development.

Erecting protective barriers that will prevent falls off the sides or backs of bleachers onto nonshock-absorbing surfaces can effectively eliminate the risk of significant injuries (e.g., brain injury[5]). Whereas, falls from the first row of seats (approximately 20 inches above the ground) can occur by forward movements off the bleachers as well as the side, to erect barriers to prevent falls from this height may be impractical for the use of the bleachers. To ascertain whether a significant number and/or the severity of injuries could be reduced by the use of protective barriers above this height (20 inches) as opposed to the 30 inches specified in current codes, available injury data from both bleachers and playgrounds were examined.

An examination of NEISS injury data associated with bleachers for the year 1998 revealed 138 incidents wherein an individual "fell off of" or "fell from" a bleacher. Forty-nine of these incidents involved the most vulnerable population, children 0-5 years of age. Thirteen of the 49 incident narratives provided fall heights, which revealed that one of the 13 falls involved a 2-year-old who fell 2 feet, suffering "head injury with forehead laceration". A review of the same data for falls from a height of 3 feet revealed no incident narratives that specified falls from this height Similarly, in a review of a special study of playground injuries from 1978[6] (a time period that preceded the widespread use of shock absorbing surfaces), 54 injuries out of 293 total involved children 0-4 years of age (5 year olds were not considered since in this study the data were presented in age ranges; 5 year olds were included in the 5-7 group). Twenty-four of the 54 cases included incident narratives that specified heights, which revealed that five children had fallen to the underlying surface from a height of 2 feet. Four of these involved head injuries (1 laceration, 1 dislocation, 1 puncture, and 1 concussion). Three incident narratives described falls from 3 foot heights, two of which involved head injuries (1 laceration and 1 fracture).

The available data reviewed indicate that children ages 5 and under experience fall injuries from 2 and 3 foot heights on bleachers and playground equipment. However, because the data are limited and contain other confounding variables (e g., children might play differently on bleachers than on playground equipment), they do not permit one to conclude that injuries from a 2-foot fall are more abundant or of a more serious nature than those from 3 foot falls. Thus, there is insufficient evidence to strongly support the position that protective measures should be initiated at 20 inches rather 30 inches.

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[1] Handbook for public playground safety. U.S. Consumer Product Safety Commission, 1999.
[2] Tibbs RE, Haines DE, Parent AD. The child as a projectile. Anat Rec 1998;253:167-75.

[3] Tarantino CA, Dowd MD, Murdock TC. Short vertical falls in infants. Pediatric Emer Care 1999;15:5-8.

[4] Guthrie E, Mast J, Richards P, McQuaid M, Pavlakis S. Traumatic brain injury in children and adolescents. Child Adolesc Psychiatr Clin North Am 1999;8:807-26.

[5] CPSC Memorandum from J. Goldsmith, Division of Health Sciences, to Scott Heh, Directorate for Engineering Sciences, entitled "Petition CP 99-2 (Bleachers)", November 30, 1999.

[6] Rutherford, G. HIA Hazard Analysis: Injuries associated with public playground equipment. U.S. Consumer Product Safety Commission 1979.