



UNITED STATES  
CONSUMER PRODUCT SAFETY COMMISSION  
WASHINGTON, DC 20207

Memorandum

Date: May 15, 2002

TO : Caroleene Paul, ESME  
Directorate for Engineering Sciences

THROUGH: Susan Ahmed, Ph.D., AED *SA*  
Directorate for Epidemiology  
Russell H. Roegner, Ph.D., Director, EPHA *RR*  
Directorate for Epidemiology

FROM : Prowpit Adler, EPHA *P.A.*

SUBJECT : Nail Gun Related Injuries and Deaths

The purpose of this memo is to present the estimated number of injuries associated with nail guns<sup>1</sup> (Figure 1) treated in U.S. hospital emergency rooms, the number of deaths, and the scenarios describing the sequence of events that occurred prior to and during the incidents.

Based on a weighted regression<sup>2</sup>, there has been an average increase of 1,356 non-occupational hospital emergency-room treated injuries per year between 1996 and 2001 associated with nail guns as shown in Table 1.

Table 1  
Estimated Non-Occupational Hospital Emergency-Room Treated Injuries  
Related to Nail Guns  
January 1, 1996-December 31, 2001

Year	Sample	Estimated Injuries	CV
1996	174	8,966	.19
1997	169	8,728	.11
1998	219	10,507	.12
1999	263	11,947	.09
2000	282	12,982	.13
2001 <sup>3</sup>	323	14,625	.12
<b>Total</b>		<b>67,755</b>	

Source: U.S. Consumer Product Safety Commission (CPSC), National Electronic Injury Surveillance System (NEISS), 1996-2001, Directorate for Epidemiology, Hazard Analysis Division.

<sup>1</sup> Such as compressed air nail guns, cordless nail guns, and electrical nail guns. The term "nail guns" will be used for these nail guns throughout the memorandum.

<sup>2</sup> Where the weights are the elements of the inverse of the variance-covariance matrix.

<sup>3</sup> As of May 14, 2002. The number may change when NEISS data for CY 2001 is complete.

*661 cleared 7/12/02*  
NFR/PRVLBR NOTIFIED  
\_\_\_\_ No comments made  
\_\_\_\_ Comments attached

## 1. Product Description<sup>4</sup>

Nail guns are hand-held powered tools that typically use compressed air (pneumatic nail gun), expanding gases from powder (powder actuated nail gun/stud gun), battery charge /fuel gas (cordless nail gun), or electricity to drive a nail into concrete, fabric, fiberboard, metal, plastic, wood, and other similar materials. They are commonly used in wood applications such as deck building and roofing. In this memorandum, only injuries or deaths related to pneumatic, cordless, or electric nail guns ( in Figure 1) are reported. These nail guns are generally used in both non-occupational and occupational settings. The injuries or deaths associated with powder actuated nail guns or stud guns are not included in the report<sup>5</sup>.

Figure 1.

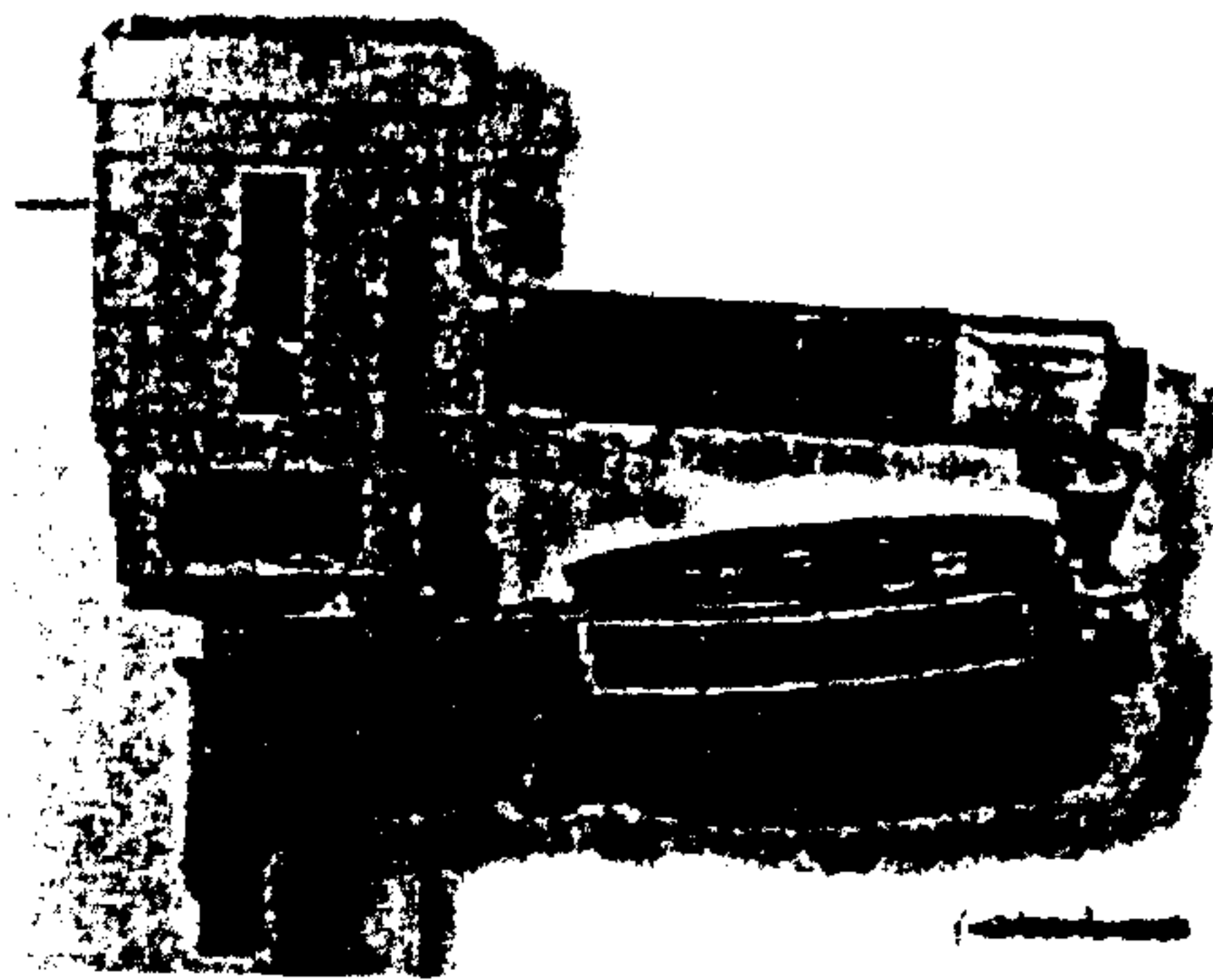


Figure 1a. Pneumatic Nail Gun

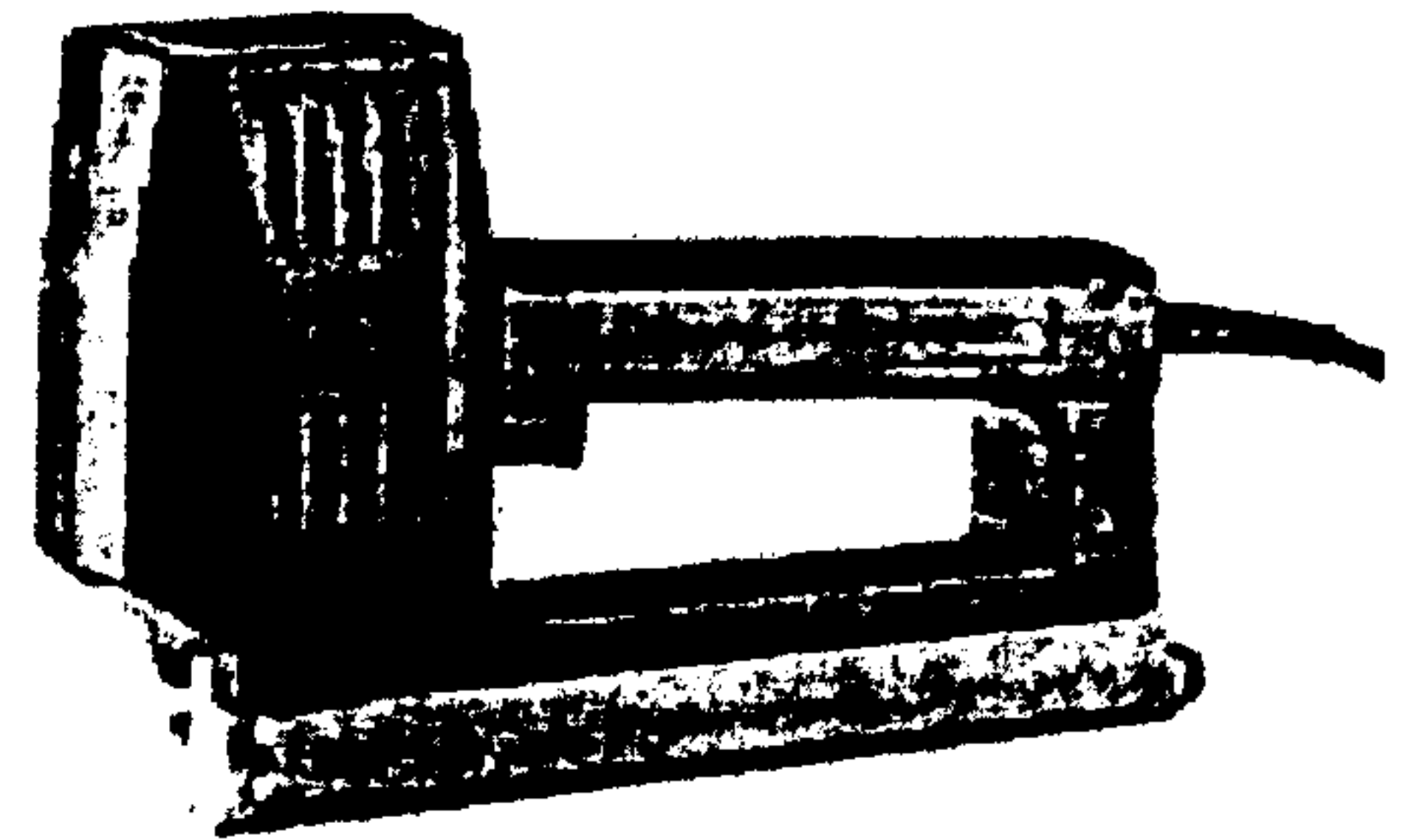


Figure 1b. Electric Nail Gun

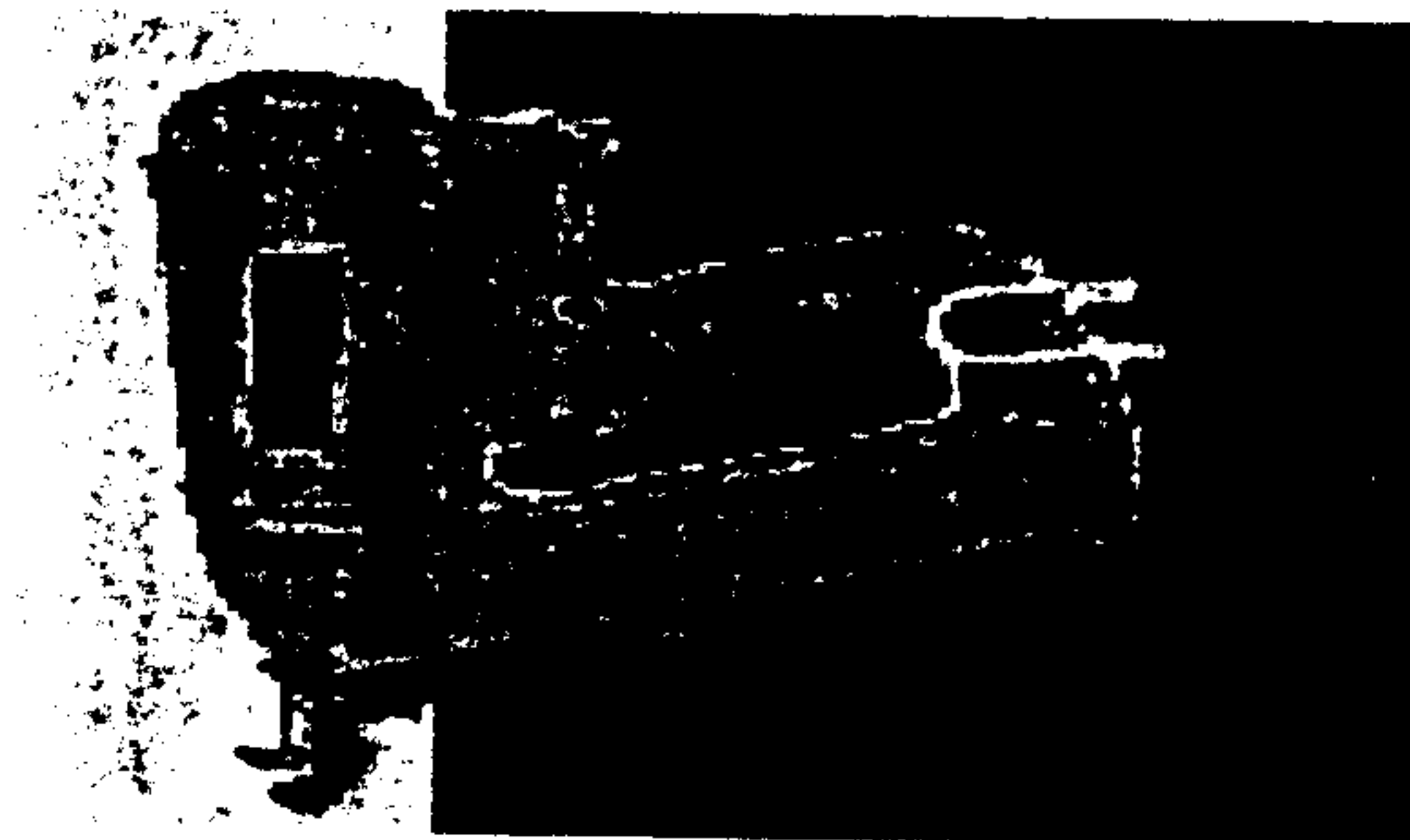


Figure 1c. Cordless Nail Gun

---

<sup>4</sup> Paul, Caroleene, ESME, Directorate for Engineering Sciences, CPSC

<sup>5</sup> This is because mainly professionals use these nail guns and certified training is normally a requirement for using these nail guns.



There are two dominant types of firing mechanisms for nail guns – the touch-trip trigger and the sequential-firing trigger. The touch-trip trigger requires the operator to push a safety-contact piece (located at the muzzle of the nail gun) against the material while the trigger is depressed. The touch-trip trigger is the most popular type of firing mechanism. It is popular due to the ease of operating the nail gun by holding the trigger down and firing by simply touching the contact. The sequential-firing trigger requires the operator to depress the safety-contact piece before releasing the trigger each time the gun is fired. The sequential trigger is less popular due to the additional time required to release the trigger after each firing.

**2. Data Source Description.** Results presented in this memo are based on two sources: (1) NEISS and (2) Non-NEISS.

### **NEISS**

NEISS is an injury data collection system. It was comprised of a statistical sample of 91 hospitals between 1991 and 1996, 101 hospitals between 1997 and November 1999, 100 hospitals between December 1999 and May 1, 2000, and 99 hospitals thereafter. The system serves the Commission primarily in two ways. First, the NEISS provides national estimates of the number and severity of injuries associated with, but not necessarily caused by, consumer products and treated in hospital emergency departments. Second, the system serves as a means of locating victims so that further information may be gathered concerning the nature and probable cause of the incident. Information gathered from the NEISS and other sources guides the Commission in setting priorities for selecting types of products for further investigation and/or actions that may eventually lead to product modification or the development of safety standards. The NEISS product code used in the analysis is 0882 (nail guns).

Through an interagency agreement with the National Institute for Occupational Safety and Health (NIOSH), CPSC has modified NEISS to meet the needs of NIOSH to measure the number and rate of occupational injuries in specific occupations and industries. These modifications expanded the scope of data collected through the NEISS to include occupational injuries regardless of product involvement. CPSC began collecting all occupational injuries from a sample of 65 NEISS hospitals between October 1995 and September 1997, from a sample of 67 NEISS hospitals between October 1997 and December 1999, from a sample of 66 NEISS hospitals between January 2000 and April 2001, and from a sample of 65 NEISS hospitals after April 2001.

### **Non-NEISS**

The Injury or Potential Injury Incident file (IPII) and Death Certificate file (DCRT) contains reports of injuries or potential injuries/complaints or deaths that involve consumer products under the jurisdiction of the Commission. The reports contained in these files come from news clips, consumer complaints (received through the mail, by HOTLINE telephone calls, or through the INTERNET), Medical Examiners and Coroner Alert program (MECAP) reports, letters from lawyers and similar sources.



### **3. Injury Analysis (Special Study – August 1, 2000 Through July 15, 2001)** **Non-Occupational and Occupational Related Incidents**

Consumer-used nail guns are generally used in both non-occupational and occupational settings. This section shows the similarity of the injuries, injured body parts, and incident scenarios involving these nail guns for non-occupational and occupational users.

#### **A. General Information<sup>6</sup>**

Based on a statistical sample of 329 NEISS reported cases<sup>7</sup>, the Directorate for Epidemiology estimated that about 11,000<sup>8</sup> victims of non-occupational incidents and about 17,800<sup>9</sup> victims of occupational incidents were treated in U.S. hospital emergency departments for injuries associated with nail guns<sup>10</sup> between August 1, 2000 and July 15, 2001.

The average age of the non-occupational victims was 34 years old with a minimum age of 3 and a maximum age of 69 while the average age for the occupational victims was 40 years old with a minimum age of 17, and a maximum age of 65. Overall, almost all of the victims from both groups were males.

Over 80 percent of the injuries to either non-occupational or occupational victims were puncture wounds from nails or for embedded nails. About 65 percent of the injuries were to the hand or finger; the remaining 35 percent of the injuries were to the head, face, eyeball, shoulder, lower arm, wrist, thigh, knee, and foot. It is interesting to note that besides the hand and finger, the thigh was another body part that most often required treatment among the non-occupational or occupational victims. Hospitalization rates for non-occupational and for occupational victims was about 3 percent and 4 percent, respectively. The average rate of hospitalization for all consumer products is 4 percent.

#### **B. Specific Information<sup>11</sup>**

**B.1. Product Identification.** Information was collected on types of nail guns, types of trigger mechanisms, age of nail guns, ownership of nail guns, whether the products were modified, the presence of operating manuals, safety warnings, and the makes and/or models of nail guns.

**Type of nail guns.** Pneumatic nail guns were involved in about 94 percent of the non-occupational injuries and about 90 percent of the occupational injuries. Cordless nail guns (battery charge/fuel gas canister) or not specified nail guns<sup>12</sup> were involved in the remaining injuries.

---

<sup>6</sup> Victims in this section mean operators, helpers, and bystanders combined.

<sup>7</sup> These cases were assigned for the telephone follow-up investigations to obtain specific information such as product identification, victim's characteristics, and incident scenarios.

<sup>8</sup> The 95% confidence limits are (7,800, 14,200). The estimated number was adjusted for wrong products and out-of-scope cases. The estimate is subject to change when the NEISS data for CY 2001 is complete.

<sup>9</sup> The 95% confidence limits are (10,700, 24,900). The estimated number was adjusted for wrong products and out-of-scope cases. The estimate is subject to change when the NEISS data for CY 2001 is complete.

<sup>10</sup> Pneumatic nail guns, cordless nail guns, or nail guns (types unknown to the respondents).

<sup>11</sup> One hundred forty-seven responded to the questions concerning product identification, victim's characteristics, and incident scenarios.

<sup>12</sup> The respondents were either relatives or others who did not know the type of nail guns involved.



**Trigger mechanism.** About 72 percent of the non-occupational injuries were associated with a nail gun with a touch-trip trigger; the remaining 28 percent of the non-occupational injuries were distributed among sequential-firing trigger (22%), a switch for single or repeated firing (<1%), or don't know (6%). Similarly, about 66 percent of the occupational injuries were associated with a nail gun with a touch-trip trigger; the remaining 34 percent of the injuries were associated with a nail gun with a sequential-firing trigger (30%), modified and not sure of original trigger (1%), or don't know (3%).

**Nail gun's age.** About 76 percent of the non-occupational injuries and 73 percent of the occupational injuries were associated with a nail gun that was less than 5 years old.

**Nail gun ownership.** Almost half of the non-occupational injuries involved a nail gun that belonged to the victims<sup>13</sup> while over 70 percent of occupational injuries involved a nail gun that either belonged to an employer or was rented.

**Nail gun modification.** About 15 percent of non-occupational injuries and 15 percent of occupational injuries involved a nail gun that had been modified. Most of the modifications involved adding a safety device to a nail gun or taking off/defeating a safety device in order to complete the job quicker. Some nail guns were entirely rebuilt.

**Operating manual.** About 60 percent of nail guns (associated with either group of the injuries) were reported to have an operating manual at the time of purchase. Less than half of the non-occupational or occupational victims remembered seeing warnings to wear eye protection, to avoid pointing/depressing the tip of nail gun to self or others, or to keep a finger away from the trigger, etc.

Detailed information on the involved nail guns associated with non-occupational or occupational injuries is presented in Table 2 through Table 4.

Table 2  
Estimated Hospital Emergency-Room Treated Injuries  
To Non-Occupational and Occupational Victims  
Classified By Type of Nail Guns  
August 1, 2000 – July 15, 2001

Type	Estimated Injuries		Total
	Non-Occupational	Occupational	
Pneumatic Nail Gun	10,365 (94%)	16,052 (90%)	26,417 (92%)
Cordless Nail Gun	341 (3%)	1,542 (9%)	1,883 (6%)
Don't know	297 (3%)	236 (1%)	533 (2%)
<b>Total</b>	<b>11,003 (100%)</b>	<b>17,830 (100%)</b>	<b>28,833(100%)</b>

Source: U.S. Consumer Product Safety Commission (CPSC), National Electronic Injury Surveillance System (NEISS), Telephone Follow Up Investigation, August 1, 2000–July 15, 2001, Directorate for Epidemiology, Hazard Analysis Division.

<sup>13</sup> The remaining injuries were related to a borrowed nail gun.

Table 3  
 Estimated Hospital Emergency-Room Treated Injuries  
 To Non-Occupational and Occupational Victims  
 Classified By Type of Trigger Mechanisms  
 August 1, 2000 –July 15, 2001

Type	Estimated Injuries		Total
	Non-Occupational	Occupational	
Touch Trip Trigger	7,932 (72%)	11,758 (66%)	<b>19,690 (68%)</b>
Sequential Firing Trigger	2,381 (22%)	5,384 (30%)	<b>7,765 (27%)</b>
Switch for Single or Repeated Firing	60 (<1%)	0 (0%)	<b>60 (&lt;1%)</b>
Modified, Not Sure of Original	0 (0%)	160 (1%)	<b>160 (&lt;1%)</b>
Don't Know	630 (6%)	528 (3%)	<b>1,158 (4%)</b>
<b>Total</b>	<b>11,003 (100%)</b>	<b>17,830 (100%)</b>	<b>28,833(100%)</b>

Source: U.S. Consumer Product Safety Commission (CPSC), National Electronic Injury Surveillance System (NEISS), Telephone Follow Up Investigation, August 1, 2000–July 15, 2001, Directorate for Epidemiology, Hazard Analysis Division.

Table 4  
 Estimated Hospital Emergency-Room Treated Injuries  
 To Non-Occupational and Occupational Victims  
 Classified By Nail Gun Age  
 August 1, 2000-July 15, 2001

Age	Estimated Injuries		Total
	Non-Occupational	Occupational	
Less than 1 Year	2,773 (25%)	4,154 (23%)	<b>6,927 (24%)</b>
1 Year ≤ Age < 5 Years	5,568 (51%)	8,826 (50%)	<b>14,394 (50%)</b>
5 Years ≤ Age < 10 Years	814 (7%)	1,676 (9%)	<b>2,490 (9%)</b>
10 Years & Older	473 (4%)	303 (2%)	<b>776 (3%)</b>
Don't Know	1,375 (13%)	2,871 (16%)	<b>4,246 (14%)</b>
<b>Total</b>	<b>11,003 (100%)</b>	<b>17,830 (100%)</b>	<b>28,833 (100%)</b>

Source: U.S. Consumer Product Safety Commission (CPSC), National Electronic Injury Surveillance System (NEISS), Telephone Follow Up Investigation, August 1, 2000–July 15, 2001, Directorate for Epidemiology, Hazard Analysis Division.

## **B.2. Victim Description**

### **Operators**

Over 80 percent of non-occupational or occupational injuries were to the operators. The remaining injuries were to the helpers and bystanders.

Only 5 percent of the injured operators were females. All of these operators were injured while they were performing non-occupational activity.



The average age of the operators associated with non-occupational injuries was 35 with a minimum age of 5<sup>14</sup>, and a maximum age of 65. The average age of the operators associated with occupational injuries was 33 with a minimum age of 18, and a maximum age of 65.

About 95 percent of non-occupational operators and 87 percent of occupational operators were treated for punctured or embedded wounds from a nail from the nail guns. The remaining injured operators were treated for fractures, nerve damage, amputations<sup>15</sup>, contusions/abrasions, hematomas, or not stated.

The most often treated body parts of the injured operators for non-occupational and for occupational were similar. Injuries to finger, hand, knee, thigh, lower leg, or foot were about 93 percent for non-occupational and 92 percent for occupational. The remaining injuries occurred to eyeball, upper arm, lower arm, wrist, lower trunk, or toe.

The rate of hospitalization for injuries to non-occupational operators was 7 percent, 3 percent above the average rate for all consumer products. The rate of hospitalization for occupational operators was 3 percent, one percent under that of the average rate.

Seventy percent of non-occupational operators and 52 percent of occupational operators operated nail guns less than 5 hours each time of using a nail gun. None of the occupational operators was a first-time user compared to 6 percent of non-occupational operators.

Sixty percent of non-occupational operators and 85 percent of occupational operators were wearing eyeglasses, safety goggles, hard hat, hat, gloves, boots, or a combination of these safety accessories at the time of the incidents.

Sixty-three percent of non-occupational operators and 69 percent of the occupational operators were right-handed, the remaining 37 percent of non-occupational operators and 31 percent of occupational operators were left-handed, ambidextrous, or not stated.

None of the non-occupational operators or occupational operators was reported to be under medication, drugs, or alcohol at the time of the incident.

Detailed information on the victim's characteristics, the operator's age, types of injuries to the operators, the injured body parts, the average number of times, and the average number of hours each time the operator used a nail gun during the last year are presented in Table 5-Table 10.

### **Helpers**

About 8 percent of non-occupational injuries and 6 percent of occupational injuries were to the helpers. All were male. The average age of the helpers of non-occupational activity was 42 with a minimum age of 19, and a maximum age of 56. The average age of the helpers of occupational activity was 37 with a minimum age of 21, and a maximum age of 57. All of the

---

<sup>14</sup> A child picked up a nail gun from the floor with his thumb against the nose of the gun when he pulled the trigger. This gun is equipped with a touch-trip trigger mechanism.

<sup>15</sup> Such as a nail gun exploded and blew away the victim's finger.

victims were treated for a punctured or embedded wound. The injuries to non-occupational helpers were to the hand (60%), knee (17%), finger (16%), and neck (7%). The injuries to occupational helpers were to the finger (52%), lower arm (42%), and wrist (7%). All of the helpers for both categories were treated and then released.

### **Bystanders**

About 24 percent of non-occupational bystanders were children under 5 years old while none of the occupational bystanders were younger than 20 years old. All of the victims were males, and all were treated for punctured or embedded wounds. For non-occupational bystanders, the injuries to the lower trunk accounted for about 65 percent and the remaining 35 percent were to the head, upper trunk, and hand. For occupational bystanders, the injuries to the upper arm accounted for 41 percent, to the finger 38 percent, and to the leg 21 percent of the injuries. All of the victims were treated and then released.

Table 5  
Estimated Hospital Emergency-Room Treated Injuries  
To Non-Occupational and Occupational Victims  
Classified By Victim's Description  
August 1, 2000-July 15, 2001

Victim	Estimated Injuries		Total <sup>16</sup>
	Non-Occupational	Occupational <sup>17</sup>	
Operator	9,562 (87%)	15,929 (89%)	<b>25,491 (88%)</b>
Helper	925 (8%)	1,131 (6%)	<b>2,056 (7%)</b>
Bystander	516 (5%)	770 (4%)	<b>1,286 (4%)</b>
<b>Total</b>	<b>11,003 (100%)</b>	<b>17,830 (100%)</b>	<b>28,833 (100%)</b>

Source: U.S. Consumer Product Safety Commission (CPSC), National Electronic Injury Surveillance System (NEISS), Telephone Follow Up Investigation, August 1, 2000–July 15, 2001, Directorate for Epidemiology, Hazard Analysis Division.

<sup>16</sup> Column detail does not add up to 100% because of rounding.

<sup>17</sup> ibid



Table 6  
 Estimated Hospital Emergency-Room Treated Injuries  
 To Non-Occupational and Occupational Operators  
 Classified By Operator's Age  
 August 1, 2000-July 15, 2001

Age	Estimated Injuries		Total <sup>18</sup>
	Non-Occupational	Occupational	
Younger than 10 yrs.	60 (<1%)	0 (0%)	60 (<1%)
10 yrs. ≤ Age < 20 yrs.	1,388 (15%)	1,269 (8%)	2,657 (10%)
20 yrs. ≤ Age < 30 yrs.	993 (10%)	5,170 (32%)	6,163 (24%)
30 yrs. ≤ Age < 40 yrs.	3,891 (41%)	4,556 (29%)	8,447 (33%)
40 yrs. ≤ Age < 50 yrs.	2,195 (23%)	3,812 (24%)	6,007 (24%)
50 and Older	1,035 (11%)	1,122 (7%)	2,157 (8%)
<b>Total</b>	<b>9,562 (100%)</b>	<b>15,929 (100%)</b>	<b>25,491 (100%)</b>

Source: U.S. Consumer Product Safety Commission (CPSC), National Electronic Injury Surveillance System (NEISS), Telephone Follow Up Investigation, August 1, 2000–July 15, 2001, Directorate for Epidemiology, Hazard Analysis Division.

Table 7  
 Estimated Hospital Emergency-Room Treated Injuries  
 To Non-Occupational and Occupational Operators  
 Classified By Diagnosis  
 August 1, 2000-July 15, 2001

Diagnosis	Estimated Injuries		Total
	Non-Occupational	Occupational	
Puncture	5,133 (54%)	8,492 (53%)	13,625 (53%)
Foreign Body <sup>19</sup>	3,922 (41%)	5,475 (34%)	9,397 (37%)
Hematoma	157 (2%)	0 (0%)	157 (1%)
Fracture	116 (1%)	446 (3%)	562 (2%)
Amputation	63 (<1%)	0 (0%)	63 (<1%)
Contusion/Abrasion	0 (0%)	1,224 (8%)	1,224 (5%)
Nerve Damage	0 (0%)	292 (2%)	292 (1%)
Not Stated	171 (2%)	0 (0%)	171 (1%)
<b>Total</b>	<b>9,562 (100%)</b>	<b>15,929 (100%)</b>	<b>25,491 (100%)</b>

Source: U.S. Consumer Product Safety Commission (CPSC), National Electronic Injury Surveillance System (NEISS), Telephone Follow Up Investigation, August 1, 2000–July 15, 2001, Directorate for Epidemiology, Hazard Analysis Division.

<sup>18</sup> Column detail does not add up to 100 percent because of rounding.

<sup>19</sup> By embedded nail.

Table 8  
 Estimated Hospital Emergency-Room Treated Injuries  
 To Non-Occupational and Occupational Operators  
 Classified By Injured Body Parts  
 August 1, 2000-July 15, 2001

Body Part	Estimated Injuries		Total
	Non-Occupational	Occupational	
Finger	3,984 (42%)	6,354 (40%)	10,338 (41%)
Hand	2,343 (24%)	4,159 (26%)	6,502 (26%)
Foot	927 (10%)	236 (1%)	1,163 (5%)
Knee	843 (9%)	1,982 (12%)	2,825 (11%)
Thigh	764 (8%)	1,243 (8%)	2,007 (8%)
Wrist	381 (4%)	292 (2%)	673 (3%)
Lower Arm	163 (2%)	160 (1%)	323 (1%)
Eyeball	157 (1%)	72 (<1%)	229 (1%)
Ankle	0 (0%)	292 (2%)	292 (1%)
Lower Leg	0 (0%)	616 (4%)	616 (2%)
Upper Arm	0 (0%)	292 (2%)	292 (1%)
Toe	0 (0%)	160 (1%)	160 (<1%)
Lower Trunk	0 (0%)	71 (<1%)	71 (<1%)
<b>Total</b>	<b>9,562 (100%)</b>	<b>15,929 (100%)</b>	<b>25,491 (100%)</b>

Source: U.S. Consumer Product Safety Commission (CPSC), National Electronic Injury Surveillance System (NEISS), Telephone Follow Up Investigation, August 1, 2000-July 15, 2001, Directorate for Epidemiology, Hazard Analysis Division.

Table 9  
 Estimated Hospital Emergency-Room Treated Injuries  
 To Non-Occupational and Occupational Operators  
 Classified by Times of Operation  
 August 1, 2000-July 15, 2001

Times Of Operation During the Last Year	Estimated Injuries		Total
	Non-Occupational	Occupational	
0 Time	549 (6%)	0 (0%)	549 (2%)
1 Time ≤ Operation < 20 Times	4,017 (42%)	2,576 (16%)	6,593 (26%)
20 Times ≤ Operation < 40 Times	891 (9%)	1,810 (11%)	2,701 (11%)
40 Times ≤ Operation < 60 Times	828 (9%)	975 (6%)	1,803 (7%)
60 Times ≤ Operation < 80 Times	507 (5%)	0 (0%)	507 (2%)
80 Times ≤ Operation < 100 Times	163 (2%)	0 (0%)	163 (<1%)
100 Times or More	1,480 (15%)	7,252 (46%)	8,732 (34%)
Several Times	396 (4%)	768 (5%)	1,164 (5%)
Daily Basis	215 (2%)	1,706 (11%)	1,921 (8%)
Weekly	159 (2%)	0 (0%)	159 (<1%)
Don't Know	357 (4%)	842 (5%)	1,199 (5%)
<b>Total</b>	<b>9,562 (100%)</b>	<b>15,929 (100%)</b>	<b>25,491 (100%)</b>

Source: U.S. Consumer Product Safety Commission (CPSC), National Electronic Injury Surveillance System (NEISS), Telephone Follow Up Investigation, August 1, 2000-July 15, 2001, Directorate for Epidemiology, Hazard Analysis Division.



Table 10  
 Estimated Hospital Emergency-Room Treated Injuries  
 To Non-Occupational and Occupational Operators  
 Classified By Hours of Operation  
 August 1, 2000-July 15, 2001

Hours of Operation Each Time	Estimated Injuries		Total
	Non-Occupational <sup>20</sup>	Occupational	
0 hr. (1 <sup>st</sup> Time)	385 (4%)	0 (0%)	385 (2%)
Less than 1 hr.	788 (8%)	0 (0%)	788 (3%)
1 ≤ Operation < 5 hrs.	5,573 (58%)	8,275 (52%)	13,848 (54%)
5 ≤ Operation < 10 hrs.	1,231 (13%)	6,215 (39%)	7,446 (29%)
10 hr. or More	611 (6%)	737 (5%)	1,348 (5%)
Don't Know	974 (10%)	702 (4%)	1,676 (7%)
<b>Total</b>	<b>9,562 (100%)</b>	<b>15,929 (100%)</b>	<b>25,491 (100%)</b>

Source: U.S. Consumer Product Safety Commission (CPSC), National Electronic Injury Surveillance System (NEISS), Telephone Follow Up Investigation, August 1, 2000–July 15, 2001, Directorate for Epidemiology, Hazard Analysis Division.

### **B.3. Hazards and Incident Scenario**

#### **Hazard to the Operators**

Accidental contact or accidental firing accounted for about 62 percent of the total injuries to non-occupational operators and about 47 percent of the total injuries to occupational operators. The remaining injuries to non-occupational operators (38%) and occupational operators (53%) involved hazards such as: a nail ricocheted off a knot in the wood; a nail went through a piece of wood/board; safety not working properly; a child playing with a nail gun; the operator miss-aimed a nail gun; a nail gun exploded; a nail gun jammed; the operator slipped and miss-aimed a nail gun; or the operator shot him/herself with a nail gun (not specified), (Table 11).

#### **(i) Accidental Firing Scenarios**

Among incidents involving accidental firing, about 74 percent of non-occupational operators and 83 percent of occupational operators had their fingers on the trigger when the gun accidentally discharged a nail. Based on the responses, the typical incident scenarios were: (1) the tip of the gun touched a knot or imperfection in the wood causing the gun to fire twice; (2) the gun kicked back and fired off the second nail; (3) the operator tripped on the air hose and his hand with a nail gun (with his finger on the trigger) went up and accidentally hit a safety switch and fired the gun; (4) the operator dropped the nail gun and a nail was discharged; or (5) the operator picked up the nail gun by the air hose causing the gun to discharge a nail.

<sup>20</sup> Column detail does not add up to 100 % because of rounding.



The accidental firing of a nail gun with a touch-trip trigger occurred to non-occupational operators 83 percent of the time and to occupational operators 71 percent of the time. About 95 percent of the total injuries to non-occupational operators were to the wrist, hand, and finger; the remaining 5 percent of the total injuries were to the thigh. About 78 percent of the injuries to occupational operators were to the upper arm, wrist, hand, or finger; the remaining 22 percent of the injuries were to the thigh, knee, and lower leg.

### **(ii) Accidental Contact Scenarios**

Among incidents involving accidental contact, about 91 percent of non-occupational operators and 87 percent of occupational operators had their fingers on a nail gun trigger when they unintentionally touched the tip of the nail gun. Based on the responses, the typical incident scenarios were: (1) the operator tripped over the air hose and his body part contacted the muzzle of the nail gun; (2) the operator was climbing up/down a ladder and his body part bumped the gun, causing the nail gun to fire; (3) the operator was reaching for material and in doing so brushed across his body with the nail gun; (4) the operator was walking down a steep roof with a nail gun with his finger on the trigger and the gun made contact with his body part; or (5) the operator slipped while working on a roof, with his finger on the trigger, as he reached to save himself, the gun touched the victim's body part.

The accidental contact by a nail gun with a touch-trip trigger resulted in about 74 percent of non-occupational injuries to the operators and in about 84 percent of occupational injuries to the operators. The most frequently injured body parts of the operators (of both categories) were the thigh, knee, lower leg, or foot.

### **(iii) Other Hazard Scenarios**

Other hazards involved: (1) a nail ricocheted off a knot in the wood; (2) a nail went through a piece of wood/board; (3) a safety was not working properly; (4) a child playing with a nail gun; (5) the operator miss-aimed a nail gun; (6) a nail gun exploded; (7) the operator slipped and miss-aimed the gun; or (8) the operator accidentally shot him/herself (not specified).

The injured body parts of non-occupational operators were elbows, hands, or fingers and accounted for 91 percent, the remaining 9 percent of the injured body parts were knees or eyeballs. For the occupational operators, half of the injuries were to the eyeball, lower arm, hand, or finger while another half of the injuries were to the thigh, knee, ankle, or foot.

Most of the operators were on a roof, on a ladder, or in a tight area where it was difficult to operate the nail gun. Based on the responses, the typical incident scenarios were: (1) the operator was nailing at an angle; (2) the operator was performing an overhead nailing; (3) the operator was shooting close to the edge of the wood; (4) the operator was hurrying to get a job done; or (5) the operator was trying to free the nail gun hose, lost balance and missed a target.



Table 11  
 Estimated Hospital Emergency-Room Treated Injuries  
 To Non-Occupational and Occupational Operators  
 Classified by Hazards  
 August 1, 2000 and July 15, 2001

Hazard	Estimated Injury		Total
	Non-Occupational	Occupational	
Accidental Firing	3,383 (35%)	5,690 (36%)	9,073 (35%)
Accidental Contact	2,604 (27%)	1,786 (11%)	4,390 (17%)
Nail Hit Knot In Wood	1,730 (18%)	2,142 (13%)	3,872 (15%)
Nail Went Through Wood	1,221 (13%)	2,359 (15%)	3,580 (14%)
Safety Not Working Properly	0 (0%)	399 (3%)	399 (1%)
Child Played With Nail Gun	60 (<1%)	0 (0%)	60 (<1%)
Miss-Aimed Nail Gun	340 (4%)	1,566 (9%)	1,906 (7%)
Explosion	63 (<1%)	0 (0%)	63 (<1%)
Nail Gun Jammed	0 (0%)	293 (2%)	293 (1%)
Slipped & Miss-Aimed Nail Gun	161 (2%)	1,081 (7%)	1,242 (8%)
Accidental Shot Self (Not Specified)	0 (0%)	613 (4%)	613 (2%)
<b>Total</b>	<b>9,562 (100%)</b>	<b>15,929 (100%)</b>	<b>25,491(100%)</b>

Source: U.S. Consumer Product Safety Commission (CPSC), National Electronic Injury Surveillance System (NEISS), Telephone Follow Up Investigation, August 1, 2000–July 15, 2001, Directorate for Epidemiology, Hazard Analysis Division.

### **Hazard to the Helpers**

For non-occupational activity, accidental firing resulted in about 64 percent of the total injuries to the helpers. The remaining 36 percent of the injuries resulted from miss-aiming the nail guns. All of the incidents occurred when the operators had their fingers on a nail gun trigger. The nail gun with a touch-trip trigger was involved in about 3 out of every 4 incidents. At the time of the incidents, the helpers were in very close proximity to the nail guns. A majority of the helpers were holding a work piece (wood, board, or shingle) for the operators who were to the right or to the left of them. When the incident (accidental firing, double firings, or miss-aiming a nail gun) occurred, the helper who was holding the work piece usually received an injury. The injuries to the hand or finger accounted for about 76 percent of the incidents. The remaining 24 percent of the injuries were to the neck or knee.

For occupational activity, accidental firing resulted in about 72 percent of the total injuries to the helpers. The remaining 28 percent of the injuries resulted from the operators miss-aiming the nail guns. Similar to non-occupational incidents, all of the operators had their finger on the triggers when the accidental firing or double firings occurred. About 72 percent of nail guns had a touch-trip trigger mechanism while 28 percent of them had a sequential firing mechanism. When the operators accidentally fired a nail gun, a nail from the nail gun usually went into the helper's body part that was close to the nail gun. All of the injuries were located on the lower arm, wrist, or hand.

## Hazard to the Bystanders

The injuries to the bystanders for non-occupational activity were the result of a nail hitting a knot in the wood and ricocheting out (76%) or a child bystander picking up a nail gun and touching the muzzle on him/herself and the gun going off (24%). About 35 percent of the incidents involved a touch-trip trigger or a sequential trigger nail gun. The remaining 65 percent of the incidents involved a nail gun with an unknown trigger mechanism. About 65 percent of the injuries were to the lower trunk; the remaining 35 percent of the injuries were to the head, upper trunk, or hand.

The injuries to the bystanders for occupational activity occurred when the operators accidentally fired a nail gun or when a nail ricocheted off a knot in the wood. Touch-trip trigger nail guns were involved in about 79 percent of the incidents; the remaining 21 percent of the incidents involved a modified-trigger nail gun. The injuries to the upper arm or finger accounted for about 79 percent; the remaining 21 percent of the injuries were to the thigh.

### 4. Deaths

The fatal incidents associated with consumer-used nail guns were obtained from the Injury or Potential Injury Incident file (IPII) and Death Certificate file (DCRT). These reported incidents are not a statistical sample and they do not represent all incidents that may have occurred in the U.S. between January 1, 1990 and October 10, 2001.

There were five deaths<sup>21</sup> associated with consumer-used nail guns during the 11-year period. The deaths are summarized as follows:

<u>Date of Deaths</u>	<u>State</u>	<u>City</u>	<u>Age</u>	<u>Sex</u>	<u>Scenario</u>
01/23/1990	CA	Los Angeles	23	M	Died from a wound to his head when the nail gun exploded.
03/14/1991	MI	Kalamazoo	26	M	A nail from his nail gun penetrated the skull.
10/06/1991	ND	Fargo	61	M	A nail from a pneumatic nail gun entered left brain.
06/26/1994	KS	Emporia	53	M	Hit in the chest with a nail from a nail gun while helping construct a deck.
11/24/1996	MS	Hattiesburg	55	M	Died from abdominal wound from a nail of the nail gun.

---

<sup>21</sup> Three additional deaths involved two incidents of powder actuated nail gun/stud gun related and one incident of a man falling from a roof while using a nail gun.



## **Conclusion**

The hospital emergency department treated injuries associated with nail guns increased at a rate of 1,356 injuries per year between 1996 and 2001. Over 80 percent of the injuries to either non-occupational or occupational victims were treated for puncture wounds from nails or for embedded nails. About 65 percent of the injuries were to the hand or finger; the remaining 35 percent of the injuries were to the head, face, eyeball, shoulder, lower arm, wrist, thigh, knee, and foot. Over 80 percent of the victims were the operators (non-occupational activity or occupational activity). The remaining injuries were to the helpers or bystanders. The rate of hospitalization for non-occupational operators was 7 percent, 3 percent above the average rate for all consumer products. The rate of hospitalization for occupational operators was 3 percent, one percent under the average rate. Accidental contact and accidental firing were the major hazards for non-occupational operators and accounted for 62 percent of total injuries. However, less than half of the injuries to occupational operators involved these two hazards. A majority of the operators had their fingers on the triggers when the incidents occurred. It appears that stretching/reaching, climbing up/coming down a ladder, slipping/tripping, kicked back/recoiled action of the nail gun, or a knot in the wood were typical incident scenarios that resulted in the injuries to either non-occupational or occupational operators. The touch-trip trigger nail guns were the nail guns most often used by the non-occupational and occupational operators.