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CONSUMER PRODUCT SAFETY COMMISSION
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MEMORANDUM

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SUBJECT: Snow Thrower-Related Hazards, 1990-1997

This memorandum provides data on injuries related to snow throwers from 1990 through 1997. The subjects discussed in this memo are - (1) national estimated annual injuries (2) the results of in-depth investigations of the blade-contact injuries associated with clearing the discharge chute of wet, heavy snow, (3) the injured body parts, and (4) characteristics of the snow throwers involved.

Background Information on Snow Throwers

The voluntary standard for snow throwers is maintained by the American National Standards Institute (ANSI). The standard, ANSI B71.3, applies to walk-behind powered snow throwers, ride-on powered snow throwers, and lawn and garden tractors used with snow thrower attachments. It was first published on February 7, 1975 and a Revised Version was approved on July 19, 1984. The principal purpose of this revision was to separate the requirements for walk-behind snow throwers from those for ride-on snow throwers.

The safety specifications for snow throwers, ANSI B71.3-1975 and ANSI B71.3-1984, address the following:

- Controls
- Guards, Shields, Guides, Deflectors, and Housings
- Electrical Requirements
- Sound Level Requirements
- Slip-Resistant Surfaces and Reflectors for Riding Vehicles
- Labels

Under safety specifications for controls, there is a safety control or a "deadman safety control" that automatically stops the collector-impeller in 5 seconds when the operator disengages the control. The functional operation of the deadman control should prevent many injuries such as lacerations, amputations, and fractures to wrists, hands, and fingers.

Walk-behind and attachment snow throwers can be categorized into two classes:

1. Single-stage has a large auger in the front, which cuts into the snow and simultaneously ejects it through the discharge chute by a single device, which combines the collecting and impelling functions. This device can be correctly identified as a collector/impeller, or auger.

2. Two-stage has a second set of smaller impeller blades located at the base of the discharge chute. Snow is collected by the auger after which it is accelerated through the discharge chute by a separate impeller fan. These impeller blades operate at right angles to the auger. While the auger turns more slowly than the one on a single-stage machine, the impeller blades rotate at a high speed to eject snow out of the chute. The collector and impeller functions are separate. The impeller can be independently powered.

Most models of self-propelled types manufactured since 1975 are equipped with a deadman safety control. This device is located at the handle of the walk-behind type snow thrower. When the operator releases the lever at the handle without disengaging the auger/impeller control, the engine will automatically shut off and in turn stop the blade rotation.

Attachment units require attachment to tractors and are operated by power take off (PTO) from the tractors' engines. The deadman control will automatically stop the auger/impeller blades when the operator leaves the operating position on the tractor.

National Estimated Annual Injuries, 1990-1997

Based on the National Electronic Injury Surveillance System (NEISS), an estimated 34,359 snow thrower related injuries, an average of 4,295 injuries per year, were treated in U.S. hospital emergency rooms during the subject 8-year period. All annual estimates of injuries for the years 1990 through 1996 were adjusted to account for the 1997 NEISS sampling frame update. These adjusted estimates are presented in Table 1. The fluctuation in snow thrower related injuries was influenced by factors such as the amount of annual snowfall, the amount of moisture in snow for a particular year, and the extent of snow thrower use.

Injuries to wrists, hands, and fingers accounted for about 3,068 injuries, a dominant 71 percent of the total injuries, per year. Amputations, fractures, and lacerations were the most frequently diagnosed with 2,844 injuries, about 66 percent of the total injuries, per year. The hospitalization rate for these injuries was about 9 percent. This is a much higher hospitalization rate than the average rate of 4 percent related to all consumer products.

Table 1
Estimated Annual Injuries Related to Snow Throwers
Treated in U.S. Hospital Emergency Rooms
1990-1997

YEAR	EST. TOTAL	SAMPLE SIZE	CV[1]	WRIST, HAND, FINGER	AMPUTATION FRACTURE, LACERATION
1990	4,172	51	.26	3,068(74%)	2,782(67%)
1991	3,848	79	.23	2,720(71%)	2,340(61%)
1992	2,831	73	.28	2,111(75%)	1,915(68%)
1993	5,252	123	.22	3,669(70%)	3,262(62%)
1994	4,174	101	.21	2,858(68%)	2,733(65%)
1995	4,541	111	.20	3,300(78%)	3,273(72%)
1996	5,363	153	.20	3,868(72%)	3,853(72%)
1997	4,178	70	.25	2,952(71%)	2,592(62%)
AVG.	**4,295**			**3,068(71%)**	**2,844(66%)**

Source: U.S. Consumer Product Safety Commission (CPSC), National Electronic Injury Surveillance System (NEISS), 1990-1997, Directorate for Epidemiology and Health Sciences, Hazard Analysis Division

[1] A measure of relative dispersion for the estimated annual injuries (obtained by dividing the estimated standard error by the estimated injuries).

Telephone and On-Site Investigations of Incidents Between 1990-1997

Information concerning the nature and probable causes of the incidents was not available from the NEISS reports nor from reports such as news clippings, government referrals, or complaints. This information was acquired by telephone and/or on-site follow-up investigations of selected snow thrower related incidents, reported by these sources, between 1990 and 1997. While they include detailed information, these incidents are not a statistical sample of all snow thrower related incidents that may have occurred in the U.S. over this period. They are used to provide more detailed information on the scenarios associated with snow thrower incidents. Information obtained from these sources was pooled for analysis in order to achieve a sufficient level of detail desired to quantify the nature and probable causes of blade-contact incidents related to snow throwers.

Of the 77 completed investigations, 53 cases were related to blade contact. Within this group, 43 blade contacts (81 percent) occurred in the course of attempting to clear the clogged discharge chute of wet, heavy snow. Unclogging a discharge chute appears to be the most hazardous activity associated with the use of snow throwers. Therefore, the 43 blade-contact incidents were examined in greater detail to determine (1) specific information such as the location of the incidents and product and operator characteristics, and (2) probable causes or contributing factors that the operators experienced before or at the time of the incident. The results are summarized below.

Location of the Incidents

A rough breakdown of locations by time zone - Eastern, Central, Mountain, and Pacific - of the 43 blade-contact incidents is as follows:

Time Zone	State	Frequency
Eastern	Connecticut	3
	Maine	1
	Maryland	1
	Massachusetts	1
	Michigan	8
	New Hampshire	1
	New Jersey	1
	New York	5
	Pennsylvania	2
	Rhode Island	1

Central	Illinois	2
	Iowa	2
	Kansas	1
	Minnesota	3
	Wisconsin	6
Mountain	South Dakota	4
	Utah	1
Pacific	None	

Future breakdown should be by the amount of moisture in snow (wet versus powder) and granular size. This will require a broader study including meteorological input.

Product and Operator Characteristics

- Thirty-five of the 43 blade-contact injuries were not work-related incidents.
- The ages of the operators ranged from 15 to 72 years.
- Thirty-two operators had used the same snow thrower at least one other time in the same season.
- Over half of the blade-contact injuries were amputations.
- All except one blade-contact injury were to fingers.
- Nineteen of the blade-contact injuries required hospitalization and 14 of these involved amputations.
- Forty blade-contact injuries were associated with walk-behind, gasoline powered snow throwers and 2 injuries involved tractor/mower attachment units.
- Based on available information, about 32 of the blade-contact injuries were related to snow throwers manufactured in the 1970's and 1980's.
- Thirty-seven blade-contact injuries involved two-stage walk-behind snow throwers, 3 injuries involved single-stage walk-behind snow throwers, and 2 injuries involved attachment units.
- Thirty-six blade-contact injuries involved machines with the engine running and 7 blade-contact injuries with the engine shut off. From the standpoint of the severity of injury, it appeared that the injuries occurring while the snow thrower was powered tended to be more severe (23 amputations) than those occurring while the machine was not powered but the blade was still rotating (2 amputations).

- Of the 36 blade-contact injuries associated with the snow throwers with running engines, 10 of these cases involved the machines with an auger/impeller drive control disengaged. Informal tests in one of these cases showed that it took between 7 and 8 seconds from release of the auger/impeller drive control until the blade stopped rotating.

- Seven blade-contact injuries were associated with snow throwers with the engine off. One of these snow throwers was tested to determine the length of time it took for the auger and impeller blades to come to a complete stop. The test procedure was conducted three times; each time both the auger and impeller blades stopped in three seconds.

- Available information indicated that the machines were purchased between late 1970 and 1994. The manufacturers for these machines are:

1. MANUFACT1	1
2. MANUFACT2	13[2]
3. MANUFACT3	4[3]
4. MANUFACT4	1
5. MANUFACT5	1
6. MANUFACT6	4
7. MANUFACT7	2
8. MANUFACT8	2
9. MANUFACT9	1
10. MANUFACT10	1
11. MANUFACT11	3
12. UNKNOWN	10

Contributing Factors

The following factors described in the scenarios may have contributed to the blade-contact incidents:

- Leaving the engine running and blade engaged while attempting to clean the discharge chutes.

- Not waiting until the coasting blades stopped rotating.

- Gloves or mittens caught in the blades.

- Lack of a deadman control or defeated/removed the deadman.

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[2] Shared about 20 percent of the market in 1992

[3] Two cases are walk-behind snow throwers and 2 cases are lawn and garden tractors

- The deadman control in earlier models (manufactured in the 1970's or early 1980's) may not operate accurately after many years.

- Machine malfunction or drive-belt adjustment.

- Unfamiliarity with machines (first-time users).

- Prolonged operation, fatigue, rushing to complete the job and slipped on icy surface.

Probable causes or contributing factors were not easy to determine in many incidents. A short synopsis of each of the 43 blade-contact related incidents is presented in Appendix.

Conclusions

Clearing the discharge chute of wet heavy snow appears to be the most hazardous activity associated with the use of snow throwers. Of 53 blade-contact incidents, 43 incidents (81%) involved this activity. A majority (83%) of the operators left the engines running while performing this activity. It appeared that the injuries occurring while the snow thrower was powered tended to be more severe (23 amputations) than those injuries occurring while the machine was not powered but the blade was still rotating (2 amputations).

APPENDIX

INCIDENT SCENARIOS OF BLADE-CONTACT INJURIES THROUGH DISCHARGE CHUTES

(1) Engine on with Engaged Blades (25 cases)

900105HEP9002 A 19 year old male sustained a crushed middle finger with the top joint amputated. He was clearing the clogged wet and heavy snow from the discharge chute of his two-stage, walk-behind snow thrower. **He stated that the engine was running, the auger drive control was engaged, and the wheel drive was in neutral. He also reported that his MANUFACT2 snow thrower, purchased new 3-4 years ago, had a deadman control in the form of 2 handles[4]. One handle operates the auger; the other operates the impeller. However, at the time of the accident, he was holding onto the impeller control while unclogging the snow in order to help facilitate clearing of the chute. He had gotten away with this 3-4 times previously.**

900124HEP9004 A 72 year old male sustained 3 partially amputated fingers of his right hand from the rotating impeller blade of a running walk-behind, 2-stage snow thrower which he bought new in 1970. **He stated that the engine was running, the auger drive control was engaged, and the wheel drive control was in neutral position when he stuck his gloved, right hand in the chute. Even though he knew it was unsafe, he still did it. This was because the only way to disengage the blades was by turning off the engine.**

900126HEP1521 A 62 year old male had 3 fingers of his right hand amputated after they caught in the rotating impeller blade of a running, MANUFACT2 walk-behind, 2-stage snow thrower as he was clearing the discharge chute. **He usually sprayed the chute with W-D 40 to prevent clogging but neglected to do so this time. The chute clogged after 10 minutes and he let the engine run with the auger drive control engaged as he tried to clear the chute with his mittened hand. The machine has 2 clutches - one for auger-drive control and one for wheel-drive control. There was an off switch on the left to stop the blade(s) from rotating. He thought there was a lot of space between the blade and his fingers. He bought this machine new in 1970.**

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[4] This information is being verified by the manufacturer

900126HEP1522 A 19 year old male incurred a fractured middle finger and lacerated ring finger of which half an inch had to be amputated. The operator was using his MANUFACT5 walk-behind, 2-stage snow thrower to clear neighbor's sidewalk. **After 3 hours the chute clogged, the throttle was fully open, auger drive engaged, and the wheel drive in neutral as he put his hand into the chute to clear it. The machine was bought used and estimated to be about 15 years old. It has a master clutch to engage and disengage the blades.**

900219HEP1121 A 15 year old male sustained an amputation to the left middle finger when he was clearing the wet snow from the discharge chute of his MANUFACT2 2-stage, walk-behind snow thrower. **He was in a hurry to finish the job and forgot to take his hand off the deadman control. Since he did not hear the blade turning, he stuck his gloved hand in the chute to clear the clogged snow. The engine was running, the auger control was engaged, the wheel drive control was in forward position, and the throttle was fully open at the time of the accident.**

900221HEP1841 A 66 year old male sustained 2 lacerated fingers when he was cleaning wet snow from the discharge chute of his 2-stage, walk-behind snow thrower and the rotating impeller blade contacted his fingers. **There are two different clutches on the handle that operate separately - the auger-drive control and the wheel-drive control. The operator continued to hold the auger control with his left hand which caused the auger and impeller blades to continue rotating. He stated that he was not thinking. The operator then reached his right hand into the discharge chute. He thought he had enough space before it would touch the impeller blade. At the time of the incident, the engine was running, the wheel-drive control was in neutral position, and the throttle was barely open. The machine was purchased new in 1980.**

900226HEP2401 A 69 year old male incurred an amputation to the finger on his right hand when he reached into the discharge chute of his 2-stage, MANUFACT11 walk-behind snow thrower to clear out wet snow. **Without thinking, he kept the lever pushed down that keeps the engine on. The machine originally had a deadman control but the operator removed it**

because he felt it was a hassle. There is just one control for the auger and impeller and a separate one for the wheel drive. The machine was purchased new in 1979.

90026HEP2402 A 20 year old male incurred a crushed and lacerated finger by the impeller blade when he was clearing wet snow from the discharge chute of his MANUFACT2, 2-stage walk-behind snow thrower. **One of the belts was broken on the machine so the discharge chute was clogged up. The machine has 3 clutches on the handle - one for the impeller, one for the auger, and one for the wheel controls[5]. While the engine was running, the operator was holding down the impeller control with his right hand and stuck his gloved left hand in the discharge chute. The impeller blade hit his finger crushing it. The machine was bought in used condition about 8 years ago.**

900301HEP3761 A 37 year old male sustained an amputation to his ring finger and fractured and lacerated middle finger through the glove, from the rotating impeller blade of his MANUFACT2 2-stage, walk-behind snow thrower. **The engine was running, the auger drive was engaged (no deadman control), wheel drive was in neutral with throttle fully open as he reached too far into the chute to clear wet snow. His glove became jammed on the impeller blade. The machine was about 15 years old and was obtained in used condition.**

900318HEP3601 A 44 year old male sustained a laceration to his right middle finger from the auger blade when he put his gloved hand into the chute of a single-stage, walk-behind snow thrower. **He did not turn off the engine, which is the only way to stop the auger blade from rotating. He bought the machine in used condition and it is over 10 years old.**

900318HEP3602 A 44 year old male incurred a laceration to the left middle finger from the impeller blade when he was clearing heavy, wet snow from the discharge chute of a borrowed, MANUFACT2 2-stage, walk-behind snow thrower. **The deadman control lever was taped down, the engine was running, and both the auger and impeller blades were rotating when he used his gloved hand to dig out the snow from the discharge chute.**

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[5] This statement is being verified by the manufacturer.

901219HCN0373 A 42 year old male suffered a fracture to middle finger, dislocated index finger, and lacerated ring finger to his left hand, while he was attempting to clear wet snow out of discharge chute of a 2-stage, self-propelled unit. **There was no deadman control on it. He was possibly in a slight hurry to get the job done. He stated that he disengaged the self-propelled drive and he thought he had disengaged the lever for the auger and impeller. However, he now knows that he did not. The machine was purchased in used condition at a yard sale and estimated to be at least 15 years old.**

910109HCN0483 A 44 year old male lost the tips of three fingers when he reached into the discharge chute to clear the wet, heavy snow. Approximately 18 years ago, the operator purchased a single-stage snow thrower. **It has 2 levers, one lever is used to stop/start the blade and the other lever is used to stop/start the wheels from moving. There is no deadman lever on the machine. There were no injuries associated with using the machine until this incident. After 5 minutes of using the machine, it became clogged with wet snow. He put both levers into off position. However, he realized later on that he only turned off the lever to stop the wheels from moving. The blade was still turning when he reached into the discharge chute to clear away the snow.**

930301HCC1057 A 40 year old male sustained an amputation to the tip of his middle finger and a laceration to his ring finger when he was attempting to clear the clogged discharge chute of his 2-stage, walk-behind snow thrower with his hand. **The operator stated that he released his grip on the clutch lever and began clearing the snow from the chute. He thought that the impeller blade had been disengaged. The blade contacted his fingers. The operator stated that the clutch release had always worked, and he has never had any problem with it. He did determine afterward that the cable had broken and he had ordered replacement parts for it. He bought the snow thrower on 11/15/78. According to the manual, when the operator's hand is removed from the power clutch lever, tension is removed from the drive belts, therefore unit motion and impeller/auger rotation stop. This unit has an impeller/auger drive control lever that is used to disengage power to impeller/auger without interfering with power to drive wheels.**

950223HEP9008 A 60 year old male incurred an amputation to the tip of his right ring finger when he reached into the discharge chute of his 23 year old, MANUFACT3 2-stage, walk-behind snow thrower. **The engine must be turned off manually by a lever on the handlebar in order to stop the blades. The operator was tired and hungry since this was his tenth job that day. He thought he had turned the engine off because he did not hear noise, but he had not, when he reached into the chute and the impeller blade amputated the tip of his finger.**

970408HCN0403 A 37 year old male sustained an amputation to his right hand when he was attempting to clear wet, heavy snow from the discharge chute of a MANUFACT3, 20 HP lawn and garden tractor with a snow thrower attachment. **The snow thrower was attached to the front of the tractor and was driven by a power take-off (PTO). He got off the tractor and went over to the chute. He did not shut off the engine or PTO, which powers the snow thrower, when he put his right hand inside the chute to unclog the snow. His hand was grabbed by the blade and was completely amputated above the wrist. There is a safety switch beneath the seat of the tractor. It is designed to shut off the PTO and engine if the operator gets up from the operating position. The switch for this tractor hasn't worked for several years.**

970409HEP9011 A 46 year old male suffered a fracture and laceration to the right index finger when he was clearing the discharge chute of his MANUFACT11 2-stage, walk-behind snow thrower. **He was in a hurry to get the job done. He disengaged the traction drive, and with the machine in a forward gear, the engine running, and the auger control engaged he reached into the discharge chute to clear the blockage. The impeller blade contacted the glove he was wearing. The machine was estimated to be over 10 years old and equipped with a deadman control.**

970409HEP9014 A 28 year old male suffered an amputation to the left thumb after his hand made contact with the spinning impeller blade of the rebuilt 20-year-old MANUFACT2, 2-stage walk-behind snow thrower. **When the snow blockage became very severe, he disengaged the traction drive, left the engine running, and reached into the discharge chute to clear the blockage. As the chute cleared, his gloved hand**

made contact with the spinning impeller.

970409HEP9016 A 53 year old male sustained partially severed middle and index fingers and a broken ring finger as he was attempting to unclog a discharge chute of his company's 2-stage, walk-behind snow thrower. **The operator, while standing behind the machine, reached into the chute to clear the blockage. He slipped, and his right hand came off the handle and jarred the machine into gear. His gloved left hand was thrust into the chute. The machine was purchased in 1978. It does not have a deadman safety device.**

970409HEP9017 A 35 year old male fractured one finger and lacerated two others while cleaning out the discharge chute of his 15-20 year old MANUFACT2, 2-stage walk-behind snow thrower. **He was in a rush and was trying to finish quickly in order to get to other household tasks. The discharge chute became clogged with wet snow; while the engine was running and the blade was spinning, he reached into the chute to clear the blockage.**

970409HEP9018 A 33 year old male suffered an amputation to his right ring finger down to the first knuckle when he was cleaning the ice and wet snow from the discharge chute of a MANUFACT10 2-stage, walk-behind snow thrower. **He stated that he had turned off the machine before he attempted to clean the chute. However, the engine fired once and the blade rotated severing his finger. He believed that the right side handle he was using to hold the machine was broken and prevented proper operation of the clutch mechanism. The machine was purchased in 1992.**

970409HEP9025 A 40 year old male sustained a partial amputation of his right ring and middle fingers. The fingers have healed, although he lost both nails. **His 2-stage MANUFACT6, walk-behind snow thrower has controls at the handlebar - the traction-drive clutch on the left and a gearshift on the right. The impeller/auger has to be manually engaged or disengaged by means of a lever located between the discharge chute and the fuel tank. The operator stated that this was the first time he could ever remember that the discharge chute became clogged. He released the traction-drive clutch, bringing the forward motion to a halt.**

He left the engine running and the blade engaged. He could not see the impeller blade turning because of the clogged snow. He reached into the discharge chute to clear the wet snow and his gloved hand and fingers immediately made contact with the blade. The machine was bought in a used condition about 3 years ago. Based on the design and features, it probably dates back to the early 1970's.

970409HEP9027 A 40 year old male suffered a compound fracture of the index finger and partial amputation of the middle finger of his right hand when he reached into the discharge chute to clear a piece of ice and snow. The MANUFACT2 2-stage, walk-behind snow thrower was purchased in 1981. **There are spring-loaded handgrips on the left and right handlebars. The right one engages the traction control drives and the left engages the impeller/auger. When the grips are released, the machine comes to a halt and the impeller/auger stops. The operator stated that it had been his experience that the discharge chute was less likely to clog while working in wet snow if the impeller was kept spinning. When the chute was clogged, he stopped the machine's forward motion and then reached into the chute with his gloved hand while the engine was still at full throttle and the impeller was spinning. He said he had no idea the impeller blades were so close to the top of the chute.**

971215HEP9003 A 59 year old male suffered lacerations to his left index and middle fingers while trying to clear the discharge chute of his MANUFACT6, 2-stage, walk-behind snow thrower. **He left the engine running, the blades engaged, the gearshift in neutral, and the throttle was fully open while he was attempting to clear the discharge chute. As he cleared the chute he slipped. In an attempt to stabilize himself, he extended his arms. His gloved left hand became entangled in the impeller blade. The machine was bought in 1983 by the original owner and by the operator in 1985.**

980326HEP9003A 34 year old male lost the tip of the middle finger on his right hand when he reached inside the discharge chute of his 8-year-old, MANUFACT2 2-stage, walk-behind snow thrower.

The operator stated that he was tired at this point and wanted to finish the job of cleaning his next door neighbor's driveway. He had already cleared the snow from his own driveway, as well as the walkway in front of his home and two other neighbors' driveways and walkways. When the discharge chute became clogged with snow, he left the engine running and the auger control clutch engaged and placed his gloved hand into the chute to scoop out some of the snow. The impeller blade clipped his middle finger. The operator added that after the incident he spoke to several people who were knowledgeable about snow throwers. They all said that the interior of the discharge chute should be waxed before each use to prevent the accumulation of snow so that a person would not need to clear the snow out.

(2) Engine On with Disengaged Blades (10 Cases)

900123HCN0847 A 41 year old male lost the middle finger of his right hand when he reached into the chute area to unclog the snow of his MANUFACT9 2-stage, walk-behind snow thrower. The operator indicated that he always shoveled snow and he had not used the snow thrower at all for the last 2 years. The machine clogged up on at least 2 occasions prior to the incident. He had used a stick to unclog the snow on those 2 occasions. When the chute clogged again and when he was unable to clear the snow with a stick, he reached into the discharge chute with his right hand. The impeller blade caught his hand. He also indicated that when he let go of the snow thrower, he did not turn the machine off and the impeller blade continued to rotate. It is not known if the deadman switch malfunctioned or the blade recoiled. The snow thrower has a deadman switch on the handle which disengages the auger/impeller blades when not being held down.

900123HCN0848 A 39-year old male lost his middle finger, which was successfully reattached, in the impeller blade of the MANUFACT6 2-stage, walk-behind snow thrower while attempting to unclog snow from the discharge chute. He stated that on the previous 3 occasions, he was able to unclog snow by manually shaking the chute. When it clogged for the 4th time and shaking the machine did not work, he left the engine

running, disengaged the blades, and reached from below into the auger area. His fingers contacted the impeller blade, which amputated his middle finger and fractured his index and ring fingers. The repair shop owner estimated that the machine is at least 15 years old. He also stated that the problem with the old machine is even if the blade was disengaged, the belt has enough torque left in it that once the snow is unclogged, the impeller is able to spin around a few times.

900205HEP1281 A 44 year old male incurred a bruised finger, a lacerated finger, and a broken finger when he put his right hand in the discharge chute of his MANUFACT1 2-stage, walk-behind snow thrower. The snow was very wet and heavy which caused a blockage in the discharge chute. **He had left the engine running and had disengaged the blade with a clutch before he stuck his right hand in to clear the snow from the discharge chute. The impeller blade was still turning and it struck his gloved hand. The machine was purchased in used condition and was estimated to be about 7 years old.**

930324HCC1078 A 57 year old male sustained an amputation to the tips of his index and middle fingers as he attempted to clear the snow from the discharge chute of his employer's MANUFACT6 2-stage, walk-behind snow thrower. **The operator reported that he had a difficult time in starting the machine. As he was using this machine, it became clogged on 2 or 3 occasions, which caused him to insert his hand into the chute to remove the wet snow. In each case the victim disengaged the blades and cleaned out the chute without incident. The machine clogged again and he is pretty sure that he had disengaged the blade before putting his hand inside the chute. This time the blade amputated the tips of both fingers. When tested as part of the insurance company investigation, the disengaging function of the machine did not respond properly and the blade continued to rotate. Again the operator was questioned as to whether or not he disengaged the machine through the use of the disengaging mechanism. The victim is not completely sure, but feels as if he must have pushed the gearshift to disengage the machine.**

930408HCC2150 A 44 year old male sustained open fractures and tendon injuries to his left index and long finger when he put his hand down the discharge chute of a borrowed, 5- year-old MANUFACT4, 2-stage, walk-behind snow thrower. **The machine has two levers on the handle. One is a drive clutch lever, which is controlled by the operator's left hand. On the right side of the handle is the auger clutch lever. This lever is activated with the right hand. When the snow clogged the discharge chute, the operator released the drive and auger clutch levers and walked around to the chute. He kicked the chute in attempts to clear it and then stuck his left, gloved hand in the chute to clear out the snow. The rotating impeller blade struck his gloved hand. When informally tested by an attorney it took between 7 and 8 seconds for the blades to stop rotating. According to the manual, when both levers are squeezed, the drive clutch lever locks the auger clutch lever down. Releasing the drive clutch lever then unlocks and releases the auger clutch lever. The auger clutch lever remains locked down so long as one hand continues to squeeze the drive clutch lever.**

970409HEP9003 A 46 year old male had his right middle and index fingers partially amputated when he reached into the discharge chute of an MANUFACT2 2-stage, walk-behind snow thrower. The operator had used this machine numerous times since he bought it in 1988. **He had experienced gear-switching problems, drive belt problems, and discharge chute clogging problems since the unit was purchased (new). However, he was not injured while using this machine until now. He stated that after the machine stopped expelling the snow, he left the engine running and placed the gearshift in neutral position and removed his left hand from the wheel drive clutch lever. He then removed his right hand from the auger clutch lever and walked around the left side of the machine and used his right hand to remove the snow. His finger contacted the rotating impeller blade. The contact was severe enough to slice through the heavy winter glove he was wearing.**

970409HEP9006 A 40 year old male suffered fractures to the index and middle fingers of his left hand as he was clearing the snow out of his

MANUFACT8 2-stage, walk-behind snow thrower which he bought in 1988. **According to the operator, the deadman was not functioning properly. However, with the engine running, the gearshift in neutral, and the traction drive and auger drive disengaged, he attempted to clear the discharge chute. As he cleared the chute the rotating impeller blade contacted his fingers.**

970409HEP9021 A 35 year old male suffered contusions to his right index and ring fingers and a partial amputation of his right middle finger while trying to clear snow from a discharge chute of his MANUFACT2 2-stage, walk-behind snow thrower. **The machine had been purchased new in 1992 and has a deadman control on the handle. One lever stops the wheels from moving and a second lever stops the auger/impeller blades. He let go of both handles but left the engine running with the throttle fully open. As he attempted to unclog the chute with his gloved hand, the impeller blade pulled his glove in as it finished its final rotation. The operator lost the tip of his middle finger just above the first joint. His ring and index fingers were also crushed but not broken.**

970409HEP9023 A 59 year old man incurred amputations to his finger tips when he put his hand down into the discharge chute of his MANUFACT2 2-stage, walk-behind snow thrower to clear it of clogged snow. **He bought this machine new in 1985. It is a belt drive model with no special accessories. He used the machine each winter from 1985 to 1996. He did change the impeller attachment drive belt himself in the fall of 1996. He had used the machine on one occasion since replacing the belt and it had performed satisfactorily. The operator stated that on the day of the accident, he had been clearing the wet and slushy snow for at least 2 hours when the discharge chute became clogged. He released the wheel drive clutch lever and the attachment clutch lever (controls auger/impeller blades) at the handlebars. He did not turn off the engine. He then walked around to the front of the machine and reached down into the discharge chute with his gloved hand in an attempt to clear the snow. He had done this same thing for 11 years, 2-3 times a year without incident. The impeller blade**

apparently recoiled as it was freed, spinning fast enough to amputate his finger tips on his right hand.

970409HEP9026 A 59 year old male amputated one finger and broke two others when he attempted to clear wet snow from a discharge chute of his snow thrower attachment to a MANUFACT3 lawn and garden tractor. The operator stated that after using the machine for approximately one hour the snow became clogged in the discharge chute. **He placed the tractor in neutral and the throttle was set at a little faster than idle. He left the engine running and flipped the front PTO clutch control switch to disengage the snow thrower. He then got off the tractor to the left and reached into the chute to unclog the snow. The clutch did not disengage the blade and his gloved hand contacted the auger blade. He also stated that he was in too much of a hurry on the date of this accident and should have turned off the tractor engine completely.**

(3) <u>Engine On and Unknown Blade Status (1 Case)</u>

971202HEP9002 A 56 year old female suffered a near amputation of 2 fingers on her right hand. She reached into a discharge chute to clear the wet, heavy snow. Her hand contacted the impeller blade. She spent 5 nights in the hospital.

(4) <u>Engine Off (7 Cases)</u>

900131HEP1281 A 54 year old male incurred a nearly severed, fractured right middle finger through a glove from the still rotating impeller blade of a 2-stage, walk-behind snow thrower. **The discharge chute clogged and he turned the engine off. He thought the impeller blade had stopped and immediately put his gloved, right hand into the chute to unclog it. The machine was brand new at the time of purchase in 1975. It has a lever on the right side of the unit near the motor. The lever is pulled up to start the blades and to stop the blades the same lever is pushed down.**

900215HEP3041 A 15 year old male incurred a broken and lacerated right ring finger and a laceration to a right middle finger when he tried to clear a

discharge chute of his 2-stage, walk-behind snow thrower. **He stated that he had turned the engine off. He first tried to clean the chute with a broomstick. He then used a screwdriver to unclog the snow, as the snow became loose the blade rotated and his gloved right hand was caught and stuck. This machine has a deadman control on the handle. It was purchased in a used condition and estimated to be about 4 years old.**

900320HCN1189 A 49 year old male suffered multiple lacerations to three fingers as he reached into the discharge chute of a MANUFACT7 single-stage snow thrower. The operator, who is a maintenance employee, used the snow thrower again after lunch on that day. **After an hour of using the machine, he turned off the engine. Unknown to the operator, the belt came off and the blade was still turning as he stuck his right hand in the discharge chute to clean out the snow. The snow thrower is a self-propelled type, powered by rear wheels. He had used the machine approximately 4 times in 1990 and approximately 6 times in 1989. Due to lack of snowfall several prior winters, it was not used.**

940608HCC1792 A 36 year old male had a tip of his right ring finger severed after placing his hand in the discharge chute of a 1984 MANUFACT11, 2-stage, walk-behind snow thrower. The operator is a maintenance supervisor and considered himself fully knowledgeable concerning how to use the snow thrower. **He stated that he had been removing the snow for about 5 hours when the accident happened. During that 5 hours, he had unclogged the discharge chute about 3 times. The chute again became clogged with slush. He removed his hands from the traction drive control and the auger/impeller control levers. He then turned the ignition switch to "off" position. He said that he did not release the spark plug wire. During this on-site investigation, the snow thrower was tested to determine the length of time it took for the auger and impeller blades to come to a complete stop after the deadman control lever was released. The test procedure was conducted three times, each time the blades stopped in three seconds.**

970409HEP9013 A 29 year old male suffered a fracture and lacerations to his left ring finger. He was clearing snow build up from the discharge chute of a MANUFACT3 2-stage, walk-behind snow thrower that he was using at work. **After 45 minutes of clearing the snow from the grounds of the facility, the chute became clogged with wet, heavy snow. He released the deadman control and the traction drive control. He also turned the engine off before reaching his gloved hand into the chute several times to clear the blockage. On the third attempt his ring finger made contact with the spinning impeller blade. The operator stated that he is not certain if the impeller blade continued to spin after he had turned the engine off or if the blade simply spun a final time as a result of built-up tension once the blockage was removed. He also believes that the deadman control malfunctioned, possibly due to a water build up near the controls.**

970409HEP9022 A 26 year old male victim suffered lacerations and fractures to the index and fourth finger of his left hand, when he attempted to clear the discharge chute of his MANUFACT8 2-stage, walk-behind snow thrower which he bought in 1994. **The operator stated that before he attempted to clear the snow and ice from the chute, he had turned the engine off, and disengaged the traction drive and the auger control. Once he cleared the snow and ice the blade "kicked back", as if the blade were under pressure.**

970505HEP9001 A 40 year old male suffered multiple fractures to three fingers on his right hand and partial severing at the tip of one of the fractured fingers. He was clearing the discharge chute of his 20 year old, MANUFACT7 2-stage, walk-behind snow thrower. **After using the machine for about 30 minutes, the chute became clogged with wet, heavy snow. He turned the engine off and immediately began clearing the discharge chute with his hand. He stated that he was not paying attention and that he did not wait for the impeller blade to come to a complete stop before reaching into the chute.**