



UNITED STATES  
CONSUMER PRODUCT SAFETY COMMISSION  
4330 EAST WEST HIGHWAY  
BETHESDA, MD 20814

This document has been electronically  
approved and signed.

**DATE:** August 28, 2019

**BALLOT VOTE SHEET**

**TO:** The Commission  
Alberta E. Mills, Secretary

**THROUGH:** Mary T. Boyle, Executive Director  
Patricia M. Hanz, General Counsel

**FROM:** Patricia M. Pollitzer, Assistant General Counsel  
Hyun S. Kim, Attorney, OGC

**SUBJECT:** Table Saw Update 2019

BALLOT VOTE DUE: Thursday, September 5, 2019

In 2017, CPSC staff initiated a study to obtain emergency department-treated, table saw blade-contact injury estimates for saw type, incident, and injury characteristics of table saws, including information on table saw use with modular blade guards required by the voluntary standard. In the attached briefing memorandum, CPSC staff recommends conducting concurrently, a follow-up NEISS special study and table saw exposure survey, to collect additional information on whether the voluntary standard effectively reduces blade-contact injuries on table saws.

Please indicate your vote on the following options:

I. Adopt CPSC staff recommendation.

\_\_\_\_\_  
(Signature)

\_\_\_\_\_  
(Date)

CPSC Hotline: 1-800-638-CPSC(2772) ★ CPSC's Web Site: <http://www.cpsc.gov>

II. Take other action specified below.

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\_\_\_\_\_  
(Signature)

\_\_\_\_\_  
(Date)

Attachment: Briefing Package, Table Saw Update, September 2019.



# BRIEFING PACKAGE

## TABLE SAW UPDATE

September 2019

For Further Information Contact:

Caroleene Paul  
Project Manager  
Directorate for Engineering Sciences  
301-987-2225

## EXECUTIVE SUMMARY

**Background:** A table saw is a power tool consisting of a circular saw blade protruding through the surface of a table and driven by an electric motor. Historically, table saws sold in the United States employed a traditional blade guard (TBG) system that combines a hood-type blade guard, splitter, and anti-kickback device as a single unit that is bolted to the saw's carriage assembly.<sup>1</sup> In 2007, a new modular blade guard (MBG) system design, composed of a removable modular guard and anti-kickback device attached to a riving knife, was introduced to the U.S. market.<sup>2</sup> In the same year, the voluntary standard for table saws, UL 987 *Stationary and Fixed Electric Tools*, was revised to require the MBG system on all table saws by January 2010.

In 2004, a novel safety device was introduced to the U.S. table saw market with active injury mitigation (AIM) capabilities that mitigate injuries once a hand/finger makes contact with a rotating saw blade. SawStop, LLC (SawStop) developed this AIM technology based on electrical detection of the human body, and a mechanical brake reaction that stops the blade and moves the saw blade assembly beneath the table top quickly enough to avoid injury. SawStop owned patents on AIM technology until July 2017, at which time Tooltechnic Systems (TTS) acquired SawStop and is now the legal owner of the patents.

In 2017, the Commission published a notice of proposed rulemaking (NPR) proposing to establish a performance standard that requires table saws to mitigate injuries once a hand/finger makes contact with a rotating saw blade. The Commission determined preliminarily that there may be an unreasonable risk of blade-contact injuries associated with table saws and that the voluntary standard requirement for a MBG does not adequately address blade-contact injuries. CPSC staff examined table saw injury data reported through the National Electronic Injury Surveillance System (NEISS) and performed trend analyses for blade-contact injuries from 2004 to 2015 (this includes the 2004 to 2009 timespan before the voluntary standard implemented the requirement for MBGs on table saws, and the 2010 to 2015 timespan after the MBG requirements were implemented). The analysis found no discernible change in the number of injuries or types of injuries related to table saw blade contact. This finding suggested the voluntary standard requirement for MBGs was not effective in reducing blade-contact injuries on table saws. CPSC staff's preliminary regulatory analysis (PRA) suggested that the benefits of the proposed rule would likely be substantially greater than the costs. Staff was unable to attribute the benefits and costs for each of the three major table saw categories because the distribution of injuries by table saw type was not known.<sup>3</sup> However, a breakeven analysis suggested that the proposed rule would likely result in substantial net benefits for each of the three saw types.

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<sup>1</sup> The splitter generally serves as the main support and connection point for the blade guard and the anti-kickback device. Thus, removing the splitter for any reason, necessarily removes the rest of the blade guard system and the protections those devices might offer.

<sup>2</sup> Riving knives are curved metal plates that are similar to, and perform the same function as, splitters, but are often located closer to the blade, rise no higher than the top of the blade, and attach to the arbor assembly so that they are raised and lowered with the blade. Thus, when necessary, the blade guard can be removed without removing the protection afforded by the riving knife.

<sup>3</sup> Table saws typically are segregated into three product types: bench, contractor, and cabinet. Generally, bench saws are the smallest most portable type of table saw, contractor saws are larger and capable of heavier-duty work than bench saws, and cabinet saws are the largest and heaviest type of table saw and are not designed for mobility.

In January 2017, staff initiated a study of emergency department-treated table saw blade contact injuries to obtain information regarding the type of table saws involved and to generate national estimates of injuries by saw type.

**Status:** The 2017 Study successfully collected information on blade contact injuries by saw type and information on the types and usage of blade guards. However, the 2017 Study analysis indicates that, in 2017, the risk of injury on table saws manufactured with TBG was about seven times higher than the risk of injury on a table saw manufactured with a MBG. If correct, a lower risk of injury on a table saw that meets the voluntary standard would imply that the voluntary standard is effective in reducing risk of blade-contact injuries on table saws. This result seems to be in conflict with staff's assessment in the NPR that the voluntary standard is ineffective, and it would alter staff's PRA by substantially reducing the net benefits for the proposed rule stated in the NPR.

To confirm staff's assessment of the voluntary standard in the NPR, staff updated the NEISS trend analysis for this briefing package to include the years 2016 to 2018. If the relative risk of injury was actually seven times lower on MBG table saws compared to TBG table saws, staff would expect the annual estimates of table saw injuries to show a significant decline; however, the updated NEISS trend analysis continues to show no change or reduction in injuries.

**Path Forward and Recommendation:** The data is conflicting, and staff is unable to explain why the 2017 Study results do not align with the updated NEISS trend analysis. To better understand this apparent conflict, CPSC staff recommends that staff conduct a follow-up NEISS special study and table saw exposure survey, concurrently, to collect information that could help explain the contradictory information in the 2017 Study and updated NEISS trend analysis.<sup>4</sup> In addition, the work could provide information on whether the voluntary standard effectively reduces blade-contact injuries on table saws, which would be needed to advance any rulemaking.

Conducting the follow-up NEISS special study of table saw injuries and exposure survey of table saw users would be the most direct method to obtain information on table saw population and usage. This direct and detailed evaluation of table saws could confirm the estimates (of table saws in use) used in the 2017 Study, or could show if characteristics of table saw users, such as age or exposure, explain the apparent conflict between the results of the NEISS trend analysis and the 2017 Study. Such analysis would also allow staff to identify those factors that increase the risk that a user will be injured, including whether the MBG required by the voluntary standard reduces the risk of blade-contact injury.

If staff can explain the current discrepancy between the 2017 Study and the NEISS data, and if staff has direct information on MBG use and risk of injury that could be used to assess the effectiveness of the voluntary standard, staff would be able to produce a final regulatory analysis that has more definitive conclusions than is possible with the current conflicting results.

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<sup>4</sup> Alternatively, the Commission could direct staff to conduct only an exposure survey or only a follow-up NEISS special study, but not both. This approach would have weaknesses, and may not reconcile the issues identified. However, doing only the exposure study or the follow-up NEISS study may provide some additional information on the relative risk of injury that occurs on TBG versus MBG equipped table saws.

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## Memorandum

August 28, 2019

TO: The Commission  
Alberta E. Mills, Secretary

THROUGH: Patricia M. Hanz, General Counsel  
Mary T. Boyle, Executive Director

FROM: Duane E. Boniface, Acting Assistant Executive Director  
Office of Hazard Identification and Reduction

Caroleene Paul, Project Manager  
Directorate for Engineering Sciences

SUBJECT: Table Saws Update

### I. INTRODUCTION

Staff of the U.S. Consumer Product Safety Commission (CPSC) prepared this briefing package for the Commission to review information related to the table saw rulemaking project and to determine future action. This package will provide information on:

- Table saw product
- Status of table saw rulemaking activity
- Status of voluntary standards for table saws
- Status of patents
- NEISS trend analysis of table saw blade-contact injuries
- Differences between the NPR and 2017 Study
- Discussion of path forward.

### II. BACKGROUND

#### A. PRODUCT

##### 1. Types of Table Saws

###### Bench Saws

Because bench saws are intended to be transportable, they tend to be small, lightweight, and relatively inexpensive (see Figure 1). In recent years, bench saw designs evolved to include saws with larger and heavier-duty table surfaces, with some attached to a folding stand with wheels to

maintain mobility (see Figure 2). These larger, portable saws on wheeled stands are called jobsite saws because they are capable of heavier-duty work, but they are still portable enough to move to a work site



**Figure 1. Bench saw (or benchtop saw).**



**Figure 2. Jobsite saw.**

### Contractor Saws

Contractor saws have larger table tops and more powerful motors than bench saws; therefore, they are heavier and less portable (see Figure 3). In recent years, contractor saw designs evolved to include saws with an enclosed base that imitate the look of a heavier-duty cabinet saw while still retaining the motor and weight of the contractor class saw (see Figure 4).



**Figure 3. Contractor saw.**



**Figure 4. Hybrid saw.**

### Cabinet Saws

Cabinet saws are among the heaviest duty and weight table saws because the higher-powered motor is enclosed in a solid base (see Figure 5). These saws are typically the highest grade saw found in the home woodworking shop and are not intended to be portable. Staff also is aware of a specialized type of cabinet-level table saw that is equipped with a sliding table on the side of the saw to move the table surface, as a whole, into the blade of the saw (see Figure 6). The weight and space required for this sliding table saw are substantial, as is the price. Sliding table saws and many other cabinet saws require specialized power outlets to accommodate their higher power rating, and therefore, are less likely to be used by consumers.



**Figure 5. Cabinet saw.**



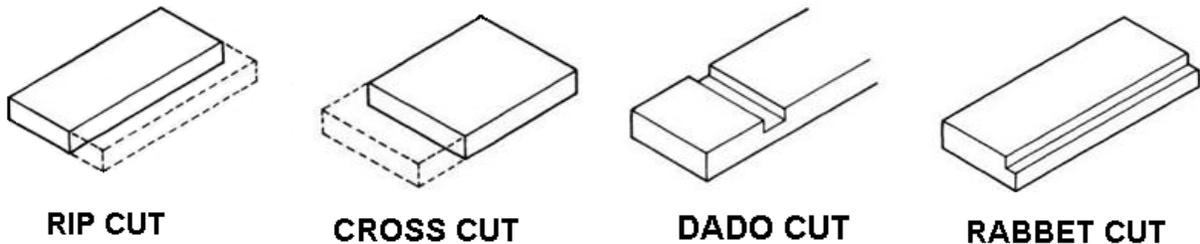
**Figure 6. Sliding saw.**

## 2. Table Saw Operations

To make a cut, the operator places the workpiece on the table and, using a rip fence or miter gauge as guides (see Figure 7), pushes the workpiece into the blade.

The most common cuts made on a table saw are:

- Rip cut - reduces the width of a workpiece by sawing along its length
- Cross cut - shortens the length of a workpiece by sawing across its width
- Dado cut - produces a channel or groove in workpiece
- Rabbet cut – produces a channel or groove at the edge or end of a workpiece.



## 3. Safety Devices

Historically, safety devices on table saws were designed to reduce contact between the saw blade and the operator and to reduce kickback, a phenomenon in which the saw blade imparts its kinetic energy to the workpiece and ejects the workpiece back towards the operator. In 2004, safety technology was introduced to the table saw market with the capability to mitigate injuries once a human body part made contact with a rotating saw blade.

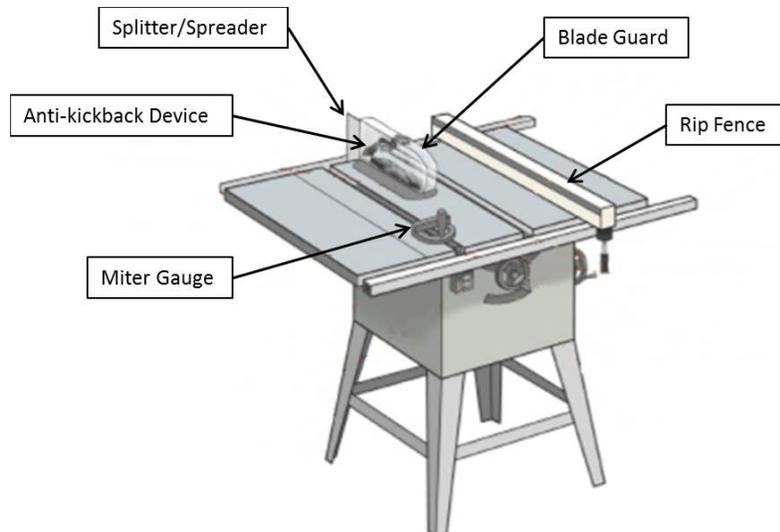
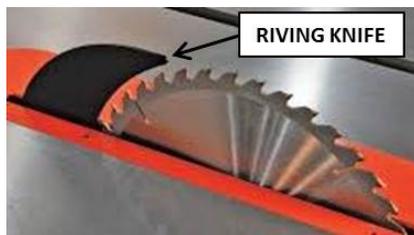


Figure 7. Typical table saw components.

## Kickback-Prevention Devices

Kickback-prevention devices are located behind the blade and reduce kickback of the workpiece by preventing the workpiece from closing up on itself after it passes the blade, which can cause the workpiece to be thrown upwards and back toward the operator, or by preventing the workpiece from moving towards the operator. Kickback-prevention devices include:

- Splitter - A flat piece of metal, which rides within the cut of a workpiece, vertically aligned directly behind the saw blade. The splitter does not move up and down with the arbor and must be removed to make a dado or rabbet cut (see Figure 7).
- Riving knife - A curved metal plate that performs the same function as a splitter, but is often located closer to the blade, rises no higher than the top of the blade, and attaches to the arbor assembly so that it raises and lowers with the blade (see Figure 8). A riving knife does not need to be removed to make a dado or rabbet cut.
- Anti-kickback device - A pair of spring-loaded pieces of metal with barbed teeth, mounted on splitter or riving knife, that allow passage of the workpiece in one direction, but dig into it if it begins to move back toward the operator (see Figure 9 ).



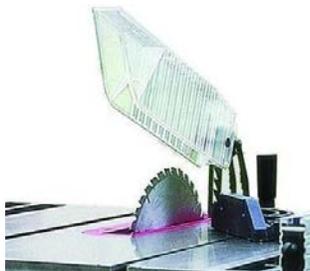
**Figure 8. Riving knife.**



**Figure 9. Anti-kickback device.**

## Blade Guards

Blade guards surround the exposed blade and function as a physical barrier between the blade and the operator. Until 2007, table saws sold in the United States employed a traditional blade guard (TBG) system that combines a hood-type blade guard, splitter, and anti-kickback device as a single unit that is bolted to the saw's carriage assembly (see Figure 10). The splitter generally serves as the connection point for the blade guard and the anti-kickback device. Thus, removing the splitter for any reason, necessarily removes the rest of the blade guard system and the protections those devices might offer.



**Figure 10. Traditional blade guard (TBG).**



**Figure 11. Modular blade guard (MBG).**

In 2007, a new blade guard system entered the U.S. market. The modular blade guard (MBG) system consists of a removable modular guard (fixed top barrier and independent side barriers) and removable anti-kickback device attached to a riving knife (see Figure 11). The MBG system allows removal of the blade guard (for instance, to make a dado cut) without removing the protection afforded by the riving knife.

The voluntary standard for table saws, UL 987 *Stationary and Fixed Electric Tools*, was revised in 2007 to require the MBG system on all table saws by January 2010. In general, table saws manufactured before 2009 were equipped with the TBG system, but table saw manufacturers started to meet the voluntary standard MBG requirements and, by January 2010, virtually all table saws sold in the United States were manufactured with the MBG.

#### Active Injury Mitigation (AIM) Technology

At a basic level, any AIM system must perform two functions: (1) *detect* contact between the rotating table saw blade and a human body part, and (2) *react* to mitigate injury. The AIM system is not intended as a replacement for blade guards, but rather to mitigate the consequences of blade contact when it occurs despite the use of other safety systems. Current AIM technologies remove the spinning blade from the point of contact quickly enough, within milliseconds, to reduce significantly the severity of injury.

SawStop, LLC (SawStop) developed and patented AIM technology based on electrical detection of the human body, and a mechanical brake reaction that stops the blade from spinning and moves the saw blade assembly beneath the table top surface.<sup>1</sup> In 2004, SawStop released an industrial table saw featuring AIM technology, and has since introduced to the market a professional cabinet saw, a contractor saw, and a jobsite saw with the same AIM technology.

In 2016, Robert Bosch, LLC (Bosch) released a jobsite table saw featuring AIM technology based on electrical detection of the human body and a combustion-based mechanical reaction that forces the saw blade assembly beneath the table top surface. SawStop filed a patent infringement complaint against Bosch, and in January 2017, the U.S. International Trade Commission (ITC) prohibited Bosch from selling the jobsite saw.

## **4. Table Saw Market**

### Suppliers

Staff identified 23 firms that supply table saws to the U.S. market (see Tab B).<sup>2</sup> Three firms listed in the NPR no longer supply the U.S. market with table saws. Staff identified an additional four firms as suppliers of table saws through acquisitions of known brands from other firms.

Retail prices for table saws can vary widely among saw types, and even among saws of the same type. For example, bench saws range in price from \$129 to \$975. Cabinet and sliding saws retail

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<sup>1</sup> SawStop also patented other versions of this general detection and reaction technology.

<sup>2</sup> IEC (2016a), IEC (2016b), with CPSC staff updates.

for significantly higher prices than bench saws, as the lowest price cabinet saw is \$1,399 and the most expensive is priced over \$25,000.

Bench saws account for a majority of annual sales of table saws, with a five year (2013-2017) average equating to approximately 500,000 or 79.2 percent of total sales. Average sales over the same time period for contractor and cabinet/sliding saws equate to 77,400 (12.3 percent) and 54,200 (8.6 percent) respectively. These sales translate to an estimate of average number of table saws in use of approximately 6.9 million. Bench saws account for a small majority of total table saws in use at 58.4 percent with cabinet at 21.1 percent and contractor at 20.5 percent.

## **B. STATUS OF TABLE SAW RULEMAKING ACTIVITY**

### Petition and Advance Notice of Proposed Rulemaking (ANPR)

On April 15, 2003, Messrs. Gass, Fanning, and Fulmer, et al., members of SawStop LLC, petitioned the Commission to require performance standards for a system to reduce or prevent injuries from contact with the blade of a table saw.<sup>3</sup> On July 11, 2006, the Commission voted to grant Petition CP 03-2 and directed staff to draft an advance notice of proposed rulemaking (ANPR). On July 15, 2006, the Commission lost its quorum and was unable to move forward with publication of an ANPR. However, CPSC staff continued to evaluate table saws and initiated a special study, from January 2007 to December 2008, to gather more accurate estimates on table saw injuries and a better understanding of hazard patterns related to table saw injuries. On October 11, 2011, the Commission published an ANPR to consider whether a new performance safety standard is needed to address an unreasonable risk of injury associated with table saws.<sup>4</sup> The Commission received approximately 1,600 comments in response to the ANPR.

### 2014-2015 NEISS Special Study

CPSC staff implemented a 2014-2015 special study, conducted by contractors, to collect computer-aided telephone interview (CATI) responses from individuals treated for table saw injuries in emergency departments of National Electronic Injury Surveillance System (NEISS) member hospitals between July 2014 and December 2015.<sup>5</sup> However, after contractors completed the CATI interviews and CPSC staff compiled the data, CPSC subject matter experts and statisticians discovered unexpected patterns in participant responses. Further analysis revealed that the interviewer affected the participants' responses, a phenomenon known as "interviewer effect," which indicated that the responses might not be reliable or reproducible.<sup>6</sup> CPSC senior statisticians recommended that the CATI interviewer-collected participant

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<sup>3</sup> Petition CP 03-2 is available on CPSC's website at:

<http://www.cpsc.gov/library/foia/foia03/petition/Bladesawpt1.pdf>.

<sup>4</sup> 76 FR 62678 Table Saw Blade Contact Injuries; Advance Notice of Proposed Rulemaking

<sup>5</sup> The National Electronic Injury Surveillance System (NEISS) is a national stratified probability sample of emergency departments in the United States and its territories that provides the data to generate national estimates of emergency department-treated injuries related to consumer products. To facilitate injury estimates associated with a product or product group, each injury has a product code that identifies the type of product involved. Information that is recorded for each injury includes sex, age, diagnosis, disposition, and body part. Additional information about the NEISS can be found online at: <http://www.cpsc.gov/en/Research--Statistics/NEISS-Injury-Data>.

<sup>6</sup> Stralka, K. (2016). 2014-2015 Table Saw Special Study Cautionary Statement.

responses to the 2014-2015 NEISS special study results not be used for regulatory development. Instead, staff used only the data abstracted from NEISS hospital records for injuries related to product code 0841 (table or bench saws).

### Notice of Proposed Rulemaking (NPR)

In 2017, staff prepared a briefing package with a recommendation to publish a notice of proposed rulemaking (NPR). The Commission voted to publish an NPR, which included a proposed performance standard that would require table saws, when powered on, to limit the depth of cut to 3.5 millimeters when a test probe, acting as surrogate for a human body/finger, contacts the spinning blade at a radial approach rate of 1 meter per second (m/s).

The Commission also directed staff to:

- 1) Commence a study of table saw blade-contact injuries reported in NEISS between January 1, 2016, and December 31, 2016 (2016 Study); and
- 2) Complete a NEISS 2017 study that staff had begun to provide information on table saw injuries by saw type, and publish the study for comment in the Federal Register (2017 Study).

The Commission also directed staff to include in the NPR a discussion of the American National Standards Institute's (ANSI) patent policy and to seek comment on reasonable and non-discriminatory (RAND) commitments. The RAND commitments are more commonly referred to as FRAND commitments (fair, reasonable and non-discriminatory). On May 12, 2017, the Commission published the NPR in the Federal Register. 82 FR 22190. On August 9, 2017, the Commission held a public meeting to hear oral presentations concerning the NPR.

The comments received to the NPR generally repeat the comments to the ANPR which were addressed in the NPR. Any future final rule, if issued, would respond to the NPR comments. The issue of FRAND was newly raised by the Commission in the NPR. We discuss the key patent issues these comments raised to provide context regarding the current status of the patent issues involving SawStop.

### 2016 Study

On October 27, 2017, staff provided the Commission with the 2016 study, titled "2016 NEISS Table Saw Type Study Final Report." Due to insufficient information on table saw type (62 percent of the completed investigations were in the unknown saw type category), staff concluded that the 2016 study is not statistically valid for extrapolating estimates of table saw type for emergency department-treated, blade-contact injuries at the national level. Moreover, with such a high number of unknown saw type cases, staff concluded that the results could not be used to draw any conclusions about the distribution of blade-contact injuries for the table saw types.

## 2017 Study

On November 14, 2018, staff provided the Commission with the 2017 study, titled “Table Saw Blade-Contact Injuries Special Study Report, 2017.” We discuss the 2017 study in detail below. On December 4, 2018, the Commission published a notice of availability for the report in the Federal Register, and requested comments on the report. The comments to the 2017 study are reviewed below.

### **C. STATUS OF THE VOLUNTARY STANDARDS**

Underwriters Laboratories Inc. (UL) has published several editions of UL 987 *Stationary and Fixed Electric Tools*.

- The first edition, published in 1971, included requirements for table saws that specified the following safety devices: a single-piece blade guard, a spreader, and anti-kickback devices. As stated earlier, the single-piece design guard attached to a spreader is referred to as a traditional blade guard (TBG).
- In 2005, UL published the sixth edition of UL 987, which added requirements for a riving knife to the general requirements for table saws (with January 2014 effective date).<sup>7</sup>
- In 2007, UL published the seventh edition of UL 987, which expanded the table saw guarding requirements to include a new modular blade guard (MBD) design (with January 2010 effective date).
- In 2011, UL published the eighth edition of UL 987, which clarified requirements for table saws, and the eighth edition remains the current edition of UL 987.

In February 2016, UL balloted a proposal to adopt the first edition of International Electrotechnical Commission (IEC) 62841-3-1, *Standard For Electric Motor-Operated Hand-Held Tools, Transportable Tools and Lawn and Garden Machinery – Safety – Part 3-1: Particular Requirements for Transportable Table Saws*, as the first edition of UL 62841-3-1. The blade guard requirements in IEC 62841-3-1 are essentially equivalent to the MBG requirements in UL 987. This effort was part of UL’s international harmonization goal to adopt international standards, such as one published by the IEC (International Electrotechnical Commission) or ISO (International Organization for Standardization), into one UL standard, based on the IEC/ISO standard, with appropriate national differences.<sup>8</sup> The proposal passed, and in August 2016, UL published the first edition of UL 62841-3-1 *Electric Motor-Operated Hand-Held Tools, Transportable Tools and Lawn and Garden Machinery Part 3-1: Particular Requirements for Transportable Table Saws*. UL 62841-3-1 is recognized as an American National Standards Institute (ANSI) standard.

The effective date for UL 62841-3-1 is August 29, 2019. Until that date, UL 987 remains in effect, and table saw manufacturers can list their products to UL 987 or UL 62841-3-1.

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<sup>7</sup> Although the effective date for riving knives in the sixth edition of UL 987 was January 2014, riving knives essentially became effective with the effective date for modular blade guards in the seventh edition of UL 987, which expanded the table saw guarding requirements to include a new modular blade, effective January 2010.

<sup>8</sup> UL’s harmonization efforts are described at: <http://ulstandards.ul.com/about/harmonizing-standards/>.

## D. STATUS OF PATENTS

As discussed in the NPR briefing package, prior to the acquisition of SawStop by Tooltechnic Systems (TTS), SawStop held approximately 100 patents related to AIM technology. As the sole patent holder, SawStop held a monopoly over AIM technology if it involved (1) electrical detection of the human body, and (2) a mechanical brake reaction that stops the blade from spinning and moves the saw blade assembly beneath the table top surface electric system. The Sawstop patents are relevant because of the potential limiting effect the patents would have on the ability of other manufacturers to satisfy the Commission's proposed performance requirement limiting the depth of cut of a test probe to 3.5 mm. The patents also affect the costs of complying with the proposed standard. The performance requirement did not specify the test method to meet the performance requirement so that other detection methods (such optical, thermal, electromagnetic, and ultrasonic) could also be used. However, with the exception of Bosch, manufacturers appeared unlikely to develop their own AIM technology given the complex and extensive reach of the SawStop patents. As the NPR explained, if the proposed rule is finalized, manufacturers likely would have to (1) license SawStop AIM technology for use in their saws; or (2) leave the table saw market.

The NPR also explained, that if manufacturers have to license SawStop technology, the royalty fee for licensing the AIM technology from SawStop is uncertain. The manufacturers did not agree with SawStop's royalty payment structure (8 percent of a saw's wholesale price if all table saws are required to use SawStop's AIM technology); and attempts by several companies to license the technology were unsuccessful. Staff estimated that approximately \$30 million to \$35 million annual royalty fees for the AIM technology could accrue to patent holders. In addition to the royalty payments, AIM technology would necessitate a complete redesign of all saws that did not currently incorporate the AIM technology. Staff estimated that the cost to redesign and retool existing table saws would range from \$2 million to \$10 million per company.

Since the NPR was issued, there have been several new developments. However, as discussed below, these developments do not significantly alter staff's analysis of the patent issue and its impact on table saw manufacturers.

### TTS Acquisition of SawStop

In July 2017, SawStop, LLC was acquired by Tooltechnic Systems (TTS). Due to this acquisition, TTS is now the legal owner of all SawStop patents concerning flesh sensing technology. TTS has stated that it is open to the possibility of licensing the AIM technology should the Commission issue a mandatory rule requiring AIM technology on all table saws sold in the U.S.<sup>9</sup> However, in a subsequent communication with Fabian Klopfer, CEO of TTS, on June 1, 2019, TTS indicated that "given the breadth of intellectual property that has been developed by SawStop, it is no longer a simple matter to say what such a license would or should include and what structure it would be." TTS is currently in the process of incorporating AIM

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<sup>9</sup> Telephone conversation with TTS USA Chief Executive Officer Fabian Klopfer on 4/18/2019.

technology into a Festool-branded table saw, but there is no indication that this Festool-branded AIM table saw will be made available for sale in the United States.<sup>10,11</sup>

### Bosch Licensing of SawStop Patents

On July 16, 2015, SawStop filed a complaint against BOSCH for patent infringement before the U.S. International Trade Commission (ITC). On January 27, 2017, the ITC issued an order against Bosch to prohibit Bosch from importing and selling the Bosch REAXX™ saws based on a determination that Bosch had infringed on two SawStop patents ('927 patent and '279 patent). On August 8, 2018, SawStop and Bosch entered into an agreement by which SawStop agreed to license Bosch the disputed patents. On February 26, 2019, the ITC stated that its remedial orders permit the licensed activity. Details related to licensing compensation are not public, and the CEO of TTS USA has stated in communications with CPSC staff that currently no details on business cases with partners can be shared due to confidentiality agreements.

### Fair, Reasonable and Non-Discriminatory (FRAND) Licensing

In the NPR, the Commission specifically requested comments on FRAND commitments. The Commission sought information on how the American National Standards Institute (ANSI) patent policy would apply to situations in which a proposed voluntary standard may require the use of an essential patent claim. CPSC received comments regarding FRAND commitments from ANSI and Axinn, Veltrop & Harkrider, LLP (Axinn).

The ANSI patent policy generally requires that when an ANSI-Accredited Standard Developing Organization (ASD) receives notice that an American National Standard (ANS) may require the use of an essential patent claim, the ASD must obtain an assurance from the patent holder that: (1) such party does not hold any essential patent claim(s); or (2) that a license to such patents will be made available to applicants desiring to use the license for the purpose of implementing the standard under reasonable terms and conditions that are demonstrably free of any unfair discrimination, with or without compensation. ANSI emphasizes, however, that ANS is a voluntary consensus standard and does not apply to “any voluntary standard for table saws” unless such voluntary standard has been developed by an ASD and such standard has been voluntarily submitted for approval as an ANS.

UL is accredited by ANSI, and is one of six organizations that is granted Audited Designator status. An Audited Designator is an ANSI ASD who has demonstrated a “consistent record of successful voluntary standards development.” The most recent designation of UL 987, Standard for Stationary and Fixed Electric Tools as an ANSI standard occurred on October 19, 2011. (ANSI/UL 987). UL also has a patent policy that is virtually the same as the ANSI patent policy. UL has attempted, but failed to develop a voluntary standard that requires AIM technology on table saws. In February 2015, UL balloted a proposal to add AIM requirements for table saws to the *Standard for Stationary and Fixed Electric Tools*, UL 987. In April 2015, the ballot failed to reach consensus; the ballot received 14 votes against (versus 7 votes for) the proposal. In February 2016, UL balloted another proposal to add AIM system requirements for table saws as

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<sup>10</sup> <https://www.youtube.com/watch?v=zZ0IIRABOjU> Accessed on 5/1/2019

<sup>11</sup> Festool is a subsidiary of TTS.

part of the adoption of IEC or as part of ANSI/UL 987 (since UL 987 will be merged with IEC 62841-3-1). However, the proposal to add an AIM requirement did not reach consensus; the ballot received 12 votes against (versus 5 votes in favor of) the proposal. The ballots failed, in part, because the table saw industry objected to making AIM requirements part of the UL standard, and because they believed that the proposed requirements were not sufficiently developed.

Axinn argues that the CPSC should not finalize a mandatory rule without assurance that standard-essential patents using AIM technology will be licensed on FRAND terms. According to Axinn, the CPSC, by rule, could incorporate by reference, an ANSI standard that includes FRAND assurances.

However, currently, there is no UL standard or ANSI standard in existence that would require essential patent claims using AIM technology, and no such standard has been submitted for approval. Although standards setting organizations (SSO) such as ANSI and UL require all participants to disclose essential patent claims, and license such patents, before adopting a standard, the policy only applies to members of the SSO, and non-members are not bound by the SSO patent policies. Thus, an outside party, such as SawStop (and now TTS, its parent company) that has a patent claim would not be obligated to commit to licensing arrangements under FRAND terms. Neither SawStop, nor TTS has indicated that it intends to participate in the standard-setting process or enter into licensing arrangements with any other firm (aside from Bosch).

Based on the current status of these standards and the lack of information regarding future licensing plans of TTS regarding SawStop's flesh-sensing technology, the issue of whether parties will enter into FRAND commitments can only be addressed by further standards development and additional information on future licensing arrangements with TTS and other entities, all unknown factors at this time.

The uncertainty surrounding the status of SawStop's (TTS) patents, the lack of information on parties' willingness to enter into licensing arrangements, or on the acceptable terms under which parties would enter into such agreements largely remain unchanged since the NPR. As discussed above, the existence of the patents would affect manufacturers' ability and costs to meet the proposed table saw standard.

## **E. STATUS OF TREND ANALYSIS OF BLADE-CONTACT INJURY**

In the NPR briefing package, CPSC staff performed trend analyses for blade-contact injuries, as well as blade-contact amputations, hospitalizations, and finger/hand injuries.<sup>12</sup> Staff assessed trends for table saw blade-contact injuries reported through NEISS and concluded that there was no discernible change in the number of blade-contact injuries or types of injuries related to table saw blade contact from 2004 to 2015. Staff did not detect any trend in any of the analyses for

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<sup>12</sup> Proposed Rule: Safety Standard Addressing Blade-Contact Injuries on Table Saws. Retrieved from: <https://cpsc.gov/s3fs-public/Proposed%20Rule%20-%20Safety%20Standard%20for%20Blade-Contact%20Injuries%20on%20Table%20Saws%20-%20January%2017%202017.pdf>

number of blade-contact injuries, amputations, hospitalizations, and finger/hand injuries (p-values = 0.19, 0.44, 0.53, and 0.17, respectively). Staff also conducted a trend analysis to include the rate of injury per 10,000 table saws in use for each year in the analysis.<sup>13</sup> The analysis showed that there was no discernible change in the risk of injury associated with blade contact related to table saws from 2004 to 2015.

The date range for the trend analysis covered a timespan before the voluntary standard for table saws required the product to be equipped with MBGs (2004 to 2009) and a timespan after the voluntary standard requirements became effective on most table saws (2010 to 2015). Table saws manufactured before 2009, equipped with TBGs, remained in use throughout the 2010 to 2015 date range. However, as TBG table saws reached the end of their product life and were replaced with MBG table saws, the proportion of the table saw population equipped with MBGs increased each year.<sup>14</sup> Thus, if the voluntary standard was impacting the number or severity of injuries, staff would expect a steady decrease in the number of injuries or severity of injuries as the proportion of compliant table saws increased. This was not observed in the trend analyses conducted in the NPR package.

For this briefing package, CPSC staff performed an updated trend analysis for number of blade-contact injuries, amputations, hospitalizations, and finger/hand injuries by adding information from 2016 to 2018 to the earlier analysis (see Tab A). The updated range for the trend analysis covers a timespan when all table saws were equipped with TBG (2004 to 2009) and a longer time span when an increasing proportion of table saws in use were equipped with MBG (2010 to 2018). As with the NPR, if the voluntary standard was impacting the number or severity of injuries, staff would expect a steady decrease in the number of injuries or severity of injuries as the proportion of compliant table saws increased.

Staff found no discernible change in the number of blade contact injuries or types of injuries related to table saw blade contact from 2004 to 2018. No trend was detected in the analysis of table saw blade-contact injuries (p-value = 0.24) or any of the injury severity analyses (p-values = 0.82, 0.62, and 0.20 for amputations, hospitalizations, and finger/hand injuries, respectively). Staff also conducted a trend analysis to include the rate of injury per 10,000 table saws in use for each year in the analysis. The analysis found no discernible change in the risk of injury associated with blade contact related to table saws from 2004 to 2018 (p-value = 0.84).

## **F. DIFFERENCES BETWEEN NPR AND 2017 STUDY**

### **1. Summary of NPR**

The NPR addressed the findings required under the rule under section 9(f) of the CPSA.<sup>15</sup> Based on staff's analysis, the Commission concluded preliminarily that there is an unreasonable risk of

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<sup>13</sup> The estimated number of table saws in use yearly was provided by CPSC's Directorate of Economics in TAB C of the NPR briefing package.

<sup>14</sup> CPSC's Directorate of Economics estimated an average product life of 10 years for bench saws, 17 years for contractor saws, and 24 years for cabinet saws in TAB C of the NPR briefing package.

<sup>15</sup> Before promulgating a consumer product safety rule the Commission must make findings on: the degree and nature of the risk of injury that the rule is designed to eliminate or reduce; the approximate number of consumer

injury associated with blade-contact injuries on table saws and finds that the proposed rule is reasonably necessary to reduce that unreasonable risk of injury.

### **a. Injury Estimates**

In the NPR, staff estimated that 30,800 table saw-related injuries involving blade contact were treated in hospital emergency departments (ED) in 2015. An estimated 93.8 percent of these injuries involved the finger. The most common diagnoses in blade-contact injuries are laceration injuries, fractures, amputations, and avulsion. Thousands of amputations— an estimated 4,700 amputation injuries were reported to EDs in 2015 alone—occurred each year on table saws. When compared to all other workshop products, table saws accounted for an estimated 52.4 percent of all amputations related to workshop products in 2015.<sup>16</sup> Staff’s review of the injury data found no evidence that the table saw market’s shift towards the MBG design was effective in reducing the number or severity of blade-contact injuries on table saws. In addition, staff reviewed a modular blade guard survey conducted in 2015. A majority of respondents (80%) reported that there are circumstances that require the blade guard to be removed, and a majority of respondents reported they did not use the blade guard “sometimes” (28%), “often” (17%) or “always” (14%). According to staff, any situation where the blade guard is not used eliminates the effectiveness of the blade guard in preventing blade-contact injuries.

### **b. Preliminary Regulatory Analysis**

CPSC staff’s preliminary regulatory analysis (PRA) showed substantial net benefits for the proposed rule. Estimates of net benefits, across all table saw types, averaged about \$1,500 to \$4,000 per saw over its expected product life. Aggregate net benefits over approximately 1 year’s production and sale of table saws could amount to about \$625 million to about \$2.3 billion. Based on estimates from NEISS and the Injury Cost Model (ICM), staff determined that the proposed rule would address an estimated 54,800 medically treated blade-contact injuries annually.<sup>17</sup> The societal costs of these injuries (in 2014 dollars and using a 3 percent discount rate) amounted to about \$4.06 billion in 2015.

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products subject to the rule; the need of the public for the products subject to the rule and the probable effect the rule will have on utility, cost, or availability of such products; and the means to achieve the objective of the rule while minimizing adverse effects on competition, manufacturing, and commercial practices. The Commission must also make findings that rule is reasonably necessary to eliminate or reduce an unreasonable risk of injury associated with such product and that issuing the rule is in the public interest. Additionally, if a voluntary standard addressing the risk of injury has been adopted and implemented, the Commission must find that: 1) the voluntary standard is not likely to eliminate or adequately reduce the risk of injury, or that 2) substantial compliance with the voluntary standard is unlikely. The Commission also must find that expected benefits of the rule bear a reasonable relationship to its costs and that the rule imposes the least burdensome requirements which prevent or adequately reduce the risk of injury for which the rule is being promulgated.

<sup>16</sup> Workshop products include tools such as radial arm saws, miter saws, circular saws, band saws, and routers, along with other power and manual woodworking tools.

<sup>17</sup> The number of table saw injuries initially treated outside of hospital EDs are estimated with the CPSC’s Injury Cost Model (ICM), which bases its estimates on empirical relationships between the characteristics of injuries (diagnosis and body part) and victims (age and sex) initially treated in hospital EDs and the characteristics of those initially treated in other settings. The societal costs of the medically treated table saw blade-contact injuries are quantified with the ICM. The ICM is fully integrated with NEISS, and in addition to providing estimates of the

Staff estimates showed that increased manufacturing cost, as well as the expected costs of replacement parts for the AIM system, would range from about \$240 to \$540 per bench saw, and from about \$400 to \$960 per contractor or cabinet saw. These costs likely would be mitigated somewhat over time, but the extent of any future cost reduction is unknown. Based on 1 year's production and sale of table saws, aggregate gross costs could range from about \$168 million to \$345 million annually.

Staff's PRA evaluated the expected benefits and costs of the proposed rule over the table saw market as a whole, combining all of the saw types into a single category. While not statutorily required, in keeping with OMB guidance, staff attempted but was unable to evaluate the relationship between benefits and costs for each of the three major saw categories because the distribution of injuries by saw type was not known. An analysis by saw type is useful because the saw types have different physical characteristics and different patterns of usage. Contractor saws, in general, are heavier, are less mobile, and more expensive than bench saws; similarly, cabinet saws are heavier, less mobile, and more expensive than contractor saws. Some types of table saws may be used more frequently or extensively than others, or may be used by more experienced woodworkers. Consequently, because of the different characteristics and potentially varying use patterns associated with the various saw types, it is possible that the costs of the proposed rule might exceed the benefits for one or more table saw types, even though, in aggregate, benefits exceed aggregate costs for the market as a whole.

In the absence of information on injury by saw type, CPSC staff conducted a breakeven analysis by estimating the approximate number of injuries that would have to be substantially mitigated for each type of saw for the benefits to equal or exceed the costs. Staff then developed several hypothetical distributions of injuries across saw types to compare the expected injury reduction for each breakdown. This analysis suggested that, under most plausible injury distributions, the benefits likely would exceed the costs for each saw type.

## **2. Summary of 2017 Study**

The 2017 study was initiated to obtain emergency department-treated, table saw blade-contact injury estimates for saw, incident, and injury characteristics which are otherwise not available in the standard NEISS data collections. The study began in January 2017 and was conducted by CPSC field staff. The 2017 Study provided detailed information based on incidents that occurred in a single year; therefore, it is a snapshot of table saw injuries that occurred in 2017. The study subject matter expert (SME) reviewers categorized table saws by the three most common types (bench, contractor, cabinet) based on information available such as manufacturer model, weight, and photographs.

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societal costs of injuries reported through NEISS, the ICM also estimates the costs of medically treated injuries that are initially treated outside of hospital emergency departments. The major aggregated societal cost components provided by the ICM include: medical costs, work losses, and the intangible costs associated with lost quality of life or pain and suffering.

## **a. Injury Characteristics**

The 2017 Study injury estimates correspond to the NPR findings that 95 percent of injuries are to the finger, and the majority of injuries are lacerations, fractures, and amputations. The 2017 study also indicates that many of the lacerations are severe injuries. In 2017, there were an estimated 26,500 table saw blade-contact, emergency department-treated injuries. Of these, an estimated 25,600 injuries (96.4 percent) involved the finger. The most common diagnoses in blade-contact injuries were: an estimated 16,100 laceration injuries (60.9 percent), an estimated 5,500 fractures (20.6 percent), and an estimated 2,800 amputations (10.7 percent).<sup>18</sup>

## **b. Table Saw Type**

CPSC staff noted in the NPR that the lack of injury estimates by type of saw impacted the ability of staff to complete a full benefit analysis by type of saw. As noted, while not statutorily required, in keeping with OMB guidance and the Record of Commission Action on the NPR, a detailed analysis of benefits, and costs, by saw type is the most appropriate method to account for the variability in the characteristics and users of the different saw types.<sup>19</sup> The 2017 Study provided estimates on table saw type distribution in the injuries. Of the estimated 26,500 table saw blade-contact injuries: an estimated 60.7 percent of the injuries (16,100) involved bench saws; an estimated 26.6 percent of the injuries (7,000) involved contractor saws; and an estimated 9.2 percent of the injuries (2,400) involved cabinet saws.

## **c. Blade Guard Use**

The 2017 Study provided estimates of blade guard use, and an analysis of each individual case provided anecdotal information on MBG and TBG usage. Overall, of the estimated 26,500 table saw blade-contact injuries in 2017, the blade guard was not in use in an estimated 88.9 percent of injuries (23,600). Anecdotally, the blade guard was not in use for 89.2 percent of the cases (91 of 102 cases) involving a TBG table saw and the blade guard was not in use in 88.0 percent of the cases (22 of 25 cases) involving MBG table saws.

In the NPR, staff concluded that reliance on a blade guard for injury prevention is insufficient because a guard is only effective if used, and incident data and survey data indicated users would remove MBGs for similar reasons that they had removed TBGs. The 2017 Study finding confirms that the majority of injuries occur on table saws without a blade guard installed, and injured MBG table saw users removed the blade guard anecdotally at the same rate as injured TBG table saw users.

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<sup>18</sup> A SME review that compared the IDI information and NEISS diagnosis determined that the original NEISS diagnosis did not always capture the severity of the injury. The SME review redistributed the injuries by adding a “severe laceration” category and the diagnosis as follows: 14,100 lacerations (53.2 percent); 4,000 severe lacerations (15.1 percent); 3,500 amputations (13.3 percent); and 4,900 fracture or avulsion (18.4 percent).

<sup>19</sup> Record of Commission Action retrieved from: [https://www.cpsc.gov/s3fs-public/MinutesofCommissionMeeting04\\_27\\_2017\\_ProposedRuleTableSaws.pdf?VEbDzgxtuBc62nXr8UGv6G9hYxXIYpm](https://www.cpsc.gov/s3fs-public/MinutesofCommissionMeeting04_27_2017_ProposedRuleTableSaws.pdf?VEbDzgxtuBc62nXr8UGv6G9hYxXIYpm)

#### **d. Injuries on TBG versus MBG Table Saws and Risk**

The 2017 Study also provided estimates of injuries that occurred on table saws manufactured with a TBG (did not comply with the current voluntary standard for table saws) and table saws manufactured with a MBG (complied with the current voluntary standard for table saws). Of the estimated 26,500 table saw blade-contact injuries in 2017, an estimated 17,800 (67.0 percent) occurred on a TBG table saw and an estimated 3,200 (12.2 percent) occurred on a MBG table saw. A non-trivial proportion (19.6 percent or an estimated 5,200 injuries) of the estimated blade-contact injuries occurred on a table saw where the type of blade guard manufactured with the saw could not be determined.

Staff compared the number of injuries that occurred on TBG and MBG table saws with the estimated 6.9 million table saws in use and the estimated 3.9 million MBG table saws in use.<sup>20</sup> Based on estimates of injuries and estimated population of table saws in use, the 2017 Study estimated that the risk of blade-contact injury with a TBG saw is 60.76 per 10,000 TBG table saws and the risk of blade-contact injury associated with a MBG table saw is 8.19 per 10,000 MBG table saws. Therefore the relative risk of a blade-contact injury is approximately 7 times more on a table saw with a TBG (that does not meet the voluntary standard for table saws) than on a table saw with a MBG (that does meet the voluntary standard). These results appear to indicate that the voluntary standard is effective because the risk of injury on a MBG table saw is lower than on a TBG table saw. If one concludes from the 2017 Study that the voluntary standard is effective, this would conflict with the NPR's preliminary assessment that the voluntary standard is ineffective based on the trend analysis of table saw blade-contact injuries from 2004 to 2015. It would also affect staff's preliminary estimates of costs and benefits of a table saw rule. Staff's preliminary regulatory analysis (PRA) for the proposed rule implicitly assumed that the requirements of the voluntary standard were ineffective in preventing blade contact injuries and estimated benefits of the NPR based on a projected 70 to 90 percent risk reduction associated with table saws equipped with AIM technology. The 2017 Study suggests that the risk reduction associated with MBG (about 85 percent) is roughly comparable to the risk reduction estimated for the NPR. If true, this would substantially reduce the net benefits for the rule. However, as noted elsewhere in this briefing package, were this to be the case, there should be an overall reduction in injuries and injury rates, given the market penetration of the MBG-equipped saws. No such reduction has been identified in the analysis of NEISS data.

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<sup>20</sup> The annual number of table saws in use was estimated with the CPSC's Product Population Model (PPM), a statistical model that projects the number of products in use given estimates of annual product sales and estimates of product failure rates over time. The annual number of table saws in use equipped with a MBG was estimated using table saw sales estimates for the years 2007 through 2017. Sales estimates were based on information provided by the Power Tool Institute (PTI) and market research report published by Global Info Research. Expected product life was based on information provided by PTI. For more detail see Tab C in the 2017 NEISS Table Saw Special Study briefing package retrieved from: [https://cpsc.gov/s3fs-public/Draft%20Notice%20of%20Availability%20Table%20Saw%20Blade%20Contact%20Injuries%20Special%20Study%20Report%20-%202017%20-%20November%2014%202018.pdf?Ry74kzkWujhwQJRal\\_EFUyEeKcrFM7gw](https://cpsc.gov/s3fs-public/Draft%20Notice%20of%20Availability%20Table%20Saw%20Blade%20Contact%20Injuries%20Special%20Study%20Report%20-%202017%20-%20November%2014%202018.pdf?Ry74kzkWujhwQJRal_EFUyEeKcrFM7gw).

### **e. Comments on the 2017 Study**

PTI submitted comments to the 2017 Study stating that the Study confirm PTI's position that the voluntary standards process for table saws is working. However, PTI stated they disagreed with staff's estimate of benchtop and total table saw populations and that, therefore, the Study underestimated the benefits of MBG. In general, PTI comments indicated that the Study's assumptions and estimates on table saw sales, MBG market penetration, table saw population, and table saw type lifespan differed from PTI's estimates and generally underestimated the benefits of the MBG table saws.

Other comments on the 2017 Study questioned whether the 2017 Study's conclusion, that the risk of a blade-contact injury is 7 times more on a TBG table saw than on a MBG table saw, can be accurate when a reduction in annual table saw blade contact injuries reported through NEISS from 2010 to 2017 (the time frame that modular blade guard table saws saturated the market) has not occurred.<sup>21</sup> The commenters quote CPSC staff's analysis from the NPR that if the voluntary standard requirement for modular blade guards "was having an impact on the number or severity of injuries, there would be a steady decrease in the number of injuries or severity of injuries as the proportion of table saws compliant with the new standard increases."

Comments from PTI and Stephen Gass, a founding member of SawStop, stated that table saw injury risk should be expressed in terms of exposure, and both provided their own analyses of table saw risk based on hours of use and average lifespan of the table saw type. Staff agrees that exposure is an important parameter in determining risk of injury. In the NPR, CPSC staff estimated number of injuries per 10,000 table saws in use, but noted that risk could also be estimated by number of injuries by population of table saw users or by number of hours of use. Comments to the 2017 Study indicate that risk analysis based on total population of table saw users (both injured and not injured) or number of hours table saws are in use may be a more meaningful method to assess risk of injury on table saws.

## **III. PATH FORWARD**

### **A. Addressing Apparent Conflict Between 2017 Study Results and NEISS Data**

Staff is unable to explain why the 2017 Study results indicating higher relative risk of injury on TBG table saws compared to MBG table saws do not align with the updated NEISS trend analysis. Thus, we have conflicting data. Staff believes that additional work could help explain the contradictory information and provide information on whether the voluntary standard effectively reduces blade-contact injuries, which would be needed to advance any rulemaking.

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<sup>21</sup> The commenters based their observations on NEISS estimates for annual table saw injuries that is available by searching CPSC's website. However, CPSC staff's updated trend analysis confirms the lack of reduction in annual table saw injury estimates from 2004 to 2018.

## Exposure Survey coupled with Follow-Up NEISS Special Study

In order to determine relative risk of injury between TBG and MBG table saws in the 2017 Study, staff required estimates of the number of table saws in use by type. To estimate table saws in use, staff relied upon information on annual sales and estimates of the average useful life of table saws provided by the Power Tool Institute and a market research report.<sup>22</sup> This is an indirect method and may not be as accurate as estimates obtained through a more direct method. The most direct method to obtain information on table saw population and usage is through an exposure survey of table saw users coupled with a follow-up NEISS special study of table saw injuries. This direct and detailed evaluation of table saws would directly estimate the number of table saws in use and could confirm the estimates (of total table saws in use or proportion of MBG and TBG table saws in use) used in the 2017 Study, or could show if characteristics of table saw users (such as blade guard use, age, exposure on certain type saws, etc.) explain the apparent conflict between the results of the NEISS trend analysis and the relative risk result from the 2017 special study. Conducting the follow-up NEISS special study and exposure survey would ideally allow staff to directly estimate the total number of table saw users, the total number of table saws in use, the proportion of table saws in use that are equipped with TBGs and MBGs, the expected average product life of each type of table saw, the number of hours each type of table saw is typically used, and the blade guard use habits of TBG table saw users and MBG table saw users.

The follow-up NEISS special study would be similar to the 2017 special study and would allow the Commission to collect information on the characteristics of table saw users who are injured (*e.g.*, age, sex, experience), their table saw usage patterns (*e.g.*, frequency of table saw use, use of blade guards, use of eye protection or other safety equipment), and the characteristics of the table saws involved in the injuries (*e.g.*, age of saw, type of blade guard, other safety features). This information would be compared to the concurrent exposure survey information. A follow-up NEISS special study is necessary because the 2017 Study is a snapshot of table saw injuries that occurred in 2017, and information on those injured users cannot readily be compared to information for non-injured users from an exposure study in a different time frame.

The exposure survey would collect information on the characteristics of all table saw users who are not injured (and therefore would not be reported through NEISS) concerning their characteristics, their table saw usage patterns, and the characteristics of the table saws involved in the injuries. The exposure survey would directly ask table saw users what type of table saw they own, what type of blade guard came with the saw, how many hours they use their table saw, how often they use the blade guard, and how many years or months they use their table saw before replacing it. This information could be used to directly estimate the total table saw population, the TBG and MBG table saw populations, the population of table saws by saw type, the product life of each type of table saws, and the usage patterns for blade guards (such as whether consumers are using MBG more than TBG).

Conducting the follow-up NEISS special study and exposure survey at the same time would allow staff to conduct a risk analysis by directly comparing the characteristics of those who were

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<sup>22</sup> The market research report published by Global Info Research. Information on expected product life of each category table saw was provided by PTI.

injured (and their usage patterns), with the characteristics of those who were not injured. It would use a methodology similar to what is known as a case-control study, a methodology in which the characteristics of the cases (*i.e.*, injuries) are directly compared to the characteristics of the controls (*i.e.*, those not injured) to determine the factors associated with risk. As stated before, such an analysis would allow a greater understanding of table saw use that could explain the discrepancy between the 2017 Study results and the NEISS data. For instance, if the analysis shows a high number of MBG table saw users are using the blade guard without injury (compared to a low number of injured MBG table saw users reported in NEISS), the risk of injury on a MBG table saw would be low, and this would support the 2017 Study results. Such an analysis would also allow staff to identify those factors that increase the risk that a user will be injured, including whether the MBG required by the voluntary standard reduces the risk of blade-contact injury. Information on MBG use and risk of injury could be used to assess the effectiveness of the voluntary standard.

If staff can explain the current discrepancy between the 2017 Study and the NEISS data, and if staff has direct information on MBG use and risk of injury that could be used to assess the effectiveness of the voluntary standard, staff would be able to produce a final regulatory analysis that has more definitive conclusions than is possible with the current conflicting results.

The staff resources required to conduct an exposure study and/or NEISS special study would involve EC and EPI staff time to develop the studies, award contracts and/or train Field staff, and execute and manage the studies over a time period sufficient to provide meaningful response rates. The NEISS special study and exposure survey questionnaire would have to be carefully prepared to ensure comparability. The follow-up NEISS special study, like the 2017 special study, would require extensive Field staff time to conduct follow-up investigations of NEISS-reported injuries and EPI staff time (with support from ES, EC, and HS staff) to review, code, and analyze the data. An exposure survey would require contract funding that's likely to cost at least \$1 million and would require OMB clearance under the requirements of the Paperwork Reduction Act. The risks involved in conducting these studies include insufficient response rates to make estimates, inadequate responses to questions that prevent drawing clear conclusions, or overall information gathered that's insufficient to explain the data discrepancy or to provide information on the effectiveness of MBGs. Although there are risks involved in conducting this type of study, examples of successful risk analyses conducted in the past, based on parallel injury and exposure surveys, include those provided for bicycles in Tinsworth, Polen, and Cassidy (1994) and for ATVs in Rodgers and Rubin (1989) and Rodgers and Adler (2001). The Rodgers and Rubin study in particular played an instrumental role in demonstrating that three-wheeled ATVs were substantially more risky than four-wheeled models and provided statistical support for the three-wheel ATV stop-sale contained in the 1987 consent decrees. An example of a recent exposure survey conducted by the CPSC was the 2013 Nursery Products Survey. The purpose of the survey was to assist in the analysis of the section 104 safety rules for nursery products. This survey was designed to evaluate the types and number of durable nursery products in use, the characteristics of the nursery products, and how consumers used them. When combined with injury data reported by the Directorate for Epidemiology, the exposure information allowed staff to determine injury rates for each of the products and to make inter-product comparisons of risk. If the Commission committed to a table saw exposure study, it could probably be completed during fiscal year 2021.

If only the exposure study were conducted, staff could obtain information on consumer usage patterns and exposure, but comparisons with the usage patterns of the injured population would have to be made somewhat more cautiously because we would be comparing the characteristics of the uninjured users in 2021 with the characteristics of the injured users in 2017. Staff may still be able to directly estimate table saw population (including proportion of MBG and TBG equipped table saws), population of table saws by saw type, the product life of each type of table saws, and the usage patterns for blade guards (such as whether consumers are using MBG more than TBG). The staff and funding resources, and timeframe required to conduct the exposure study, would still apply.

If only the follow-up NEISS special study were conducted, it could provide support for the results of 2017 study if the relative risk of injury on MBG versus TBG table saws is replicated. However, if the overall NEISS injury trends remain unchanged, the Commission may not be confident in the studies' results without an explanation for the discrepancy. On the other hand, if the follow-up NEISS special study found that MBGs were less effective than suggested by the 2017 special study, and the overall NEISS injury trend remains unchanged, it would cast additional doubt on the results of the 2017 study and provide more confidence in the benefits estimate from the PRA. The special study would need to be conducted in 2020 or 2021 to provide another snapshot of table saw injuries that is far enough in the future to capture a time when even more MBG table saws have saturated the overall population of table saws in use. The staff resources and timeframe required to conduct the follow-up special study, would still apply.

## **B. Addressing Patent Issues**

Pursuing a follow-up NEISS special study or an exposure survey, or both, does not address the standing patent issue of a single entity owning the patents to the AIM technology currently used with available table saws. As mentioned earlier, TTS is, in general, open to the possibility of licensing the AIM technology if the CPSC promulgates a rule requiring the technology on all table saws. However, the CEO of TTS has indicated that, given the breadth of intellectual property that has been developed by SawStop, it is not a simple matter to say what such a license would or should include, and what structure it would be. As such, it would be a time-consuming and expensive effort for TTS to determine what the details of any such license would be and consequently, TTS has chosen to defer an effort to determine the details of a licensing arrangement until such time as it appears that the CPSC is moving forward with a rule.

Because of the uncertainty surrounding the complexity of SawStop's patents and lack of information concerning future licensing arrangements, the Commission could consider funding a study to evaluate existing patents for the AIM technology, and what implications the existing patents on the AIM technology would have on the market for table saws. For example, such a study could examine the current patent landscape of AIM technology patents. The study could identify when the essential patents would expire, whether competitors would be able to use and market AIM table saws using an older SawStop technology (covered by the expired patents) that did not have the latest improvements, or preclude existing table saw manufacturers from independently developing their own version of the AIM technology (covered by new, unexpired patents).

Such a study would not address whether parties would enter into any agreements if there is no mandated rule, or whether parties are likely to enter into licensing arrangements with FRAND commitments if there is no voluntary standard requiring AIM technology. Moreover, the technical challenges would remain the same; the research and development needed to implement AIM technology, with or without licenses, may be an obstacle for many manufacturers. Thus, even if a study were conducted, many questions would remain regarding the viability of adopting AIM technology, and the willingness of parties to enter into licensing arrangements under any circumstances.

### **C. Recommendation**

CPSC staff recommends that the Commission direct staff to conduct a table saw exposure survey and NEISS special study, concurrently, to directly collect information that could help explain the contradictory information in the 2017 Study and updated NEISS trend analysis. In addition, the work could provide direct information on whether the voluntary standard effectively reduces blade-contact injuries on table saws, which would be needed to advance any rulemaking.

Alternatively, the Commission could direct staff to conduct only an exposure survey or only a follow-up NEISS special study, but not both. As previously discussed, such an approach would have weaknesses, and may not reconcile the issues identified. However, doing only the exposure study or the follow-up NEISS study may provide some additional information on the relative risk of injury that occurs on TBG versus MBG equipped table saws.

# TAB A





UNITED STATES  
CONSUMER PRODUCT SAFETY COMMISSION  
BETHESDA, MD 20814

## Memorandum

Date: July 12, 2019

TO : Caroleene Paul  
Table Saw Project Manager  
Division of Mechanical and Combustion Engineering

THROUGH: Stephen Hanway  
Associate Executive Director  
Directorate for Epidemiology

Risana Chowdhury  
Director, Division of Hazard Analysis  
Directorate for Epidemiology

FROM : Ted Yang  
Mathematical Statistician  
Division of Hazard Analysis

SUBJECT : Table Saw Blade-Contact Injury Trend Analysis<sup>1</sup>

### I. Introduction

In a briefing package recommending that the Commission issue a notice of proposed rulemaking (NPR) to address the risk of blade-contact injuries associated with table saws, CPSC staff performed trend analyses for blade-contact injuries, as well as blade-contact amputations, hospitalizations, and finger/hand injuries.<sup>2</sup> Staff assessed trends for table saw blade-contact injuries reported through the National Electronic Injury Surveillance System (NEISS) and concluded that there was no discernible change in the number of blade-contact injuries or types of injuries related to table saw blade contact from 2004 to 2015. No trend was detected in any of the analyses for number of blade-contact injuries, amputations, hospitalizations, and finger/hand injuries (p-values = 0.19, 0.44, 0.53, and 0.17, respectively). Staff also conducted a trend analysis to include the rate of injury per 10,000 table saws in use for each year in the analysis. The analysis showed that there was no discernible change in the risk of injury associated with blade contact related to table saws from 2004 to 2015.

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<sup>1</sup> This analysis was prepared by CPSC staff. It has not been reviewed or approved by, and may not necessarily reflect the views of, the Commission.

<sup>2</sup> Proposed Rule: Safety Standard Addressing Blade-Contact Injuries on Table Saws. Retrieved from: <https://cpsc.gov/s3fs-public/Proposed%20Rule%20-%20Safety%20Standard%20for%20Blade-Contact%20Injuries%20on%20Table%20Saws%20-%20January%2017%202017.pdf>

The date range for the trend analysis covered a timespan before the voluntary standard for table saws required the product to be equipped with a riving knife and modular blade guard design (2004 to 2009) and a timespan after the voluntary standard requirements became effective on most table saws (2010 to 2015). Table saws manufactured before 2009, equipped with traditional blade guards (TBG), remained in use throughout the 2010 to 2015 date range. However, as TBG table saws reached the end of their product life and were replaced with MBG table saws, the proportion of the table saw population equipped with MBGs increased each year.<sup>3</sup> Thus, if the voluntary standard was impacting the number or severity of injuries, staff would expect a steady decrease in the number of injuries or severity of injuries as the proportion of compliant table saws increased. This was not observed in the trend analyses conducted in the NPR package.

## II. Updated Trend Analysis<sup>4</sup>

For this briefing package, staff performed trend analyses for the number of blade-contact injuries, amputations, hospitalizations, and finger/hand injuries from 2004 to 2018. Staff followed the same methodology for the NEISS analyses described in TAB B of the NPR briefing package. Staff reviewed NEISS cases associated with product code 0841 (all injuries recorded in the NEISS as associated with a table or bench saw) treated in 2016, 2017, and 2018. The caveats mentioned in the NPR still apply: (1) There is limited information regarding details of an incident within the NEISS; thus, cases are likely included that are not blade contacts within the 0841 product code, leading to overestimates in blade-contact injuries for that product code. (2) Table saw blade-contact cases that should be included in code 0841 are likely included within product codes 0845 (saw, not specified) and 0895 (power saws, other or not specified), leading to underestimates of table saw blade-contact injuries in product code 0841. CPSC staff does not know to what extent either of these caveats affects the results.

The date range for the trend analysis covers a timespan when all table saws were equipped with TBG (2004 to 2009) and a time span when an increasing proportion of table saws in use were equipped with MBG (2010 to 2018).

Table 1 provides the estimated number of table saw blade-contact, emergency department-treated injuries from 2004 through 2018.

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<sup>3</sup> CPSC's Directorate of Economics estimated an average product life of 10 years for bench saws, 17 years for contractor saws, and 24 years for cabinet saws in TAB C of the NPR briefing package.

<sup>4</sup> Table saw-related incidents are not commonly reported to CPSC through means other than the NEISS. CPSC staff has received a small number of reports of table saw-related injuries through Consumer Product Safety Risk Management System (CPSRMS), which includes sources such as news articles, consumer-submitted reports, attorney-submitted reports, and manufacturer and retailer reports. However, CPSRMS does not contain a representative sample of all blade-contact injuries, and any analysis based on it is strictly limited in scope and in the possible conclusions that can be drawn. As such, for an update of nationally representative table saw and/or blade-contact injury estimates, only NEISS data has been used for this analysis.

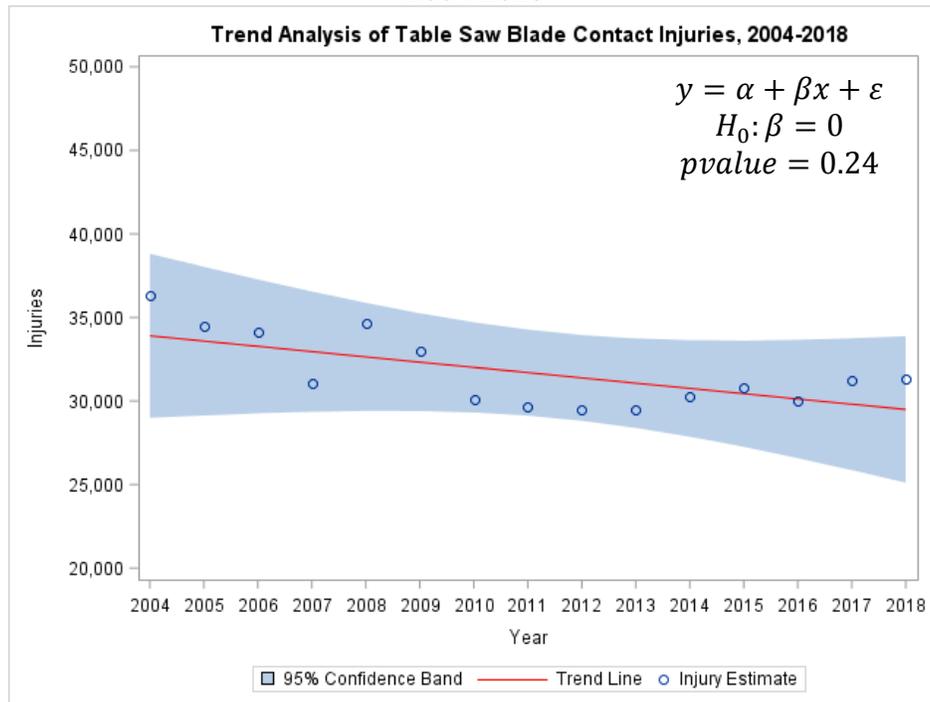
**Table 1: NEISS Estimates for Table Saw Blade Contact Injuries, 2004-2018**

Year	Table Saw Blade Contact Injury Estimates			
	N	Estimate	CV	95% Confidence Interval
2018	649	31,300	0.09	25,500—37,100
2017	654	31,300	0.09	25,800—36,700
2016	646	30,000	0.09	25,000—35,000
2015	642	30,800	0.09	25,100—36,500
2014	631	30,300	0.08	25,300—35,300
2013	662	29,500	0.09	24,500—34,500
2012	648	29,500	0.09	24,100—34,900
2011	632	29,600	0.09	24,300—35,000
2010	657	30,100	0.10	24,000—36,200
2009	714	33,000	0.10	26,500—39,500
2008	723	34,600	0.09	28,700—40,500
2007	694	31,100	0.09	25,400—36,700
2006	766	34,200	0.09	27,900—40,400
2005	812	34,500	0.09	28,300—40,700
2004	773	36,300	0.09	29,600—43,100

Source: U.S. CPSC: NEISS

Figure 1 provides the estimated blade-contact injuries associated with table saws and the fitted trend line with a 95 percent confidence band for the fitted line from 2004 through 2018. The p-value associated with the slope of the fitted line is 0.24, which indicates that there is not a statistically significant trend in blade-contact injuries associated with table saws.

**Figure 1: Trend Analysis of Table Saw Blade-Contact-Related Injuries, 2004-2018**



Source: U.S. CPSC: NEISS

To assess any changes across time in the severity of table saw blade-contact injuries, CPSC staff performed trend analyses for blade-contact amputations, hospitalizations (includes two dispositions: treated with admission and treated with transfer), and finger/hand injuries. No trend was detected in any of these analyses (p-values=0.82, 0.62, and 0.20 for amputations, hospitalizations, and finger/hand injuries, respectively). Table 2 provides the estimated number of blade-contact injuries from 2004 through 2018, for amputations, hospitalizations, and finger/hand injuries from blade contact, with the percentage of each to the total number of estimated blade-contact injuries.

**Table 2: NEISS Injury Estimates for Table Saw Blade-Contact Amputations, Hospitalizations, and Finger/Hand Injuries, 2004-2018**

Year	Amputations		Hospitalizations		Finger/Hand Injuries	
	Estimate (95% CI)	% of blade contact injuries	Estimate (95% CI)	% of blade contact injuries	Estimate (95% CI)	% of blade contact injuries
2018	4,400 (3,100–5,600)	13.9%	3,100 (2,100–4,200)	10.0%	30,600 (24,900–36,400)	97.8%
2017	4,800 (3,200–6,400)	15.4%	2,800 (1,700–3,900)	8.9%	30,400 (25,100–35,800)	97.4%
2016	4,000 (2,600–5,300)	13.2%	3,500 (2,100–5,000)	11.8%	29,600 (24,600–34,500)	98.5%
2015	4,700 (3,100–6,300)	15.2%	3,800 (2,300–5,300)	12.3%	30,500 (24,900–36,100)	99.1%
2014	4,000 (2,400–5,500)	13.1%	3,100 (1,700–4,400)	10.1%	29,400 (24,600–34,300)	97.2%
2013	3,400 (2,300–4,600)	11.7%	3,000 (1,800–4,200)	10.2%	29,200 (24,300–34,200)	99.2%
2012	4,100 (2,700–5,600)	13.9%	2,900 (1,300–4,400)	9.8%	29,100 (23,700–34,400)	98.7%
2011	3,900 (2,700–5,100)	13.2%	2,900 (1,900–3,900)	9.9%	29,400 (24,200–34,700)	99.3%
2010	3,500 (2,500–4,500)	11.6%	2,800 (2,000–3,600)	9.2%	29,800 (23,700–36,000)	99.2%
2009	4,100 (3,000–5,200)	12.5%	3,000 (2,000–3,900)	9.0%	32,500 (26,100–38,900)	98.5%
2008	3,700 (2,700–4,600)	10.6%	2,600 (1,700–3,400)	7.4%	34,200 (28,300–40,100)	98.7%
2007	3,900 (2,600–5,200)	12.6%	3,000 (1,800–4,100)	9.5%	30,700 (25,100–36,200)	98.7%
2006	4,300 (3,100–5,500)	12.5%	2,700 (1,600–3,800)	7.9%	33,700 (27,500–39,900)	98.7%
2005	4,600 (3,100–6,200)	13.5%	2,800 (2,000–3,600)	8.2%	34,100 (28,000–40,200)	98.9%
2004	5,100 (3,600–6,700)	14.1%	2,900 (1,900–3,900)	8.0%	36,000 (29,300–42,800)	99.2%

Source: U.S. CPSC: NEISS

Table 3 gives the estimated blade-contact injuries per 10,000 table saws in use for each year in the analysis, 2004 to 2018. Figure 2 provides the trend analysis results for the estimated number of injuries per 10,000 table saws in use including the fitted trend line with a 95 percent confidence band. The p-value associated with the slope of the fitted line is 0.84, which indicates that there is not a statistically significant trend.<sup>5</sup>

**Table 3: Estimated Table Saw Blade-Contact Injuries per 10,000 Table Saws in Use, 2004-2018**

Year	Table Saw Blade Contact Injury Estimates		Estimated Number of Table Saws in Use (in 10,000s)*	Estimates** of Table Saw Blade Contact Injury per 10,000 Table Saws in Use	
	Blade Contact Injury Estimate	95% Confidence Interval	Table Saws in Use Estimate <sup>6</sup>	Estimate <sup>7</sup>	95% Confidence Interval
2018	31,300	25,500—37,100	685.0	45.7	37.3—54.2
2017	31,300	25,800—36,700	686.3	45.6	37.7—53.5
2016	30,000	25,000—35,000	686.4	43.7	36.4—51.0
2015	30,800	25,100—36,500	689.9	44.6	36.4—52.9
2014	30,300	25,300—35,300	692.2	43.8	36.5—51.0
2013	29,500	24,500—34,500	697.9	42.3	35.1—49.4
2012	29,500	24,100—34,900	706.6	41.7	34.1—49.3
2011	29,600	24,300—35,000	715.1	41.5	34.0—48.9
2010	30,100	24,000—36,200	727.1	41.4	33.0—49.8
2009	33,000	26,500—39,500	756.3	43.6	35.0—52.2
2008	34,600	28,700—40,500	768.8	45.0	37.4—52.7
2007	31,100	25,400—36,700	774.0	40.1	32.9—47.4
2006	34,200	27,900—40,400	760.6	44.9	36.7—53.2
2005	34,500	28,300—40,700	746.2	46.2	38.0—54.5
2004	36,300	29,600—43,100	733.7	49.5	40.3—58.7

Source: U.S. CPSC: NEISS

\*CPSC's Directorate for Economics provided the estimated numbers of table saws in use for this analysis (TAB B).

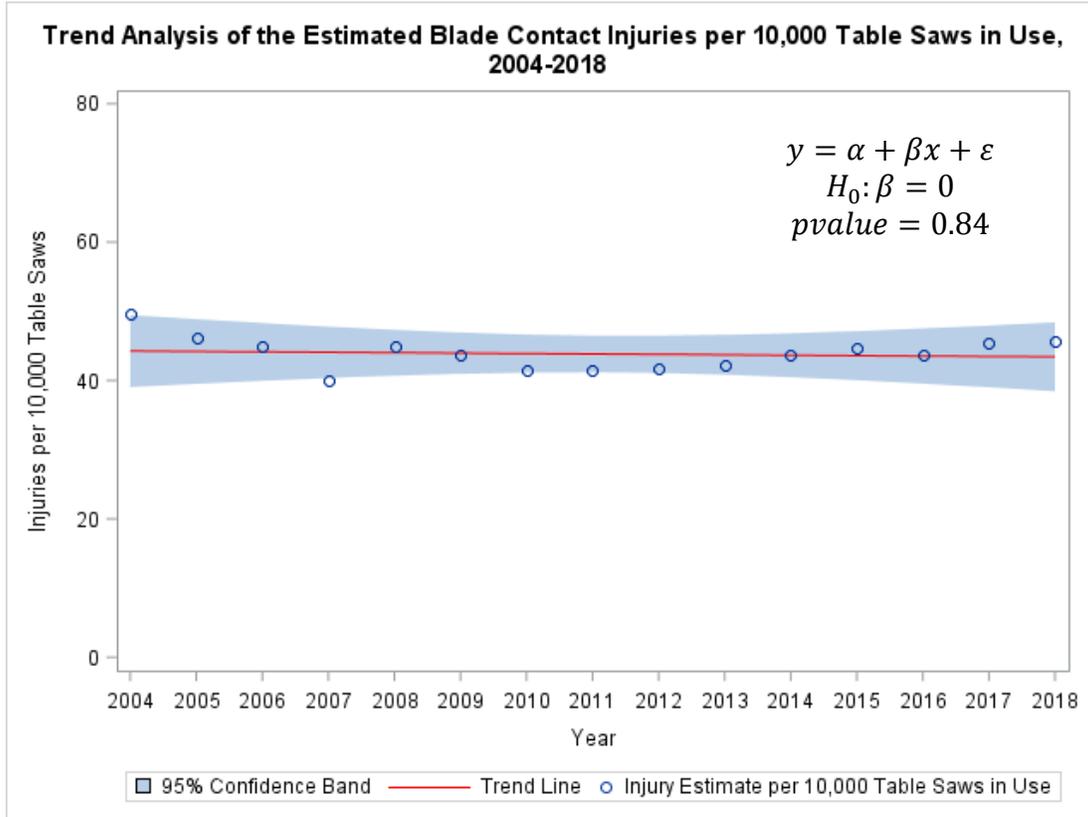
\*\*Estimates are calculated from the exact number of injuries point estimate, not the rounded estimate.

<sup>5</sup> This analysis does not account for usage patterns of table saws.

<sup>6</sup> No estimates of variance or covariance associated with the number of table saws in use were calculated. CPSC staff determined that the ability to detect trend is increased by omission of the variance-covariance associated with the denominator variable (thus, creating a more conservative approach). Variance for estimated blade contact injuries per table saws in use will increase if using both numerator and denominator variance and covariance structures; this makes it harder to detect trend mathematically. However, CPSC staff determined that there is minimal impact on the analyses performed, and conclusions are unlikely to change if another method was chosen.

<sup>7</sup> CVs for estimates are equivalent to the CVs for injury estimates, due to no variance estimates being used for the denominator estimates.

**Figure 2: Blade-Contact Injuries per 10,000 Table Saws in Use Trend Analysis, 2004-2018**



Source: U.S. CPSC: NEISS

### III. Conclusion

Staff concludes that there was no discernible change in the number of blade-contact injuries or types of injuries related to table saw blade contact from 2004 to 2018. No trend was detected in the analysis of table saw blade-contact injuries (p-value = 0.24) or any of the injury severity analyses (p-values = 0.82, 0.62, and 0.20 for amputations, hospitalizations, and finger/hand injuries, respectively). Staff also conducted a trend analysis to include the rate of injury per 10,000 table saws in use for each year in the analysis. The analysis showed that there was no discernible change in the risk of injury associated with blade contact related to table saws from 2004 to 2018 (p-value = 0.84).

# TAB B





UNITED STATES  
CONSUMER PRODUCT SAFETY COMMISSION  
BETHESDA, MD 20814

**Memorandum**

Date: July 11, 2019

TO : Caroleene Paul, Table Saw Project Manager  
Division of Mechanical and Combustion Engineering, Directorate for  
Engineering Sciences

FROM: Mark Bailey, Directorate for Economic Analysis  
Gregory B. Rodgers, PhD, Associate Executive Director, Directorate for  
Economic Analysis

SUBJECT: Table Saw Market and Economic Update

Part 1 of this memorandum provides a summary of the table saw market and information on any substantial changes in the market that may have occurred since publication of the NPR. Part 2 discusses risk and economic implications of the results of the 2017 special injury study and possible next steps.

**Part 1: Table Saw Market**

*Product Description, and Type*

A table saw is a power tool consisting of a circular saw blade protruding through the surface of a table and driven by an electric motor. Table saws can be separated into three categories: bench, contractor, and cabinet.<sup>1</sup> There is no definitive way to identify the table saw type but generally size, weight, and price are useful in identification. Cabinet saws are much easier to identify from bench, and contractor saws due to their weight.<sup>2</sup> Bench saws are typically much lighter and portable, allowing for easy transportation by even a single individual.<sup>3</sup> Contractor saws are heavier than bench saws, but typically, contractor saws can be moved safely by two people without special equipment. However, weight and portability can vary widely for all saw types, based on additional features, accessories, and stands provided.

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<sup>1</sup> There are two additional table saw categories. One shares features of both contractor and cabinet saws and are categorized as hybrid saws. The other is sliding saws that are typically larger than cabinet saws and are equipped with additional features.

<sup>2</sup> For a more detailed discussion of the types of table saws, see Zamula, Rodgers, and Bailey (2016). Sliding and cabinet saws can weigh up to 2000 pounds, which would require special tools to relocate or move safely. Bench, contractor, and hybrid saws typically weigh less than 500 pounds and can be moved by hand or using a rolling stand.

<sup>3</sup> The average weight of bench saw models identified during staff review amounted to 65 pounds.

### *Available Models, Retail Price, Average Yearly Sales by Type, and Product in Use Estimate*

Cabinet saw models available in the United States account for the majority (approximately 57.9%) of the total table saw models available for purchase.<sup>4</sup> Contractor and bench saws account for 14.6 percent and 27.5 percent, respectively.<sup>5</sup> Retail prices for table saws can vary widely between saw type and even among saws of the same type. For example, more expensive bench saw models retail for 9.3 times more than lower-price models.<sup>6</sup> Cabinet saws retail for significantly higher than bench saws, as the lowest price cabinet saw is \$1,399, and the most expensive is priced at more than \$25,000.<sup>7</sup>

Bench saws account for a majority of annual sales of table saws with a 5-year (2013-2017) average equating to approximately 500,000 or 79.2 percent of total sales.<sup>8</sup> Average sales over the same period for contractor and cabinet saws equate to 77,400 (12.3 percent) and 54,200 (8.6 percent), respectively. These sales translate to an estimate of average number of table saws in use of approximately 6.9 million.<sup>9</sup> Bench saws account for a small majority of total table saws in use at 58.4 percent, with cabinet saws at 21.1 percent, and contractor saws at 20.5 percent.

### *Table Saw Suppliers/Manufacturers*

Staff identified a total of 23 firms that supply table saws to the U.S. market.<sup>10</sup> Three firms listed in the NPR no longer supply the U.S. market with table saws. Staff identified an additional four firms as suppliers of table saws through acquisitions of known brands from other firms.

### *Issues Related to Active Injury Mitigation (AIM) Technology*

Tool Technic Systems Acquisition of SawStop. In July 2017, Tooltechnic Systems (TTS), acquired SawStop, LLC.<sup>11,12</sup> TTS is now the legal owner of all SawStop patents with flesh-sensing technology. TTS has indicated that it is open to the possibility of licensing the AIM technology if the CPSC promulgates a rule requiring the technology on all table saws. However, TTS has also said that “given the breadth of intellectual property that has been developed by SawStop, it is no longer a simple matter to say what such a license would or should include and what structure it would be” (personal communication with Mr. Fabian Klopfer, CEO of TTS, June 1, 2019). Staff notes that TTS is incorporating AIM technology into a Festool-branded table saw, but there is no indication that this Festool-branded AIM saw will be available for sale in the United States.<sup>13</sup>

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<sup>4</sup> Total number of table saw models available for sale is 171.

<sup>5</sup> To stay consistent with data provided in Zamula, Rodgers, and Bailey (2016), and Bailey (2018), sliding saws are included with cabinet and hybrid saws are included with contractor.

<sup>6</sup> MSRP for bench saws ranges from \$139 to \$1,299.

<sup>7</sup> Review of table saw manufacturer, supplier, and retailer websites, press releases, and product catalogs.

<sup>8</sup> Refer to Bailey (2018) for more detailed information on table saw sales.

<sup>9</sup> Refer to Bailey (2018) for more detailed information on product in use estimate methodology.

<sup>10</sup> See IEc (2016a), IEc (2016b), with CPSC staff updates.

<sup>11</sup> TTS also owns another power tool brand called Festool. Festool does not currently supply the U.S. market with table saws but does supply a number of other power tool products.

<sup>12</sup> See <https://www.sawstop.com/company/news/press-releases/sawstop-TTS> Accessed on 5/1/2019

<sup>13</sup> See <https://www.youtube.com/watch?v=zZ0IIRABOjU> Accessed on 5/1/2019.

International Trade Commission Order (ITC). After the Commission issued an NPR in May 2017 to address an unreasonable risk of blade-contact injuries associated with table saws, there were two firms supplying AIM system-equipped table saws to the U.S. market. The two firms were SawStop, which equipped all table saw models with an AIM system, and Bosch, which had one model equipped with an AIM system. As a result of ITC investigation 337-TA-965, the ITC issued a limited exclusion order prohibiting the import of Bosch table saws equipped with AIM technology.<sup>14</sup> Once this order went into effect on March 27, 2017, SawStop became the only firm supplying the U.S. market with AIM-equipped table saws.<sup>15</sup>

On December 21, 2018, Sawstop petitioned the ITC regarding investigation 337-TA-965 to modify the limited exclusion order to allow Bosch to import an AIM-equipped saw.<sup>16</sup> This indicates that Sawstop and Bosch have reached an agreement to license AIM technology. In the petition, Sawstop states that a settlement and non-exclusive license agreement were reached. This agreement covers US patents 7,895,927 and 8,011,279. No details related to licensing compensation have been made public, and the CEO of TTS USA has stated in communications with staff that currently, he cannot share any details on business cases with partners, due to confidentiality agreements.

## **Part 2. Impact of 2017 Special Study on the Economic Analysis and a Discussion of Possible Next Steps**

The Commission's May 2017 NPR proposed to establish performance requirements to limit the depth of a cut on a test probe, which serves as a surrogate for a finger, to a maximum of 3.5 mm when it approaches the blade at a rate of 1 m/s (CPSC, 2017). To meet the requirements of the NPR, table saws would need to be equipped with an active-injury mitigation (AIM) system, an unspecified technology that would mitigate blade contact from a rotating saw blade by braking or retracting the saw blade.

During calendar year 2017, the Directorate for Epidemiology conducted a special injury study (Garland and Tu, 2018). The results of that study, if confirmed, would have a significant impact on the results of a regulatory analysis of the proposed rule because the results conflicted with an important assumption in the preliminary regulatory analysis (PRA). This section discusses what implications the 2017 study has for the economic analysis, and discusses the analyses or studies that staff believes could resolve the resulting conflict. The discussion below is based on information from the 2017 special study, other technical work conducted in support of the 2017 special study (Goldsmith, 2018; Bailey, 2018), and the information used to conduct the preliminary regulatory analysis (PRA) contained in the NPR (Zamula, Rodgers, and Bailey, 2016).

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<sup>14</sup> See [https://www.usitc.gov/secretary/fed\\_reg\\_notices/337/337\\_965\\_notice01272017sgl.pdf](https://www.usitc.gov/secretary/fed_reg_notices/337/337_965_notice01272017sgl.pdf) Accessed on 5/1/2019

<sup>15</sup> 14 CFR § 294.51 states that any department order under §294.50 is subject to presidential review for 60 days after issue. The ITC ban was issued on January 27, 2017.

<sup>16</sup> ITC denied the request to modify the limited exclusion order on February 25, 2019, because it already permits licensed activity.

## *Preliminary Regulatory Analysis and the 2017 Special Study*

The PRA suggested that the benefits of the proposed rule requiring AIM technology would likely be substantially greater than the costs. The expected costs of a rule were high – projected to range from about \$240 to \$540 per saw for bench saws and from about \$400 to \$960 per saw for contractor and cabinet saws. Nevertheless, because the societal costs of blade-contact injuries were also high,<sup>17</sup> and because the AIM technology was projected to reduce blade contact injuries by roughly 70 percent to 90 percent, staff projected the expected benefits of the proposed rule would range from about \$2,000 to \$4,000 per saw over a saw’s expected useful product life. Although this benefits estimate did not distinguish among the types of table saws, a breakeven analysis suggested that the proposed rule would likely result in substantial net benefits (*i.e.*, benefits – costs) for each of the three saw types.

The PRA results were premised on the data available at the time of the NPR, which provided no evidence that the voluntary table saw standard under the 7<sup>th</sup> edition of UL 987, which became effective in 2010, and that required, among other things, modular blade guards (MBG),<sup>18</sup> effectively reduced the likelihood of blade-contact injury (Garland, 2016). This preliminary determination was based on a trend analysis conducted by the Directorate for Epidemiology in 2016. To evaluate the possible impact of MBGs on the risk of blade contact injury, the 2016 analysis relied upon an evaluation of injury trends from 2004 through 2015, using only information available from NEISS records involving NEISS product code, 0841 (table or bench saws). The analysis was based on table saw injuries that were considered most likely to involve blade contact.<sup>19</sup>

While the PRA suggested that the benefits of the proposed rule were greater than the costs, data limitations precluded the PRA from directly comparing the benefits and costs for each of the saw types (*i.e.*, bench, contractor, and cabinet (Stralka, 2016)). To address the data limitations contained in the injury analysis of the NPR, and to prepare for a final regulatory analysis, the Directorate for Epidemiology conducted the 2017 NEISS table saw special study. The 2017 special study consisted of in-depth investigations conducted by CPSC field staff

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<sup>17</sup> The societal costs associated with table saw injuries were derived from the CPSCs Injury Cost Model (Lawrence et al., 2018). Economic losses accounted for about 30 percent of societal costs, and the non-economic losses associated with pain and suffering accounted for the remaining 70 percent. Benefits were estimated as the reduction in societal costs associated with the projected prevention of injuries. For more detail, see Zamula, Rodgers, and Bailey (2017).

<sup>18</sup> As reported in Amodeo and Gill (2016), and based on a Power Tool Institute (PTI) presentation, “The new modular guard design was intended to be an improvement over traditional hood guard designs, by providing better visibility, offering easier methods to remove and install the guard, and incorporating a permanent riving knife design.”

<sup>19</sup> According to the Epidemiology staff analysis (Garland, 2016), some “cases are likely included [in the analysis] that are not blade contact within the 0841 product code, leading to overestimates in blade-contact injuries. However, table saw blade contact cases are likely included within product code 0845 (saws not specified) and 0895 (power saws, other or not specified). Due to the limited information available in the NEISS regarding the product and incident scenario, these cases are not identifiable as table saw and blade contact, and these are not included in the estimates provided. This leads to underestimates of the table saw blade contact injuries. CPSC staff does not know to what extent either of these caveats affects the results.”

investigators of table saw injuries reported through NEISS; its primary goals were: (1) to obtain national estimates of the types of table saws involved in blade-contact injuries, (2) to collect information on the types and usage of blade guards to evaluate the impact of the voluntary standard's requirements for MBGs, and (3) to collect additional injury and incident details (Garland and Tu, 2018). The results of the special injury survey were made available for public comment, as described in a December, 2018, *Federal Register* (FR) notice (CPSC, 2018).

### *Results from the 2017 Special Table Saw Survey*

The 2017 special study successfully collected information on blade-contact injuries by saw type and information on the types and usage of blade guards. An important result was that the voluntary standard's requirements for the MBGs, contrary to the earlier 2016 analysis (Garland, 2016), were highly effective in reducing blade contact injuries.<sup>20</sup>

Based on the 2017 special study results, the Directorate for Epidemiology estimated about 60.75 injuries per 10,000 table saws originally equipped with the traditional (*i.e.*, pre-MBG) blade guard system compared to about 8.19 injuries per 10,000 table saws equipped with the MBG system currently required by the voluntary standard. Consequently, the risk of injury associated with table saws with the *traditional* blade guards, relative to the risk of injury associated with table saws equipped with the *MBG system*, amounted to about 7.4 to 1 (*i.e.*, 60.75/8.19). This estimate is called a relative risk, and suggests that the risk on a table saw with traditional blade guards was about 7.4 times higher than the risk on a saw originally equipped with the MBG (as required by the current voluntary standard). Consequently, the study indicates that the estimated risk of blade-contact injury involving a table saw originally equipped with an MBG (*i.e.*, those conforming to the voluntary standard) was about 85 percent *less* than the risk associated with a table saw not so equipped.

If this relative risk result is correct, it would substantially alter the results of the PRA which, as noted above, assumed that the requirements of the voluntary standard were ineffective in preventing blade-contact injuries. In fact, this new finding would suggest that the projected risk reduction associated with the MBGs (about 85 percent) is roughly comparable to the projected risk reduction associated with the AIM technology (about 70 percent to 90 percent) used in the preliminary regulatory analysis. Thus, the benefits associated with the MBG requirements of the voluntary standard would be generally of the same magnitude as the benefits projected for the AIM technology in the PRA, without the added costs of the AIM technology (\$240 to \$960 per saw), and without the industry disruption that would accompany a safety rule that would effectively require manufacturers to adopt a technology patented by a competitor. In contrast to the costs associated with the AIM technology, requirements for MBGs would entail no additional incremental costs over and above of the current costs associated with table saws because, as required by the existing voluntary standard, all table saws currently being produced are already equipped with MBGs.

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<sup>20</sup> Because the MBGs were generally accompanied with riving knives (also required by the voluntary standard), the benefits of the voluntary standard would also implicitly include those associated with riving knives, which are believed to address blade-contact injuries resulting from kickback.

This result, if correct, suggests that the benefits that could be attributable to the AIM technology would be substantially lower (and the net benefits of a rule requiring an AIM technology would be correspondingly lower) than those estimated in the PRA. This is because the only benefits that could be attributable to the AIM technology would be those available after the benefits of the MGBs were taken into account. In other words, if MGBs reduce societal costs by 85 percent, the only benefits that could be attributable to a rule requiring AIM technology would be those associated with reducing the remaining 15 percent.

Consequently, while the 2017 study successfully answered the survey questions regarding the *type of saws* involved in blade-contact injuries and the *type of blade guards* provided on the saws involved in the blade-contact injuries (two of its major goals), the estimate of relative risk, based on the blade-guard results, were in conflict with the results of 2004-2015 trend analysis from the earlier 2016 injury study (Garland, 2016).

The Directorate for Epidemiology has updated the trend analysis to include the years 2016 through 2018, with results similar to the 2016 analysis. Specifically, if the projected risk reduction from MBG-equipped saws was as forecast, and the market penetration of these saws was as assessed, we would have expected a similar reduction in overall injury rates. However, the trend analysis continues to find no statistically significant decline in the table saw blade-contact injuries. Several public comments on the 2017 study also pointed out that table saw injuries do not appear to have significantly declined since 2010. Thus, we have conflicting data. If the results of the 2017 study related to the relative risks of table saws equipped with modular versus traditional blade guards is correct, we might have expected to see a decline in the number of table saw injuries by now. On the other hand, if there is no difference in risk as suggested by the trend analysis, it is unclear why the 2017 study showed such a difference.

### *Paths Forward*

Because of the apparent conflict between the risk findings from the trend analysis and the relative risk findings from the 2017 special study (Garland and Tu, 2018), as well as the economic implications of the conflicting findings discussed above, additional studies are required to resolve the conflict to produce a final regulatory analysis that has more definitive conclusions. This section describes the options available for addressing the conflicting results and the advantages or disadvantages of each approach.

The best approach would be to conduct an injury survey and an exposure survey in the same time frame. The injury survey would be similar to the 2017 special study and would allow the Commission to collect information on the characteristics of the injured (*e.g.*, age, sex, experience), the table saw usage patterns of the injured (*e.g.*, frequency of table saw use, use of blade guards, use of goggles or other safety equipment), and the characteristics of the table saws involved in the injuries (*e.g.*, age of saw, type of blade guard, other safety features). The exposure survey would collect similar types of information of those who were exposed to risk but not injured.

A major focus of an exposure survey would be consumer table saw usage patterns, including the use of MGBs. The 2017 NEISS special study concluded that the risk of blade-

contact injury was substantially lower on saws that had been equipped with the types of MBGs required by the voluntary standard, UL 987. However, the estimate of relative risk was based on estimates of table saws in use, by blade-guard type (based on sales and product life estimates), and the proportion of injuries involving saws sold with MBGs. An exposure survey would allow for a direct and more detailed evaluation of MGB usage patterns, including what proportion of consumers use MBGs; how frequently are table saws with (or without) MBGs used by consumers; what proportion of cutting time (or what proportion of cuts) the MBGs are engaged; and under what circumstances MBGs are not used. For an example of the types of usage information that has been collected from exposure surveys conducted by CPSC in the past, see Rodgers (1999).

Conducting the injury and exposure surveys at the same time would allow the staff to conduct a risk analysis by directly comparing the characteristics of those who were injured (and their usage patterns), with the characteristics of those who were not injured. It would use a methodology similar to what is known as a case-control study, a methodology in which the characteristics of the cases (*i.e.*, injuries) are directly compared to the characteristics of the controls (*i.e.*, those not injured) to determine the factors associated with risk. Such an analysis would allow us to identify those factors that increase the risk that a user will be injured. For example, it could answer questions such as whether the use of a blade guard reduces the risk of injury, whether infrequent users are as likely to be injured as frequent users, and whether age or sex affect risk.

Conducting both injury and exposure surveys would be resource intensive. The injury and exposure survey questionnaire would have to be prepared carefully to ensure comparability. The injury survey, like the 2017 special study, would require substantial resources to complete. An exposure survey would require OMB clearance under the requirements of the Paperwork Reduction Act, and the hiring of a contractor to conduct the survey. Although there are risks involved in conducting this type of study, examples of successful risk analyses conducted in the past, based on parallel injury and exposure surveys, include those provided for bicycles in Tinsworth, Polen, and Cassidy (1994) and for ATVs in Rodgers and Rubin (1989) and Rodgers and Adler (2001).<sup>21</sup> If the Commission committed to such a study, it could probably be completed during fiscal year 2021.

Alternatively, the Commission could also direct the staff to conduct either an exposure survey or a follow-up injury survey, but not both. Such an approach would have weaknesses, but nevertheless, it might provide additional information regarding the risk findings from the trend analysis of 2016 (Garland, 2016) and the relative risk findings from the 2017 special study (Garland and Tu, 2018).

Conducting an exposure study without a new injury study would still provide us with information on consumer usage patterns and exposure. However, comparisons with the usage patterns of the injured population would have to be made somewhat more cautiously because we

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<sup>21</sup> As an example of the utility of conducting and comparing the results of injury and exposure surveys, the analysis presented in Rodgers and Rubin (1989) played an instrumental role in demonstrating that three-wheeled ATVs were substantially more risky than four-wheeled models and provided statistical support for the three-wheel ATV stop-sale contained in the 1987 consent decrees.

would be comparing the characteristics of the uninjured users in 2021, with the characteristics of the injured users in 2017. Conducting a second NEISS special injury study without an accompanying exposure study would allow us to determine whether the preliminary findings of the 2017 special study would be replicated. A second special study would be justified because the results regarding the effectiveness of the modular blade guard were unexpected and have been questioned in public comments. If the results of the 2017 special study were generally replicated, the Commission could be more confident in the findings that MGBs are effective in reducing risk, but only if overall NEISS injury trends changed significantly. On the other hand, if the follow-up special study found that MGBs were less effective than suggested by the 2017 special study, it would cast additional doubt on the results of the 2017 study and provide more confidence in the benefits estimate from the PRA. We also note that conducting a second special study alone would not provide insight into how the characteristics of the saws and users not involved in injuries differ from those who were injured.

Finally, we note that the patent issue present ongoing challenges. As mentioned, TTS is open, in general, to the possibility of licensing the AIM technology if the CPSC promulgates a rule requiring the technology on all table saws. However, Mr. Klopfer, the CEO of TTS, says that, “given the breadth of intellectual property that has been developed by SawStop, it is no longer a simple matter to say what such a license would or should include and what structure it would be.” Mr. Klopfer noted that it would be a time-consuming and expensive effort for TTS to determine what the details of any such license would be. Consequently, TTS has chosen to defer an effort to determine the details of a licensing arrangement until such time as it appears that the CPSC is moving forward with a rule.

Because of the uncertainty surrounding the complexity of SawStop’s patents and lack of information concerning future licensing arrangements, the Commission could consider funding a study to evaluate existing patents for the AIM technology, and what the implications of the existing patents on the AIM technology would have on the market for table saws. For example, such a study could examine the current patent landscape of AIM technology patents. The study could identify when the essential patents would expire, whether competitors would be able to use and market AIM table saws employing an older SawStop technology (covered by the expired patents) that did not have the latest improvements, or preclude existing table saw manufacturers from independently developing their own version of the AIM technology (covered by new, unexpired patents).

However, such a study would not address whether parties would enter into any agreements if there is no mandated rule, or whether parties are likely to enter into licensing arrangements with FRAND commitments if there is no voluntary standard requiring AIM technology. Moreover, the technical challenges would remain the same; the research and development needed to implement AIM technology, with or without licenses, may be an obstacle for many manufacturers. Thus, even if a study were conducted, many questions would remain regarding the viability of adopting AIM technology, and the willingness of parties to enter into licensing arrangements under any circumstances.

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