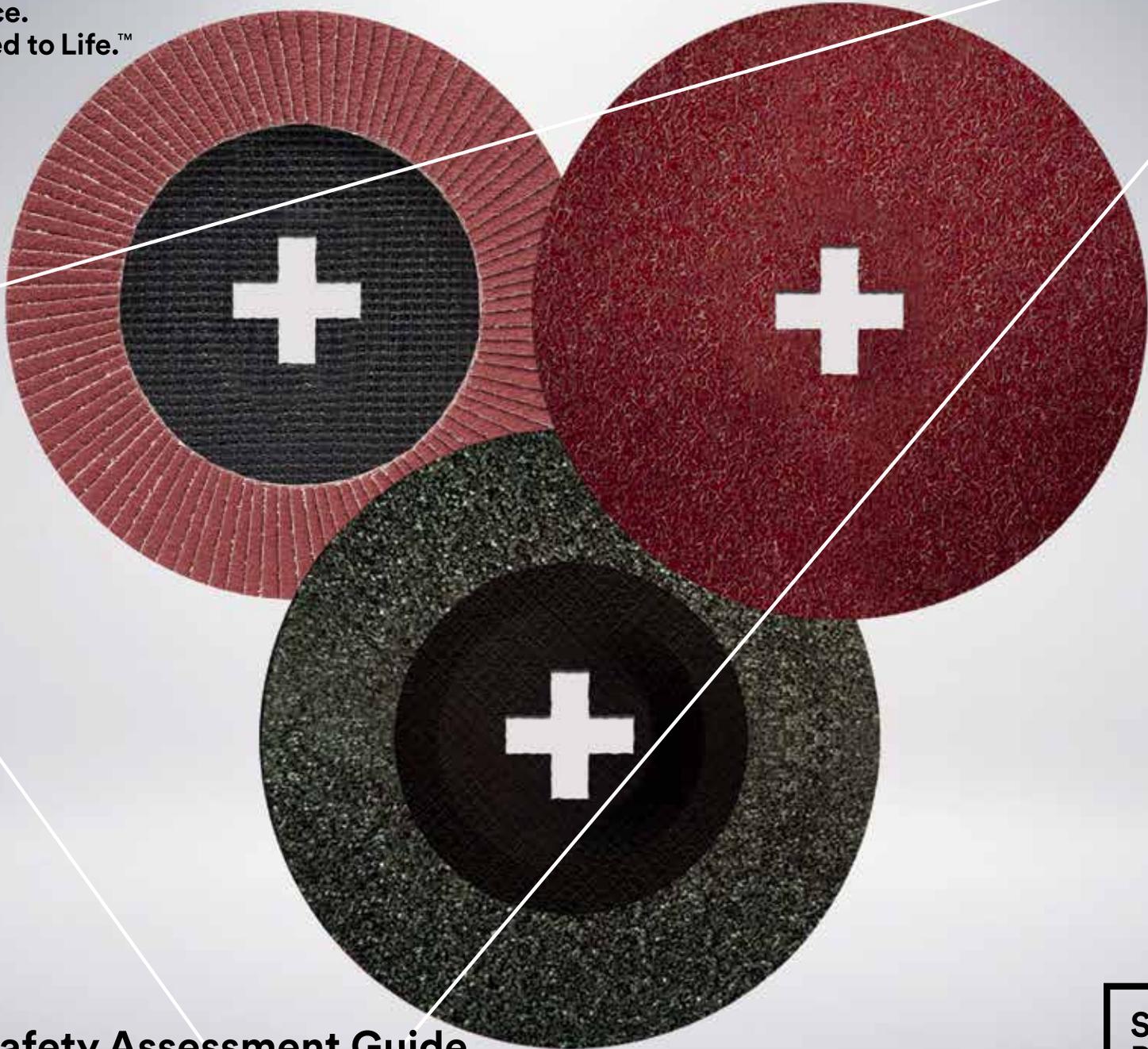


3M Science.
Applied to Life.™



Abrasive Safety Assessment Guide

Helping to move the dial on abrasive safety in the workplace.



Contents

Introduction	3
Abrasive hazards	4
Managing the risks	5
The Risk Reduction Indicator	6
3M™ Cubitron™ II Abrasives	7
Product options: Grinding Wheel	8
Product options: Cut-off Wheel	11
Product options: Rotating Wire Brush or Wheel	13
Product options: Fibre Disc	15
Product options: Sanding Disc	17
Links and further reading	19



Abrasive Safety Assessment Guide

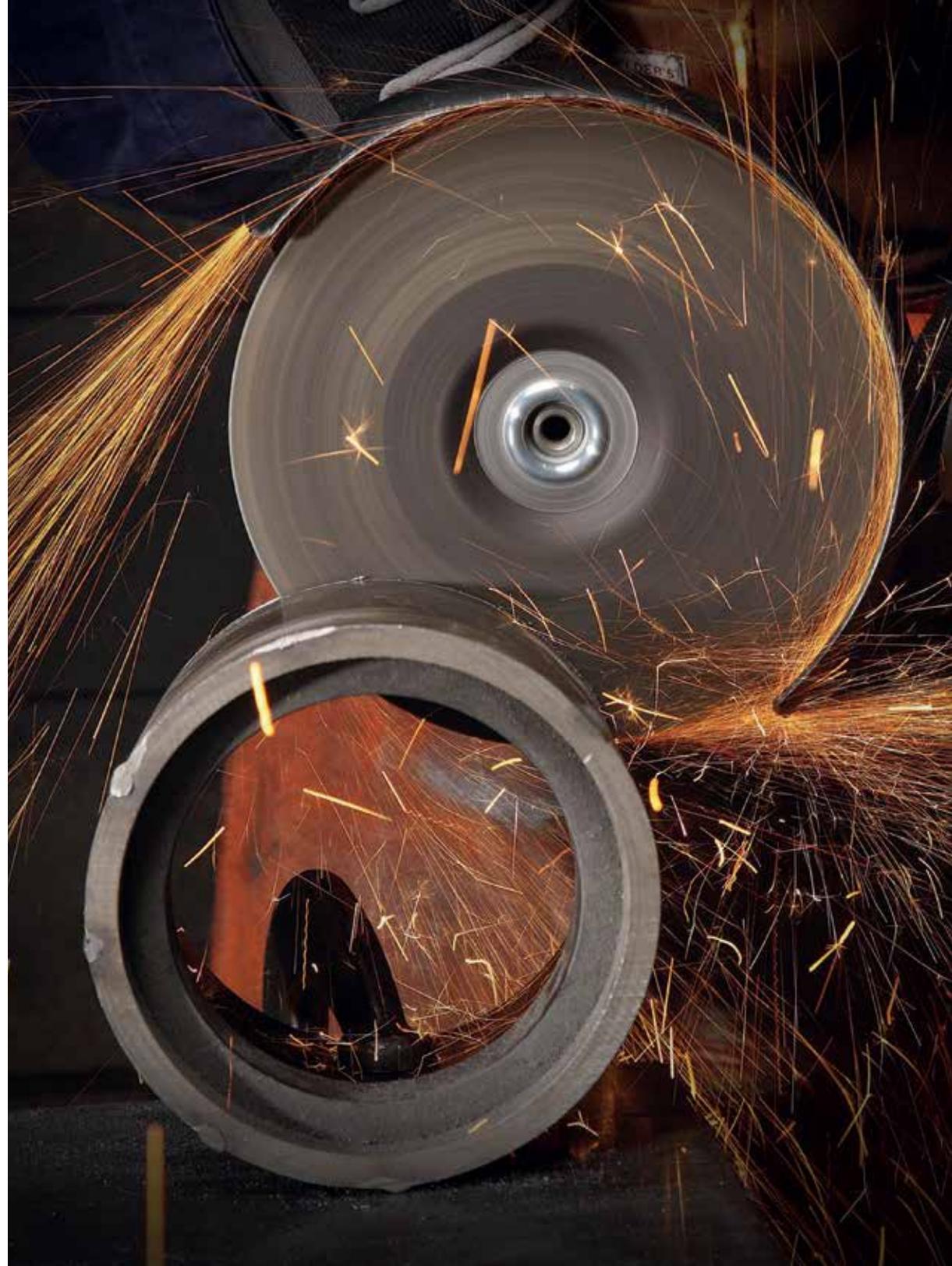
This guide will focus on four principal hazards associated with the use of abrasives in the workplace and the actions that can be taken to help reduce these risks:

-  Hand-arm vibration
-  Airborne particles
-  Noise
-  Injury

Abrasive processes using hand-held or bench-top equipment play a critical role in many industries and are often the fastest and most efficient way to complete tasks or achieve production objectives.

The use of abrasives can involve an element of risk; the high speeds, temperatures and forces involved create immediate safety hazards due to the potential for equipment failure or accidental contact with moving parts. In addition, if not properly managed and controlled, the routine use of abrasives can potentially create significant long-term health hazards, from hand-arm vibration, airborne particles and noise.

This guide will explain how engineering controls, such as replacing existing abrasive methods with more efficient/safer ones can help to reduce the risks associated with abrasive operations like grinding, cutting and sanding.



Abrasive hazards

It is the responsibility of all employers to ensure the safety and well being of their staff, especially those involved in potentially hazardous work. Employers must comply with a range of health and safety legislation, taking all the necessary steps to mitigate risk and provide employees with appropriate protection in a workplace.

Hand-arm vibration

The risk of vibration-related injury is associated with tasks that require excessive bending of the wrists or time on tool.

- Prolonged exposure to vibration can cause damage to blood vessels, nerves and tendons in fingers, hands and wrists, leaving the sufferer with reduced sensitivity, strength and dexterity.
- Once these conditions take hold, they are often irreversible and can become more severe over time if vibration exposure continues.



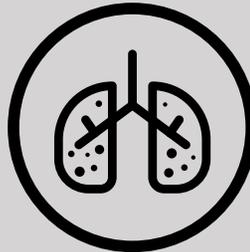
Employers' responsibility

There are no formal Canadian regulations governing vibration. Canadian agencies will use the Threshold Limit Values (TLVs) and guidelines recommended by the American Conference of Governmental Industrial Hygienists (ACGIH). The ACGIH (2016) sets TLVs for hand-arm vibration exposure to a daily vibration exposure [8 hour equivalent total value] of 5 metres/sec². This value represents "conditions where it is believed that most workers may be exposed repeatedly without progressing beyond Stage 1 of the Stockholm Workshop Classification System for Vibration-Induced White Finger. Stage 1 is termed "mild" and is described as "occasional attacks affecting only the tips of one or more fingers".

Airborne particles

The creation of airborne particles is inherent in most abrasive processes. The composition and physical cross section (quantity and distribution of particle sizes) depends on the workpiece and the properties of the abrasive product being used.

- Airborne particles are hazardous to operators through contact with exposed skin or eyes, and especially by inhalation.
- Extremely fine airborne particles can be particularly hazardous, as they are often invisible to the naked eye and are more easily absorbed into lungs and respiratory tracts, leading to long-term health risks.



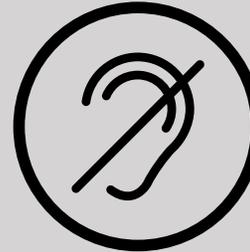
Employers' responsibility

Employers are required to implement measures to eliminate, reduce and control occupational exposures to hazardous substances to levels below the applicable occupational exposure limits. Respiratory protection must be used in accordance with the requirements of the CSA Standard Z94.4 and the requirements of the applicable jurisdiction.

Noise

Sound is energy transmitted by pressure variations that are detected by the human ear. Noise is normally defined as unwanted sound and is one of the most common health hazards.

- At high or sustained levels, noise can quickly damage the pressure-sensitive organs within the ear.
- Exposure to a single loud sound event, or prolonged exposure to persistent levels of noise can cause temporary or permanent hearing loss, along with other conditions such as tinnitus.



Employers' responsibility

Noise exposure limits are found in Canada Labour Code, Part II, (R.S.C. 1985, c. L-2) and Canada Occupational Safety and Health Regulations, (SOR/86-304) as well in local (provincial) regulations. Employers must prevent or reduce noise-related risks to their staff. The regulations set out maximum acceptable levels for average noise exposure (87dB). **Note that these values can vary with provincial regulations.** CCOH&S recommends every employer uses reasonably practicable engineering controls or other physical means other than hearing protectors to reduce the exposure of sound to employees to a level that does not exceed the limits given by section 7.4

Cuts and other injuries

Fixed or hand-held abrasive equipment such as grinding wheels operating at high speeds create a hazard if they are incorrectly used or if grinding wheels or discs are damaged.

- Injury can be caused by direct bodily contact with rotating surfaces, leading to cuts and burns – often requiring hospital treatment.
- There is also a risk to workers in the immediate vicinity if debris is ejected at high speed from unguarded work areas, or if a tool is damaged or breaks in use.



Employers' responsibility

It is an employer's duty to protect the health, safety and welfare of their employees, protecting them from anything that may cause harm in the workplace. Managing the risks involves a number of factors: ensuring that each tool and consumable is safe and fit for purpose; checking that appropriate guarding is in place; and making sure that employees are fully trained in the use of equipment and the correct Personal Protection Equipment (PPE) is selected and worn.

Managing the risks

Best practice in health and safety management begins with a thorough risk assessment. The first priority is to identify hazards, e.g. the equipment and activities with the potential to cause harm, the nature of the hazard, the extent of exposure, and employees that might be affected.

Once hazards have been identified and categorized for their risk potential, the next step is to implement the appropriate controls to help eliminate or minimize each risk. Controls such as risk assessments, using the right tools, regular training, improvements to workplace conditions and wearing the correct Personal Protective Equipment (PPE) are generally implemented to mitigate risk.

Hierarchy of Controls

There are five fundamental control stages that should be used in risk management. These are normally represented by the Hierarchy of Controls (see diagram), where the control methods at the top of the inverted pyramid have the greatest potential to eliminate or mitigate risk, and should therefore form the natural starting point for any risk management programme.

Engineering controls administrative controls

Choosing the right abrasive

An important factor that is often overlooked when assessing engineering controls is the selection of the abrasive products, ensuring the most appropriate abrasive product and abrasive mineral have been selected to help reduce the risks from hand-arm vibration, airborne particles and noise.



Scotch-Brite™

3M™ Scotch-Brite™ Radial Bristle Brushes and Discs

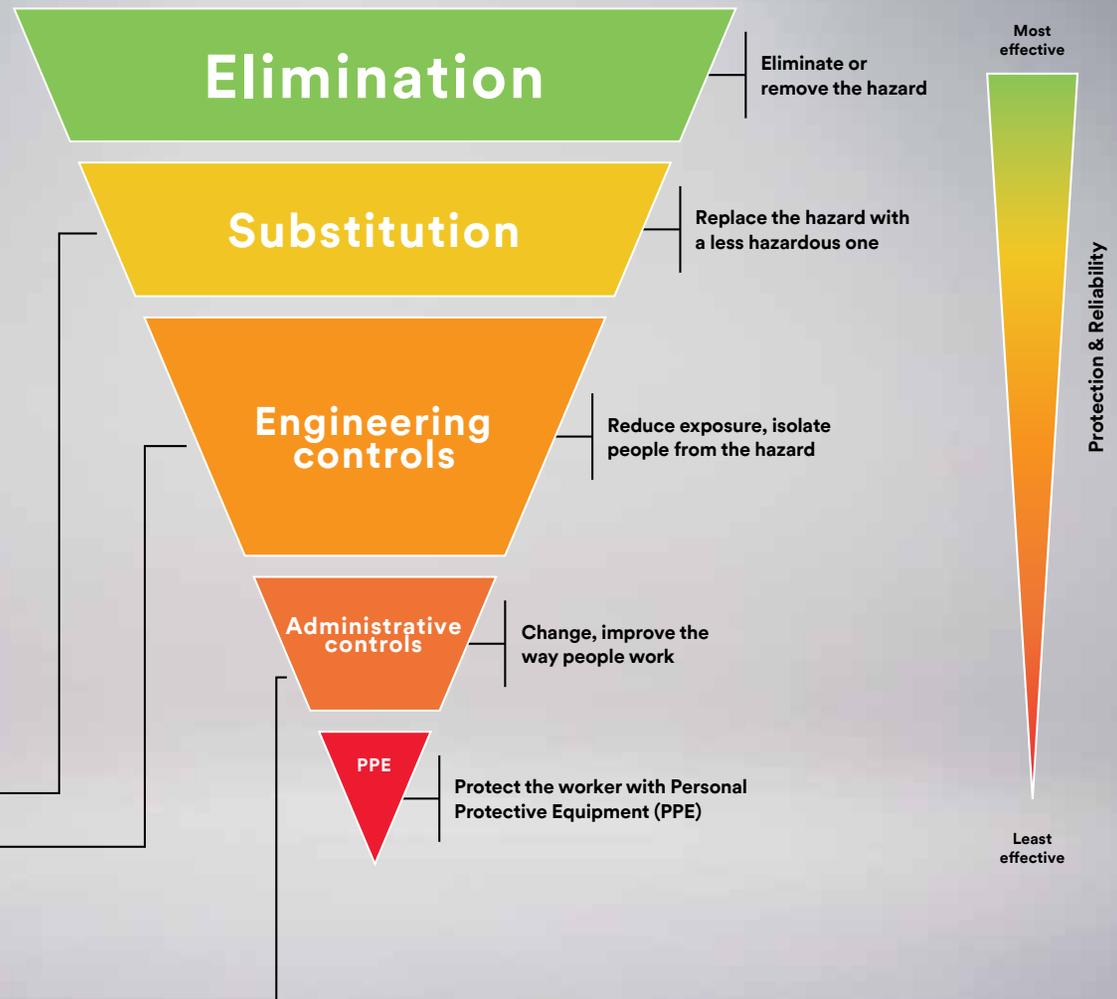


CUBITRON II

3M™ Cubitron™ II Hand-Held Abrasives - powered by 3M's Precision Shaped Grain technology.

Although these controls will not eliminate the need to use the appropriate PPE, they play a vital role in reducing risk and, combined with other steps in the hierarchy of controls, they will help protect the safety and long-term health of employees, and the employer from the consequences of an industrial accident.

Hierarchy of Controls*



The Risk Reduction Indicator

Minimizing risk depends on a combination of factors. Critical among these is the correct choice of tools and consumable products for each application.

We have focused on three main workplace risks: hand-arm vibration, airborne particles and noise. The risk reduction indicator shows how these risks can be reduced by replacing existing abrasive products with alternative options that work more efficiently and could help minimize hazards and reduce exposure.

Working closely with our industrial customers over many years, 3M offers innovative solutions, support and training to help improve abrasive processes. We have developed a generation of advanced abrasive products and tools that help improve safety and reduce the exposure to the risks in the workplace, while improving both productivity and quality of the finished job.

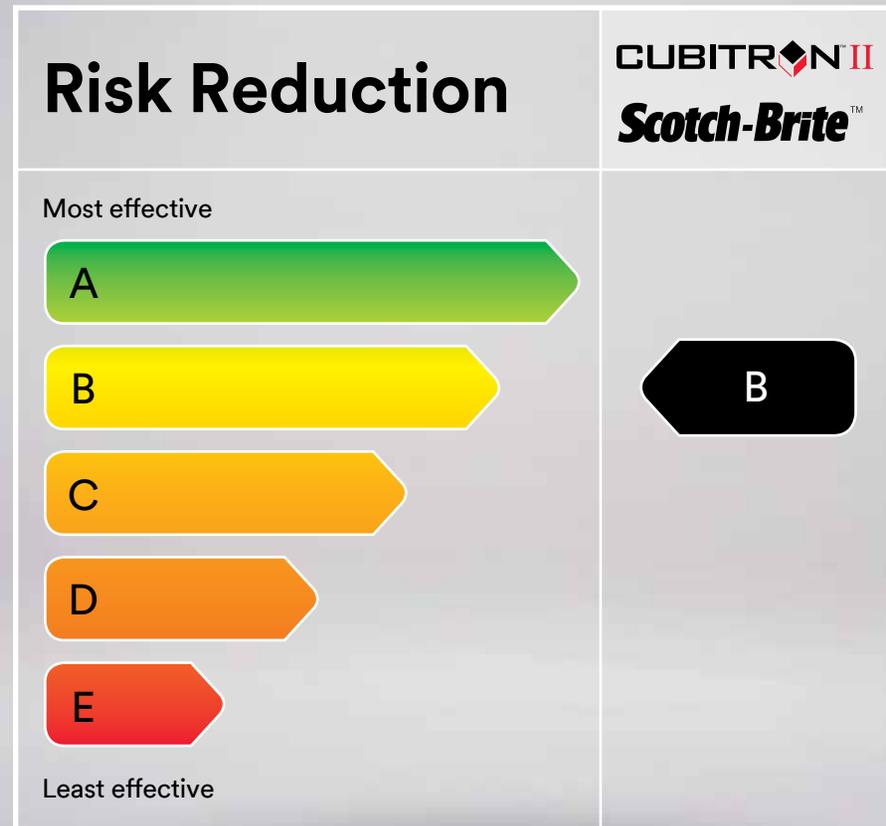
3M's Precision Shaped Grain technology, used in 3M™ Cubitron™ II Abrasives is engineered to continuously fracture to form sharp points and edges – slicing cleaner and faster, staying cooler, and lasting longer than conventional abrasives. By cutting faster using 3M™ Cubitron™ II Abrasives, you can complete tasks more quickly. This reduced time spent cutting, grinding or sanding can result in less 'trigger time' for the operator and less operator fatigue meaning less exposure to some of the risks highlighted in this guide.

By using the risk reduction indicator, the next section explains in greater depth how each of the three main abrasive hazards could be minimized by considering an alternative abrasive method or product.



The Risk Reduction Indicator

The Risk Reduction Indicator represents the differential in the risks associated with abrasive processes; green indicating the most effective in risk reduction and red being the least effective in risk reduction when switching from conventional hand-held abrasives* to 3M™ Cubitron™ II and Scotch-Brite™ Hand-Held Abrasives.



3M™ Cubitron™ II Abrasives

3M™ Cubitron™ II Abrasives powered by Precision Shaped Grain technology

3M's Precision Shaped Grain technology in 3M™ Cubitron™ II Abrasives can help reduce the risks from exposure to hazards in the workplace. It has been engineered to continuously fracture to form sharp points and edges – slicing cleaner and faster, staying cooler, and lasting longer than conventional abrasives.

3M™ Cubitron™ II Abrasives:



Require less pressure – allows the abrasive to do more of the hard work, helps in reducing operator fatigue



Cut faster – helps improve productivity, reducing “trigger” time on tool



Cut cooler – less heat built up



Last longer – can help reduce waste generated and lower costs



Safer operation – helps reduce exposure to vibration, airborne particles and noise



Run smoother – easy to use

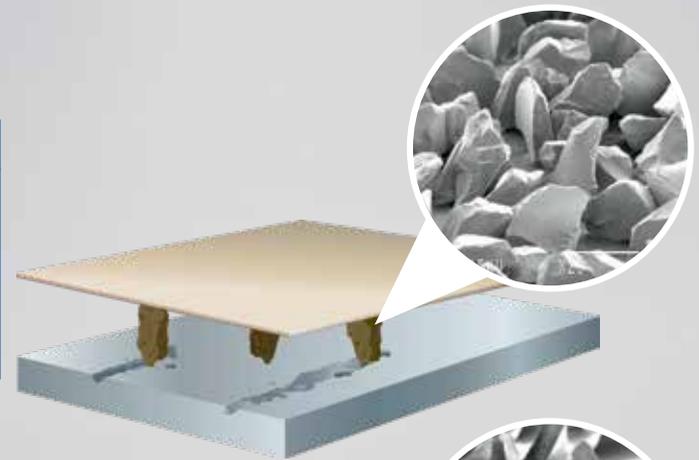
CUBITRON™ II

How 3M's Precision Shaped Grain technology works

It acts like a cutting tool, slicing through metal like a knife. The material is continuously self-sharpening, as points break off during use to expose new sharp edges – slicing cleaner and faster, staying cooler and lasting many times longer than conventional grain types.

Conventional abrasives

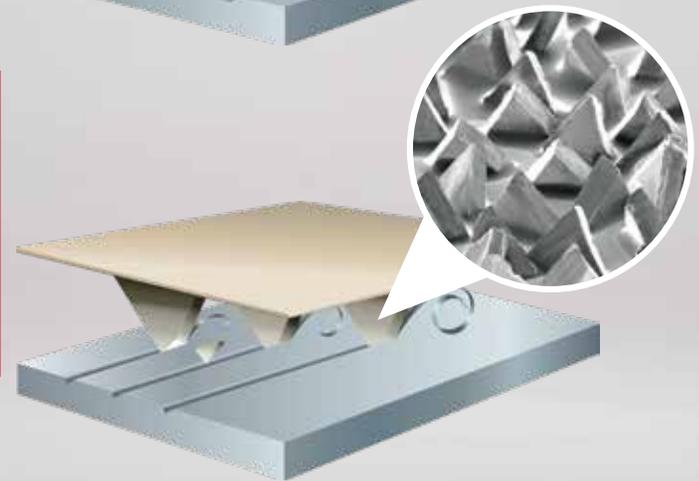
Conventional ceramic abrasive grain is irregular in shape and tends to “plough” through the metal, causing heat to build up in the workpiece and the abrasive – resulting in a slower cut and shorter product life.



VS

3M™ Cubitron™ II abrasives

3M's Precision Shaped Grain uses proprietary microreplication technology to form sharp peaks that easily “slice” through metal – cutting cooler, faster and lasting longer than conventional abrasive grain.





Currently using

Grinding Wheel

with an angle grinder

Currently using

Grinding Wheel

with an angle grinder

Application:

Flat heavy weld removal, bevelling and edge prep.

Switching to 3M™ Cubitron™ II Fibre Discs 982C can help reduce your level of risk when using angle grinders.

How 3M can help.

When considering the full spectrum of health and safety risks associated with metal fabrication, the use of hand-held power tools with grinding wheels is among the most hazardous.

If the grinding application does not involve grinding into corners or where the edge of the grinding wheel must be used, 3M offers an ingenious solution which compared to a standard grinding wheel provides significant mitigation against noise, airborne particles and vibration while at the same time providing substantial increases in productivity and throughput.



Our recommendation:

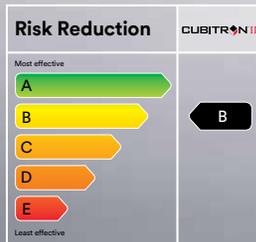
3M™ Cubitron™ II Fibre Disc 982C

Putting 3M's proprietary Precision Shaped Grain technology into an open face format such as a fibre (sanding) disc, delivers exceptional levels of cutting capability, delivering the stock removal capability of a grinding wheel.

The 3M™ Cubitron™ II Fibre Disc 982C is perfect for demanding weld removal, bevelling or other stock removal jobs on flat surfaces. This flexible sanding disc, performing the same job as a hard grinding wheel, offers a highly effective fabricating tool with significantly reduced risk, as shown on the risk reduction indicators below.

3M™ Cubitron™ II Ribbed Back-Up Pad

Designed for heavy stock removal, the 3M™ Cubitron™ II Ribbed Back-Up Pad, used with a 3M™ Cubitron™ II Fibre Disc, offers improved disc life and cut rate.



HAZARD REDUCTION:

Noise



Reduce noise energy by up to

50%*



Reduce the risk to those in the immediate vicinity not directly using the tool



Up to **6db*** quieter



HAZARD REDUCTION:

Hand-arm vibration

Up to **91%*** reduction in vibration exposure



The less rigid, lightweight fibre construction generates less vibration, so **less vibration is transmitted to the operator**

↓ ↓ **Less applied pressure is required**, minimizing operator fatigue

Reduced trigger time due to a significantly better material removal rate, reduces time on the tool, cutting vibration exposure even FURTHER



HAZARD REDUCTION:

Airborne particles



Up to **71%**** less airborne particles

Innovative slicing action means larger, longer metal chips (swarf) staying **airborne for less time**



Conventional grinding wheels are responsible for a large proportion of the airborne particles produced as they wear. **Moving to a fibre disc construction can significantly help reduce the hazard**

HAZARD REDUCTION:

PPE check list



The **correct PPE and operating techniques** should always be used when working with abrasives

3M respirators and face protection

3M hearing and eye protection

Safety clothing, boots and gloves

* Noise and hand-arm vibration compared Tyrolit basic 2in1 Wheel and 3M™ Cubitron™ II Fibre Disc 982C – According to independent testing by Fraunhofer Institute.

** Airborne particles compared 3M™ High Performance Grinding Wheel to 3M™ Cubitron™ II Fibre Disc 982C – According to independent testing by VITO.

Currently using

Grinding Wheel

with an angle grinder

Application:

Fillet weld removal, grinding into corners, weld prep and bevelling.

Switching to 3M™ Cubitron™ II Depressed Centre Grinding Wheels can help reduce the level of risk associated with angle grinding.

How 3M can help.

When considering the full spectrum of health and safety risks associated with metal fabrication, the use of hand-held power tools with grinding wheels is among the most hazardous.

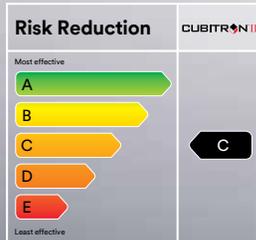
3M offers an innovative solution, which can provide significant mitigation of the risks from noise, airborne particles and hand-arm vibration, while at the same time providing substantial improvements in productivity and throughput.



Our recommendation:

3M™ Cubitron™ II Depressed Centre Grinding Wheel

Engineered to cut significantly faster and last up to four times longer than competing products, where applications demand use on the face and edge of the wheel. Just as importantly, 3M™ Cubitron™ II Depressed Centre Grinding Wheels can play a vital role in reducing risk, as shown on the risk reduction indicators below.



HAZARD REDUCTION:

Noise



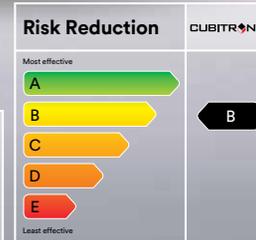
Reduce noise exposure by completing the job quicker



Reduce the risk to those in the immediate vicinity not directly using the tool



Up to 3db* quieter



HAZARD REDUCTION:

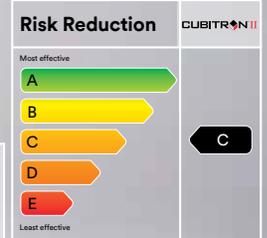
Hand-arm vibration



Minimize vibration by up to 64%*

Less applied pressure is required minimising operator fatigue

With a fixed grinding workload, the fast removal rates reduce trigger time and vibration exposure



HAZARD REDUCTION:

Airborne particles



Up to 40%** less airborne particles

Significantly reduced wear means less airborne particles emanate from the abrasive wheel itself

Innovative slicing action means larger, longer metal chips (swarf) staying airborne for less time



HAZARD REDUCTION:

PPE check list



The correct PPE and operating techniques should always be used when working with abrasives

3M respirators and face protection

3M hearing and eye protection

Safety clothing, boots and gloves

* Noise and hand-arm vibration compared Tyrolit basic 2in1 Wheel to 3M™ Cubitron™ II Depressed Centre Grinding Wheel – According to independent testing by Fraunhofer Institute.

** Airborne particles compared 3M™ High Performance Grinding Wheel to 3M™ Cubitron™ II Depressed Centre Grinding Wheel – According to independent testing by VITO.



Currently using

Cut-off Wheel

with an angle grinder

Currently using

Cut-off Wheel

with an angle grinder

Switching to **3M™ Cubitron™ II Cut-Off Wheels** can help reduce your level of risk when using angle grinders.

How 3M can help.

Of all the metal fabrication processes, cutting metal with a cutting wheel is one of the most hazardous. This is due to the cutting wheels being relatively thin and the technique required by the operator to complete the job. Uneven pressures, cutting angles, damaged wheels and the close proximity of the operator to the high speed cutting wheels all contribute to the risks.

3M products can help mitigate these risks by reducing the time on tool. The remarkable cutting speed of 3M™ Cubitron™ II Cut-Off Wheels enable work to be processed quicker and the smooth cutting action requires less operator pressure, boosting operator comfort.



Our recommendation:

3M™ Cubitron™ II Cut-Off Wheel

3M™ Cubitron™ II Cut-Off Wheels have been engineered to cut significantly faster and last up to four times longer than competitive wheels.

Designed to offer high levels of performance, while reducing the hazards from noise, airborne particles and vibration; compared with other products, 3M™ Cubitron™ II Cut-Off Wheels offers a far lower risk profile, as shown on the risk reduction indicators below.



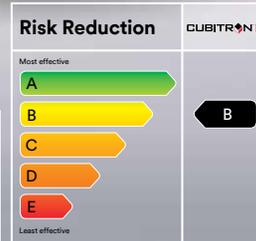
HAZARD REDUCTION:

Noise



Faster cutting action enables work to be **completed faster**, helping to **reduce exposure**

Reduce the risk to those in the immediate vicinity **not directly using the tool**



HAZARD REDUCTION:

Hand-arm vibration



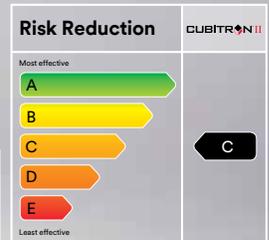
Reduction in vibration exposure



Less pressure required due to the smoother cutting action puts less strain on the operator



Reduced trigger time due to significantly faster cut rate



HAZARD REDUCTION:

Airborne particles



Less airborne particles

Innovative cutting action means larger, longer metal chips (swarf), staying **airborne for less time**

Significantly reduced wear means **less particles emanate** from the abrasive wheel itself



HAZARD REDUCTION:

PPE check list



The **correct PPE and operating techniques** should always be used when working with abrasives

3M respirators and face protection

3M hearing and eye protection

Safety clothing, boots and gloves



Currently using

Rotating Wire Brush or Wheel

with a bench motor, disc sander
or grinder

Currently using

Rotating Wire Brush or Wheel

with a bench motor, disc sander or grinder

Help reduce your level of risk when cleaning and finishing metal by switching to Scotch-Brite™ Radial Bristle Brushes and Discs.

How 3M can help.

The use of rotating wire brushes, composed of fine wire bristles that are attached to a metal wheel, puts workers at significant risk as individual wire bristles can break off during the process. These stray bristles become airborne and can be easily embedded into the operator's eyes, other body parts and clothing. Beyond potential projectile injury, the use of wire brushes contributes to operator fatigue.

Significantly help diminish safety risk while improving performance, with Scotch-Brite™ Radial Bristle Brushes and Discs. This patented line of moulded products are filled with 3M™ Cubitron™ Abrasive Grain, which enables them to outperform in metal cleaning and deburring applications while helping to reduce the hazards from airborne hand-arm vibration, user fatigue, cuts and other injuries.



Our recommendation:

3M™ Scotch-Brite™ Radial Bristle Brushes and Discs

Switching to Scotch-Brite™ Radial Bristle Brushes and Discs from wire brushes reduces your level of risk when cleaning and finishing metal. Durable, yet flexible, the soft bristles cannot penetrate the eyes or skin. The patented bristle design requires less pressure and reduces operator fatigue.

Risk Reduction	Scotch-Brite
Most effective	
A	
B	B
C	
D	
E	
Least effective	

HAZARD REDUCTION:

Noise



Faster cutting action enables work to be **completed faster**, helping to **reduce exposure**

Reduce the risk to those in the immediate vicinity **not directly using the tool**



HAZARD REDUCTION:

Hand-arm vibration



Performance testing shows that radial bristle brushes **cut faster and more efficiently** than wire solutions, reducing exposure to vibration



Less pressure required to achieve the desired finish result reduces operator fatigue



Reduced trigger time due to significantly faster cut rate

Risk Reduction	Scotch-Brite
Most effective	
A	
B	B
C	
D	
E	
Least effective	

HAZARD REDUCTION:

Cuts and other injuries



No metal wires

Durable, yet flexible, the **soft bristles cannot penetrate the eyes or skin**



No metal wires breaking off means **less chance of injury**



Risk Reduction	Scotch-Brite
Most effective	
A	
B	B
C	
D	
E	
Least effective	

HAZARD REDUCTION:

PPE check list



The **correct PPE and operating techniques** should always be used when working with abrasives

3M respirators and face protection

3M hearing and eye protection

Safety clothing, boots and gloves

On materials such as mild carbon steel, radial bristle brushes outperform 0.014 mil wire brushes by as much as 10 to 1 in cut rate testing.



Currently using

Fibre Disc

with an angle grinder

Currently using

Fibre Disc

with an angle grinder

Switching to **3M™ Cubitron™ II Fibre Discs 982C** can help to reduce the level of risk with angle grinders.

How 3M can help.

For light and medium weld removal, a fibre disc is often the ideal solution. 3M's fibre discs deliver superior cutting power and product life, reducing time on tool and the frequency with which discs need changing - a procedure during which incorrect mounting of the disc on the tool can result in an increased risk of employee injury.



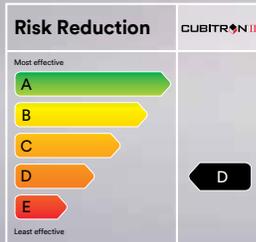
Our recommendation:

3M™ Cubitron™ II Fibre Disc 982C

Cubitron™ II Fibre Discs use 3M's proprietary Precision Shaped Grain to deliver their winning performance. For heavier MIG welds, bevelling and other heavy stock removal, you can use the 982C Series and for all other applications up to a 120 grit finish, we recommend 3M™ Fibre Disc 787C.

3M™ Cubitron™ II Fibre Discs have been designed to offer high levels of performance, while reducing the hazards from noise, airborne particles and vibration; compared with other products, 3M™ Cubitron™ II Fibre Disc offers a far lower risk profile, as shown on the risk reduction indicators.

In each case, 3M™ Cubitron™ II Fibre Discs have been designed to offer high levels of performance, which in turn can reduce the hazards from noise, airborne particles, and vibration when compared with other products. Thus, 3M™ Cubitron™ II Fibre Disc can offer a comparatively lower risk profile when properly used.



HAZARD REDUCTION:

Noise



Reduce noise exposure by completing the job quicker



Help reduce the risk to those in the immediate vicinity not directly using the tool



HAZARD REDUCTION:

Hand-arm vibration



Up to **32%*** Reduction in vibration

Less pressure required due to the smoother cutting action puts less strain on the operator



With a fixed grinding workload, the fast removal rates **reduce trigger time** and vibration exposure



HAZARD REDUCTION:

Airborne particles



Up to **48%**** less airborne particles

Innovative slicing action of 3M's proprietary grain means larger, longer metal chips (swarf) staying **airborne for less time**



HAZARD REDUCTION:

PPE check list



The **correct PPE and operating techniques** should always be used when working with abrasives

3M respirators and face protection

3M hearing and eye protection

Safety clothing, boots and gloves

* Noise and hand-arm vibration compared 4515 Siabite fibre disc to 3M™ Cubitron™ II Fibre Disc 982C – According to independent testing by Fraunhofer Institute.

** Airborne particles compared 3M™ Cubitron™ Fibre Disc 985C to 3M™ Cubitron™ II Fibre Disc 982C - According to Independent testing by VITO.



Currently using

Sanding Disc

with a random orbital sander

Currently using

Sanding Disc

with a random orbital sander

Switching to **3M™ Cubitron™ II Sanding Disc 775L** can help reduce the level of risk when sanding.

How 3M can help.

Due to the way in which random orbital sanders work, vibration exposure using this type of tool actually represents more of a risk to employees and their employers than using a right angle grinder.

The finer abrasive grades used in such applications also mean that airborne particles become an even greater issue. 3M sanding discs resolve these problems, with exceptional cutting rates and class-leading airborne particle extraction capabilities.

3M™ Elite Series random orbital sanders are optimized for advanced airborne particle extraction, precision-balanced to run smoothly with less vibration, rubber grips to absorb and reduce vibration and internal mufflers to help reduce noise.

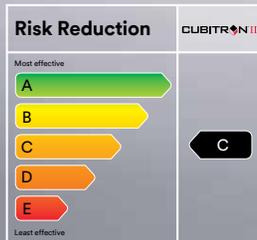


Our recommendation:

3M™ Cubitron™ II Sanding Disc 775L

The 775L Disc is engineered to work faster than conventional discs thanks to its Precision Shaped Grain technology. The same technology also helps the product to last up to six times longer than competing materials. For even greater efficiency, pair our Cubitron™ II discs with 3M™ Elite Random Orbital Sander .

3M™ Cubitron™ II Sanding Discs and 3M 'Elite' sanders have been designed to offer high levels of performance, while reducing the hazards from noise, airborne particles and vibration, offering a far lower risk profile, as shown on the risk reduction indicators.



HAZARD REDUCTION:
Noise

Reduce noise exposure by completing the task quicker



Stay on the job far longer without compromising legal exposure limits



3M tools designed with internal mufflers to help reduce noise by up to 6db



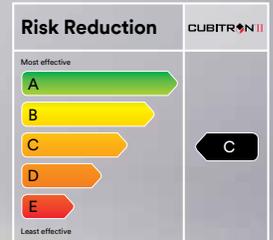
HAZARD REDUCTION:
Hand-arm vibration

Get **more work done** where capacity is constrained by legal vibration exposure limits

3M tools are **precision-balanced to run smoothly** with less vibration, their compact, low-profile and lightweight design helps operators produce more with less effort and fatigue

Minimize vibration

With a fixed grinding workload, the fast removal rates **reduce trigger time** and vibration exposure



HAZARD REDUCTION:

Airborne particles



Less airborne particles released into the workplace



3M tools are designed to **maximize airflow** into your central extraction system, or can come with their own self-generated vacuum action, **extracting airborne particles** into a removable bag

The proprietary multi-hole configuration delivers **exceptional airborne particle extraction rates**

HAZARD REDUCTION:

PPE check list



The **correct PPE and operating techniques** should always be used when working with abrasives

3M respirators and face protection

3M hearing and eye protection

Safety clothing, **boots and gloves**

Links to further reading:

Canadian Centre for Occupational Health and Safety
www.ccohs.ca

Industrial Noise Control:
www.industrialnoisecontrol.com/inc-library/noise-control-faqs

Hierarchy of Controls – National Institute for Occupational Safety and Health
www.cdc.gov/NIOSH

* For further information on the independent test data carried out by the Fraunhofer Institute and the Flemish Institute for Technological Research (VITO), please contact us: abrasives.ca@mmm.com



For more information please contact your local 3M representative.

Visit [3M.ca/Metalworking](https://www.3m.ca/Metalworking)

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