

A REPORT ON THE RISK MANAGEMENT OF THE TOSHIBA BMC6B

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This paper is a report submitted for assessment in the unit 51374 Management of Occupational Health and Safety, and features a very good application of the risk management framework in a particular industrial location. It is conceded that the company has undergone a number of changes to work practices in the area targeted in the report and that some of these changes were in train at the time the research was carried out. While the study is based on some observations with a particular organisation, the arguments do not necessarily reflect or represent the views of that organisation.

1.0 Organisational Context

The organisation which is the focus of this report, is involved in research and development; product design development, and manufacturing; moulding and casting; pattern making; machining; and finishing and assembling.

There are various divisions in the organisation including the core shop, dressing shop, machine shop, warehouse, packing shop, maintenance, administration, and the foundry which includes the JK line and the melt deck.

There is one operator to each machine on the shop floor at all operational times.

2.0 Workplace Issue

This report will be focusing on the Toshiba BMC6B (Shibaura) found in the machines shop division. The main issue is guarding, however, other safety hazards identified with respect to the Toshiba will also be included in the discussion.

The Toshiba can be used in the manufacturing of a variety of products. Its function is to drill holes into the cast metal components. The machine is fully automatic and computer operated. It has the capacity to work on two parts at any one time. A large rotating component at the top of the machine is fitted with numerous drill bits that require changing manually according to the specific part being processed (see Appendix 1 & 2 for diagram & picture). The Toshiba BMC6B is 20 years old at the time of writing this report.

2.1 Effects of the Workplace Issue

Guarding is required on the Toshiba BMC6B because the numerous moving components on the machine have the potential to collide with the tasks of the operator. The moving components create potential crush points within the machine, indicating the need for appropriate protective measures, i.e. guarding, at those points.

The relevance of this issue to the workplace is clearly demonstrated by an incident which occurred on the 24 February, 2000 where the machine operator had his hand caught in one of the crush points. This resulted in the removal of skin from the back of his hand and lower arm.

3.0 The Need For Management Action

3.1 Legislative Requirements

The legal framework within which occupational health and safety operates includes both common law and legislation.

Under common law, employers have a duty to provide:

- a) reasonably competent staff;
- b) a sufficient number of workers to carry out the work safely;
- c) a reasonably safe place to work;
- d) proper plant and equipment; and
- e) a reasonably safe system or method of work.

(CCH, 1996, p.34, as cited in Smith, 2000)

The discussion which follows in Section 4.1 Risk Identification, shows that management within the organisation has not made adequate provisions for these requirements which, under common law, could be construed as negligence. Therefore, in order to protect itself in a court of law, management needs to take action.

The Workplace Health and Safety Act (1995) Qld. is the legislation detailing the obligations of employers, employees and other people in the workplace (Smith 2000, p. 6.7). It states that the obligations of management, under the section of 'people in control of a workplace', are to:

- a) ensure that people can come to work at the workplace with minimum risk of injury or illness;
- b) ensure safe access to the workplace for all people including those who are not workers;
- c) ensure that any plant or substance they provide for work by people who are not their workers is safe when properly used.

(Department of Training and Industrial Relations, 1998, p. 5, as cited in Smith 2000)

This legislature clearly shows a need for action by the organisation's management to ensure the health and safety of operators of the Toshiba BMC6B.

3.2 Health and Safety Implications

The need for management action may also be expressed from an economical viewpoint. The cost of an injured worker can be measured in terms of lost time, lost production, worker's compensation and rehabilitation costs and, in severe cases, the cost of replacement of the employee and the training of a new worker.

With regard to the considerable potential costs to the business, it is economically viable for management to take preventative health and safety measures for the Toshiba BMC6B.

It is also important to examine why it is the manager's primary responsibility to ensure the safety of the operator of the Toshiba BMC6B.

It can be seen from the relevant accident investigation report that the direct causes of the recent accident involving the Toshiba BMC6B were lack of effective guarding around the crush point, and lack of training and instructions for the operator. Both of these are managerial responsibilities. Under common law the manager is required to ensure the competence of staff (CCH 1996, p.34, as cited in Smith 2000), and outside of the law it would be unreasonable to expect a new employee to find and organise their own training for a specific machine. With reference to guarding around the crush point, this is also a managerial responsibility, once again, under common law and legislation. Similarly, although it is the employee's responsibility to use any risk control, i.e. guarding, that is in place, they cannot be expected to implement their own guarding in areas that are perceived as hazardous.

Therefore, considering the issues discussed above and in Section 4.1 Risk Identification, it is reasonable to argue that there is a need for management action to ensure safety of the operator of the Toshiba BMC6B.

4.0 Risk Management System

Glendon (1994, p.5, as cited in Smith 2000, p.7.6) refers to risk management as 'the management of mainly physical (but also psychological) occupationally-derived risks to the health, safety and well being of the operations of a business, enterprise or other organisation'. Coletta (1996, p.359) incorporates the economical perspective saying that risk management is a term used to describe various operational and financial activities aimed at minimising the impact of accidental or unplanned loss.

In the case of the foundry, it is necessary to adopt a risk management approach to ensure the health and safety of the workers, specifically through machine guarding, with regards to the Toshiba BMC6B. It is also important to consider the necessity for risk management in terms of long-term decreases in costs related to injury.

This report will use the risk management process advised by Bos and Farr (1993, as cited in Smith 2000, p.7.6) in order to demonstrate systematically to management the extent of the risk and what action is required to minimise this risk. The steps involved in this process are:

- risk identification;

- risk assessment;
- risk control;
- implementing recommendations; and
- risk monitoring.

Coletta (1996, p.366) emphasises the need for integration of all segments of the risk management process in order to build an effective, productive program for accident prevention.

4.1 Risk Identification

The risk identification process is 'concerned with what risks are involved in different elements in the workplace including plant, equipment, people and work processes' (Smith 2000, p.7.6).

The hazards involved in operating the Toshiba BMC6B were identified through a number of sources. An inspection was carried out of the machine's various actions, accident reports were examined, a safety audit was conducted, employees involved in the operation of the machine were questioned for their concerns, and work processes were examined.

4.1.1 Inspection

Observation of the machine's various actions exposed a number of hazards. The majority of these are crush points created during the rotating of the two parts being worked on. There are two main crush points identified (as shown in Appendix 1 and 2). These are:

- 1) The joint between the two separate sections as they move together for rotation; and
- 2) Behind section 2 as section 2 moves back to its original position after rotation.

Another risk identified at this stage relates to the pieces of hot metal, or swarf, which spin off during the drilling process. These flying pieces of metal are unhindered and were seen to land directly where the operator must stand in order to control the computer.

4.1.2 Accident Report

Through examination of the accident report, two hazards became apparent. The first of these is the crush point where the operator's hand was caught. This supports the evidence found during the inspection of the machine in operation. Secondly, it was found that the operator either did not know the correct procedures for the operation of the machine, or that he did not follow these instructions.

4.1.3 Safety Audit

The safety audit was conducted with the use of a checklist (see Appendix 3). The safety audit conducted on the Toshiba BMC6B revealed the following hazards:

- 1) Lack of guarding, particularly around the crush points;
- 2) The small guards which are in place are easily removable and even when left on, do not prevent access to crush points or provide protection from flying swarf;
- 3) There is a noticeable lack of signage on and around the machine, with only one danger sign — approximately 5 x 10cm high — up on the front panel. There are no signs near the crush points or the emergency button. There are also no signs with instructions as to the operation of the machine, or what to do in an emergency;
- 4) The machine itself has no cut-outs or interlocks to prevent operation when appropriate safety measures are not in place. The only type of cut-out existing is at the point where the two sections interlock for rotation. It should be noted here that this cut-out, which effectively prevents further operation if a foreign object is sensed between the interlocking sections, did manage to prevent a more serious injury to the operator's arm in the recent accident.

4.1.4 Employee Concerns

After discussion with a number of employees on the work floor, it was established that their attitude towards risk prevention was not a positive one. They expressed a belief that fully enclosed guarding of the equipment would interfere with operation, and removal of the guarding was not an uncommon occurrence.

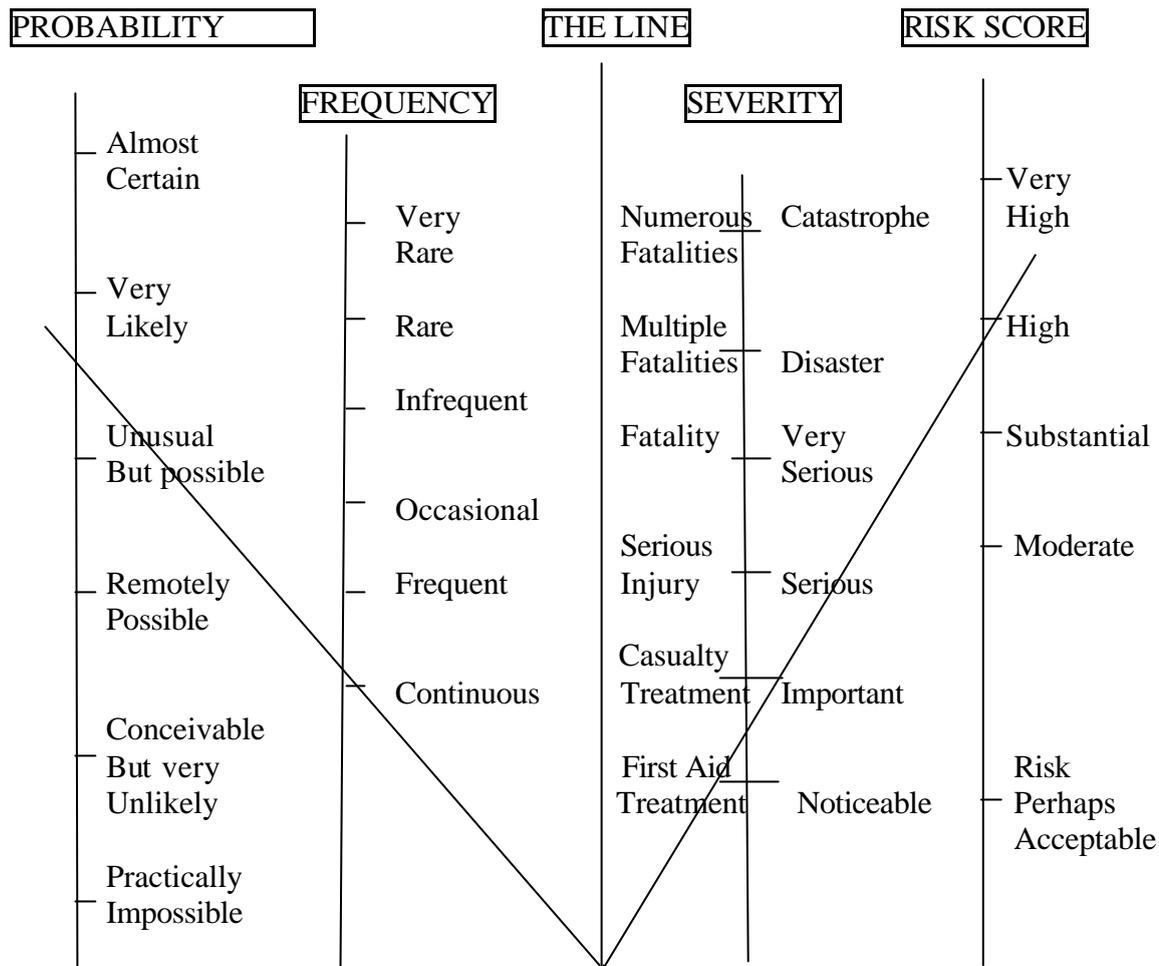
4.1.5 Work Processes

The major danger or hazard identified in the work process is the scheduling of operators. Of the four employees who operate the Toshiba BMC6B, only two are experienced. Due to the system of shift work used, there are times where an inexperienced operator is required to work unsupervised.

The other work procedure that was identified as hazardous is the changing of the drill bits. It appears the correct procedure has not been adequately communicated to the employees, or that the employee has not fully understood the inherent danger of not complying with instructions. This results in the practice of standing on thin, sharp and wet parts of the machine, which are not designed to be steps, in order to reach the drill bit.

4.2 Risk Assessment

Risk assessment is described by Stranks (1994, p.54, as cited in Smith 2000, p.7.7) as the ‘identification of the hazards present in an undertaking and an estimate of the extent of risks involved, taking into account whatever precaution has already been taken’. Appropriate risk assessment includes probability, frequency, and consequence or severity (Smith, 2000). For the purpose of risk assessment of the Toshiba BMC6B, the instrument shown below was used.



4.2.1 Probability

Probability is the likelihood of an (unplanned and undesirable) event taking place (Kohn et al. 1996, p.75, as cited in Smith 2000, p.7.7). Considering the work processes, the moving components creating various crush points, and the evidence of previous accidents, the probability of an accident occurring from the various hazards is rated between ‘unusual but possible’ and ‘very likely’.

4.2.2 Frequency

Frequency or exposure measures how often the accident may occur (Ridley 1994, p.177, as cited in Smith 2000, p.7.7). The fact that the machine is in use on a 'continuous' basis throughout the day, and regularly during the year, results in a 'continuous' rating for frequency.

4.2.3 Severity

Incidents involving the three identified crush points may result, and have resulted, in serious injury such as loss of skin. An extreme consequence could also be the loss of a finger or hand. Considering this, severity was placed between 'serious' and 'very serious'.

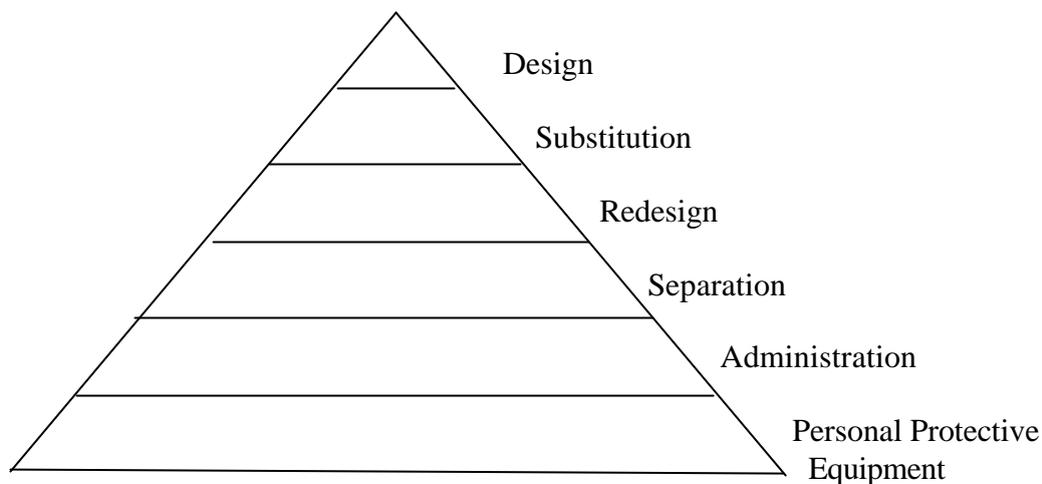
4.2.4 Risk Score

From these three measurements, a risk score of 'very high risk' was established.

Therefore, the results of the risk assessment for the Toshiba BMC6B show that the risks on the health and safety of the operator of the machine are very high. This reinforces the need for immediate preventative action.

4.3 Risk Control

Managing risks involves the necessary process of preventing the risk from progressing into an incident or attempting to control the risk. Risk control can be most effectively demonstrated using the risk control hierarchy as shown in Smith (2000 p.7.11)



4.3.1 Design

‘Design includes the initial design of the workplace, plant and equipment and work processes which eliminate or minimise hazards’ (Smith 2000, p.7.11). Although this is the most effective form of risk control, the fact that the foundry has been in operation since 1871 makes design a fairly expensive and, perhaps, more unlikely proposition.

4.3.2 Substitution

‘Substitution usually involves the replacement of a hazardous material or process with a safer one’ (Smith 2000, p.7.11). Examples given by Smith, including factors such as ‘toxic substances’ and ‘contaminants’, indicate that this method of risk control is mostly concerned with chemical hazards. The risk identification carried out for the Toshiba BMC6B found no such hazards, therefore, risk control in this area is not considered.

4.3.3 Redesign

‘Redesign refers to redesigning features of the workplace, plant and equipment, and work processes to reduce or eliminate risks’ (Smith 2000, p.7.12).

The possibility for controlling risk through a redesign strategy involves the emergency stop button, as discussed in Section 4.1.3 Safety Audit. In redesigning the machine, the emergency stop button could be relocated to the more accessible side of the control panel. Even more effective than this would be additional emergency stop buttons to be located near the potential crush points to allow the operator easy access if he/she is caught in a crush point.

4.3.4 Separation

‘Separation ... refers to the control of risks by isolating the hazard from the person’ (Smith 2000, p.7.12). Separation is the preferred control strategy for the Toshiba BMC6B. As identified in 4.1.3 Safety Audit, the lack of adequate guarding, in conjunction with the absence of cut-out devices, constitutes the greatest source of hazard.

Two forms of risk control integrating guarding and cut-outs have been identified. First is the use of concertina metal doors to encase the fore section of the machine (see Appendix 4). These doors should have interlocking at all joints. An advisable height is approximately 1.8m, as this prevents operator access to crush points from above (Miles pers. comm., 13/04/2000).

The second guard advised is to be situated in front of the drilling equipment (see Appendix 4). Here, a sliding door, with clear perspex inserted, could be

fitted. This allows the operator to monitor the process while being protected from the metal swarf. The door could be approximately 1.8m high to effectively block flying swarf, and fitted with a cut-out device.

Another consideration for redesign is to incorporate light beams into the machinery. The purpose of these would be to provide a cut-out mechanism whereby if the operator breaks the light beam, and in doing so puts his/herself at risk, the machine stops operation. These would need to begin at the height of the base of the machine approximately 40cm from the ground to prevent access from underneath. The height would need to be approximately 120cm to block access by the operator from over the top. Considering the low height of the crush points, it would be impossible for the operator to reach over a 120cm light beam without causing the machine to stop.

The poles used for the light beams would need to be protected using bollard, making them easy to see for any forklift drivers and other users and visitors to the area.

4.3.5 Administrative

As identified in Section 4.1.3 Safety Audit, there is a lack of signage on and around the machine. Signs may be used for the Toshiba BMC6B in three ways:

- 1) Warning signs could be installed near crush points;
- 2) The position of the emergency stop button could be made noticeable through the use of signs; and
- 3) Operation instructions should be visible.

The other possibility for administrative risk controls is identified in Section 4.1.5 Work Processes. There is a need for more intensive training of the operators of the Toshiba BMC6B. It may be necessary to schedule one experienced and one inexperienced operator on shift at the same time, at least until a level of mastery is achieved. A system may be implemented whereby new employees must first undertake a training programme for any machine which they are expected to operate, and not be allowed to operate the machine alone until they have passed all training requirements.

In conjunction with this, it is also prudent/desirable to develop a written set of operating instructions. These should be used during the training programme and should also be present on or around the machine for future reference.

Communication with employees also reveals a common belief that guarding hinders effective work performance. In order to reduce these psychological barriers, management may need to run an educational programme showing employees the importance of health and safety procedures, and the impact of poor workplace practices on all parties.

4.3.6 Personal Protective Equipment (PPE)

All employees are currently required to wear earplugs and safety glasses, and the accepted work attire is long-sleeved overalls. No further PPEs are advised here.

4.4 Implementing Recommendations

The three areas identified for effective risk control strategies are redesign, separation, and administrative. In this section of the report, the advantages and disadvantages, and a cost-benefit analysis, will be examined for each of the strategies suggested.

4.4.1 Emergency Stop Buttons

The present position of the emergency stop button makes it all but redundant to an operator stuck in the machine. The relocation of the emergency stop button to the other side of the control panel would make it more accessible. This is also a relatively inexpensive operation when contrasted to the cost of an injury, and to alternative strategies.

As stated earlier, the installation of additional emergency stop buttons near the crush points could also be effective. However with the problem already dealt with through the use of guards with cut-outs (as discussed later) and the relocation of the original emergency stop button, this may be an unnecessary expense.

Therefore, the relocation of the emergency stop button is recommended, however, the installation of additional emergency stop buttons is not considered necessary.

4.4.2 Metal Concertina Doors

There is one problem arising with this recommendation. The new casts to be drilled are carried onto the front of the machine using a crane from above. If metal doors were situated around the machine, the access to the machine would be blocked. It may be possible to place the foremost metal concertina door on hinges to allow for opening so the crane can move freely. However, the necessary space for this is not available. If the operator uses the crane to lift the new cast over the doors a new risk arises — that of the cast either dropping, or the operator knocking his head on it.

All factors considered, although metal concertina doors may provide a cheaper short term option, in the long run it could result in difficulties for the operator and greater costs to the organisation.

4.4.3 Light-beams

Light-beams would be effective where used as a form of guarding the operator from the crush points using a cut-out system. Poles, containing the light

beams, would be situated at each corner (as demonstrated in Appendix 4) with light beams running from pole to pole. Any disruption of these beams could cause the machine to cease operation, and to restart operation the control unit would have to be manually adjusted.

It is important to note here that light beams are a costly solution, ranging from \$6000 to \$26000 (<http://www.baneng.com>). However, the problems discussed earlier concerning metal concertina doors would be eliminated using this technique. Although the initial cost may be greater, in the long run costs may be lower and operator satisfaction higher.

Therefore, light-beams are recommended as the major form of guarding for the Toshiba BMC6B.

4.4.4 Signs

Signs are a cheap method of risk control. Although they do not prevent the operator from putting him/herself at risk, they do warn of the dangers. Signs are also required, by law, to show hazards. Considering the low cost and ease of implementation, signs are recommended as a strategy of risk control.

4.4.5 Training and Education

Discussions with employees, and the recent accident, demonstrate the real need for the training and education of the employees regarding the use of equipment and safety procedures. The cost of the programme would consist of a number of hours wages and perhaps a number of lost work hours. It is likely that these costs are lower than the cost of compensation and rehabilitation and the hours likely to be lost in the event of an injury. Therefore, final recommendations include a training and education programme.

4.5 Risk Monitoring

‘The ongoing monitoring of hazards and of the effectiveness of control measures is vital to a process of continuous improvement in occupational health and safety’ (Smith 2000, p. 7.12). In order to effectively monitor or evaluate the risk controls which have been implemented, it is useful to refer back to those methods used for risk identification.

Following the installation of those devices recommended in Section 4.4 of this report, the machine should be re-inspected during operation to ensure cut-outs are working, crush points are appropriately guarded, light beams function properly, and the sliding door effectively stops flying swarf.

While the machine is in action, it should also be observed whether or not the emergency stop button is easily accessible from the most important positions around the machine.

Signs should be examined to ensure their noticeability and their compliance with legal requirements.

It is also necessary to discuss the effectiveness of the new safety measures with the employees. Questions may be asked such as: Are they hindering productivity?; What is their attitude towards the control measures?; Is the protection provided adequate?

Finally, the requirements designed as part of the training and education programme should be compared to the skills and capabilities of the employees to ensure that training and education has been carried out effectively.

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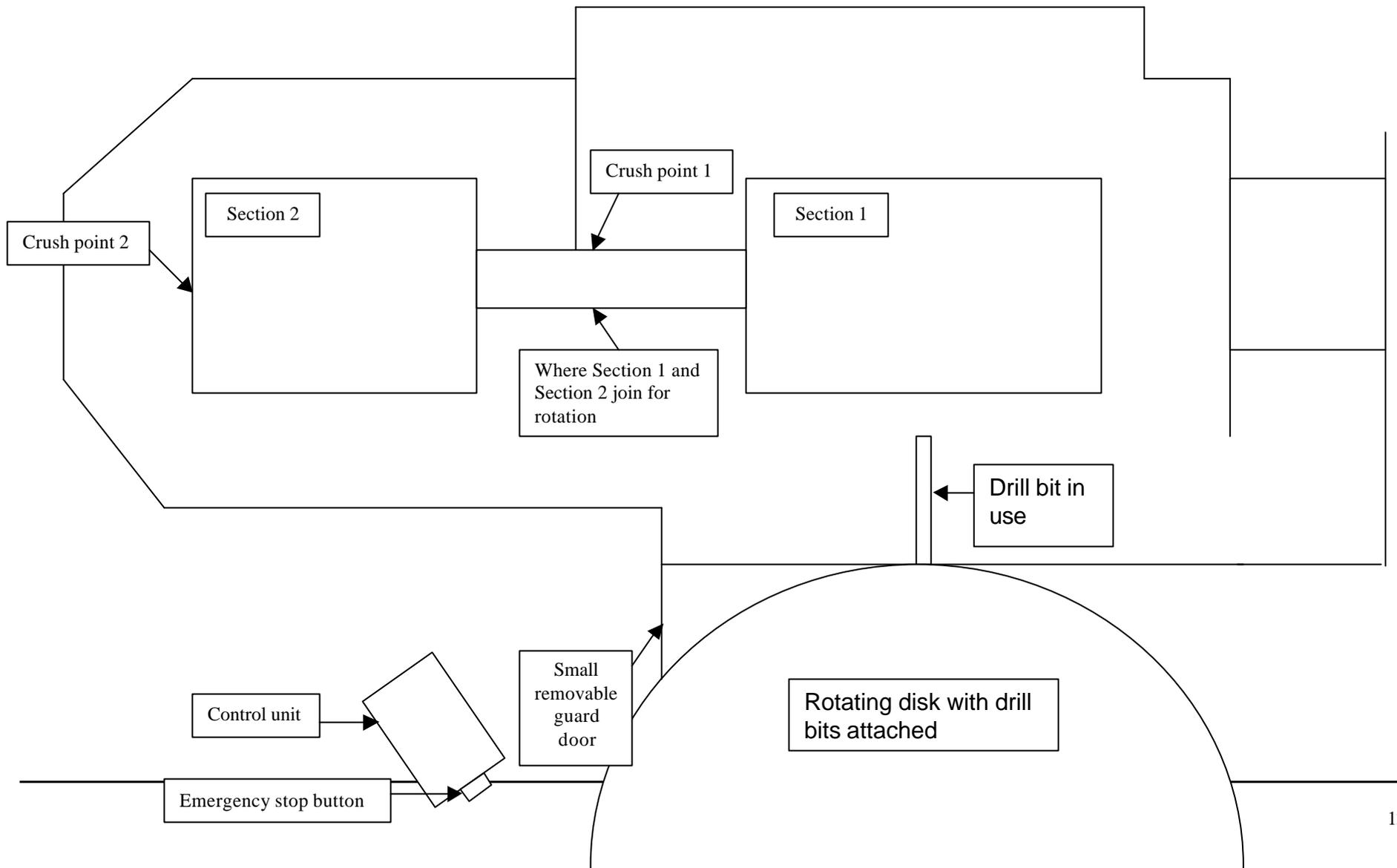
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Appendix 1 – Diagram: Toshiba BMC6B currently



Appendix 2



Appendix 3 — Risk Identification Checklist

Date:		Time:		
		OK	Not OK	Comments
Chemicals	Well contained, containers clearly labelled and not leaking, drip trays used			
Cut-outs	Used in appropriate places, in working order			
Electrical	No broken plugs, sockets or switches, leads in good condition and used appropriately			
Floor	Not slippery, clean, unobstructed, suitable floor covering, no trip hazards			
Guarding	Secure, appropriate size, covers all hazardous areas, protects operator from hazards			
Lighting	Sufficient, well maintained			
Machine hazards	Rounded edges on machine parts, no projecting fittings etc, appropriate design for work methods			
Signs	Obvious, clean, warn of risks			
Tools & Equipment	Stored properly, well maintained, clean, parts in good condition and suitable for use			

Appendix 4 – Diagram: Toshiba BMC6B with advised changes

