

# Submission to the Inquest into the Death of Steven Ewing

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7106**

**The International Association  
of Machinists and Aerospace  
Workers, Local 1848,**

**The International Brotherhood of  
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## Section 1

# Introduction

Early on the morning of August 8, 2000, an explosion took place in the reverberatory furnace at the Hudson Bay Mining and Smelting (HBM&S) smelter in Flin Flon, Manitoba. The blast injured 13 men (11 employees and two contractors). Seven of the injured men were treated at the Flin Flon Hospital and released on the night of the explosion, while six others remained in hospital. Steve Ewing and Roland Pruden were flown to Winnipeg for treatment, and Brad Russell and Daren Stular were flown to Edmonton. Rich Moore was later flown to Winnipeg.

Thirty-three-year-old Steve Ewing died on August 16, 2000, at the Winnipeg Health Sciences Centre. Of the approximately 50 men on duty that night, 43 filed workers compensation claims for stress, while 28 lost time from work.

Following investigations by the RCMP and the Mines Inspection Branch, in 2001 charges were laid against Hudson Bay Mining and Smelting. On November 27, 2001, the company pleaded guilty to a single contravention of Section 4(2) (a) of *The Workplace Safety and Health Act*, which creates an obligation to provide and maintain a workplace, necessary equipment, systems and tools

that were safe and without risks to health so far as was reasonably practicable. The court levied the maximum fine allowed under provincial law at the time, \$150,000 along with a victim surcharge of 15 per cent.

### **Mandate of Inquest**

On January 22, 2002, Dr. Thambirajah Balachandra, Manitoba's Chief Medical Examiner, wrote to Manitoba Justice, directing that, in accordance with *The Fatalities Inquiry Act*, an inquest be held into the circumstances surrounding Steve Ewing's death.

Under *The Fatality Inquiries Act* this Inquest was mandated to determine the circumstances that led to Mr. Ewing's injuries and subsequent death and to determine what, if anything, can be done to prevent similar deaths from occurring in the future (K 1.1, Dr. A. T. Balachandra to Bruce Kaplan, January 22, 2002).

The Inquest commenced in 2004 and, after a lengthy hiatus caused by various legal appeals, concluded in 2008. The United Steelworkers, Local 7106, the International Association of Machinists and Aerospace Workers, Local 1848, and

International Brotherhood of Electrical Workers, Local 1405, all represent workers who were on duty on August 7-8, 2000 and were affected by the explosion. These unions had standing throughout the hearing. Public, independent inquiries into workplace deaths are essential to create safer, healthier workplaces. An inquest plays an important role:

- in allowing for a public investigation into deaths that result from a variety of causes including man-made disasters,
- in providing family and friends of the deceased, along with those who may have been injured by the event that lead to the death under investigation, with a needed explanation of what happened, and,
- leading to changes that prevent similar deaths and injuries in the future.

This particular inquest faced, as noted above, numerous challenges that have led to unnecessary delays. As a result, we are presenting a separate submission outlining our arguments for changes to The Fatality Inquiries Act.

### **Causes of the explosion**

An inquest is not about blame but causation. This is a complex issue in a corporate setting, where much of what a worker does is predetermined by managerial decisions about the allocation of resources, design, planning, and supervision. The evidence presented to this Inquest has made it clear that the immediate cause of the explosion that killed Steve Ewing was the mixing of molten metal and water. The search for cause must, however, go further.

Molten metal and water were allowed to mix in the furnace as the result of a series of inter-

related failures of systems that were under direct management control. These failures took place at the supervisory level, the planning level, the management safety system level, and ultimately, at the senior management level. These failures are the true causes of the explosion and the death of Steve Ewing. What we present here is a summary of those failures; the evidence that supports our conclusions appears in subsequent sections of this submission.

This was a death and a tragedy that could have been predicted and prevented. It took place within an environment that was created by management, using tools and processes proscribed by management. The workers performed their tasks as a directed: the actions of individual workers were not the cause of the explosion.

### Supervision

On the evening of August 7-8, 2000, when the smelter shutdown and washdown took place, the company supervisory system failed to provided the direction needed to protect worker safety and health. This failure was evidenced by the following facts.

- The washdown was not closely supervised.
- Supervisors had little direct experience of the washdown procedure.
- Supervisors did not consider direct experience when assigning workers to do the washdown.
- Supervisors were not aware of the hazards created by the washdown.
- The men assigned to the washdown were not given a plan for the washdown. As a result, they were not able to anticipate and respond to emerging hazards.

- Supervisors were not aware of the nature, composition and characteristics of the products with which they were working (for example, the composition of what was referred to as “goo”, the melting points of certain products).
- There was no monitoring of reductant being added to the furnace, the amount of water being added to the furnace, or the temperature of the metal in the furnace.
- Supervisors did not understand the rationale for some of the processes employed on the evening of the explosion.
- The evidence suggests that the washdown was being hurried in an effort to rapidly cool down the furnace and make up for lost time.

### Planning

The evidence does not disclose an effective planning process. Prior to 2000 there was no written shutdown manual. Instead the company relied on the experienced supervisors. While it did attempt to develop a shutdown manual during the 2000 planning process, it did not set itself a goal of having such a plan in place for the shutdown. Instead, in 2000, the planning process:

- did not consider the potential impact of small changes in the process. (The small changes include the determination to drain the furnace as fully as possible, the decision to bring a bulldozer into the furnace, and the decision not to have a break between shutdown and washdown).
  - did not call for bringing experienced supervisors out of retirement even though the shutdown manual was not complete.
- did not contemplate catastrophic events and, as a result, exit doors were locked and workers were tethered to machines.
  - relied on assumptions about the hazards associated with specific tasks without conducting the needed rigorous analysis to determine the accuracy of those assumptions.

### Management Safety Programs

This refers to the management approach to hazard identification, the familiarity of managers and workers with company safety systems, and health and safety training, particularly in regard to potential hazards in the workplace, and the degree to which the company involved the Joint Health and Safety Committee in planning and hazard identification. Evidence of failure at this level includes the following facts:

- health and safety training often appeared to be conducted under a system that kept track of whether or not the safety lesson had been given but did not attempt to determine whether or not the workers had fully understood the issues being addressed.
- shutdown planners ignored the company’s own management safety program in designing work procedures and, as a result, did not carry out the appropriate hazard analysis. The safety program that they did not implement was the program that intended to integrate safety into all aspects of company operations.
- shutdown hazard identification was based on previous injuries only, and as a result, latent, low-frequency hazards were not analyzed or assessed.
- emphasis during the 2000 shutdown was given to safety measures that controlled worker

behaviour rather than controlling potential hazards.

- management witnesses were not familiar with the basic concepts of the internal responsibility system and could not identify the company loss control program.
- neither workers nor supervisors received training as to the possible hazards of adding water to the furnace during washdown.
- the Joint Safety and Health Committee was excluded from the shutdown planning process, particularly from the development of job procedures.
- the company had failed to learn from previous tragedies involving water and molten metal. The 1996 death of Richard Beasley had resulted in a coroner's report warning of the dangers of mixing water and molten metal.
- there was a failure to report near misses. According to the report prepared by management appointees to the Joint Workplace Safety and Health Committee investigating the explosion, "there was an explosion inside the furnace, as a result of water being applied but on a much smaller scale than the August 8 2000 explosion." This was never documented by the management safety system.

### Management responsibility

The failures listed above could only have taken place because senior Hudson Bay Mining and Smelting managers failed to ensure that the health and safety system, the planning system, and the supervisory system were functioning properly. Despite the testimony of various company witnesses, health and safety was not integrated into

all company activities and was not a priority. Senior managers, for example, did not:

- ensure that the company's safety program was used to identify hazards and develop job procedures for the shutdown.
- did not ensure that priority was given to eliminating identified hazards rather than controlling them through changes in worker behaviour and the use of personal protective equipment.
- require reporting on the implementation of company safety programs during the shutdown planning process.
- ensure that there were clear lines of authority during the planning process and the shutdown process. (Evidence was presented indicating that there were two shutdown coordinators during the planning process, while there were numerous washdown supervisors, none of whom seemed to have complete authority for the procedure).
- ensure that the appropriate level of resources were available. The shutdown coordinator said that he was not given adequate resources to plan and execute the 2000 shutdown but was given the proper resources in 2006.

The presence of these systemic failures at Hudson Bay Mining and Smelting in 2000 is of broad significance. Hudson Bay Mining and Smelting has, since its founding, been an international corporation that is involved in a high-risk endeavor. It is a well-known large-scale industrial concern in the province of Manitoba. While the immediate causes of the explosion revolve around the use of water in the shutdown of the furnace and the composition of the materials that were in the furnace at the time of shutdown, the lessons of

this tragedy are greater than the message that water and molten metal don't mix.

The broader causes of the explosion of August 2000 lie in the systemic failures described in this submission. If these problems were undetected and unresolved at Hudson Bay Mining and Smelting, then there is good reason to suppose that they are latent, but present, in other firms. Given the right sets of circumstances, catastrophic events could recur elsewhere. For this reason, we believe the Inquest report has the opportunity to make an important positive impact on all Manitoba workplaces, not just HBM&S.

Provincial law establishes the minimum standards by which all employers must abide and provides a guide to employers on key prevention practices and processes needed to make work safe. The management failures at Hudson Bay Mining and Smelting in 2000 demonstrate the need for improved government regulation. Specifically:

- Manitoba legislation and enforcement does not provide sufficient criteria to ensure senior management accountability to integrate health and safety into all management functions.
- Manitoba legislation and enforcement does not provide sufficient criteria to ensure that supervisors had the appropriate level of training.
- The Manitoba government did not have adequate regulation and enforcement in place governing industries that use hot and molten metals.
- *The Workplace Safety and Health Act* and its regulations did not mandate the needed hazard identification and safe job procedures for high-risk industries that are undertaking low-frequency, high-risk operations.

The evidence to support our assertions is presented in the following three sections of this report.

- 1) A narrative description of the events of August 7, 2000
- 2) A discussion of the expert reports on the immediate cause of the explosion
- 3) A review of the planning process in light of the events of August 7, 2000

The final section of the submission presents our recommendations, which are intended to address the failures that we have identified throughout the course of this report.

## **Systems intended to protect workers**

Before proceeding to these sections, it is appropriate to define some key concepts that are crucial to any discussion of workplace safety and health in Canada:

- the internal responsibility system
- joint workplace health and safety committees,
- effective hazard control systems

The internal responsibility system

*The Workplace Safety and Health Act* of Manitoba sets out the rights and responsibilities of workers and employers in relation to providing and maintaining safe and healthy workplaces in provincially regulated workplaces. The term commonly used to describe the health and safety system that the Act intends to operate within a firm is “the internal responsibility system.”

The Canadian Centre for Occupational Health and Safety<sup>1</sup> has developed the following comprehensive definition of this system:

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<sup>1</sup> Established in 1978, the CCOHS is a federal departmental corporation reporting to Parliament through the federal Minister of Labour. The Centre is

The internal responsibility system is the underlying philosophy of the occupational health and safety legislation in all Canadian jurisdictions. Its foundation is that everyone in the workplace—both employees and employers—is responsible for his or her own safety and for the safety of co-workers. Acts and regulations do not always impose or prescribe the specific steps to take for compliance. Instead, it holds *employers* responsible for determining such steps to ensure health and safety of all employees (Emphasis added).

(<http://www.ccohs.ca/oshanswers/legisl/irs.html> accessed July 4, 2008).

Since the 1970s federal and provincial governments have adopted workplace safety and health legislation that is based on the principles of internal responsibility, which were first articulated by the Ham Royal Commission on safety and health in the Ontario mining industry. Employers have increasingly been required to develop safety and health plans and programs, provide training in health and safety, and ensure that work supervisors have the appropriate knowledge and qualification.

Internal responsibility has always required a vigorous public regulator to enforce minimum standards and ensure the mechanisms of the system are working. In 2000, the Act required companies such as Hudson Bay Mining and Smelting to have a safety and health system in place.

## Joint Workplace Safety and Health Committees

At the same time as the internal responsibility system was developed, governments provided workers with a number of legislated workplace safety and health rights. Key legislative developments were the introduction of a legal right to refuse unsafe work, a right to participate in joint workplace safety and health committees, and the right to know about the properties of the products that workers worked with (this was accomplished in large measure through the development of a nation-wide hazardous materials information system).

Joint Workplace Safety and Health Committees were intended to be key elements of the internal responsibility system. *The Workplace Safety and Health Act* requires that committees be established in workplaces with more than 20 workers. Made up of an equal number of worker and management representatives, the committees meet regularly to discuss and recommend on workplace safety and health issues. They are vehicles for worker participation in the discussion and deliberation of workplace safety and health issues. They can bring workplace safety and health issues into the open, and focusing attention on them until they are resolved. They are also a link to the external monitors; government inspectors (in the HBM&S case, Mines Inspectors).

For Joint Workplace Safety and Health Committees to function well, both the employer, including senior management and employees, must commit to the process. Committee members who have been adequately trained, must be given sufficient time to conduct committee business during working hours, and should be made

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governed by a Council representing three key stakeholder groups: government (federal, provincial and territorial), employers, and workers.

full participants in hazard identification and elimination.

While the labour movement has been generally supportive of the internal responsibility system and the system of worker rights that were set in place in the 1970s and 1980s, it is also aware that these systems can be distorted in ways that reduce the role of the provincial government as a regulator and enforcer of workplace safety and health laws. The distortions arise because when the internal responsibility system is interpreted on the basis of a belief that workers and employers have equal power over health and safety decision-making and that, because of their capital investment, employers will take all needed steps to protect their plant and their employees. This Inquest has brought to light evidence of both of these distortions: the key shutdown decisions (both at the planning and operations stages) were made by employers and supervisors without worker involvement (indeed, the key vehicle for worker involvement was cut out of the planning process) and the company, by underinvesting in hazard identification in 2000 (particularly in comparison to its investment in such identification in 2006), nearly destroyed its own smelter.

As is noted in the CCOHS definition of the internal responsibility system, employers and workers have workplace safety and health responsibilities. However, in fulfilling their responsibilities, workers are dependent on management to provide the appropriate tools, processes, and direction. It is management that determines (subject to legislative regulation) the products to be manufactured, the processes by which they will be manufactured, the raw materials that will be used in production, the pace

at which production will proceed, the heating and ventilation systems of the workplace, and the way in which labour will be scheduled. These become the latent conditions of the workplace. Once they are hired, workers are expected to use the tools and processes selected by the employer in an appropriate manner. The dependent position of workers manifests itself in a number of ways. For example, while legislation grants workers the right to refuse unsafe work that they believe to be dangerous, as the events of 2000 demonstrate, some workers may not fully appreciate the hazards to which they may be exposed. This may also be the case for the worker members of the Joint Committee if the appropriate information is not shared with them.

#### Effective hazard control

The internal responsibility system cannot function unless there are effective processes put in place to identify, analyze and control hazards. There is a range of options available to management when it comes to controlling hazards once they have been identified. These range from eliminating the hazard (for example, not using water at all during the shutdown process) to engineering controls (for example, punching cooling holes in the furnace to allow the surface of the furnace bath to cool more rapidly), to administrative controls (having a delay prior to the start of the washdown), to personal protective equipment (having workers wear hard hats, masks, safety boots and so forth).

These methods have been listed in order of their effectiveness, and for this reason, the list is often referred to as the hierarchy of control. Measures that focus on elimination and engineering

can be described as hazard elimination and control approaches, while those that focus on administrative controls and personal protective equipment are more often focused on changing employee behaviour. They are often referred to as behaviour-based approaches. In his testimony, Hudson Bay Mining and Smelting smelter superintendent Alan Hair identified and endorsed this hierarchical approach (Inquest transcript, May 27, 2008, page 73-76, lines 7-9).

When an employer is overly reliant on behaviour-based approaches, hazards are often identified by past injury rates, and workers are advised as to how to avoid those injuries. Little attention is devoted to identifying the hazards that may be lurking in the latent conditions of the workplace or to eliminating them if they are identified. Such conditions, in the form of poor planning, lack of understanding of work processes, or poor design, may be present for years without giving rise to injury. However, given an opportunity—a change in work process for example—they can lead to tragedy.

## Section 2

# The Shutdown: August 2000

### **Hudson Bay Mining and Smelting Operations in Manitoba**

In 2000 Hudson Bay Mining and Smelting was a wholly owned subsidiary of Anglo-American PLC, registered in the United Kingdom and listed on both the Johannesburg Securities Exchange and the London Stock Exchange. Anglo-American was at that time one of the largest mining and natural resources companies in the world. The company's Flin Flon operation employed approximately 1,500 people in its mines, concentrators, zinc plant, copper smelter and ancillary plants in the vicinity of Flin Flon and Snow Lake Manitoba. The smelter turned copper concentrate (the product that remains after mine ore has been crushed, milled and concentrated) into high-grade copper anode.

#### The smelting process

At the outset of the smelting process, copper concentrate is fed to roasters that remove a portion of the sulphur, producing calcine, which is 20 to 25 per cent copper. The calcine is fed to the reverberatory furnace by bottom-dump rail cars. Converter slag (a copper-rich byproduct that arises

from the conversion process described below) is also added to the furnace.

Built in 1930, the furnace is one of the last of its kind in the world. With an arched hanging brick ceiling (often referred to as the arch), the furnace is 31 metres long, 9 metres wide, and 4 metres high. The furnace runs from east to west and the western end of the furnace is two metres wider than the eastern end.

The heat comes from four heavy oil burners at the western end of the furnace. Oxygen is added to increase the efficiency of the burners. It is termed a reverberatory furnace because the heat from the burners is bounced off the bath surface to the ceiling and then down the length of the furnace. It is usually referred to as simply the reverb furnace.

When heated in the furnace, the calcine and converter slag separate out into three layers. The top layer is comprised of slag, a generic term for the byproduct created in the smelting process. The middle layer is made up of matte (which is 45 per cent copper). The bottom layer is made up of magnetite, an iron oxide that settles out of the furnace if it is low in silica.

The furnace structure itself has three levels. The top level, which is above the arch and is known as the calcine floor, is connected by a railway track to the roaster. The single line of track splits in two upon entering the area above the furnace, referred to as the “Y”. Rail cars enter the furnace full of calcine, which is emptied directly into hoppers that extend one floor down to the feed floor. From there calcine is fed into the furnace. Converter slag is added to the furnace via a chute (known as a launder) located above the burners on the feed floor. The third and lowest floor is the concrete floor around the base of the furnace.

The process of removing slag and matte from the furnace is called tapping. The slag is tapped through holes on the east side of the furnace while the matte is tapped on the south side. In both cases, the molten material travels down launders into ladles. The matte ladles are sent by railcar to the converter pit, where the matte is converted into a product that is 98 per cent copper. As noted above, slag from the conversion process (converter slag) is fed back into the furnace.

At the east end of the furnace there are uptakes that draw off the hot gases from the furnace. The uptakes feed the hot gasses into two waste heat boilers and then through a series of flues to the 825-foot stack. There are a series of dust-capture apparatuses along the flue. A new electro-static precipitator (a particulate collection device) was being tied in to the system as part of the 2000 smelter shutdown.

### Shutdown and tear down of the smelter

Because the heat from the burners and the smelting process burns away the brick on walls and arch over time, the furnace must be periodically

shut down, demolished, and rebuilt. Up until the 1970s, the brick was replaced annually (in the early days of the company’s operations, the shutdowns took place even more frequently). Since then, improvements in combustion and the bricks and the bricklayers’ ability to replace and repair the arch without shutting off the furnace (known as making repairs on the fly) has allowed the company to increase the period of time between shutdowns. Prior to the explosion, the most recent shutdowns took place in 1990, 1994 and 1997. While the Flin Flon smelter is one of the last of its kind, it should be noted that shutdowns and rebuilds are common practices in a wide range of industries that use furnaces, kilns and incinerators.

The key steps in a shutdown are relatively straightforward. The slag, and then the matte, is tapped out to desired levels, and the oil to the burners is cut off. At this point the boiler ash is removed from beneath the boilers and the washdown (described in detail below) takes place. Once the furnace has been given time to cool, the arch and walls are demolished. In the past, the walls were demolished by hand-held jackhammers and the brick had been removed from the furnace by a slusher (a plough-type piece of equipment). The slusher’s relatively small blade was dragged in and out of the furnace by a series of cables attached to an air tugger (an industrial winch). Jackhammers are then used to remove magnetite residue from the drained furnace. Because this is a time-consuming process, steps are taken during furnace operations and particularly prior to shutdown, to control the magnetite build up.

### Controlling magnetite build up

Prior to shutdown, magnetite can be removed from the furnace floor and walls on which it settles by introducing silica into the furnace. This was done at Hudson Bay Mining and Smelting in a number of ways according to the witnesses. One was to add what is known as silvery pig iron, which is pig iron with high silica content, to the furnace. When this is added, the magnetite becomes a part of the slag in the furnace and can be removed with the slag. Aside from the silvery pigs, scrap cast iron from other parts of the HBM&S operation that contained silica was also added to the furnace. The added products are often referred to as reductant.

Once the brick rubble and magnetite has been removed, the furnace is rebuilt.

### Innovations planned for the 2000 shutdown

In 2000, to speed the demolition process, contractors had been hired to use a number of remote-controlled demolition machines (referred by their trade name as Brokks) to knock in the walls. Furthermore, preparations had been made to use a bulldozer to remove the brick and debris, once the demolition had taken place.

It also became apparent during the planning process that under normal shutdown conditions it would not be possible to get such a bulldozer into the furnace interior. The equipment, including its rollover protection, was too tall to fit under the bull-nose (the name given to the large beam spanning the point where the arch transitions into the uptakes). This was the lowest point inside the furnace where the bulldozer would enter. To address this issue, the company sought and received permission from the provincial Mines Inspection Branch to remove its rollover protection. To

provide additional headroom for the bulldozer, the planners also sought to drain the furnace bath to as low a level as possible. At a meeting held at the change from the day to night shift on August 7, 2000, Ray Gauthier, the shutdown coordinator, reminded the oncoming shift of the importance of draining the furnace; stating that the “furnace had to be drained as low as possible” (Inquest transcript, April 29, 2008, page 63, line 27).

The desire to drain the furnace to as low a level as possible to accommodate the bulldozer also meant that more magnetite had to be removed via the addition of reductant prior to turning the burners off (Inquest transcript, April 29, 2008, page 4, lines 1-8). Smelter superintendent Alan Hair testified that in 1997, the company had not done a thorough job of smelting down the furnace, particularly the backend of the furnace, which led to delays in the rebuild of the furnace (Inquest transcript, May 21, 2008, page 19, lines 1-9). Reg Hillier, one of the supervisors on duty on August 7, testified that in 2000 the furnace bath had been emptied to the lowest level that he was aware of (Inquest transcript, April 22, 2008, pages 96-97, lines 31-2). Jim Harrower, another reverb furnace supervisor, confirmed that at shutdown in 2000 the floor was lower than he had ever seen it before (Inquest transcript, April 17, 2008, page 38, lines 16-17).

**Comment:** The decision to use a bulldozer to remove brick and debris following the teardown introduced an additional incentive for HBM&S to drain the furnace bath to as low a level as possible. While it was always company policy to drain the furnace to a low level, the need to be able to fit the bulldozer under the bullnose, led to the most thorough draining in

the experience of those involved in the shutdown.

### **Measuring and monitoring the reductant**

According to Alan Hair, the smelter superintendent, and Ray Gauthier, who was the shutdown coordinator, records for the amount of reductant added to the furnace were not kept because it was felt it was negligible when compared to the size of the bath (Inquest transcript, May 27, 2008, page 27-28, lines 14-34; April 23, 2008, page 33, lines 32-34). In the weeks leading to shutdown, the reductant added to the furnace included 600- to 800-pound roaster arms (the arms came from the copper and the zinc roasters). As well, various worn-out cast-iron launders were added to the furnace in this process. This material, referred to as cast, was added in response to measurements of magnetite on the furnace floor (Inquest transcript, April 17, 2008, pages 60-65, lines 28-2). Harrower, as a day shift supervisor at the reverb furnace, testified to this practice. According to Harrower, the addition of the cast iron to the furnace was not monitored by chemical engineers (Inquest transcript, April 17, 2008, page 65, lines 22-28). The only limits on its addition to the bath were its availability and the ability to move it to the furnace (Inquest transcript, April 17, 2008, page 66, lines 18-22). Reg Hillier, who had been a supervisor since 1958 at HBM&S was asked the following questions regarding this practice.

Q: Now, were you aware, though, Mr. Hillier, that Mr. Harrower, or people under his instruction, were adding entire unbroken 800-pound roaster bars into the furnace as

part of this shutdown?

A Was I aware of that?

Q Yes, sir.

A No, I wasn't.

Q That would be unusual, would it not? In that it had never happened before?

A Yes. I, I have never seen something like that happen. (Inquest transcript, April 22, 2008, page 105, lines 22-32)

Gauthier testified that two different products: ferrosilicate and ferrosilicon were added to the furnace to serve as reductant. Ferrosilicon was added through the slag launder (Inquest transcript, April 23, 2008, page 32-33, lines 29-1), while ferrosilicate was added to the furnace to help remove magnetite from the bottom of the furnace at the recommendation of company metallurgists (Inquest transcript, April 23, 2008, page 31, lines 22-32). One product would lift the magnetite from the furnace floor, while the other product would remove it. Gauthier stated that he usually ordered ten tons of ferrosilicate for each shutdown, noting that not all the ferrosilicate was used prior to the shutdown (Inquest transcript, April 29, 2008, page 15, lines 7-17).

Hair stated that ferrosilicate was not added to the furnace, only ferrosilicon. He said that when the Shutdown Manual (Exhibit 27) indicated that ferrosilicate was to be added, the use of the word was a typographical error (Inquest transcript, May 27, 2008, page 24, lines 2-30). When HBM&S vice-president of metallurgy Thomas Goodman was asked if someone from the metallurgy department worked with the furnace operator and the supervisor to determine how much of the silver pig or cast went in to furnace, he said that

generally this was the case (Inquest transcript, April 30, 2008, page 13, lines 20-29). It would appear that his understanding of the level of involvement by the metallurgists differed from the actual involvement.

**Comment:** There was no ongoing professional monitoring of the addition of reductant to the furnace. The evidence suggests that the addition of roaster arms was a new practice. The unmonitored introduction of reductant may have helped achieve an effective burnout. However, it may also have contributed to unanticipated changes in the content of the bath.

There also appears to have been confusion between the shutdown coordinator (Gauthier) and the smelter superintendent (Hair) about the chemical composition of the products being added to the furnace.

There appears to be a difference between senior management's expectation of the level of involvement by the metallurgists in the use of reductant and their actual involvement.

## **The washdown**

The shutdown of the Hudson Bay Mining and Smelting furnace was intended to commence on August 7, 2000. According to planning documents, the furnace was to have been drained and shutdown by 7:00 p.m., the end of the dayshift of August 7. The planning chart (known as a Gantt chart, named after the early twentieth century engineer who developed this particular planning chart) showed the washdown of the furnace commencing immediately after the burners were shut off. The purpose of the

washdown was to remove the calcine and other dirt and dust that accumulated on the floors and beams of the smelter since the 1997 shutdown and thereby reduce the number of eye injuries that were suffered by people doing the teardown and rebuild of the furnace (Inquest transcript, April 15, 2008, page 70, lines 19-23). None of the evidence presented to the Inquest cited a date at which the washdown was introduced. When smelter supervisor Alan Hair was asked if washing down the furnace was a common practice in previous shutdowns he said "That's what I'm led to believe" (Inquest Transcript, May 21, 2008, page 77, line 34). Ray Gauthier, who coordinated a number of shutdowns, testified that the reason for the washdown was the number of eye injuries that occurred during the rehang of the furnace arch (Inquest transcript, April 23, 2008, page 91, lines 3-6). This would suggest that the washdown was of a relatively recent vintage, since people were aware of the eye injuries that had led to its introduction.

Several supervisors also made statements to the effect that they were under the impression that the point of the washdown was to cool the furnace. John Laidlaw, who was originally assigned to oversee the washdown, told the workplace safety and health committee investigating the explosion on August 31, 2000, that he had been assigned to "cooling off the furnace and washing it down" (Inquest transcript, April 9, 2008, page 44, lines 16-24). Calvin Woods, who supervised the washdown, testified that the washdown also cooled the arch of the furnace, which made it easier to knock in (Inquest transcript, May 20, 2008, page 85, lines 1-25). Garry Willetts, the maintenance general foreman, testified that he believed that the cooling of the furnace was one of the benefits of

the washdown (Inquest transcript, April 10, 2008, page 32, lines 3-22).

**Comment:** It would appear that many workers, including the person who was scheduled to supervise the washdown, believed that the washdown was also a cool down. Cooling the furnace could speed the teardown, an overall goal of the shutdown planners.

When the evening shift reported to work on August 7, 2000, the furnace had not been shut off. It would continue to run until operators concluded that no more matte could be tapped from the furnace. This conclusion was reached at approximately 11:00 p.m. (Inquest transcript, April 15, 2008, page 43, lines 7-8).

Supervisors on duty on August 7, 2000

There were five Hudson Bay Mining and Smelting Company supervisors on duty in the reverb furnace area on the evening of August 7, 2000: William (Bill) Morrell, Reg Hillier, Jim Harrower, Kal Woods, and John Laidlaw (Exhibit 26, Section C, Appendix L).

William Morrell had started as a labourer at Hudson Bay Mining and Smelting in 1975. He became the safety and loss control co-ordinator, and then reverb general foreman in 1999. Morrell had received compete-to-win, supervisor, and loss control training, along with Workplace Safety and Health Act, problem solving, team building, safety loss control, licensed auditor, and ISO9000 training. He had also been a union member of the Joint Workplace Safety and Health Committee. During the 1997 shutdown, Morrell was safety and loss control coordinator and safety supervisor for the night shift (Inquest transcript, April 15, 2008,

page 4, lines 15-22; pages 62-63, lines 25-6, page 69, lines 32-34).

Reg Hillier started at Hudson Bay Mining and Smelting in 1958. He left the company in the early 1970s and returned in 1976. He worked in the converter pit, the fuming plant, the roasters and the bag house. At the time of the explosion, his regular job was shift boss or supervisor in the feed prep. He stated he was general foreman with responsibility for all functions during the 1997 shutdown. This was the position that he believed Morrell held during the 2000 shutdown (Inquest transcript, April 22, 2008, pages 3-4, lines 14-25; page 15, lines 18-23).

Jim Harrower started with Hudson Bay Mining and Smelting in 1981 on the bull gang (the general labour crew). He stated that he worked in the furnace until 2000, working as feeder man, matte tapper, and furnace operator, finally moving to supervision in 1987. He worked as both supervisor of the reverb furnace and roaster supervisor. He held a day-shift supervisory position for the reverb area in 2000. While Harrower had no professional accreditation, he testified that he had taken first-aid training, safety training, and supervisory training courses (Inquest transcript, April 16, 2008, pages 85-86, lines 12-17; page 131, lines 16-21).

Kalvin Woods started work at HBM&S in 1990 on the bull gang in the smelter. Following that, he worked in the fuming plant, the bedding bins and returned to the reverb furnace in 1996. For much of his time with HMB&S, he worked as a bricklayer (Inquest transcript, May 20, 2008, pages 30-31, lines 24-21). At the time of the 2000 shutdown he was a supervisor and furnace operator (Inquest transcript, May 20, 2008, page 33, lines 1-5). He had taken on these positions in 1999

(Inquest transcript, May 20, 2008, page 32-33, lines 13-30). During the period leading up to the shutdown, he was a shift boss (Inquest transcript, May 20, 2008, pages 34-35, lines 28-1).

John Laidlaw started at Hudson Bay Mining and Smelting in 1976. A bricklayer by trade, with the exception of one year, he had worked in the smelter ever since 1976 (Inquest transcript, April 9, 2008, page 19, lines 7-18).

Morrell, who held the position of reverb foreman on August 7, was the most senior supervisor in terms of authority. According to Morrell's testimony, he reported to Alan Hair, the smelter superintendent. According to the shutdown assignment sheet, Hillier had no specific assignment for that evening. Harrower was responsible for wall demolition, the bulldozer in the furnace, and removing rubble, fettling pipes, feed gates, and matte launder. Woods was to supervise the cleaning of the roaster flues, cleaning under the tracks, and removal of the calcine floor plates. Laidlaw was responsible for the washdown, the demolition of the arch and the bullnose, and the removal of the burners (Exhibit 26, Section C, Appendix L).

In testimony Morrell stated that he was the reverb general foreman (Inquest transcript, April 16, 2008, page 60, lines 30-33). Hillier testified that he thought that he was reverb foreman that night, and that Morrell was supposed to be the general foremen over the whole shutdown (Inquest transcript, April 22, 2008, page 15, lines 9-20). Before that night Hillier had never been the reverb foreman alone (Inquest transcript, April 22, 2008, page 15, lines 26-30). Hillier thought that Harrower was reverb maintenance foreman that

night (Inquest transcript, April 22, 2008, page 93, lines 20-22).

There was no technical supervisor assigned for the night shift. In his testimony, Morrell could not explain why no such supervisor had been assigned to that shift (Inquest transcript, April 15, 2008, page 106, lines 4-10).

**Comment:** There appears to have been confusion among the supervisors as to their roles on August 7-8, 2000.

#### Shutdown assignment sheet

The shutdown assignment sheet, which was undated, had been sent out prior to August 7, 2000 (Exhibit 26, Section C, Appendix L). It identified tasks, assigned supervisors to those tasks, and identified the workers who would be performing the tasks. Shutdown coordinator Ray Gauthier said he had developed the shutdown assignment sheet, with input from Morrell, Harrower and probably most of the Reverb Team (the Reverb Team is discussed below). In retrospect, he felt that the assignment sheet should not have linked names and tasks in such a detailed manner since there was no certainty as to who would be working when these activities would be carried out (Inquest transcript, April 23, 2008, pages 53-54, lines 29-10). Morrell testified that he did not know who developed the assignment sheet. He further stated that he was not involved in developing it (Inquest transcript, April 15, page 88, lines 32-34).

Gauthier testified that he did not know whether Morrell, Hillier, Harrower, Woods or Laidlaw had been involved in a washdown before (Inquest transcript, April 23, 2008, page 91, lines 18-28). Given that Hillier had more experience than Morrell, Gauthier expected Hillier would be taking

the lead in directing the reassignments on the night of the shutdown (Inquest transcript, April 23, 2008, page 85, line 12-16).

Morrell testified that the major decisions that night were made by a team of supervisors included himself, Hillier, Harrower, Laidlaw, and Woods (Inquest transcript, April 15, 2008, page 36, lines 29-33).

**Comment:** The supervisory witnesses were not able to provide a rationale for the assignment decisions for August 7, 2000. Furthermore, the supervisory witnesses provided conflicting evidence as to who made the actual assignments.

Previous shutdown and washdown involvement

Laidlaw, who had been assigned to supervise the washdown, had never seen a washdown before (Inquest transcript, April 9, 2008, page 47, lines 13-16) and had never supervised one (Inquest transcript, April 9, 2008, page 20, lines 10-12). The company took no pro-active steps to provide him with any training as to how the washdown should be done (Inquest transcript, April 9, 2008, page 46, lines 16-20) and although he did, on his own, contact a number of experienced workers and ask them for advice on washdown procedures. He testified that he was probably informed of this responsibility a week before the washdown. He testified that he may have attended some of the early planning meetings, but he chose not to attend most of the planning meetings, explaining that he did not need the extra pay and that the meetings conflicted with family responsibilities (Inquest transcript, April 9, 2008, page 23, lines 16-21; page 46, lines 1-11).

Morrell had never worked the shift on which the furnace was being washed down before (Inquest transcript, April 15, 2008, page 27, lines 12-17), and was counting on the experience of Harrower and Hillier. Morrell stated that he worked every shutdown except for the 1994 shutdown. Morrell also acknowledged that he did not have significant knowledge of the actual shutdown process. He viewed his participation on the Reverb Team as an opportunity to learn (Inquest transcript, April 15, 2008, page 17, lines 17-31).

Hillier thought he had worked on the washdown on the year of his return to the company, in either 1976 or 1977. He also had seen washdowns done in other years, but had not participated in one since 1976 or 1977 (Inquest transcript, April 22, 2008, pages 68-69, lines 28-15).

Harrower had been a supervisor assigned to the reverb furnace during a washdown, however he was not sure of the date (Inquest transcript, April 16, 2008, page 105, lines 13-20; April 17, 2008, page 2, line 30-31). While he worked every shutdown since 1981, he had never monitored a washdown (Inquest transcript, April 17, 2008, page 2-3, line 32-1). In his October 12, 2000, statement to the Joint Workplace Safety and Health Committee team investigating the explosion, he was asked if he had monitored the washdown on previous shutdowns. His answer was: "Specifically no. That is a tricky question. I was on the Reverb staff at the time and I checked on guys at the time but that was not my specific task" (Section E. Explosion interview notes, Jim Harrower, October 12, 2000 interview, page 8).

Woods testified that he took part in the 1994 washdown as an hourly employee (Inquest transcript, May 20, 2008, page 35, lines 13-17).

He played no role in either the 1990 or 1997 washdowns (Inquest transcript, May 20, 2008, page 37, lines 16-26; page 92, lines 1-4). August 7, 2000, was Woods's first night as a reverb shutdown shift boss. While he said he had been a member of a planning team, he did say not which team he had participated in (Inquest transcript, May 20, 2008, page 38, lines 5-10). On August 7, 2000, he would have taken direction from Morrell, Hillier, and Harrower, (Inquest transcript, May 20, 2008, page 39, lines 20-24). He stated that prior to the start of shift on August 7, 2000, he had received no information from Morrell, Hillier, or Harrower as to the type of work he would be doing that evening, or the level of experience that would be required of the men that he would be supervising that night (Inquest transcript, May 20, 2008, page 40, lines 13-19).

Comment: The man who was originally assigned to supervise the washdown had never participated in a washdown, had never seen a washdown, had not participated in shutdown planning and was given no instruction as to how to carry out or supervise a washdown.

The evidence indicates that of the five supervisors who testified, only two had ever participated in a washdown (both of them only once, in one case six years earlier, in the other case, 24 years earlier). None had ever supervised a washdown.

The man who would eventually supervise the washdown did not know that he would be supervising the washdown when he came on shift that night. He had worked one washdown six years earlier, but 2000 was the first time he worked as a shutdown supervisor. He was provided with

no guidance as to how to supervise the washdown.

Was there a written procedure for doing a washdown?

Because of a loss of experienced staff and the growing length of time between washdowns, in 2000, HBM&S was in the process of developing a shutdown planning manual. (The creation of this manual is discussed elsewhere in this submission.) The shutdown manual (Exhibit 27) gave the following description of the washdown procedure:

Four fire hoses are used to wash down the furnace. Attach two hoses to hydrant at front of furnace located on the northwest side of landing. Attach two hoses to hydrant located on the east wall of the slag tapping area. Using two fire hoses start at the west end and wash calcine floor west to the middle. Using two fire hoses start at the east end and wash calcine floor to—from west to middle. After floor is washed down, start at west and east end of furnace and wash down upgrade beams and archway.

While the testimony is quite clear that the manual was not completed prior to the 2000 shutdown, and according to managers, was never meant to be a manual for that shutdown, but rather to serve as a guide to future shutdowns, it is apparent that portions of it, including the washdown procedure, were used on August 7-8, 2000, as a guide to operations.

Laidlaw, who had been assigned to supervise the washdown, testified that he never received a copy

of a washdown procedure (Inquest transcript, April 9, 2008, page 47, lines 4-10).

**Comment:**The man assigned to supervise the washdown never received a copy of the washdown procedure.

Who supervised the washdown?

Jason Dutcawich, Mark Koop, Jim Rasmussen, Tai Le Vuong, Steve Ewing, Fred Ledoux, Kelvin Primrose, Tom Wolokoff, Richard French, and Mark Perkins had originally been assigned to do the washdown under Laidlaw's supervision. When, at the start of the shift, it was discovered that the furnace had not been shut down and washdown could not start for several hours, Laidlaw volunteered to take approximately half the intended washdown crew to work on the calcine track clean up. He affirmed that one of his reasons for doing this was the fact that the washdown was a hot and dirty job (Inquest transcript, April 9, 2008, page 49, lines 9-10). Laidlaw's crew worked on the calcine track clean up until the explosion occurred. As a result, Laidlaw never worked as washdown supervisor that night.

**Comment:**The supervisor originally assigned to the washdown did not supervise the shutdown.

Responsibility for supervising the washdown was later assigned to Kal Woods. According to Morrell, Woods would not have known he would be supervising the washdown prior to his coming on shift that evening (Inquest transcript, April 15, 2008, page 88, lines 24-27).

The evidence presented to the Inquest has provided no clarity as to how the decision was made to assign Woods to washdown. In his

testimony Hillier appears to have been under the impression that Laidlaw was not even working that evening (Inquest transcript, April 22, 2008, page 62, line 20). According to Harrower, Woods was assigned responsibility for the washdown by a meeting of all the supervisors at the beginning of the shift (Inquest transcript, April 16, 2008, pages 104, lines 4-16). Harrower said he did not know if Woods had supervised a washdown before, but he stated Woods would know how to supervise washdown that night from what the other supervisors told him (Inquest transcript, April 16, 2008, page 106, lines 9-19). Morrell testified that at the time the decision was made to have Woods supervise the washdown, it was not believed that the washdown required a great deal of training or experience (Inquest transcript, April 16, 2008, page 59, lines 2-10).

Woods stated that there was never any meeting with Morrell, Hillier, Harrower, and himself to reassign the tasks for that evening given the fact that the furnace was still operating when the shift started (Inquest transcript, May 20, 2008, page 45, lines 22-33).

**Comment:**There is no evidence to indicate that the supervisors knew if Woods, who they assigned to supervise the washdown, had any experience in or knowledge of washdown.

Morrell testified that he could not recall supplying Woods with a copy of the washdown procedure or instructing anyone else to provide him with a copy of the procedure (Inquest transcript, April 16, 2008, page 59, lines 21-30). Woods could not recall seeing the shutdown manual's washdown procedure section prior to

the washdown (Inquest transcript, May 20, 2008, pages 66-67, lines 34-4).

Woods said he never received any training related to the hazards that could arise from water coming into contact with the molten metal in the furnace (Inquest transcript, May 20, 2008, page 77, lines 19-23).

Hillier testified that he told Woods to ensure that the people involved in washdown were careful because floor plates and hopper tops had been taken off on the calcine floor (Inquest transcript, April 22, 2008, page 40, lines 5-11). However, Woods said he had had no conversations with Morrell, Hillier, or Harrower about how to proceed with the washdown (Inquest transcript, May 20, 2008, page 51, lines 6-8).

**Comment: Responsibility for the washdown was assigned to an individual who had had no opportunity to discover the elements of the jobs or its risks. The person responsible for supervising washdown had not read the washdown procedure in the washdown manual. Finally, the washdown supervisor never received any training about the risks associated with the washdown.**

The washdown crew

Because Laidlaw took a number of members of the crew originally assigned to the washdown to work on the calcine cleanup, a new washdown crew had to be assembled. Six men were ultimately assigned to do the washdown on that evening shift: Steve Ewing, Roland Pruden, Fred Ledoux, Tom Wolokoff, Steve Pickering, and Ron Radics. Only three of these men had been originally assigned to washdown. Two additional men, Kelvin Primrose and Brad Russell, were assigned to wash down the converter slag launder area on the west side of

the furnace. Hillier testified that this was the first time the slag launder had been cleaned during shutdown, in previous years it been cleaned prior to the shutdown (Inquest transcript, April 22, 2008, pages 49, lines 28-34).

Some workers, including Wolokoff, had expected to be put to work washing down the beams and flooring, while others, including Pruden, Pickering, Ledoux, and Radics, did not know what their assignments were likely to be when they reported to work that night. Ledoux testified that he had never been given any overview of how the shutdown was going to proceed, indeed because of the way his schedule was set up, he expected to be off work for most of the shutdown (Inquest transcript, January 21, 2004, page 76, lines 1-34). Pruden testified, "We weren't given no manuals on, on preparation of shutdown because I don't think there is one" (Inquest transcript, January 20, 2004, page 39, lines 6-8). Russell testified, "there was no manual about the shutdown at all" (Inquest transcript January 24, 2004, page 48, line 23). Barry Fox, a pipefitter who worked on the shift, but did not work on the washdown, testified that he never saw a written shutdown plan, adding "The only plan I had was a verbal plan, that I would be working dayshift on the pre-heater, until the call came, while I was on holidays, to go on the nightshift" (Inquest transcript, February 18, 2004, page 40, lines 7-10).

**Comment: there is no evidence to suggest that the men who were eventually assigned to the washdown had ever been provided with the shutdown manual or the shutdown manual's washdown procedure.**

Roland Pruden started working for HMB&S in 1989 as a member of the bull gang. From there

he went to the fuming plant (bag house), the zinc plant, smelter bag house, and the reverb furnace. After a spell as the brakeman on the calcine train, he worked as a slag tapper. Pruden worked in the bag house during the 1997 shutdown. In the previous shutdowns, he had participated in the rebuild, but not the teardown (Inquest transcript, January 20, 2004, page 17- 21, lines 32-34; page 28-29, lines 30-30).

Fred Ledoux had been with HBM&S for 17 years in the summer of 2000. A head- matte tapper, he had never worked the first evening shift of a shutdown, although in 1997 he had worked knocking in bricks during the teardown (Inquest transcript, January 21, 2004, page 75, lines 18-29).

Slag tapper Tom Wolokoff had worked for HBM&S for a dozen years and had worked on the 1997 rebuild assisting the bricklayers. However, this was the first time he would be involved in the furnace teardown and washdown (Inquest transcript, February 18, 2004, page 62, line 16; pages 64-65, lines 23-3).

Steve Pickering started at HBMS in 1995 as a calcine feeder. He later became a train driver, then a matte tapper. The 2000 shutdown was the first shutdown he had worked (Inquest transcript, January 24, 2004, pages 71-75, lines 23-29).

Ron Radics, a 32-year veteran with the company, had been a slag train driver in the smelter operation for the last decade. He had worked the teardown shift in 1997 and participated in previous washdowns (Inquest transcript, February 17, 2004, page 40-41, lines 21-7; page 42, lines 10-13; pages 74-75, lines 13-28).

**Comment:** Of the five men who survived participation in the washdown process,

only one had previous experience with the washdown.

What did the washdown crew members do when they came on shift?

Because the furnace was not completely tapped out when they came on shift, Ledoux, Pickering, Wolokoff, and Pruden were put to work tapping matte, a task that they traded off in pairs, with Ledoux and Pickering doing the seven o'clock shift. When he started, Ledoux was told by one of the workers he was relieving that the shutdown was already several hours behind schedule (Inquest transcript, January 21, 2004, page 110, lines 28-29). Because they had to relieve the tappers who were coming off shift, Ledoux and Pickering missed the start of shift safety meeting that was led by Pat Merrin (Inquest transcript, January 21, 2004, page 79, lines 3-8).

**Comment:** The work was not structured in a way to ensure that all men were able to attend pre-shift safety meetings.

The start of shift meeting

While there was a safety presentation at the start of the shift, it dealt with such matters as lockouts, confined space entry, who was in charge of the permit centre, who the safety supervisors were for the shift, and heat stress (Inquest transcript, April 15, 2008, page 39, lines 8-17).

Wolokoff testified the presentations at the meeting stressed the importance of wearing personal protective equipment such as respirators (Inquest transcript, February 18, 2004, page 86, lines 20-27). Pruden's only recollection of the meeting was that the supervisors stressed the need

to get the rest of the matte out of the furnace. Pruden testified that “as far as talking safety, I don’t think that was brought up, like no, I don’t, I don’t think so” (Inquest transcript, January 20, 2004, pages 53, lines 15-31). Radics testified “It started out with them showing the slides and Pat Merrin was giving a—kind of telling us, you know, basically what was—happened in prior shutdown and they wanted everything to work safe, and I think Bill Morrell got up and said a few words and told us to work safe” (Inquest transcript, February 17, 2004, page 43, lines 27-31).

**Comment:** The focus of the safety meeting was on worker behaviour, not on the underlying risks of the tasks being assigned. The workers doing washdown were not given any warning that the use of water during washdown could create safety risks.

### Cooling holes

When the night shift came on duty at least one hole had been knocked into the furnace wall. (In addition to holes that were knocked into the wall, there were also holes that had been created as portions of the arch, weakened by the high heat generated prior to shutdown in order to smelt material off the walls, fell off the walls.) During the shift, a self-propelled demolition machine (a Brokk) would punch at least one more hole into the wall. In planning documents these holes were referred to as cooling holes (Exhibit 27, Shutdown manual, page 8). Hillier and Gauthier stated that the punching of such holes was regular practice in shutdown. Gauthier said the holes were punched in the wall because it was something “we always did” (Inquest transcript, April 23, 2008, page 47, line 2). He indicated that he would have assumed

the purpose of the holes was to cool the furnace and provide for an opportunity to observe the bath (Inquest transcript, April 23, 2008, page 47, lines 3-13). Hillier indicated some of the holes were punched in the furnace before it was shut down (Inquest transcript, April 22, 2008, page 58, lines 3-13). There appeared to be some confusion as to why the holes were created. Morrell testified that the purpose was “To knock the, the wall out, because it had to be demolished.” It was not, he stated for cooling the furnace (Inquest transcript, April 15, 2008, page 103, lines 12-13). One of the planning documents, in Morrell’s handwriting, lists “knock cooling holes in walls” as one of the shutdown tasks (Exhibit 24, J 179.4).

Harrower testified that 2000 was the first time that a Brokk had been used, although similar machines had been used in the past. He said it did not knock any holes in the furnace until after the burners had been shutdown. He stated that the purpose of the holes was “To allow more air in to help cool the furnace and to get a look at the furnace floor and see how the burn out was” (Inquest transcript, April 16, 2008, pages 120-123, lines 27-16). Hillier said the creation of the cooling holes was a regular practice that allowed heat to vent from the furnace (Inquest transcript, April 22, 2008, page 56-57, lines 23-5).

Gauthier testified “And some of them [measures undertaken in the 2000 shutdown] we didn’t have the experience to understand what the rationale was, but we still did them because that’s the way it was done.” After the explosion, Gauthier spoke to a former employee about the rationale for the holes and was told that they were meant for observation. He was told that if one observed water building up in the furnace, in the past, the washdown would

be stopped until the water evaporated (Inquest transcript April 23, 2008, page 47-48, lines 9-14).

Comment: Management had not provided supervisors with sufficient training to allow them to understand the rationale for some of the tasks that they undertook. As a result, the supervisors in 2000 did not react when they saw water building up in the furnace.

### Shutting down the furnace

The decision to shut down the furnace marked a key step in the events of August 7-8, 2000. Morrell stated that he depended on the furnace operator Joe Klassen and the opinions of Hillier and Harrower to determine when it was no longer possible to tap out any more matte (Inquest transcript, April 15, 2008, page 42, lines 8-28). According to Harrower, he, Klassen and Morrell (and possibly Woods) made the decision to shut down the furnace (Inquest transcript, April 16, 2008, page 106, lines 23-29). Harrower acknowledged that he told the workplace safety and health committee that he and Klassen made the decision to shut down the furnace and then informed Morrell (Inquest transcript, April 17, 2008, page 43, lines 5-23). Hillier stated that he was not present when the decision was made to shutdown the furnace (Inquest transcript, April 22, 2008, page 12, lines 31-33).

Gauthier stated that, in his opinion, the decision as to when to shut down the furnace would have been made by Kal Woods and Joe Klassen (Inquest transcript, April 23, 2008, page 82, lines 17-8).

Woods testified that Joe Klassen made the decision to shutdown the furnace, which he communicated to Woods (Inquest transcript, May 20, 2008, page 42, lines 16-30).

Comment: It would appear from the evidence that senior supervisors differed in their views as to who was going to make the decision to shutdown the furnace and who in fact made the decision. This is further evidence of confusion over lines of authority on August 7-8, 2000.

It was confirmed during testimony that there was no temperature recorded for either the slag or the matte on the reverb operator's report (Exhibit 32) for August 7, 2000. In testimony Gauthier said that the temperatures might not have been taken during this period because they had exceeded the range of the Raytek infrared sensors that are used to measure temperatures in the furnace (Inquest transcript, April 29, 2008, pages 44-45, lines 11-1). Morrell testified that he was not kept aware of the temperature of the furnace on the evening of August 7 (Inquest transcript, April 15, 2008, page 100, lines 19-25). In his testimony Hair confirmed that HBM&S did not have data on the temperature at which the slag in its Flin Flon furnace would solidify (Inquest transcript, May 22, 2008, page 78, lines 7-23).

Woods said that one could take the temperature of the bath when it was being tapped out by using a probe. When it was not being tapped out, one had to use a hand-held temperature gun. However, it was not used because it was not accurate (Inquest transcript, May 20, 2008, pages 68-69, lines 22-31).

Morrell testified that the surface of the bath cools down very quickly, although he also acknowledged that his opinion was not based on the monitoring of the surface temperature (Inquest transcript, April 15, 2008, pages 78-79, lines 27-9). Morrell also testified that he had no knowledge of the temperature at which matte and slag solidify, nor

did he have any knowledge of the rate at which the crust covering the bath would thicken. He also testified that he had never been provided with any information by his employer about these specific processes (Inquest transcript, April 15, 2008, page 91, lines 11-26). Harrower did not know the solidification temperatures of matte and slag nor did he know the depth of the crust once the furnace was shut down. Harrower had also received no training in the characteristics of magnetite (Inquest transcript, April 17, 2008, page 47, lines 8-26).

**Comment:** Knowledge of the temperature of the various materials in the furnace and knowledge of the properties of those components is essential to understanding and addressing the risks presented by those components. The supervisors lacked the needed background knowledge and did not monitor the appropriate temperatures. It may even be the case that the company lacked the capacity to monitor the temperature of magnetite in the furnace. This would have required a longer cool down period prior to any washdown.

Contents of the furnace after shutdown was complete

Two supervisory witnesses (Harrower and Gauthier) used the term goo to describe the product that was left in the furnace after shutdown. They did not have an understanding of the composition or characteristics of this goo. At one point in his testimony, Gauthier referred to the goo as magnetite (Inquest transcript, April 29, 2008, page 62, lines 8-11) while on another instance he gave separate definitions of goo and magnetite (Inquest transcript, April 24, 2008, pages 57-9,

lines 28-13). Harrower, for example, said that he was not worried about the material in the furnace because it was goo that froze quickly and the water was not contained under the goo. He could not describe whether this goo was slag, matte or a mixture of the two although he was certain it was not magnetite (April 17, 2008, page 48, lines 12-29; page 53, lines 1-21).

**Comment:** The confusion and/or lack of knowledge about the nature of the materials that were left in the furnace after a shutdown are significant for a variety of reasons. One of the post-explosion investigations (discussed in greater detail below) concluded that the burnout was so thorough that there was only slag and magnetite left in the furnace. The fact that magnetite has a much higher melting point than matte meant that the temperature of the bath at shutdown might have been higher than in the past.

Starting the washdown

Morrell (Inquest transcript, April 15, 2008, page 50, lines 18-20), Harrower (Inquest transcript, April 16, 2008, page 110, lines 5-15), and Hillier (Inquest transcript, April 22, 2008, page 26, lines 14-19) all testified that it was their understanding that the washdown started as soon as the furnace was shutdown. Gauthier testified that he had expected there would be a shift meeting prior to the washdown, which had originally been scheduled to take place at a shift break. He stated that this would have allowed for a period of an hour to an hour and half to allow the furnace to cool down. He recognized that there was no explicit instruction for such a meeting since matters such as safety meetings and lunch breaks were not entered on the Gantt Chart. He also

indicated that he believed that during the planning process he had indicated that there should be a meeting prior to the washdown and had assumed there would be one (Inquest transcript, April 29, 2008, pages 49-51, lines 2-14). Exhibit 31, the Gantt chart for the 1997 shutdown calls for a furnace shut down at 10:00 p.m. with washdown starting at midnight.

Radics testified that he believed the washdown in 1997 had not started until 18 hours after the last matte had been tapped (February 17, 2004, page 51, lines 19-22).

**Comment:** While a more experienced supervisory witness expected that there would be a delay between the shutdown and commencement of washdown, there was no explicit written direction that there be a delay. The supervisors who were on duty on the evening of August 7, took the position that washdown automatically followed shutdown. It should be noted that three of these supervisors lacked any washdown experience, while the other two had only worked one washdown apiece.

Who ordered the start of the washdown?

There was general agreement that the washdown started at 11:30 p.m., a half hour after shutdown. Morrell testified that he did not know when the washdown started and he did not know who gave the order to start the washdown. He thought it would have been either Hillier or Harrower (Inquest transcript, April 15, 2008, page 50, lines 5-8). Hillier testified that he did not know who gave the order to start the washdown (Inquest transcript, April 22, 2008, page 41, lines 20-22). Harrower testified that he did not tell Woods to

start the washdown (Inquest transcript, April 16, 2008, page 110, lines 1-6).

Woods told the post-explosion investigation that Morrell told him that the washdown should start as soon as the boiler ash was removed from the furnace (Inquest transcript, May 20, 2008, page 88, lines 1-5). Woods acknowledged he was the person who assigned the crew that performed the washdown. When asked what the procedure for doing the washdown was, Woods testified, "There was no procedure" (Inquest transcript, May 20, 2008, page 47, line 28). When asked if he had provided any special instructions to the men carrying out the washdown, he responded, "Well, they knew that they had to start on the west side of the furnace and work their way east" (Inquest transcript, May 20, 2008, page 48, lines 6-7). He said he had no idea if the workers he assigned had ever done the job before (Inquest transcript, May 20, 2008, page 48, lines 15-17).

Woods said that he told the men that they should determine how long they should work before they took a break. He also said that he did not provide constant supervision, but simply checked on the men on occasion (Inquest transcript, May 20, 2008, page 52, lines 1-15).

Woods testified at one point that two men would do the job at a time (Inquest transcript, May 20, 2008, page 49, lines 6-8) (although he indicated that the job was done with shifts of three men) (Inquest transcript, May 20, 2008, page 48, lines 12-14). At another point in his testimony, Woods testified said that three people were supposed to be using the hoses, but he never saw more than two (Inquest transcript, May 20, 2008, page 86, lines 22-30).

Comment: The men who undertook the washdown were given no detailed instruction as to how to do the job or information on the risks associated with the job. Only one of the five men who survived had ever done the job before.

It would appear that Woods, on his own, gave the order to start the washdown. There was no testimony to suggest that his fellow supervisors knew if he had any experience in this job. The testimony from Woods's supervisors provides no clarity as to who instructed Woods to start the washdown.

The man who supervised the washdown had no knowledge of the washdown procedure, provided only minimal explanation of what to do (operating on the supposition that the men knew what to do), and did not know if the men had done the job before.

The washdown was not closely supervised. The washdown supervisor was unable to provide clarity about how many men were supposed to be working on the washdown at any given time. While he had assigned the job to be done in three-man shifts, he said that he was never aware of more than two men working at any given time.

The washdown crew learns of the start of washdown

Prior to the shutdown Radics and Ewing ran the train that took low-grade matte to a dump outside the smelter. It was while they were transporting the last load of matte, that Ewing, according to Radics's testimony, told Radics that he had heard from their supervisor, Kal Woods, that their next assignment would be to hose down the furnace (Inquest

transcript, February 17, 2004, page 46, lines 13-21). Radics thought it was a mistake to start the washdown so soon after turning the burners off (Inquest transcript, February 17, 2004, page 45-46, lines 33-1).

Pickering testified that when he and Pruden were in the lunchroom, Pruden called furnace operator Joe Klassen to find out how long it would be before the washdown started. According to Pickering "Joe said it would be a while. We relaxed, had something to eat" (Inquest testimony, January 24, 2004, page 88, lines 9-15). Ledoux confirmed that after Pruden finished his call with Klassen, he said that they were going to have to wait while the furnace cooled down before they started the washdown (Inquest transcript, January 21, 2004, page 89, lines 15-21). Wolokoff testified that as soon as Pruden sat down with his coffee "Kal Woods came in and told us to start washing down" (Inquest transcript, February 17, 2004, page 28, lines 29-34). This sequence of events was also confirmed by Pickering. (Inquest transcript, January 24, 2004, page 117, lines 2-5).

Comment: The men assigned to the washdown were given no advance notice to the start of the washdown procedure. According to the evidence presented by the workers, it would appear that there was an expectation that there would be a delay between shutdown and washdown.

Radics testified: "I remember distinctively Steve and Rolly standing there getting dressed to go out and I says, 'Hold on, guys.' I says 'this is not right. We shouldn't be putting water on this thing it's just been shut down,' and they said 'that's our instructions, we're going to take the first shift up there'" (Inquest transcript, February 17, 2004, page

66, lines 8-13). When, during the Inquest, Radics was asked why he had not exercised his right to refuse, he stated “I chose not to because everybody else was going out there and I thought if something is going to happen, I might as well be right along with them.” He said he wanted to bring his concerns to Morrell’s attention (Inquest transcript, February 17, 2004, page 115, lines 31-33).

**Comment:**The only worker who had previously worked this shutdown shift was concerned about the decision to commence the washdown so soon after shutdown.

Pickering, Ewing and Pruden took the first shift. The men shifted back and forth every half hour or so, with Ledoux trading off with Ewing, Wolokoff with Radics, and Pickering with Pruden. To do the washdown the men wore gloves, respirators, earplugs, helmets and protective overalls and used the fire hoses that had been strung up earlier by other workers. The testimony of the men who performed the washdown indicates that they had to use the hoses at full pressure to wash the dirt and dust off the beams and floor.

According to Pruden’s testimony, the task was relatively straightforward, “You just grab a hose and go wash the top of the floors and the beams on top of the furnace” (Inquest transcript, January 20, 2004, page 60, lines 10-11). As far as he could tell there was no master plan for the shutdown. As the evening progressed, various supervisors would appear and move the men around. At one point he was told to hose down near the large furnace uptake vents, but he decided not to since he could see pipefitters working directly below him (Inquest transcript, January 20, 2004, page 82, lines 9-17). He said that the fire hoses had been used at full

volume to dislodge the dust. The water would be falling, he testified, “onto the ceiling of the brick by the furnace. Under the beams is your ceiling of brick that covers the, the furnace” (Inquest transcript, January 20, 2004, page 71, lines 19-21). As the water fell, steam would rise from the furnace (Inquest transcript, January 20, 2004, page 76, lines 12-15).

When, during the Inquest, it was suggested to Pruden that he had been doing routine work, Pruden testified, “I don’t think it was routine, I think it’s—it was the first time I done it up there so I don’t think we—they don’t wash the furnace down every other day or the floors every other day, the beams every other day. They have arch blower that cleans up all that stuff. It’s not a routine job, no” (Inquest transcript, January 21, 2004, page 36, lines 6-11).

**Comment:**Tasks that are performed at most once every three years by workers who have never carried out those tasks are not routine.

Radics testified that when he went out for his shift he was told by Harrower to hose down the drop pipes that led from the hoppers to the furnace with a three-inch fire hose. After ten minutes, he threw the hose down because he did not think he should be watering the furnace. Instead, he assisted in the clean up being done around the slag launder. On his second shift he was instructed by Harrower to remove bricks from the area around the drop pipes (Inquest transcript, February 17, 2004, pages 48-52, lines 15-22). He worked on this with Sonny Audet, who knocked in wall tiles as Radics took off the bricks (Inquest transcript, February 17, 2004, page 70, lines 14-32).

**Comment:** One of the workers that night was sufficiently concerned by the process that he chose to do other tasks rather than continue to participate in the washdown.

While the washdown was supposed to have one supervisor, the evidence suggests that during the course of the evening numerous supervisors provided direction to the washdown workers, apparently doing so without consulting one another.

Radics said that in the past workers doing the washdown had used smaller hoses than those that were used in 2000 and only misted the dust. Furthermore, he said the operation had been closely supervised by foremen such as Mike Oliynyk or Frank Chrupalo, both of whom had retired by 2000. Radics testified that these men “were right there telling us when to start and when to take a break, and it was a break for a longer period, like a half hour break, and they’d tell us, okay, it was half hour, hour, then they would tell us to go back in and, you know, mist it down a little more” (Inquest transcript, February 17, 2004, page 75, lines 12-25; page 76, lines 2-6, page 80-81, lines 33-28).

Brian Barrett, a pipefitter who had worked on shutdowns since 1979 testified that in 2000, “The cool down period was definitely shorter than I remember it” (Inquest transcript, February 25, 2004, page 53, lines 20-21).”

**Comment:** The one washdown worker with previous washdown experience on duty that night said that in past years the washdown had been closely supervised and had included numerous informal breaks.

The slag launder clean-up workers

The testimony of workers who were involved in the slag launder clean up provides additional insight to the events of August 7-8.

Brad Russell first went to work for HBM&S after he graduated from high school in Flin Flon. He worked for a month on the bull gang, and then spent a month as a slag launderman in the reverb furnace. As a launderman, he was working with the slag that was being skimmed from the converter pit and putting back into the furnace. The slag launder is a cast-iron chute through which the company pours slag (which has matte in it) from the converters into the furnace.

In September 1999, Russell quit HBM&S to study engineering in Saskatoon, but returned to the smelter the following spring, where he worked as a brakeman on the calcine train and tapped slag. Russell was at the smelter on Monday August 7 because he had traded shifts with another worker. He had no idea what would be happening that night or what he would be expected to do (Inquest transcript, January 24, 2004, page 15, lines 15-17). As a part of the preparation for the washdown, Woods told Russell and Kelvin Primrose to go to the calcine floor of the smelter and use a bobcat to remove the floor platforms around the tracks. By the time they were done, most of the plates were gone, and all that was left in most places were the beams (Inquest transcript, January 24, 2004, page 52-53, lines 3-33).

Primrose, normally a slag tapper, expected that he would be spending the evening of August 7 doing a variety of clean up jobs when he reported to work at 7:00 p.m. Like Russell, he had not been a member of any of the shutdown planning teams nor had he been given any overview of

the shutdown plan. He had not participated in the 1997 teardown, but had passed bricks to the bricklayers during that year's rebuild (Inquest transcript, February 24, 2004, page 16, lines 11-16).

After doing some miscellaneous clean-up work, Russell and, another worker, Dave Salahub were told by Woods to connect a number of fire hoses and run them up the stairways to the calcine floor (Inquest transcript, January 24, 2004, pages 22-32, lines 16-33).

Around 10:30 p.m. Harrower told Russell, Salahub and Primrose to clean the slag launder area by hosing the sand (normally used to help the flow of the slag) into the converter pit area. The three of them took a break at 11:30 p.m. and Russell and Primrose returned about half an hour later. While Russell was on his break, a co-worker mentioned to him that the shutdown was behind schedule (Inquest transcript, January 24, 2004, page 48, lines 29-34). Primrose recalls being told that the shutdown was 17 hours behind schedule (Inquest transcript, February 24, 2004, page 45, lines 13-22).

**Comment:**The men working on the slag launder clean up had received no training that would have lead them to believe there was a danger of the washdown leading to an explosion

Russell felt that he had been pressured by Morrell and Harrower to hurry (Inquest transcript, January 24, 2004, pages 59-62, lines 27-4). Primrose stated that he felt he had been hurried by Morrell (Inquest transcript, February 24, 2004, page 30, lines 20-32).

**Comment:**The evidence of the men washing down the slag launder suggests that there was pressure to speed up the washdown

The pipefitters

There were four pipefitters working on the shutdown on August 7-8, 2000. The most senior of these was Bob Cassan. A journeyman pipefitter, Cassan had been with HBM&S for 23 years in the summer of 2000. While he had worked every shutdown since 1979, he was not involved in planning the 2000 shutdown nor did he attend a series of information presentations that that were given by an engineer-in-training (EIT), Chris Ecklund (Inquest transcript, February 25, 2004, pages 23-24, lines 11-4). As an hourly supervisor, Cassan was a union member who had responsibility for directing other workers.

In the weeks leading up to the 2000 shutdown pipefitter Barry Fox had been led to believe that he and his partner Scott Storey would be working the day shift, rebuilding the pre-heater during the shutdown. However, while Fox was on holidays in late July, he received a phone call telling him he would be working the night shift on his first day back at work, August 7. While he had worked on previous shutdowns, he had not worked the 1997 shutdown and the 2000 shutdown was his first as a pipefitter. He had not been involved in the shutdown planning nor had he seen a shutdown plan (Inquest testimony, February 18, 2004, page 39-40, lines 28-2).

Brian Barrett had been a pipefitter at HBM&S for 11 years in 2000 and had worked on shutdowns since 1979. (Inquest transcript, February 25, 2004, page 53, lines 12-21). Like the other pipefitters, he

had never seen a shutdown plan nor did he attend one of Eklund's information presentations (Inquest transcript, February 25, 2004, page 51, lines 10-14).

The role of the pipefitters at the start of the shutdown was to disconnect and dismantle the water jackets. The water jackets are pipes encased in copper that circulate water to cool strategic areas of the furnace. The pipefitters start by turning off the water, then they disconnect the water inlet and return pipelines to the water-cooled jackets, finally they remove the jackets themselves. They were to start on the east end of the furnace, since that is the end the furthest from the burners and therefore the coolest. This was the slag tapping side and slag had not been tapped for several hours prior to their starting work. The jackets were five feet in the air, hanging above the slag launders that lead out of the furnace. It would usually take a half a shift to disconnect and remove the jackets.

Cassan, Fox, Barrett, and Gerry Wilson came in at 6:30 p.m. so they could communicate with the departing shift about what had been done and what was yet to be done. Gary Willetts, the Maintenance General Foreman in 2000, told them that they were not going to be able to start disassembling the furnace because it had not been tapped out. Willetts then delivered a talk that stressed the risk of heat stress and the need to take regular breaks. According to Barry Fox's testimony, one of the workers asked if it was true that the shutdown was 12 hours behind, Willetts said that no one should worry because the overall shutdown deadlines could still be achieved (Inquest testimony, February 18, 2004, pages 15-16, lines 33-8).

After the shift change meeting, Cassan, who was the most senior of the pipefitters, gave the other three a tour of the furnace, pointing out which lines needed to be replaced and which ones they should not touch and outlining what they should expect in the days ahead. Then the pipefitters went to an old electrical shop that had been converted into a lunchroom and rest area for the trades workers.

Sometime after 11:00 p.m. Kal Woods told them that the furnace was shutdown and they could begin disconnecting the water jackets. Since Dave Salahub was leading a crew cleaning out the slag launder area, an arrangement was made by which each crew would take turns working in that area so as not to create a hazard to the other crew.

The pipefitters took a lunch break around midnight. When they went back after midnight, Fox worked with Wilson while Cassan worked with Barrett. They were still working on the east end of the furnace but had moved to a catwalk at a higher level, with Cassan, Barrett, and Wilson on top cutting pipe and handing it down to Fox. Fox testified that Harrower approached him and asked how long it would take to finish up, "I give him a rough estimation that we'd be a half an hour. Mr. Harrower responded with, 'I'll give you 20 minutes.'" And I said to him, 'No, you won't. You'll give me 40 minutes if I need it.' He—we weren't talking the way me and you are talking. We were—our voices were raised. I believe he tried to intimidate me. And he said, 'We have to wash this furnace down.' And I said to him, 'Well, why would you want to wash the furnace down? We're up there working.' And then he said to me, 'We've got to cool this furnace down.' He said, 'Wash' the first time, and then he said, 'Cool' the second

time. (Inquest transcript, February 18, 2004, pages 29-30, lines 26-9). When questioned about this conversation, Harrower testified that while he did not deny it took place, he could not recall it (Inquest transcript, April 16, 2008, pages 46, lines 18-28).

**Comment:**The testimony suggests that the washdown was being hurried in an attempt to cool the furnace and make up for lost time.

### Adding hoses

When washdown commenced only two hoses were being used on the calcine floor and one hose was being used on the feed floor (additional hoses were also being used to washdown the slag launder). At sometime before 1:00 a.m., the supervisors met and decided that two hoses should be added on the calcine floor. They testified that they did this because they believed that they were acting in accordance with the shutdown manual, cited above, which stated that “Four fire hoses are used to wash down the furnace” (Exhibit 27).

This instruction could be interpreted as meaning 1) there should be four workers doing washdown at one time or 2) there should be two workers at a time and that these workers use either the hoses on the east or west side at one time. Gauthier had stated, it was his belief that only two hoses should be used at once, since if four hoses were used at once, people would end up spraying water on each other (Inquest transcript, April 24, 2008, page 56, lines 14-34).

**Comment:**The decision to add two additional hoses would have led to a situation in which workers would have been spraying water on each other and

therefore is another reflection of the fact that the supervisors did not understand the washdown procedure.

On August 8, 2000, Harrower told the workplace safety and health committee that the decision to add additional hoses was made in order to speed up the washdown. In a subsequent interview, he stated that the hoses were added to follow the process in the shutdown manual. In his evidence, Harrower acknowledged that [speed] “would definitely be a motivating force” when it came to making a decision to add the hoses. (Inquest transcript, April 17, 2008, pages 98-100, lines 5-3).

Woods testified that he did not know whose responsibility it was to determine the number of hoses that were to be used (Inquest transcript, May 20, 2008, page 51, lines 24-27). He further testified that he did not take part in the decision to add two more hoses (Inquest transcript, May 20, 2008, page 76, lines 8-11).

**Comment:**The person who was supposed to be supervising the washdown played no role in determining that additional hoses were to be used.

The decision to add extra hoses was justified on the basis of the shutdown manual. However, the decision would have led to a situation where workers were spraying each other with water.

The addition of the extra hoses suggests that the washdown was being hurried in an attempt to cool the furnace.

Did water get into the furnace?

During the course of the washdown, Russell, Primrose, Pickering, Ledoux, Radics, and Wolokoff were all able to look through holes into the furnace (Inquest transcript, January 24, 2004, page 47, lines 9-17; February 24, 2004, page 32, lines 1-9; January 24, 2004, page 86, lines 20-28; January 21, 2004; page 107, lines 18-25; February 17, 2004, page 53, lines 27-30; February 18, 2004, page 78-80, lines 5-9 and pages 101, lines 8-30). They saw that it was glowing (Primrose, Pickering, Ledoux and Wolokoff) and giving off steam (Pickering), that there were cracks in the surface (Wolokoff), and that there was water on the surface of the bath (Russell, Primrose, Radics and Wolokoff).

In his testimony Russell stated “I did realize that, that as long as there was a crust on the, on the molten material, a crust forming as it, as it cooled, that as long as the integrity of that crust was maintained, that water sitting on top of that crust wouldn’t be, wouldn’t be an issue, and so with that, that in mind I felt that it was a (sic) okay safe situation” (Inquest transcript, January 24, 2004, page 65, lines 4-9). Primrose said that he never felt that he had the sort of information he would need to refuse to keep on working (Inquest transcript, February 24, 2004, page 58, lines 2-27).

Harrower looked into the furnace around midnight and saw between one and two inches of bubbling water on the main area of the floor. In a statement to the workplace health and safety committee he stated that he had also seen red spots on furnace surface. He said he was not worried by the presence of water (Inquest transcript, April 17, 2008, pages 38-39, lines 11-3). Woods testified that he also looked into the furnace during the

washdown stating that it was “black back past the feed section and from there on it was still molten” (Inquest transcript, May 20, 2008, page 52, lines 24-25). He described the molten area of the furnace bath as being liquid and orange in colour (Inquest transcript, May 20, 2008, page 54, line 16).

Around 1:15 a.m. Morrell pried loose some brick on the north side and looked into the furnace. It was dark and stated that he was not able to see any water (Inquest transcript, April 15, 2008, page 77, lines 4-11).

At 1:00 a.m. Hillier looked into the furnace and said it was dark, which meant to him that it was cooling off. He did not see any water on the floor of the furnace. Hillier could not say what he would have thought if he had seen water on the floor of the furnace. He stated that he looked into the furnace three or four times and never saw any water in the furnace (Inquest transcript, April 22, 2008, page 43-44, lines 25-33).

After the explosion Laidlaw looked through a hole in the furnace and saw “a crust on the, on the, the matte and that in there, but it was red and black, you know, just cooling” (Inquest transcript, April 9, 2008, page 31, lines 20-22).

**Comment:** It appears that not all the water that passed through the furnace roof immediately evaporated. Some pooled on the surface of the furnace. It also appears that the furnace surface was still red in some places after the explosion. Had the workers and supervisors received training about the potential washdown risk that this presented, they would have been able to react to the presence of water in the furnace

### Water spraying into the furnace

Wolokoff, who was washing off the calcine dust, also testified that he saw a pipe spraying water on to the arch brick near the slag launder (Inquest transcript, February 18, 2004, page 92-93, lines 33-11). Primrose noticed a waterline near the slag launder door that was pouring water into the furnace (Inquest transcript, February 24, 2004, page 28, lines 27-29). In addition, Harrower, Laidlaw, and Morrell all spoke of seeing an open valve that was spraying water into the furnace. It was not turned off until after the explosion. No evidence was presented as to who turned it on. Morrell said he was not concerned by the water that was spraying into the arch from the valves because this was a small amount of water compared to what is historically sprayed into the furnace (Inquest transcript, April 15, 2008, pages 79-80, lines 18-3).

**Comment:** It would appear that someone had opened up additional sources of water that were sprayed on to the furnace. None of the evidence clarified who did this.

### Monitoring of water

Morrell testified that neither he nor anyone under his supervision monitored the amount of water being applied to the furnace during the washdown (Inquest transcript, April 16, 2008, page 57, lines 5-10).

**Comment:** The decision not to monitor the amount of water being added to the bath is an indication of the failure to have appropriate monitoring processes in place.

### The explosion and the washdown workers

Around 1:30 a.m. August 8, Steve Ewing, who was on the catwalk in the centre of the furnace area called out to Pruden, who joined him on the catwalk. Pruden testified that Ewing told him that Reg Hillier had just asked for the two of them to wash the middle of the furnace down from the catwalk. At that point the two men heard a loud pop. According to Pruden the two men looked into each other's eyes and then a second pop went off. Pruden testified that "my glasses and respirator and helmet went flying...As soon as the second one went off, I went running and it was like, it was like tripping wire... We just ran down the catwalk."

When I ran to the end of the catwalk, it was, it was like total blackness...All the dust from the beams covered me and Steve, and all I could see as I was running down the catwalk was slag or matte, broken brick flying through the air and I was trying to protect my face...Running, because all I could do is run, and I got to the end of the catwalk and Steve and I had bumped into each other, and then I lost Steve from there. I just ran right for the first staircase, and all I could see was an orange glow, and that's where the explosion had happened, so that's the only place I could run, is run down those stairs and down to the main level. Just once in a while you, you just see orange flying, orange rock or whatever, brick or whatever  
...I just ran down to the orange glow, and I didn't know if it was going to go off again, and I, I think if it would have went off again

I wouldn't be here today, but it was—must have been where that explosion happened, it's the only place I had to run is there. Then I ran down. I got onto the main floor, and I believe I tripped onto the Brokk that was beside the north wall. (Inquest transcript, January 20, 2004, pages 102-107, lines 12-5)

At this point someone grabbed him and led him out of the building.

At the time of the explosion Wolokoff was washing up on the east side of the calcine floor. "I heard a pop, and when I looked up, [Pruden and Ewing] bumped into each other, and then before my eyes left them, it started popping, like, harder. And I just dropped the hose, and ran, because there was nothing I could do, 'cause they were basically at the end of the catwalk, and railing all around them, so I just ran out the east, like, between the uptakes." He followed the tracks out of the furnace. "It got quite violent for about ten or so seconds, while I was running. But yes, there was a lot of force underneath. I could feel the floor lifting when I was running." From there he went down through the fuming plant and out of the smelter (Inquest transcript, February 18, 2004, pages 74-76, lines 29-18).

Ledoux, Radics, Pickering and Salahub were in the lunchroom when the explosion occurred. According to Ledoux, "It shook the walls. I could see glass while I was sitting, safety glass was coming in towards me like it was ready to fold. It looked like the walls were coming in" (Inquest transcript, January 21, 2004, page 97, lines 12-16). Pickering said, "There was a couple of pops and then there was one big boom and everything went black... The walls were shaking. Felt like the walls were

going to come in. They're cinder blocks and they were probably moving a good foot and a half to two feet inwards and outwards, just swinging like that" (Inquest transcript, January 24, 2004, page 90, lines 8-15). Radics briefly opened the lunchroom door, saw the bricks flying, closed the door, and joined Ledoux, Pickering, and the others in climbing through an emergency exit to the reverb washroom, putting more room between themselves and the furnace. When it got quiet most of them climbed back into the lunchroom.

### **The slag launder workers and the explosion**

Russell was hosing the sand with his back to the furnace when he heard a loud rumble from behind him. As he turned to see what it was, he was engulfed in dust. He ran across the platform to the north, jumping across the opening where the slag launder had been. When he landed he had to turn towards the furnace to get off the platform, but was knocked off his feet by the next explosion. He backed into a corner, held his respirator to his face and curled up to protect himself. By then he had no idea where Primrose was. When smoke stopped billowing out of the furnace he thought it was safe to get up and run down the stairs. When he got to the exit he discovered it locked to prevent workers from going through the door and stepping directly in the path of a front-end loader that was removing debris from the furnace area. Eventually, someone opened the exit, allowing him to leave (Inquest transcript, January 24, 2004, pages 35-40, lines 20-14).

At the time of the explosion Primrose was waiting for Russell to finish using the hose that the two men were passing back and forth to each

other. He heard a small rumble and then a big one. “Everything went black and I just went blind and started burning, and the only thing I could—I thought of at the time was just getting out of there because I was in pain. There was a small landing there. I just climbed over that and dropped down to the floor below.” The strap on his respirator melted off. He too made his way to the exit, found it locked and then, along with another worker, crawled through an elevator shaft to the warehouse (Inquest transcript, February 24, 2004, pages 18-19 lines 10-14).

**Comment:** The locked doors prevented injured men from leaving a disaster zone and seeking medical attention. Had they been more seriously injured, the delays could have proved fatal.

### **The pipefitters and the explosion**

When the explosion took place, Cassan saw orange flames rolling towards him from the west end of the furnace.

I grabbed Brian, 'cause Gerry was sitting down, and he was protected behind a beam and I got Brian off the top there, and told him, 'Brick shed, let's go,' and then you couldn't see anything and the masks were knocked off. We got to the brick shed and I said, 'Did you see Gerry and Barry?' and Brian said, no, he hadn't, so I told him to stay there and I'd go back, and I found Barry, and got him into the—I can't remember which lunch room they call it there on the north side, and Gerry was already in there starting to flush his eyes out, so I went back and got Brian, and we went back to see how those

guys were, and then we went to the lunch room that we were using, the old electric one, but there was no eye wash bottles in there, so we all headed out across to—down to the mechanic shop and when we got there Barry and Gerald were coming along, too, so we all went over to where everybody was meeting across the tracks. (Inquest transcript, February 25, 2004, pages 17-18, lines 32-13).

Fox said that as soon as he heard the explosions, he knew water was in the furnace. “I’ve seen what water does previously, on some call-outs I’ve had in the smelter, on that very same side. Some minor leaks that had to be taken care of before the men would go back to tapping, and I’d get called out during the night to fix some of them leaks” (Inquest transcript, February 18, 2004, page 32, lines 10-15). He looked up and saw Barrett and Cassan highlighted by a six or seven foot flame. “Before I had a chance to look at where my partner was, a huge explosion took place, and I was thrown back, and when I looked for Gerry, I didn’t know where he was. Everything was black. There was calcine dust in the air. I couldn’t see. I was on my hands and knees. And I crawled to where I thought I would be safe, behind a brick wall” (Inquest transcript, February 18, 2004, page 32, lines 28-33). He was joined by Cassan and Barrett. Fox and Cassan went searching for Wilson who they took to the reverb lunchroom. Cassan then went back to look for Barrett.

### **Other workers and the explosion**

After performing a number of clean up and preparation tasks while he was waiting for the

pipefitters to complete their work, slag tapper Richard Moore went for a tour of the smelter. After coming across ankle deep water on the south side, he went up to the top level where he saw Pruden and Ewing using some of the hoses that he had been instructed to string out earlier at full blast. Then he went down to the main level where he watched the Brokk operator putting a hole in the north side of the furnace. The Brokk had punched a five-foot by five-foot hole in the wall, but as it moved lower down the wall, the Brokk began to slide backwards on the floor. Darren Stular, the contract machine operator, along with Morrell and Harrower, were looking for a way to brace the Brokk, when the first pop occurred.

According to Moore, “I looked in the direction of the noise that I heard and I could see matte coming up and hitting the arch, like the bricks, the bottom of the furnace” He turned and was about to tell the Brokk operators that they had to get out of there in a hurry when the furnace exploded, knocking him off his feet. The dust and steam were so thick he had no idea of where he was, but decided to run for where he thought the stairs ought to have been. He jumped down the stairwell but found the exit door was locked. The smelter had an elevator, which was, at that point stopped on one of the upper levels. Moore climbed the gate, walked through the shaft and exited the building. When he got out he was alone, all of his safety gear was gone. “The force of the explosion ripped my hard hat off, my respirator, safety glasses, gloves. The only thing that I had left on was the actual suspension for my hard hat, like it took the—it ripped the hard hat right off the suspension.” When he heard other men trying to leave through the locked door, he told them to use the elevator

shaft (Inquest transcript, February 24, 2004, pages 83-87, lines 5-9).

**Comment:**The locked door created potential safety problems.

Morrell attempted to assist Stular in getting out of the remote-control tether after the first explosion occurred. He was thrown about, ran into a wall, ran to the door and when the air cleared went back into the reverb area. He then went to the lunchroom (Inquest testimony, April 15, 2008, pages 54-56, lines 1-12).

**Comment:**The tethering of a worker to a machine created a serious safety hazard.

## **The general evacuation**

Workers gathered at the lunchroom; Cassan and Fox had brought Wilson into there, (although Cassan left to find Barrett) and Harrower, Woods, and about a dozen other people arrived. Ledoux and Pickering wanted to know what happened to Wolokoff, Ewing, and Pruden. When Woods did a head count, men were missing (Inquest transcript, April 15, 2008, pages 57-58, lines 23-27). Eventually the whereabouts of all men was determined and all workers left the building.

Pickering and Ledoux left by the stairs only to discover the exit locked. When they got out of the building at last, they ran to a crowd of people. Pickering found Ewing and began to wrap him in a gel blanket. Ledoux and Pickering tended to Pruden and Ewing until an ambulance arrived.

## **Post accident**

Thirteen men were taken to the Flin Flon Hospital on the night of the explosion. Seven were

treated and released that night while six others remained in hospital. One was released the next morning, while others were sent to Winnipeg and Edmonton for further treatment. The two most seriously injured men, Steve Ewing and Roland Pruden were treated in Winnipeg.

Steve Ewing received burns to over 95 per cent of his body. He was flown to the Health Sciences Centre in Winnipeg. There he underwent numerous skin grafts, escharotomies (a treatment for burns) and a laparotomy (an incision to gain access to the abdominal cavity), and a tracheostomy (emergency surgery on his windpipe) (Autopsy report, November 29, 2000, C. Littman, K5.1). He died on August 16, 2000.

Roland Pruden was severely burnt over 46 percent of his body. He needed reconstructive surgery and was in hospital for two and a half months in Winnipeg. He stayed in Winnipeg until January. Four years later he still had skin irritation and will bear the scars of his ordeal forever. His lungs were scalded by the steam requiring him to undergo lung function tests every six months. He was in need of laser surgery to remove hair follicles that create skin irritation when follicles that were burnt down. Furthermore, he has been told he will have dry eyes for the rest of his life.

In addition to these workers there were others who received first aid on site. Aside from the physical injuries, many of the workers on duty that night were severely traumatized. In some cases they have not been able to return to work in the smelter, and in other cases they have simply not been able to return to work at Hudson Bay Mining and Smelting.

## Section 3

# Expert reports on the immediate cause of the explosion

Four redacted reports by technical experts were accepted as evidence during the course of the Inquest. Three of the reports were prepared for the Manitoba government and one was prepared for Hudson Bay Mining and Smelting.

### **The Jennings Report**

A report prepared for Manitoba Labour by A.R. Jennings, a professional engineer, listed 10 potential causes of the explosion (Exhibit 69) in declining order of probability. The report stated that the most probable cause of the explosion was the “interaction of water inside the furnace after shutdown with residual molten material such as matte, or slag, resulting in a series of violent explosions.” The report stated that this would require a substantial quantity of water inside the furnace after shutdown coming into contact with a sufficient quantity of residual molten material. It noted that there was evidence of water on top of the bath. It also concluded that “There should

have been an interval of time between the two of perhaps 24 hours depending on the final bath temperature at shutdown” (Exhibit 69, page 4). In his discussion of this possibility, Jennings also recommended that there be a review of the shutdown procedure to ensure that there was an adequate cooling period, safe use of water, and adequate education, training and selection policies for all employees.

The second most likely cause identified by Jennings was a boiling liquid expanding vapour explosion (BLEVE). Such an explosion can take place when a liquid is confined in a container and heated to above its boiling point before a sudden fracture releases the pressure. The scenario would require a large volume of water spread over a very hot body (such as the residual build up and the matte and slag), with heat escaping from below rapidly bringing the water to a boil. An additional application of heat could cause the water to violently flash to steam. While there were reports

of steam over the furnace, Jennings stated that this could be a consequence rather than the cause of the explosion.

Jennings indicated that a third possibility would involve some combination of the two most probable causes.

A fourth possibility was a hydrogen gas explosion. This could be triggered by the passage of water vapour over certain materials at elevated temperatures, causing the water to break down into hydrogen and oxygen gases, which might recombine explosively. A calculation had concluded that the likelihood of hydrogen generation when water is in contact with molten copper at elevated temperatures to be low.

When combustible fine dusts in sufficient concentration become airborne there is a potential for a large-scale explosion. Smelter dust, which contains sulphur, could generate such an explosion. While there was an accumulation of dust, there was no precipitating explosion nor was there a widely reported sulphur dioxide odour following the explosion. This led Jennings to conclude that this fifth possibility was unlikely.

Jennings wrote that there was little or no evidence to suggest that possibilities six through nine were likely, while the tenth possibility, was simply unknown causes.

In conclusion, Jennings noted that “Extra weight on the bath from dumping brick and roof tiles onto the inside of the furnace may have forced molten material up to the surface to contact water” (Exhibit 69).

He also made the following comments:

Locking of exits from a reverb is not appropriate when people may have to flee

for their lives. The task which resulted in that barrier should be re-evaluated and redesigned so that no exits are blocked (Exhibit 69, page 10).

Individuals working around furnaces should not be tethered to their equipment by electrical umbilical cords that take time to remove. There should be a better control alternative to allow rapid egress or flight (Exhibit 69, page 10).

Comment: The Jennings report identifies 10 possible causes of the explosions, but indicates that only three were likely. In all three scenarios, the explosion is seen as arising from the presence of water from the washdown in the furnace. In Jennings' opinion there was not an adequate period of time between the shutdown of the furnace and the commencement of washdown. He suggests that this speaks to a lack of adequate education and training of the workers on duty that evening. He also identified the locking of reverb furnace doors and the tethering of workers to their equipment to be health and safety risks.

### **The Tennesey report**

Dr. W.W. Tennesey, a metallurgist, mechanical engineer, and certified fire and explosions investigator, conducted a metallurgical investigation into the explosion for Manitoba Labour. Tennesey reported that 17,092 U.S. gallons of water were applied to the furnace from 10:00 p.m. August 7, to 2:00 a.m. August 8, 2000. He noted that the water would not have been evenly distributed but would have fallen more heavily at certain points. The furnace operator

recorded a bath measurement of 12 inches overall at 22:55 p.m. when the burners were shutdown. This was recorded as 6-8 inches of slag, and 4-6 inches of matte, with possibly 6 to 12 inches of matte below measurement. Tennesey commented that subsequent investigation indicates that there was no matte present. Instead a layer of magnetite, in a molten or mushy state, was covered by 2.75 to 4.75 inches of slag. He also noted that magnetite has a much higher melting point than matte (1538 degrees Celsius compared with 1000 degrees Celsius). As a result, the material under the slag was approximately 500 degrees hotter than the operator might have expected.

Tennesey proposed that the water caused the slag and then the magnetite to crack. After the explosion, the crack was found to be 25 to 30 feet long, 1 to 2 inches wide in places, and at points up to 8 to 10 inches deep. According to the report, the water probably ran into these cracks, reached the magnetite and precipitated a low-level steam explosion. Tennesey stated this was not what he termed a “fully developed steam explosion” (Exhibit 67, page 31). Such an explosion, in his opinion, would have levelled the smelter.

The Tennesey report also noted that lack of monitoring of the temperature of the bath, commenting that “Temperature is the most important variable to monitor in order to determine whether the molten/solidifying material is safe to work nearby or overhead” (Exhibit 67). He also stated that mechanical cleaning rather than washing would have been a much safer and reasonable way to clean the furnace. The conditions that Tennesey identified as leading to the explosion were the short period of time between shutdown and the application of water

(which did not allow the formation of a thick layer of slag), the possibility that the layer of slag may have been thinner than in the past, and the fact that underlying layer was made up solely of magnetite rather than matte and therefore had a much higher melting point.

**Comment:** The Tennesey report suggests that the lack of a cooling off period, the thin layer of slag, and the fact that the underlying furnace layer was comprised of magnetite rather than matte were contributing factors to the explosion. The HBM&S shutdown plan did not take into account the implications of a decision to conduct a thorough burnout, did not call for the monitoring of temperatures in the furnace at the time of shutdown or washdown, and made no provision for a cooling off period prior to washdown. HBM&S did not ensure that the supervisors or hourly workers were aware of the properties of the metals found in the furnace at the time of washdown (particular their melting points), did not require staff to monitor the thickness off the crust prior to washdown, and did not provide them with training in regard to the dangers associated with a thin crust, an insufficient cool down period, or the application of water to magnetite.

### **The Lee and Dick report**

A report prepared for HBM&S (Exhibit 68) by Dr. John H.S. Lee and Hoi Dick Ng concluded that the explosion was a stratified steam explosion (such an explosion was not defined in the portion of the report that was accepted as evidence). The report provided this description of the events leading to the explosion.

It is postulated that a solid crust of slag was formed on top of a pool of molten matte while the “wash down” operation was taking place. The solid crust of slag, possibly in combination with a layer of steam, served as an insulating blanket. This permitted the water from the fire hoses entering into the furnace to accumulate on top of the slag crust.

This eventually formed a stable, stratified configuration of water on top of the molten matte separated by an insulating layer of a solid crust of slag and possibly steam. A significant trigger event fractured the solid crust layer, which permitted the water to come into contact with molten matte and started an initial precursory explosion. This precursory explosion caused further fragmentation of the crust bringing more water into contact with the molten matte. The precursory explosions escalated rapidly and brought about the final major event (Exhibit 68, page 10).

Comment: This explanation differs from the Tennessee report in that it argues that the explosion was caused by water coming into contact with matte rather than magnetite. However, the key process, water penetrating the cover layer of slag, remains identical. Again, it would appear that HBM&S had failed to identify this risk in the planning process and failed to train the supervisors and hourly workers as to the nature of the risk.

## The Gesser Report

An initial study by Dr. Hymie Gesser indicated that the likelihood of hydrogen generation when water is in contact with molten copper at elevated temperatures to be low. Dr. Gesser then conducted similar studies to determine the likelihood of other compounds present in the bath contributing to the development of a hydrogen gas explosion. His three separate reports constitute Exhibit 66. At the end of each report Gesser concluded that the explosion was the result of a BLEVE.

Comment: As with the other three reports, Gesser’s report identifies the presence of water in the furnace as the primary cause of the explosion.

As an overall comment on the portions of the expert reports that were accepted as testimony, it is the position of this submission that they all point the presence of water in the furnace as a central cause of the explosion. Furthermore, none of the reports suggest that the explosion was the result of previously unknown scientific processes. Finally, two of the reports stress the fact that there was a lack of knowledge on the part of HBM&S staff that evening of the properties and risks of the materials and processes with which they were working.

## Section 4

# Planning the 2000 shutdown

It has been argued by others that the explosion of August 8, 2000, could not have been predicted and prevented. While the reports discussed in the previous section are not unanimous in their findings, they all point to the mixing of water and molten material in the furnace as a key element in the making of this tragedy. The Inquest brought forward no evidence to suggest that in its planning process Hudson Bay Mining and Smelting had in place a hazard identification process that attempted to identify these latent hazards that were created by the introduction of large amounts (indeed, unmonitored amounts) of water to the furnace, during shutdown process. In short, the company was not even asking the sort of questions that could have led to the prediction and prevention of this sort of disaster.

A proper planning process for the shutdown would have required a hazard identification procedure that examined the underlying safety of the processes and decisions involved in the shutdown. Key processes that would have to be examined would be the decision to use water to wash down the furnace, the timing of the washdown in relation to the shutoff of the furnace,

the implications of the decision to punch holes in the furnace walls, and the decision to reduce the level of the bath through the use of large amounts of reductant.

It is our position that the evidence makes it clear that there was no adequate hazard assessment being undertaken as part of the shutdown planning process. In other words, no one was asking the sort of questions that might have led to a prediction of a catastrophic event. While it may be argued that the hazards associated with some of the individual tasks were being assessed, little attention was being paid to the hazards that were created by the overall process.

This position is upheld by the testimony of smelter supervisor Hair who stated that “the fundamental issue was the failure to recognize the, the hazard of using water to wash down the furnace, and the fact that it was treated—or certainly perceived to be a, a routine job, and as such, just hadn’t been flagged on anybody’s radar screen that, that, that, that—the huge potential hazard that was there and could have resulted in what happened” (Inquest testimony, May 27, 2008, page 80, lines 28-34).

There had, however, been numerous examples of explosions and near explosions at HBM&S when water and molten metal were inadvertently mixed. Following the 1996 death of Richard Beasley, the coroner's report (attached as Appendix A hereto) identified the risk of mixing moisture with molten metal. In his testimony Hair stated that the problem was that because the washdown process had come to be viewed as routine, it was not incorporated into any planning for catastrophic events (Inquest transcript, May 27, 2008, page 118, lines 23-30).

**Comment:** The company's failsafe or catastrophic event planning was limited in effectiveness because it did not take into consideration routine events—even when those routine events took place only once every three or four years.

This section of the report looks at the issues surrounding the planning of the 2000 shutdown and places them in the context of the broader safety and health system at HBM&S.

## **Shutdown planning and the HBM&S loss control system**

The Hudson Bay Mining and Smelting Company had a safety plan for the smelter. Titled the Smelter Department Loss Control System it is Exhibit 15 in this Inquest. Hudson Bay Mining and Smelting had begun implementing the system, which was developed by the International Loss Control Institute, in the 1990s. At the time of the explosion it had reached level six of the system's ten levels (Inquest transcript, May 27, 2008, page 54, lines 14-24). This was the system that was intended to ensure that safety was integrated into every aspect of company operations.

The loss control system has a three-page section that addresses the issue of Critical Task Analysis and Procedures (Section 4 of Exhibit 15). According to the document, critical task analysis "is essential to thoroughly describe the activities within the Job/Tasks within the department." Smelter management was expected to ensure that a task analysis was carried out on each job and that job practices and instructions were written for each job. Hazard and risk analysis were expected to form a part of the critical task inventory. The process was to involve at least one worker who was competent at the task and one supervisor who had supervised the procedure. In short, the company had a policy structure that could be employed when planning the shutdown tasks.

Gauthier was asked if the critical task analysis and procedures methods outlined in the company's Smelter Department Loss Control program were adhered to in developing the shutdown manual. In his response, he said:

Well, we didn't take the time to do that, like how do I word this? We didn't have the resources to do it all. Critical task analysis or risk analysis is a long process in itself—and we thought whatever we could get done would be better. And a lot of people weren't trained in the way we did job procedures once we started doing risk analysis, the way we stepped them out and everything. So I told them do the procedure in the way you were trained, like—and we, we were doing procedures in the smelter long before we ran into risk analysis. So a lot of people did it the way they did in the old days and that was just one step after another, no

explanation, no, no identification to hazard or anything. And we took what we could get. But we said after shutdown we wanted to do it the proper way. (Inquest transcript, April 24, 2008, page 73, lines 16-31).

Comment: The company did not provide the necessary resources prior to the 2000 shutdown to allow the planners to undertake the sort of analyses required by company policy.

Various statements were made during the Inquest to the effect that safety was a key issue for the company and central to the shutdown planning. However, the process that was supposed to make safety integral to company operations was not employed in the planning of the shutdown procedures.

### **Factors affecting shutdown decisions**

The decision to undertake a shutdown in the summer of 2000 was governed by two main factors: the fact that three years had elapsed since the previous shutdown and the company's decision to introduce a new gas-handling system that was intended to reduce fugitive emissions from the smelter. This project required the shutdown of the smelter to tie the new process into the flue systems and install new hoods over the converters.

In the past it had generally been the practice to carry out the shutdowns in the spring or fall, to avoid the extreme heat of summer and the bitter cold of a northern winter. However, it was determined that the gas-handling project was best undertaken in the summer.

Aside from the decision to undertake the project in the summer, there were a number of other planned changes to the shutdown procedure in 2000. These changes arose out of experiences with the 1997 shutdown. The 1997 shutdown was nearly 10 per cent over budget. Expected to cost \$2,847,500, it ended up costing \$3,124,238, with a total overrun of \$276,738. Most of this overrun could be attributed to the fact that the arch rebuild was 23 per cent over budget (\$228,613). The budget for the 1997 arch rebuild was \$992,000, while the actual was \$1,220,613 (Exhibit 24, J.140). It is apparent from the planning documents that there was an intent to allow more time for the rebuild by ensuring a quicker and more thorough teardown.

### **Changes to the shutdown procedure based on 1997 experience**

The undated document entitled Notes From Previous Shutdown (Exhibit 24, J.97) contains a series of comments and suggestions from individuals involved in the 1997 shutdown. One issue that emerges from this document is the search for ways to improve the teardown. This involved both more staff and additional machinery. For example it was recommended that on the first night "more men [were] needed to drop arch, 8/ shift could have worked continuously" (Exhibit 24, J.97.1). Another comment noted that the company should "Investigate using a bulldozer to replace the slusher" (Exhibit 24, J.97.6). In the same vein, it was recommend that "If a small bulldozer is used to clean out the furnace, it should push the debris out all four sides of the furnace, reducing the amount of time required to clear the furnace. This machine would also remove the need to wait for

the front end to be disassembled before cleanout commenced. Prior to shutdown an area should be cleared on the matte side to allow a bobcat to dump material into the converter pit, eliminating the need for the bobcat to haul material all the way around the furnace” (Exhibit 24, J.97.6). Another comment noted the need to have “Extra people on first night shift to knock in arch” (Exhibit 24, J.97.9). As a result, through the shutdown planning process, a decision was made to replace the slusher with a bulldozer that could be used to more quickly remove brick and debris from the furnace.

In his testimony Alan Hair stated that while the project may have been behind schedule when the explosion took place, there was no need for rush because there was slack built into the plan. In addition, it was felt that because new equipment was being used to clear the brick from the furnace, the job would take less time than in the past (Inquest testimony, May 22, 2008, page 21, lines 5-25). While slack may have been built into the process, it is also the case that the overall thrust of the planning had been to speed up the shutdown.

**Comment:** In light of its experience in 1997, HBM&S was looking for ways to carry out the teardown of the furnace in a faster manner. The evidence suggests that time was a factor in the teardown process.

One event that took place during the 1997 shutdown was not incorporated in the planning of the 2000 shutdown. Exhibit 37, the Smelter/Powerhouse Joint Workplace Safety and Health Committee Report on the Fatality of Steven R. Ewing and Injuries to the Other Employers As a Result of Explosions in the Reverb Furnace of Hudson Bay Mining and Smelting Company

on August 8, 2000 (in reality the report of the management members of the committee), contained the following passage:

The committee investigated the possible explosion during the 1997 shutdown. From interviews the committee believes there was an explosion inside the furnace, as a result of water being applied but on a much smaller scale than the August 8, 2000 explosion. It was never documented and so as with other shutdown issues from the past it is based solely on people’s memory from over three years ago.

None of supervisory witnesses testified to any recollection of this event. Nor did they recall being told of it at the time. In his testimony, Ron Radics stated that there had been a rumbling caused by water coming into contact with molten metal. This event was not recorded in the book in which such events were supposed to be noted nor was it reported the provincial safety division (Inquest transcript, February 17, 2004, pages 87-89, lines 16-29).

**Comment:** The management safety system that existed in 1997 failed to record the near-miss event that took place during that year’s washdown. There also does not appear to be a responsibility to report such events to provincial regulators.

## **Responsibility for coordinating the shutdown**

Responsibility for coordinating the 2000 shutdown was assigned to Ray Gauthier, who had been the shutdown coordinator for the 1993

and 1997 shutdowns. Gauthier had started with Hudson Bay Mining and Smelting in 1968, although he took some time off to return to school. He testified that he did not think he had missed a shutdown since 1968. During his career he was training foreman, reverb foreman, day foreman, and the company's first safety and training coordinator. It should be noted that while Gauthier in testimony described himself as the shutdown coordinator, in his testimony, smelter superintendent Alan Hair said that Pat Merrin was the shutdown coordinator (Inquest testimony, May 22, 2008, page 9, lines 2-8).

Alan Hair, the smelter supervisor, was a 1983 graduate of Leeds University in the United Kingdom. Since his graduation he worked in the metallurgical industry in the United Kingdom, South Africa, and Canada. He started at Hudson Bay Mining and Smelting in Flin Flon in 1996 as the general superintendent of the zinc plant, becoming the smelter supervisor in 1996. In Flin Flon he reported to the company vice-president of metallurgy, Thomas Goodman.

From the point of view of senior managers, the washdown was not a serious concern. Hair testified that he had not seen the shutdown manual as a whole prior to the shutdown (Inquest transcript, May 21, 2008, page 11, lines 7-9) nor could he recall any discussion of the wash down itself in any detail (Inquest transcript, May 21, 2008, page 12, lines 7-11). Hair took the position that the planning for the 2000 shutdown started earlier than past shutdowns. Furthermore, he said that since the gas-handling project was going to render certain smelter equipment redundant, the scope of the shutdown was smaller than that of previous shutdowns. Compared to the 1997 shutdown,

he testified that there were more resources being committed to the shutdown and no major projects being undertaken (Inquest transcript, May 22, 2008, page 10, lines 4-29).

### **Loss of experience**

According to Gauthier's testimony, the task of coordinating the shutdown had in the past essentially involved acquiring and scheduling sufficient supplies and staff. As he put it, the smelter superintendent and an assistant superintendent usually took care of the "top end of the job" (Inquest transcript, April 23, 2008, page 11, line 33). However in 2000, both the smelter superintendent, Alan Hair, and the assistant superintendent, Pat Merrin, were new to their positions and neither had gone through a shutdown. According to Gauthier's testimony, the smelter had lost at least nine experienced employees since the previous shutdown. Faced with the prospect of working with relatively inexperienced supervisors, Gauthier recommended that the shutdown be planned through the establishment of a number of planning teams and the development of a shutdown manual. He indicated that he had not anticipated that the manual would be complete prior to the shutdown, rather it would be developed through the planning process and would be available as a resource in future shutdowns (Inquest transcript, April 23, 2008, page 27, lines 1- 29; page 44, lines 14-20).

Because the company had lost a number of experienced workers in recent years, Gauthier wanted to bring back a number of retirees to help with the 2000 shutdown. He testified that Merrin convinced him that the manual would provide the additional information needed to carry out the

shutdown (Inquest transcript, April 23, 2008, page 75-76, lines 16-6).

**Comment:** The company did not put needed resources into addressing the loss of experienced staff. The problems created by this loss had been brought to management's attention.

The general issue of training is also related to the issue of loss of experience. Hair testified that in the years prior to the explosion the company had been moving away from an informal buddy-to-buddy training system to a more formal system. However, he testified that at the time of the explosion no training manuals for supervisors had been produced (Inquest testimony, May 27, 2008, page 46, lines 24-31; page 47, lines 5-14).

**Comment:** At the time of the August 7, 2000 explosion the company did not have training manuals for supervisors.

## **Role of professionals in planning of shutdown**

According to Gauthier, HBM&S metallurgist Adam Solomon De Friedberg's involvement in shutdown planning would have been restricted to issues connected to the hanging of the arch. As a result, it does not appear he was providing an overall technical assessment of the shutdown procedure. Clarence Kresak, an HBM&S engineer, was available to engineer any needed modifications (or inform the planners that they could not be carried out in time or on budget) (Inquest transcript, April 23, 2008, pages 29-30, lines 25-28). While Gauthier had consulted with the metallurgists when he first became reverb foreman about the use of reductant, the metallurgists did

not provide analysis on the use of reductant in the 2000 shutdown (Inquest transcript, April 23, 2008, page 31, lines 1-7).

Morrell acknowledged that during the planning process there was never a professional analysis done of the decision to create cooling holes to see if the process was either "safe or sensible" (Inquest transcript, April 15, 2008, page 138, lines 24-26).

**Comment:** While technical experts were involved in some elements of the shutdown planning, they were not asked to undertake overall assessments of the process or to monitor the process.

## **The 2006 planning process compared to the 2000 process**

In planning for the shutdown in 2006, the company found that it did not need a washdown to control the dust and dirt problem for the rebuild. Instead it used induced draft fans, arch blowers, vacuums, and air horns. In doing so it was making use of elimination and engineering controls. These are the higher and more effective levels of hazard controls in the hierarchy of hazard control. Similarly, the work processes were more closely examined and required greater approval before being adopted. Gauthier testified that:

...we would develop the procedures. Then we'd bring people in, and get them to review them. At the same time, before we even completed the procedure, we did a risk analysis on it. There should be documentation of that, the risk analysis. Then the procedure, and then the sign-off from the employees of the procedure.  
Q So it was a completely different process

than in '06?

A Well, it was the complete process, because we had the time, the resources to do it the right way. (Inquest transcript, April 23, 2008, page 50, lines 16-26).

Comment: When compared with the approach that was adopted in 2006, it is evident that HBM&S did not devote sufficient resources to planning the 2000 shutdown.

### **Supervisory familiarity with the loss-control system**

A number of supervisory witnesses did not appear to be familiar with the company's loss control program. When Garry Willetts, the Maintenance General Foreman in 2000, asked if there was a purchased corporate safety system he said, "I'm not sure what you mean by safety system. I mean, we have regular safety committees. We have, like, our joint health and safety committee. We have an obligation to safety contacts. I'm not sure what you mean by safety system" (Inquest transcript, April 10, 2008, page 90, lines 23-27).

When Hillier was asked if the company had a safety program, he made reference to ongoing crew meetings at which any accidents were discussed. Furthermore, he personally would check the fire extinguishers, the lights, and check the first-aid boxes (Inquest transcript, April 22, 2008, pages 124-125, lines 28-14).

Harrower identified the following as key elements in the health and safety regime at HBM&S:

- systems in place for employees to report safety hazards and means, means to deal with them
- the right to refuse

- safety training and was provided to employees  
When presented with a copy of the Smelter Department Loss Control System, Harrower could not recall ever having seen it before (Inquest transcript, April 17, 2008, page 103, lines 21-23; pages 103-104, lines 32-3).

Comment: The descriptions provided by the supervisors are not adequate descriptions of a safety system. The lack of supervisor familiarity with the company loss control system suggests that the supervisory staff had not been provided with the necessary training. This is further evidence that safety was not integrated into company operations.

### **The Planning Teams**

Formal planning of the shutdown commenced on September 9, 1999, with a meeting of nine managers. At this meeting, ten critical areas, including safety, were identified. In September and October meetings were held of what was called the Shutdown Committee (Exhibit 24, J.4). In November this committee became the Core Team. Ten sub-committees or teams were established to deal with various aspects of the shutdown. These teams produced a range of minutes, action registers, and reports. As noted above, the establishment of so many teams was a departure from past practices at HBM&S. This increase in planning was in large measure, however, necessitated by the loss of experienced supervisors. Furthermore, as a reading of the documents produced by these teams indicates, little attention was paid to analyzing the shutdown to determine if there were any latent hazards associated with the procedure and more, particularly, the washdown.

An April 2000 summary of team responsibilities indicated that only two teams had the responsibility to “identify any safety concerns”: namely, the Core and Safety Teams (Exhibit 24, J.155). In addition to these teams, the Reverb Team had responsibility for planning the shutdown and rebuild of the furnace and compiling a shutdown manual. In this process, it took a number of safety issues into consideration.

Gauthier testified that the two teams that had the greatest responsibility were the Reverb Team, which was planning the shutdown and rebuild of the reverb furnace, and the Core Team. Gauthier testified that Hair was the Core Team leader and Morrell was the Reverb Team leader. In both, cases Gauthier had more shutdown experience than either of the team leaders. Morrell acknowledged this, and stated that he saw himself as the coordinator of the Reverb Team. In his testimony, Hair stated that the only team he sat on was the scheduling manning cost control team (Inquest transcript, May 22, 2008, page 68, lines 17-24).

In light of the above, this submission will examine the documents associated with these three teams.

### The Core Team

There are minutes for 12 Core Team meetings between November 30, 1999 and June 13, 2000. The meetings were usually attended by between 7 to 10 people. At the Committee’s first meeting on November 30, Pat Merrin and Ray Gauthier were elected co-leaders of the shutdown. A document from April 12 indicates that Gauthier was by then the sole leader of the Team (Exhibit 24, J. 155). Allan Hair’s name does not appear as an attendee on the minutes any of the meetings. However, he

was on the minute distribution list. Among the most regular attendees were Gauthier, Merrin, Morrell, and Harrower. Morrell testified that he believed Merrin was in charge of the Core Team (Inquest transcript, April 15, 2008, page 116, lines 31-32).

The Core Team was responsible for the establishment of a Safety Team. There appears to have been some delay in establishing such a team; the minutes of the November 30, 1999, December 14, 1999, and the January 11, 2000 meetings all stated that Merrin was to enroll Bill Fulford to head the Safety Team. Fulford did take responsibility for this team, which held its first meeting on February 7, 2000. According to the Core Team minutes, Fulford attended five of its meetings.

At virtually all of its meetings in 2000, the Core Team discussed safety issues. However, according to the records that have been entered into evidence, these include such matters as:

- completed repairs
- the posting of minutes
- providing safety teams with radios and radio frequencies
- improved traffic visibility
- alternate members of the safety team
- lockout and confined space issues
- the publication of safety contacts
- availability of respirators
- signs and maps for walkways

These are important issues. However, they do not constitute an assessment of the underlying health and safety risks associated with the shutdown. Many of them have to do with accident prevention (better visibility and signage and ensuring that repairs are carried out, and respirator availability),

others have to do with improved communication (posting minutes and publishing safety contacts), while still others related to responses to injuries (safety team membership and radio supply). None relate to the examination of the workplace to determine the presence of previously unidentified hazards or an examination of changes to the work process.

At the May 30, 2000, Core Team meeting, it was reported that the Reverb Team was working on a shutdown manual. This is the only reference in the Core Team minutes to the manual (Exhibit 24, J.18).

From an early stage, the Core Team minutes suggest that one of the big issues for the team was the level of membership commitment. The Action Register attached to the minutes of the January 11, 2000 meeting (Exhibit 24, J.10) stated, "Members need to RE-COMMIT to shutdown Core and sub teams as meetings have been poorly attended and requests not filled out, time lines not met." Similarly, the minutes of the February 1, 2000 meeting (Exhibit 24 J.11) reported that the reverb team is working well but "the work is being done by only a few people. Need to expand the involvement here." At the February 7, 2000 Core Team meeting there were reports that the Reverb Team had concern about the number of hourly employees on the team.

The issue of team attendance was addressed during the Inquest. Safety Team member Roland Pruden indicated in his testimony that it was not always easy for hourly employees to participate in the work of the shutdown committees. In Pruden's case, he was also a member of the Joint Workplace Safety and Health Committee, had a variety of family responsibilities, and found that

his responsibilities as a slag tapper could conflict with safety team meetings (Inquest transcript, January 20, 2004, pages 33-35, lines 27-7).

Morrell said that the participation of hourly staff in the planning teams was limited by the scheduling system (Inquest transcript, April 16, 2008, pages 35-37, lines 2-7).

The Manning Team indicated that progress was slow and that there were "still lots of unknowns." The Action Register once more stated, "Members need to RE-COMMIT to shutdown Core and sub teams as meetings have been poorly attended and requests not filled out, time lines not met" (Exhibit 24, J.12). At the following meeting on March 16, 2000 (Exhibit 24, J.13) there was a comment about the need to recommit. It was also indicated that a letter was being written to Alan Hair regarding "concerns surrounding the manning team. No team action & many issues."

**Comment:** While the Core Team had a safety responsibility, there is no sign of any extensive discussion of health and safety in its minutes. The issue of teardown was not addressed by the Core Team in its minutes. Likewise there is no discussion of hazard identification. There is indication that its meetings were poorly attended and there was poor follow up.

#### Safety Team

The minutes or agendas exist for nine Shutdown Safety Team meetings from February 7, 2000 to August 3, 2000. There are only minutes for seven of these nine meetings. There were generally six to eight people at the meetings, including supervisors and hourly staff. Fulford, the team leader, attended six of the seven meetings for which there are minutes. Morrell also attended numerous meetings.

From the Safety Team minutes it would appear that its focus was not hazard identification but developing safe work practices for already identified hazards, ensuring that the proper personal protective equipment was available, ensuring that the workers were aware of identified hazards and motivated to use the proper methods, and that, should an accident take place, there be individuals available to investigate and provide first aid. Lunch was an initial responsibility of the Safety Team, but that was shifted to the Core Group by the March 8 meeting.

Safety team minutes refer to such issues as:

- Who was to conduct orientations
- Should there be a central lock out work at the smelter
- Responsibility for conducting lockouts
- The supply of personal protective equipment
- The safety responsibilities of contractors
- Safety promotion—contacts and contests
- The number of safety personnel needed on site
- The availability of water on site
- The need to get an exemption from workplace safety and health requirements to allow them to remove the rollbar on the caterpillar
- The hiring of students
- The availability of hoses for fire protection

The only reference to bringing experienced people back was a suggestion that Mike Olinyk, who was retiring, relight the furnace. There appears to have been considerable discussion to a variety of safety promotion ideas—awards, slogans, having a worker relight the furnace, breakfasts if there were no lost-time accidents. The request for slogans read in part: “In order to promote discussion, to bring about awareness, those with previous experience of work in the shutdown need to share their

knowledge with younger, less experienced workers” (Exhibit 24, J.58). Fulford’s letter announcing the winner of the contest reminds workers, “Have you taken the time to assess the hazards?” (Exhibit 24, J.62). The winning slogan was:

Accidents cause losses and hardships too  
So working safely is up to me and you  
(Exhibit 24, J.62).

The slogan was, it might be noted, fully in keeping with a behaviour-based approach to health and safety.

In his testimony, Safety Team member Roland Pruden confirmed that “the bulk of the work that this committee did focused on personal protective equipment, (inaudible) and lockout procedure and the safety slogan for the shutdown” (Inquest transcript, January 20, 2004, page 122, lines 13-16).

There is no indication from the Safety Team minutes that the Safety Team reviewed either the shutdown plan (Exhibit 24, J.47) or the shutdown manual.

### Safety plan

There also exists an undated a four-part plan (Exhibit 24 J.47), that was prepared by the Safety Team. It deals with:

- 1) Pre-shutdown checks
- 2) Promotions and awareness
- 3) Shutdown activities
- 4) Post shutdown review

The nine points listed under the Pre-shutdown Checks heading involve ensuring that the appropriate equipment was available: fire safety equipment (again hoses are only listed as a fire-safety tool), first-aid kits, ensuring adequate

supply of lockout permits and tags, locks, and scissors, adequate supply of water and ice, personal protective equipment, contractors, and a review of the 1994 and 1997 shutdown accidents. It does not include any hazard identification and operates on the assumption that the only thing that could go wrong was something that had gone wrong in the past.

Promotions and Awareness involved the slogan contest, safety contacts, orientations for employees, and orientation for contractors.

The Shutdown Activities included the presence of on-site safety personnel, plant protection officers, and the requisite radio communication. It also included provision for spot inspections, work observation (by safety personnel), air and heat-stress monitoring, accident investigation, the handling of permits, and the logging of safety activities. The Post Shutdown Review was to involve a review meeting and the preparation of a report on safety-related matters.

**Comment:** Hazard identification did not appear to be a part of the Safety Team's mandate. There is no suggestion that the Team was asked to consider the changes in the way in which the teardown would be conducted. Nor is there any indication the Team had the resources to analyze the impact of those changes.

#### Reverb Team

The Reverb Team was responsible for planning the actual shutdown of the furnace. There are minutes, agendas and notices of meetings for reverb furnace team meetings between November 12, 1999 and May 1, 2000. Given that the shutdown took place in August, it is likely that the team continued to meet past May 1. In many

cases, there are no minutes merely agendas, notices of meetings or references to previous meetings in minutes. In testimony, Morrell stated that the planning went on until "close to shutdown" (Inquest transcript, April 15, 2008, page 32, lines 11-15). No witness was able to provide an explanation as why there are no preserved planning minutes after the month of May for most of the planning teams.

The early Reverb Team minutes indicate who attended meetings, the latter ones do not. There were usually ten people at committee meetings: its members included Hillier, Harrower, Gauthier, and Morrell. While a November 1999 document (Exhibit 24, J.74) identifies Fred Carter and Adam Salomon de Friedberg the team leaders, a document from April 12, 2000, indicates that Harrower and Morrell were the team leaders (Exhibit 24, J. 155). At the outset the team adopted the following purpose: "To complete a safe and successful Reverb rebuild and modifications."

The structure of many of the meetings was to start with a five-minute discussion of safety, followed by discussions of the action register, team structure and projects. The safety discussion usually addresses an immediate safety issue. For example, at the December 3, 2000, meeting, one of the safety issues is a reminder to drive safely because of the icy roads (Exhibit 24, J.75).

At its December 10 meeting (Exhibit 24, J.76) there was an Action Register that stated that the team was slated to "Look at all required procedures for shutdown/startup (reverb)" either by February 1, 2000 or at a meeting on February 1, 2000. The Reverb Team was clearly planning changes in the way teardown would be carried out, but its records

do not appear to mention the need to review the safety implications these changes.

By February 24, the Reverb Team had concluded that the key components to make its critical path work were:

A Good wash out to ensure that mobile equip can slush out the brick

B Enough manpower to work both ways from the bullnose when rebuilding Grantomatic [a remote control jackhammer] being able to jackhammer out the uptakes (Exhibit 24, J.81).

There is no discussion in any team minutes or documents as to whether there were any safety implications from the decision to develop these processes.

The Reverb Team appeared to be experiencing many of the same attendance problems as the Core Team. The lack of attendance was noted in the minutes for the January 7, January 20, and February 3 minutes (Exhibit 24, J.78, J.79 and J.178). At the February 7, 2000 Core Team meeting there were reports that the Reverb Team had concern about the number of hourly employees on the team. The Manning team indicates that progress is slow and that there are “still lots of unknowns” (Exhibit 24, J.12).

A variety of documents deal with the development of the shutdown manual (Exhibit 24, J 178-184). The majority of the documents that deal with the washdown simply identify the number of men who will be required to take part in the process and the number of hours it will likely take (eight people, five hours).

In short, when it came to the shutdown, new equipment was being used, it would require

changes in procedure, and these changes were being undertaken to ensure a faster shutdown. It is not the contention of this brief that there was no safety component to the work of this team. However, it started from the assumption that the only things that could go wrong were matters that had gone wrong in the past and did not investigate the possibility that changes in procedure would cause the latent hazards that arise when water and molten metal are both present in a workplace to manifest themselves.

**Comment:** The Reverb Team experienced difficulty in gaining ongoing involvement from needed HBM&S staff.

The Reverb Team’s safety issues often did not directly involve the shutdown.

The shutdown manual

According to Gauthier, the 27-page shutdown manual (Exhibit 27) was produced by the Reverb Team without any outside professional assistance. Gauthier did not expect it to be completed by the start of the shutdown, but hoped that it would be available for use for the next shutdown (Inquest transcript, April 23, 2008, page 44, lines 14-24). As noted above, the manual was used by the supervisors on the evening of August 7-8, 2000 as a guide, since they added extra hoses to the washdown to comply with their interpretation of the manual.

A key criteria for determining how much detail would go into describing a procedure was whether that procedure had been associated with injuries in the past (Inquest transcript, April 23, 2008, page 42, lines 16-31). Unfortunately few of the people involved in developing the manual had any previous experience with the washdown.

The manual's treatment of the washdown was two paragraphs in length and these described the hoses to be used, where the hoses were to be attached, and the order in which portions of the furnace were to be washed down. It did not describe how the work was to be done: there was no talk of timing, no talk of breaks, no talk of evaporation and pooling of water and no talk of steps to ensure that the water does not come into contact molten metal (Exhibit 27).

**Comment:**The shutdown manual's section on the washdown did not address the safety issues associated with the washdown.

Gauthier testified that in his opinion the information for the washdown procedure came from either Hillier or Harrower (Inquest transcript, April 23, 2008, page 49, lines 23-26). Harrower had been a supervisor assigned to the reverb furnace during a washdown, however he was not sure of the date (Inquest transcript, April 16, 2008, page 105, lines 13-20; April 17, 2008, page 2, line 30-31). While he worked every shutdown since 1981, he had never monitored a washdown (Inquest transcript, April 17, 2008, page 2-3, line 32-1).

Hillier thought he did the washdown on the year of his return to the company (1976 or 1977). He also had seen washdowns done in other years but had not participated in one (Inquest transcript, April 22, 2008, pages 68-69, lines 28-15). Hillier could not recall any risk assessment of the washdown being undertaken as part of the shutdown planning (Inquest transcript, April 22, 2008, page 116, 17-19). He also stated that because he was on holiday in the period before shutdown he was not involved in the development

of the washdown procedure (Inquest transcript, April 22, 2008, pages 84-85, lines 27-5). However, Harrower testified that the section on the washdown was largely completed by April 20, 2000 (Inquest transcript, April 17, 2008, page 7, lines 17-34).

**Comment:**There was no evidence presented to the Inquest to suggest that the washdown procedure was developed by someone with competence in carrying out a washdown or experience in supervising a washdown.

Gauthier, who had never seen or participated in a washdown, testified that no one on the Reverb Team ever suggested that the washdown was a high-risk job or that there were dangers associated with the washdown procedure (Inquest transcript, April 24, page 22-23, lines 34-2). According to Hillier, there was no discussion of water as a hazard during shutdown during his meetings with the shutdown teams (Inquest transcript, April 22, 2008, pages 75-76, lines 29-1). Morrell also testified that during the 1997 shutdown no one had raised concerns about the use of water during the washdown nor had they done so during the planning for the 2000 shutdown (Inquest transcript, April 15, 2008, page 70, lines 24-34). Harrower provided similar testimony (Inquest transcript, April 16, 2008, page 137, lines 7-9).

**Comment:**The individuals involved in preparing the washdown procedure were not aware of the latent risk created by adding water to the furnace at the time of shutdown.

Who reviewed the shutdown manual

While Harrower (Inquest transcript, April 16, 2008, page 92, lines 14-28) testified that the Safety Team reviewed the Shutdown Manual, no evidence confirmed that this happened. For example, Harrower indicated that he had not been the person who would have passed the plan on to the Safety Team (Inquest transcript, April 17, 2008, page 5, lines 30-33). Gauthier testified that he hoped the Safety Team had reviewed the manual, but he could not confirm that it had (Inquest transcript, April 24, 2008, page 23, lines 4-13). Morrell testified that the portion of the manual dealing with the washdown was not presented to the Safety Team (Inquest transcript, April 16, 2008, page 60, lines 7-12). The minutes of the Safety Team make no reference to such a review.

Gauthier confirmed that the Joint Workplace Safety and Health Committee was not consulted during the development of the high-risk job procedures for the shutdown (Inquest transcript, April 24, 2008, page 92, lines 12-26). Furthermore, no evidence was presented to suggest that the Joint Workplace Safety and Health Committee was consulted on the planning of any portion of the shutdown.

**Comment:** There is no evidence that confirms that there was a review of the shutdown manual to determine if the work processes it described were safe. In fact, the preponderance of the evidence would seem to indicate it was not reviewed by either the Safety Team or the Joint Workplace Safety and Health Committee.

## **Workplace Safety and Health Committee involvement**

At the time of the explosion, Tom Lindsey was the United Steelworkers of America full-time health and safety coordinator at HBM&S. Lindsey started working at HBM&S in 1974. In 1994 he became the full-time health and safety coordinator and also serves as a member of the standing committee for the review of the operation of mines regulation. He testified that his responsibility was to represent workers' health and safety concerns, to participate in the development of safety and health procedures, and to work with workers, management, and inspectors to promote health and safety at the company. His responsibilities extended to all HBM&S workplaces in Manitoba including two mines in the Flin Flon area, a mine and mill at Snow Lake, the zinc plant, the mill, the smelter, the warehouse, the central services groups, the cleaning staff and the research lab a total of 11 committees. In addition, he sits as a member of the plant-wide Joint Workplace Safety and Health Committee.

In the period prior to the plant shutdown, Lindsey was a member of the Safety Team. In his testimony he indicated that he was not able to attend that Team's entire meeting due to conflicting responsibilities in relation to other issues at the plant (Inquest transcript, May 29, 2008, page 64, lines 1-12).

Lindsey testified that the Joint Workplace Safety and Health Committee did not review the 2000 shutdown procedure (Inquest transcript, May 29, 2008, page 33, lines 10-16). He further testified that there was no discussion of the fact that, as a part of the shutdown, water would be sprayed into the molten bath at any of the Safety Team meetings

he attended (Inquest transcript, May 29, 2008, page 54, lines 9-13). He also testified that there was nothing in the Safety Team minutes to indicate that the washdown procedure was ever explained to the Safety Team (Inquest transcript, May 29, 2008, page 78, lines 9-16).

Pat Merrin had attempted to have Lindsey assigned as a safety supervisor to work during the shutdown. Lindsey declined because his position was not a supervisory one and did not carry out supervisory functions (Inquest transcript, May 29, 2008, page 56, lines 2-22). The attempt to use the health-and-safety coordinator as a supervisor demonstrates a clear lack of understanding of the role that the health-and-safety coordinator (whose job was created through collective bargaining) is to play in the workplace.

**Comment:** Given the size of the HBM&S worksite and the various hazards posed by that worksite, it would be appropriate to have a full-time safety representative assigned to the smelter. While such a position was created after 2000, it has since been discontinued

## HBM&S and safety and health

As note earlier, HBM&S had a loss control system for the smelter. This submission is not providing a detailed examination of the program as written or implemented. However, there are a number of points that came to light during the Inquest that should be highlighted:

- Gauthier said that his appointment as loss control officer came out of the blue and he did not receive any training for the job. Instead he was largely self-taught. (Inquest transcript, April 24, 2008, page 86-87, lines 21-14)

- Laidlaw noted that in 2000 he was not very well informed about *The Workplace Safety and Health Act* (Inquest transcript, April 9, 2008, page 54, lines 27-30).

**Comment:** The company did not devote sufficient resources to providing safety staff with needed training nor were other staff well trained in their responsibilities under The Workplace Health and Safety Act.

- Hillier (April 22, 2008, page 130, lines 22-26), Harrower (Inquest transcript, April 17, 2008, page 104, lines 12-14), and Gauthier (Inquest transcript, April 24, 2008, page 67, lines 18-22) were not familiar with the term internal responsibility system. Morrell simply described it as “People working internally in the company” (Inquest transcript, April 16, 2008, page 64, line 32-34). Thomas Goodman, the vice-president of metallurgy for HBM&S and Hair’s immediate supervisor, gave the following definition, “Internal responsibility refers to a, a management system where individuals’ accountabilities and responsibilities are well understood not only by themselves, but by, by others and that they understand others’ key accountabilities as well” (Inquest transcript, April 30, 2008, page 55, lines 28-32). This answer makes no reference to health and safety, nor does it capture any of the elements of the internal responsibility system.

**Comment:** While it is not necessary to know the name of a system to understand its principles and operate according to them, it is disturbing that these individuals do not know the term used to describe one of the core principles of workplace safety and health under Manitoba law. It suggests a lack of training on the part of management.

- The safety contact system, in which supervisors read specific hazard-related documents to workers at the start of a shift and then had the workers sign a document to ascertain that the document had been read appears to have been an ineffective learning system (Inquest transcript, January 22, 2004, page 78-79, lines 14-32).

### Right to refuse

Numerous management staff testified that no worker raised concerns about the washdown process or exercised their right to refuse unsafe work in relation to the washdown. The shutdown workers who testified were also asked about their understanding of the right to refuse. They indicated that they were aware of the right (in some cases some of them had exercised the right in the past). The workers also testified that they were aware of the risks of mixing water and molten metal in the day-to-day operation of the smelter. Indeed, they were well aware of that risk since several HBM&S workers had been killed or injured by such explosions. In 1996, Richard Beasley was killed by the explosion that occurred when cold material along with ice and snow were dumped into a converter. (Declaration of Coroner, Appendix A). In addition there have been numerous of smaller pops in the converter pit and with breakouts on the furnace.

In their testimony the workers indicated that they were not aware of the latent risks to which they were being exposed during the shutdown. The one worker who indicated he believed he was at risk during the shutdown, Radics, testified that he chose not to exercise the right to refuse, but rather chose to stay with his fellow crew members

(Inquest transcript, February 17, 2004, page 115, lines 31-33). Radics also testified that he had attempted unsuccessfully to find Morrell and raise his concerns about the shutdown safety (Inquest transcript, February 17, 2004, page 116, lines 1-4).

The right to refuse should not be viewed as a hazard identification system. As Gauthier testified “it’s basically should be, like your last step to make sure that it doesn’t [end] up being an incident” (Inquest transcript, April 24, 2008, page 70, lines 15-16).

The full-time health and safety coordinator at the HBM&S operation, Tom Lindsey, testified that for workers, exercising one’s right to refuse unsafe work can be a frustrating and stressful process. As a result, most workers would do so only as a last resort (Inquest transcript, May 29, 2008, page 39, lines 1-15).

Furthermore, as smelter superintendent Hair testified, that while they have a legal right to refuse generally workers must do what they are told or face disciplinary action (Inquest transcript, May 27, 2008, page 50, lines 31-34).

The smelter workers doing the washdown were aware that water and molten metal represented a risk in the daily operation of the smelter. However, these risks were also present in their day-to-day work. As was demonstrated in evidence, workers were required to wear certain protective equipment to protect themselves from explosions and safety representatives carried gel to treat explosion related burns. While these are important protective measures, they also normalize a level of risk (Inquest transcript, April 22, 2008, page 129, lines 14-30). The fact that they did not exercise their right to refuse should not taken as evidence

that there was not a hazard that could have been identified by proper planning.

To argue that the fact that workers did not exercise their right to refuse is evidence that the explosion of August 8 was not predictable would be to misinterpret the point of the right to refuse. It is not intended as a hazard identification strategy. Rather it is a right of last resort. It replaces a previous legal regime under which workers were expected to carry out instructions and grieve any orders that they believed to be unsafe.

The only way in which the right to refuse figures in the issues raised by the Inquest is the fact that many of the workers who were most at risk were working at a significant remove from the hazard. Other workers had the opportunity to view the water pooling on the still hot surface of the furnace bath. Had these workers received appropriate training about the risks that the shutdown entailed, they might have been able to exercise the right to refuse on behalf of the washdown workers. Currently, however, it is not possible for workers to exercise the right to refuse on behalf of other workers.

## **The Joint Workplace Safety and Health Committee**

While there was a Joint Workplace Safety and Health Committee in existence at HBM&S during the period in which the shutdown was being planned (and while some members of the committee participated in part of the shutdown planning process there was no attempt on the company's part to formally involve the Committee in the shutdown process). As Gauthier's testimony indicates (Inquest transcript, April 24, 2008, page 92, lines 12-26) in some cases there was

a conscious decision made not to include the Committee in the planning process.

### The Joint Workplace Safety and Health Committee investigation

Following the explosion, the Joint Workplace Safety and Health Committee at HBM&S struck a committee to carry out an investigation into the explosion (as it was legally required to do). While the Joint Workplace Safety and Health Committee was made up of an equal number of worker and employer representatives, the investigating committee had a larger number of workers than employer representatives on it. The investigating committee toured the scene and interviewed HBM&S employees who were on duty the night of the explosion and as well as those involved in the planning of the shutdown. Notes were taken of the interviews and draft reports were prepared. While the intent had been to produce a single report, the union and management employees could not agree on the inclusion of certain recommendations. In particular, the union members wanted a total ban on the use of water during the shutdown and wished to make a number of recommendations for changes in government regulation and policy. In the end, two separate reports were generated: they were identical in terms of their description of the event, but had differing conclusions and recommendations (Inquest transcript, May 29, 2008, page 27, lines 24-30). In his testimony Lindsey also described how the committee system could become deadlocked because there is no way to resolve conflicts between labour and management (Inquest transcript, May 29, 2008, pages 39-40, lines 26-11).

Comment: There is a need for provisions for that would allow for accommodation of differing conclusions in Joint Workplace Safety and Health Committee accident reports. This would require a single report with conclusions and recommendations that are based on consensus not compromise and, if required, dissenting comments and recommendations.

The inability of the Joint Workplace Safety and Health Committee to produce a unified set of recommendations underscores one of the problems with the existing committee system, namely the lack of an ability to resolve impasses.

## Section 5

# Recommendations

This Inquest has been mandated to determine what can be done to prevent similar deaths from occurring in the future and to make recommendations based on those determinations to the Manitoba government.

The previous section of this report outlined our reasons for holding that Steve Ewing's death arose from a series of systemic failures. It is also our position that the Manitoba government can play an important role in reducing the likelihood of similar failures taking place in the future. It can do this through changes in the laws and regulations that shape the Internal Responsibility System in Manitoba workplaces.

Through their workplace safety and health laws and regulations, government provides guidance to employers and workers in how to create safe and health workplaces. Such legislation also provides minimum standards in regard to what is expected. The events of August 7-8, 2000 demonstrate the need for improved guidance and increased standards.

We are making recommendations in five key areas. We are calling for:

- Clarification of senior management responsibilities
- Requirement for hazard assessment and safe job procedures
- A specific regulation for Hot and Molten Metal Industries
- Enhanced role for Joint Workplace Safety and Health Committees
- Specific safety measures

There is more to this issue than the lesson that molten metal and water should not be mixed. This explosion was the result of failures that could have been prevented had senior management exercised its responsibility to ensure that appropriate safety and health policies were resourced and implemented.

There is a need to ensure that firms that are using potentially dangerous processes undertake effective, consultative, and ongoing hazard identification processes. Having done so, they should address these hazards through the use of engineering controls. In short, the Act and its regulations should be written and administered in a manner that protects workers from catastrophic work events.

We do not wish to downplay the dangers of hot metal and water. For this reason, we are also making specific recommendations related to industries that use hot and molten metal.

Joint Workplace Safety and Health Committees are key elements in the Internal Responsibility System. Any firm that claims to make safety an integral part of its activities should make them a part of its hazard identification and control process. In 2000 the Joint Committee was cut out of that process. We are making recommendations that would strengthen the role of the Committees. As the roles become strengthened there will be a need for increased training for committee members. It should be said that in large measure the recommendations that we are making here are based on the recommendations that were put forward by the union members of the Joint Workplace Safety and Health Committee team that investigated the 2000 explosion.

Finally, there were a number of specific practices—the locking of doors and the tethering of workers to equipment—that have given rise to additional recommendations.

#### Clarification of senior management responsibility

##### Recommendation 1

The Manitoba government should amend its workplace health and safety legislation to ensure that senior management has a legal responsibility to ensure that the appropriate procedures, plans, resources, and direction are in place to allow work to be carried out in a manner that is safe and healthy.

**Rationale:** In the last number of years across Canada there have been increasing attempts to describe senior management responsibility for health and safety. This is in recognition of the critical role management plays in providing the needed resources and direction and ensuring that appropriate procedures are followed. This did not take place at Hudson Bay Mining and Smelting in 2000 as was evidenced by the decision not to use the company loss procedure in developing job procedures and the decision not to bring back retired workers to supervise the shutdown.

##### Recommendation 2

The Manitoba Government review its workplace safety and health legislation to ensure that every employee in industries in which a catastrophic event can lead to the death or serious disability is under the direct supervision of a supervisor who holds an appropriate supervisor certificate. In developing these regulations the Manitoba government should seek advise and input from organizations with worker representation.

**Rationale:** The issue of the competence of supervision was a frequent concern throughout the Inquest. Evidence indicated that training was often limited or non-existent, that supervision of work that was high-risk was assigned on a last minute-basis to individuals who are not fully aware of the risks involved in the work that they are supervising, and that the lines of authority were at best blurred and in many cases overlapping

While current legislation requires that management ensure that workers be supervised by a person who is competent (due to knowledge, training or experience)

to ensure that work is performed in a safe manner, there is no standard for determining this competence. This can lead to situations in which lack of competence is only truly assessed following a catastrophic event.

Other Canadian jurisdictions such as British Columbia and Alberta have introduced requirements for the certification of supervisors for inherently high-risk industries.

Requirement for hazard assessment and safe job procedures

### Recommendation 3

The Manitoba government should amend its workplace safety and health legislation to ensure that industries using hot and molten metal along with other high-risk industries be required to have systematic procedures for the identification, analysis, and control of hazards (including hazards associated with catastrophic events). This system should apply to both normal operations and maintenance and to special activities such as shutdowns. The system of control should employ the following measures.

- Elimination: removal of the hazard from the workplace.
- Engineering controls: these controls include design or modification to equipment, ventilation systems, and processes that reduce the source of exposure.
- Administrative Controls: these are controls that alter the way the work is done, including timing of work, policies and other rules, and work practices such as standards and operating

procedures (including training, housekeeping, and equipment maintenance, and personal hygiene practices).

- Personal Protective Equipment: equipment worn by individuals to reduce exposure such as contact with chemicals or exposure to noise.

The order in which these controls has been listed represents the order in which they should be applied, with elimination being the most preferable form of control and the use of personal protective equipment the least preferred.

Such a hazard control system should be a part of the safety and health programs mandated by *The Workplace Safety and Health Act*. Before adoption, it should be reviewed by the appropriate Joint Workplace Safety and Health Committee. Once established, there should be no change to these controls without consultation with the Joint Workplace Safety and Health Committee.

Employers must commit sufficient resources to have these controls developed in a timely fashion. In developing safe job procedures, firms would review and where appropriate incorporate operating procedures from other operations and alternative technologies. Once in place, the reassessment of these controls must be an ongoing process.

Rationale: Evidence presented to the Inquest demonstrated that:

- a full hazard assessment was not carried out prior to the 2000 shutdown
- the company did not employ its own internal process for developing job procedures

- the Joint Workplace Safety and Health Committee was not involved in the planning process and the job procedure process
- in planning and carrying out the 2006 shutdown, the company devoted more resources to hazard identification, involved the Joint Workplace Safety and Health Committee, and used engineering measures to control hazards.

#### Recommendation 4

The Manitoba government should mandate the use of external engineers to assess and certify the hazard identification and safe job procedures for high-risk industries that are undertaking low-frequency, high-risk operations.

Rationale: A variety of factors increased the hazard level of the 2000 shutdown at Hudson Bay Mining and Smelting. These included:

- the loss of a significant number of senior workers
- the decision to use a bulldozer inside the furnace, requiring that the furnace be emptied to a greater extent than in the past
- the increased use of reductant to achieve the furnace burnout
- the fact that there were no limits on the amount of water being used in the washdown

- the fact that no time was set aside for the cooling of the furnace prior to washdown

These were among the local circumstances and contingent events that created the opportunity for the explosion of August 8, 2000. While engineers and metallurgists played peripheral roles in the planning of the 2000 shutdown, they were not asked to conduct a hazard analysis of the proposed shutdown process. Furthermore, Hudson Bay Mining and Smelting Company staff may not have had the background and experience to identify the potential risks associated with the process used in 2000. For this reason, it is necessary to have external professionals provide assessments of these processes.

#### The regulation of Hot and Molten Metal Workplaces

##### Recommendation 5

The Manitoba government should amend Section 18 of *The Workplace Safety and Health Act* to allow for the creation of specific regulations governing industries that use hot and molten metal. The regulation should prescribe:

- processes that would, wherever possible, eliminate the use of water.
- the appropriate use of water in both normal operations and maintenance, and during special activities such as shutdown.
- the development of procedures that ensure that when water hazards are detected, there is a cessation of work (other than that to eliminate the hazardous condition and the reporting of the presence of the hazard). The Joint Workplace Safety and Health Committee should be involved in the development of the

procedures for ensuring the cessation of work and the control of the water hazard.

**Rationale:** While water is no longer used for cleaning and cooling during shutdown at Hudson Bay Mining Smelting, other water hazards remain at Hudson Bay Mining and Smelting and other industries that use hot and molten metal.

#### Recommendation 6

The Manitoba government should amend its workplace health and safety legislation to ensure that in industries using hot and molten metal employers are required to employ a full-time Health and Safety Representative selected by the union or the workers if there is no union, for each department using hot or molten metal.

**Rationale:** A full-time, trained safety representative responsible to the workers would be able to develop a knowledge of the specific workplace hazards and, because this individual was accountable to the workers as opposed to management, would be more likely to be approached by workers with immediate safety and health concerns. This representative would also be able to provide additional support to the Joint Workplace Safety and Health Committee.

#### Enhanced Role for Joint Workplace Safety and Health Committee

##### Recommendation 7

The Manitoba Government must review its workplace safety and health regulations to ensure that Joint Workplace Safety and Health Committees have a legal mandate to:

- review and comment on all management procedures for the identification, analysis, and control of hazards (including hazards associated with catastrophic events), particularly in industries using hot and molten metal and other high-risk industries. The Joint Committee should also be consulted on any changes to such procedures.
- be involved in the development of the procedures for ensuring the cessation of work following the detection of a water hazards in and industry using hot and molten metal. The Committee should also be involved in the development of procedures to control of such hazards once they are detected.

**Rationale:** The Joint Workplace Safety and Health Committee was deliberately excluded from the planning process of the 2000 shutdown. These Committees are effective and legitimate bodies for reviewing hazard assessments and job safe procedures, providing training, and conducting investigations. In preparing for the 2006 shutdown, Hudson Bay Mining and Smelting greatly increased the involvement of the Joint Workplace Safety and Health Committee. Mandating such involvement in planning procedures and providing the sorts of resources that a full-time health and safety representative (in industries that use hot and molten metal) provides are effective ways for ensuring that health and safety does become an integral part of all of a firm's functions.

#### Specific practices

##### Recommendation 8

The Manitoba government should prohibit the tethering of workers to remote-controlled

equipment. Wherever possible such equipment should be controlled in a wireless manner.

### Recommendation 9

The Manitoba Government should review current regulations governing access and egress from all workplaces. The review should ensure that there is adequate regulation and enforcement to ensure that:

- adequate emergency exits from all workplaces and locations within workplaces
- doors that may be used for escape or to allow rescue are not locked or otherwise blocked to impede egress in event of emergency.
- exit door open outwards
- exits are clearly marked with luminous paint (or other suitable marking)
- all exit routes are identified to workers prior to the commencement of dangerous work

# Appendix A



Province of  
Saskatchewan

## Declaration of Coroner (when Inquest not necessary)

I, Russell Gordon Hill of the Town  
of Creighton in the Province of Saskatchewan, a

Coroner in and for Saskatchewan, hereby declare that, after an inquiry by me, I am of the

opinion that Richard Barry Beasley

(Born September 30, 1968) of Flin Flon

in the Province of Manitoba came to his death on the 28th

day of February, 1996 at the City

of Flin Flon in the Province of Saskatchewan under the following

circumstances: (set out brief circumstances and medical cause of death)

**CIRCUMSTANCES:** At approximately 1615-1625 hours the decedent was operator of Hudson Bay Mining & Smelting Co. Ltd. overhead crane #2 feeding sand flux into converter #1 of the Hudson Bay Mining & Smelting Co. smelter on Hudson Bay Mining & Smelting Co. Ltd. property, Flin Flon, Saskatchewan. Witnesses interviewed indicate a minor explosion occurred following seconds later by a far larger explosion violent enough to cause visibility to be obscured by dust and debris for a few seconds. When the dust cleared the puncher and bailman observed the crane cab to be on fire. From where the crane was situated it had to be pushed by crane #1 to a landing for the fire to be extinguished. The interior of the crane was badly burned; all electrical and hydraulic hoses as well as bench and seat had been incinerated. The window had been blown out and a large piece of partially burnt log 4"x4' was lying on the floor. Mr. Beasley's partially incinerated body was lying on the floor and partially out the door which may have been blown open in the blast.

Post mortem examination was ordered and performed by Dr. B. D. O'Shaughnessy at Victoria Union Hospital, Prince Albert, Saskatchewan. The notanda of necropsy report reads: "This twenty-seven year old man died from severe burn with partial incineration which occurred while he was at work at the Hudson Bay Mining & Smelting Co. Ltd. smelter in Flin Flon."

**CAUSE OF DEATH:** Severe burns and partial incineration.

**MANNER OF DEATH:** Accidental.

**RECOMMENDATIONS:** There is little doubt this accidental death was caused by the introduction of foreign substances eg. moisture into the molten matter.

This accident has been thoroughly investigated by Manitoba Mine Safety inspectors and Hudson Bay Mining & Smelting Co. Ltd. since this fatal accident. The entire training process and handling procedure for the operation has been reviewed. With appropriate changes of new policies and procedures implemented.

This writer is confident a coroners jury of six lay people could not improve upon or make additional constructive recommendations to prevent similar occurrences in the future. The decision therefore to not call an inquest into this death was made jointly in consultation with the Chief Coroners office.

and that as a result of my inquiry, I consider an inquest unnecessary, and I have therefore issued my warrant to bury the body of the

said Richard Barry Beasley

Russell Gordon Hill  
Coroner