Exhibit #69

# CONFIDENTIAL

=> Ted Hewitt

Hudson's Bay Mining and Smelting Accident

Investigation Report #1

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For: Manitoba Labour Department,

Mines Inspection Branch

3.1 Possible causes of the accident, listed in order of most probable (#1) to least probable

1. 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.
2. A "Boiling Liquid Expanding Vapour Explosion" or BLEVE.
3. A combination of 1 and 2 above.
4. A hydrogen gas and air explosion.
5. A sulphide dust explosion.
6. The accidental introduction into the furnace of gas cylinders such as acetylene, air, oxygen, propane, etc, by falling through an opening in the furnace.
7. Leaking of oil into the hot furnace from the burners after shut off, which could create explosive vapours.
8. Dangerous horseplay, i.e., flaunting of safety rules.
9. Deliberate acts of destruction.
10. Unknown causes e.g. leaking waterjackets, unusual charge material.

3.2 Discussion of possible causes

1. The interaction of water inside the furnace after shutdown with residual molten material such as matte or slag resulting in violent explosions.

   The requirements for this to happen would be a substantial quantity of water inside the furnace after shutdown, coming into contact with a sufficient quantity of residual molten material.

   There is evidence that there was water lying on top of the bath to provide the basis for a violent reaction or explosion.

The cause of there being water in the furnace soon after shutdown was the initiation of washing down the exterior of the furnace, which resulted in water pouring into the furnace and accumulating on the surface of the bath.

There should have been an interval of time between the two of perhaps 24 hours depending on the final bath temperature at shutdown.

Recommendations

1. The Smelter start-up procedure - which is imminent - should be reviewed immediately and verified by management in conjunction with the Health and Safety Committee and representatives of the Ministry.
2. The shutdown procedure for the Reverb must be revised to allow for an adequate cooling period after burners are switched off.
3. Water must be kept out of the furnace until it is safe to use it, and then only under closely controlled conditions.
4. Policies for educating, training and selecting all employees must be reviewed to ensure sufficient knowledge and experience is built into

Smelter practice to prevent such incidents. It should not be necessary to relearn a fundamental smelter rule - "don't allow inappropriate contact between molten material and water."

2&3 A BLEVE type explosion

A BLEVE type explosion might be expected when a liquid is confined in a container and heated to above its boiling point before a sudden fracture releases the pressure. An expanding vapour ball, especially if flammable, could cause considerable damage.

The smelter scenario might suggest a large volume of water spread thinly over a very hot body (the residual build up and matte/slag) is brought up to boiling point by the heat escaping from below. This we know did happen. This body of water is now approaching an unstable condition and requires only the addition of sufficient heat to convert it to a very large volume of scalding steam (at at least 100°C). Consequently, the addition of extra heat might cause the water to flash to steam suddenly, i.e., violently and explosively. A witness did report considerable steam above the furnace immediately after the explosion, but it is perhaps more likely as a secondary consequence of, rather than the primary root cause of the explosion.

4. Hydrogen gas explosion

When water vapour is passed over certain materials at elevated temperatures it can break down into hydrogen and oxygen gases. These can recombine explosively if within certain concentration limits.

Professor H. Gesser calculated the likelihood of hydrogen generation when water is in contact with molten copper at elevated temperatures and found the possibility to be low.

Conclusion

There are other compounds or elements more likely to be found at the surface of the bath where the water was located. These include magnetite- $Fe_3O_4$, iron oxide/ silica slag $2FeO. SiO_2$, chrome oxide $Cr_2O_3$ (in contact with the magnetite), matte - basically a solid or molten liquid of Fe + Cu + S in varying proportions, and possibly Fe, and ferrosilicon FeSi.

Also temperatures might vary from 1300°C down to 500°C or lower.

Recommendation 5

Professor Gesser should be asked to perform some similar calculations based on the above parameters, in order to eliminate the possibility of a hydrogen explosion.

5. Sulphide dust explosion

When combustible fine dusts in sufficient concentration become airborne i.e., surrounded by oxygen, the potential exists on ignition for an explosion of large magnitude. Known examples have occurred in underground mines, flour storage bins etc. There is certainly potential for smelter sulphur containing dusts to generate such a reaction.

Considerable dust accumulations were around the furnace, but an initial explosion might be required to fluidize or shake up the dust. Only one person reported a strong sulphur dioxide odour after the explosion - which would be expected under this scenario.

Conclusion

This scenario is unlikely, but some follow up might be appropriate regarding quantities of dust available to fall into the furnace, composition etc.

6. Accidental dropping of gas cylinders into the hot furnace.

   Conclusion

   There was no indication of this, such as broken pieces left in the furnace and knowledgeable witnesses felt there were no such cylinders up on top of the furnace. Therefore, this is a very unlikely scenario.

7. Oil leaks into the furnace

   The operator who steamed out the burners said it was not possible after valves were closed off.

8. Horseplay

   There is no evidence to my knowledge to suggest horseplay played any part in this incident.

9. Deliberate acts of destruction

   This scenario is beyond the scope of this report. No witness I heard suggested this as a possibility, however, I understand a routine police investigation was instituted.

Summary

I strongly suggest that a carefully designed industrial vacuum system be considered for dust removal in the smelter instead of daily blowing, and wash down at the end of the campaign. Hopefully, this will remove the necessity for washing down a hot furnace and improve daily working conditions.

An extended cooling period, perhaps utilizing the induced draft fans to extract heat from the furnace is necessary. This should be determined by consultation between experienced employees and engineering staff. I can foresee this might extend to 24 hours after the burners go off, as molten pools can exist for days below a cold crust.

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.

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.

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.

**I believe that virtually all smelter workers with 6 months of service (possibly much less) would have to become aware of the possibility of violent reactions /explosions if water and molten material come into contact under uncontrolled or inappropriate circumstances -whether through training or job experience.**

**I also believe that what was not common knowledge here is the <u>magnitude</u> <u>of the devastation possible</u> when a relatively <u>few tons of water</u> get into a <u>hot furnace</u> which may contain molten material still.**