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Health and Safety in Mining: INCO Ltd. (A)

Introduction:

Erik Kossatz**,** INCO's Vice President of Operations, stared at the plaque awarded to INCO's Levack Mine just one year ago. The 5 Star Safety Audit was a highly respected assessment tool used within many industries to evaluate an organization's success at achieving a superior level of worker health and safety practices. In 1986, INCO's Levack Mine had become the first mine in the world to receive a five star rating, giving it the status of the safest organization in the global mining industry in terms of the 5 Star Safety Audit. Just prior to receiving this award, an internal safety audit had been completed using the same criteria and this process had also rendered a 5 star rating for the mine. Despite internal and international affirmation of world leader status in health and safety, however, injuries and fatalities continued to occur within INCO operations that year, as they did across the mining industry. Mr. Kossatz thought of Rene Bedard, Wilbrod Gauvin, Donald Knight and Germain St. Amour, four men that had just been fatally crushed during a shaft inspection within the Levack Mine. He had been asked to meet with INCO's President and the company's executive committee to provide a presentation focused on changes in company policies and procedures that would prevent such an event from being repeated.

Injuries had always been considered inevitable in the mining industry despite layers of safety programs that were designed to guard against unsafe environments and/or substandard or unsafe work practices. While the hazards were known among both workers and management, and precautions were mandated, injuries and fatalities continued to occur year after year. Mr. Kossatz was aware that many of the workers felt that health and safety programs were merely a "paper chase" and that there was a general perception that management and workers had become disconnected on safety issues.

This incident would attract a great deal of attention from the media, the government, the industry and the community and would also put significant pressure on management to guard against another such event occuring. How could such an event take place in an organization that had just been labeled as the safest mining organization in the world?

This case was prepared by Julie Barr for Dr. Greg Baiden, Professor, Canadian Research Chair in Robotics and Mine Automation, Department of Engineering, Laurentian University. This case is intended as a basis for discussion rather than to illustrate either effective or ineffective handling of an administrative situation. Funding for this work was provided by Minerva Canada.

INCO and the Mining Industry

Founded in 1902, INCO became the second largest producer of nickel worldwide in the early 1960s. The Ontario Division has been one of the largest integrated mine and processing plant complexes in the world for several decades (Exhibit 1). INCO enjoyed solid growth throughout the century and today supplies roughly ten percent of the world nickel market with nickel mined from its operations in the Sudbury Basin in Northern Ontario (Exhibit 2). The Sudbury Basin is a huge oval-shaped depression in the rocky Canadian Shield measuring about 40 miles long by 16 miles (65 kilometers long by 25

kilometers) wide and it holds one of the Earth's richest known deposits of nickel and copper. More than 2 billion pounds (900 million kilograms) of nickel are currently consumed worldwide, according to the Nickel Development Institute, and demand continues to grow.

INCO's Levack Mine

Discovered in 1888, this property was the first nickel deposit located in the northern range of the Sudbury Basin (Exhibit 2). Ore reserves of 4 million tons were discovered in 1913 during a diamond drilling operation. The Mond Nickel Company Limited began production at Levack in 1915 and later merged with INCO in 1929. The mine finally closed in 1999 after the nickel price dipped to US$1.69/lb. A total of 60.5 million tons of ore was mined at Levack.

In 1987, INCO's Ontario Division produced approximately 250 million pounds of nickel and copper. Approximately 12 million tons of broken rock was being processed per year during this time. The Levack mine, with a depth of 4000 feet and approximately 500 employees, was one of 10 mines that produced this broken rock for processing (Exhibit 3). Access to the extensive underground workings at Levack mine was through vertical openings known as shafts. Men and materials were hoisted into the mine through elevator-like conveyances and the broken rock was hoisted to the surface through these same shafts.

Within INCO's mines, the role of the shaft inspector was perceived as one of the most important. Only those workers considered the highest skilled and most conscientious were moved into this position. Shaft inspectors would travel down the shaft in groups of four to examine the condition of the shaft and make necessary repairs. Inspectors worked in very close physical proximity to each other due to the limited space on the platform. The inherent danger involved in shaft inspections and the workers' interdependence on each other for their own safety resulted in inspection teams that were highly cohesive. These workers were among the highest paid and most respected within the mine.

The Accident

On April 14, 1987, during a shaft inspection, a shaft serviceman closed the main airline feeding an entire loading pocket while the inspection crew was below the pocket (Exhibits 4 and 5). The serviceman had closed the airline intending to place oil in the various lubricators for the control gate cylinders, which was to be done in preparation for the continuation of ore hoisting once the shaft crew had completed their inspection. After closing the valve, the serviceman walked toward the loading platform, then heard the

broken rock in the pocket above the ore pass gate begin to move. When the air was turned off at the loading pocket, the 2-8" air cylinders that had been holding and pushing down the upper control gate could no longer hold back the broken rock due to its wet, heavy state. Suddenly, water and broken rock surged over the top of the control gates, across the loading platform and through an opening in the shaft screen which had been created to provide access to electric lights and monitors. As the broken rock passed through the opening in the protective screen, it fell into the skip shaft compartments. Approximately 20 tons of broken rock and an undetermined amount of water entered the shaft, a portion of which fell onto the protective hood under which the shaft men were working, killing them instantly.

The origin of the water in the broken rock on the day of the accident prompted questioning of all concerned and a physical inspection of the crusher water drainage system. The lubricating water used to cool the crusher bearings normally drained to the crusher pit beneath the crusher. Once in the pit, it was to flow through a drill hole to the loading pocket, where it was piped to the shaft drain line. Discussions with workers after the accident revealed that problems had been encountered recently with blockages in the drain hole that allowed water to run from the crusher pit into the ore pass until the obstructions were freed by blowing compressed air up the hole from the loading pocket elevation. Investigations also revealed that the lubricating water was not going into the crusher pit and down the drain hole and had saturated the broken rock within the ore pass. A rubber hose attached to the bottom of the water ring had become displaced and water was being discharged onto the floor. From there, it entered a crack and found its way into the pass below the crusher instead of the crusher pit. Although it was difficult to establish the amount of water that entered the pass below the crusher, it is known that during the 8-12 shift of April13th and 8-4 shift of April 14th, the crusher was left idling for several hours without crushing ore and during which time no hoisting occurred from the 2825 level pocket.

Investigations revealed that several workers were not aware of the proper safety procedures at their workstations and many had not seen procedural manuals. It was also determined that there had been similar spills in the past within that loading pocket due to compressed air failure from other causes such as power interuptions. In those cases, the protective screen had prevented the broken rock from spilling down the shaft because there were no holes in the protective screen at those times.

In the months leading up to the incident in April of 1987, accidents resulting in injury or death were limited to accidents involving single workers. The industry had come to expect ongoing problems with safety, but was unprepared for the impact of the Levack multiple fatalities. Police were brought in immediately following the accident and charges of criminal negligence were laid against the serviceman involved. This was the first time in history that criminal charges were laid against an individual involved in a mining accident.

Evolution of INCO's Safety Programs Leading up to the 1987 Accident at Levack:

One of the first systems put into place at INCO and within the industry was the "5 Point Safety System" or, as it was often referred to, the "Neil George System"[1]. Created by an

INCO safety engineer, it was introduced in 1942 and later adopted at INCO's Levack and Garson mines. The very next year, the Garson Mine won the John T. Ryan Trophy as the safest metal mine in all of Canada, while the Levack Mine won it the following two years.

Implemented with success in mines across North America, Africa, Australia and South America, the 5 Point Safety System was comprised of five simple, practical steps to follow. Each step consisted of a checklist used by the supervisor as he checked on his work crews and by the workers themselves as they traveled to their workplace and conducted their assigned work activities.

A new system to assess the effectiveness of safety programs was introduced in the 1970s by the International Loss Control Institute, but didn't gain industry-wide acceptance until the 1980s. Based on a points system, the new 5 Star Audit involved independent auditors who would visit the premises, audit management and staff practices, make recommendations and follow these up at regular intervals (as required). Points were allocated to each of five main categories[2]:

1. Premises and Housekeeping
2. Electrical, Mechanical and Personal Safeguarding
3. Fire Protection and Prevention
4. Accident Recording and Investigations
5. Health and Safety Organization

The number of stars awarded was based on the total combined number of points scored. Participating organizations had to also show a reduction in lost time injuries* and sickness absences in order to qualify.

 Organization meets basic health and safety standards.

 An average standard has been achieved and maintained.

 A good level of health and safety in the organization.

 An excellent level of health and safety based on international standards.

 A world leader in health and safety in its industry.

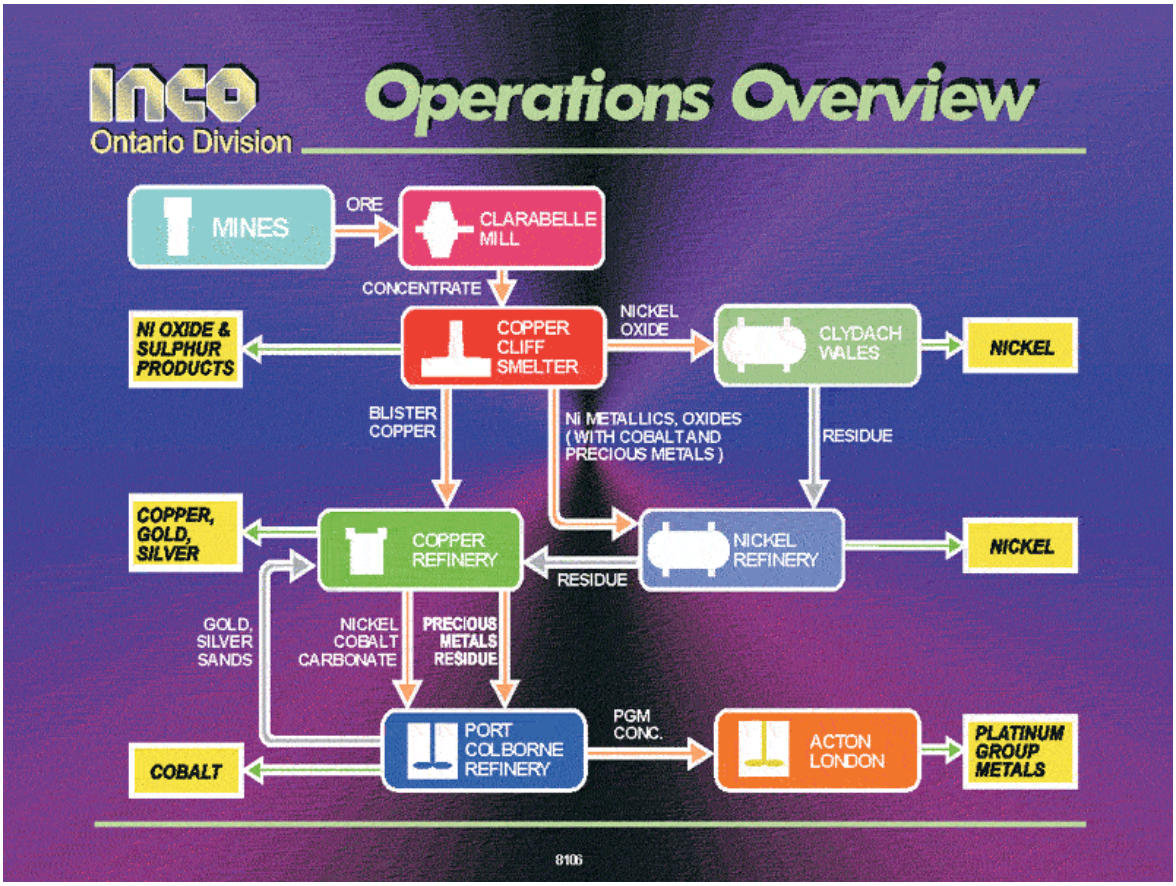
*A lost time injury is defined as an injury that causes the worker to be absent from work for more than the day of the injury.

The five star audit system was thought to require the participation of the entire work force - from senior management to the shop floor. Proponents of this safety system felt it would be successful because it would encourage a "team effort" and a sense of commitment among all levels of staff. The effectiveness of this system, however, was dependent on the way in which it was implemented.

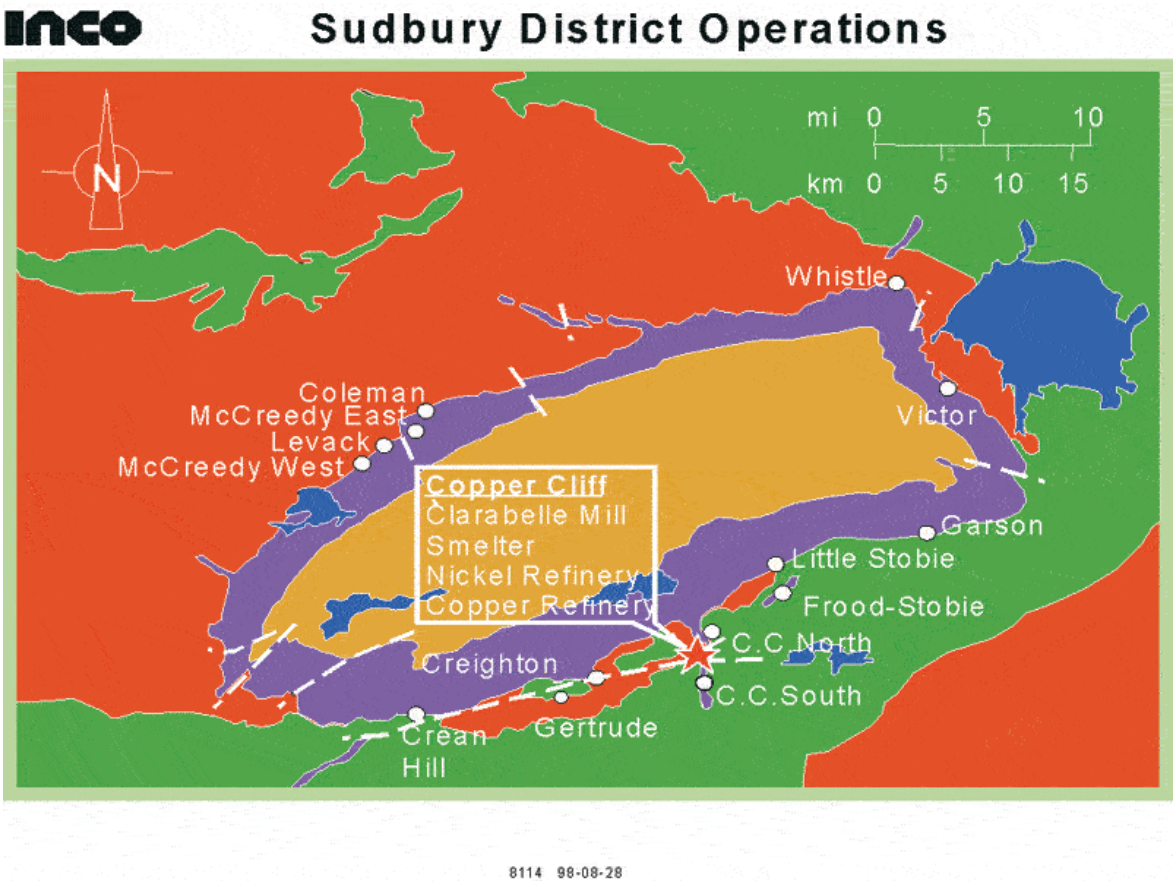
When asked how the 5 Star Audit was working within INCO, workers expressed that management and the shop floor were not connected on the safety programs and that the system actually contributed very little to safety conditions in the workplace. It seemed to them that achieving the five star rating on the audit became the primary safety goal and more time and energy were spent on completing the audit process than on the actual health and safety system. It was generally felt that the audit process took precedence over any efforts to truly improve health and safety. Safety policies were created and implemented specifically for the yearly visit from the auditor. Checklists were completed and filed, unsigned, often without anyone actually checking that the criteria were being met. All documentation required for the audit would comply with a five star rating, however, neither management nor workers on the shop floor would be aware of the existence or implementation of many of the policies.

The audit system had transferred the ownership of health and safety issues to a centralized command structure at the upper management level and away from the workers on the line. Auditors' recommendations would basically state that staff was to take whatever actions were necessary to meet the specified standard of safety. Line workers and supervisors felt that the recommendations simply stated what everyone already knew. A standard 3 Star Safety Rating could be achieved on the basis of a paper program alone for the first cycle of an audit. However, while most workers acknowledged the safety audit system as a "paper chase", it was generally felt that this system was the accepted industry-wide safety program and a 4 or 5 star rating did instill a certain sense of comfort and acceptance that the mine was as safe as could be expected. In effect, it created a false sense of security, which was often accompanied by increased complacency. In addition, since the audit provided an assessment of safety conditions at a "snap shot" in time, it was rendered irrelevant as soon as any of the conditions changed.

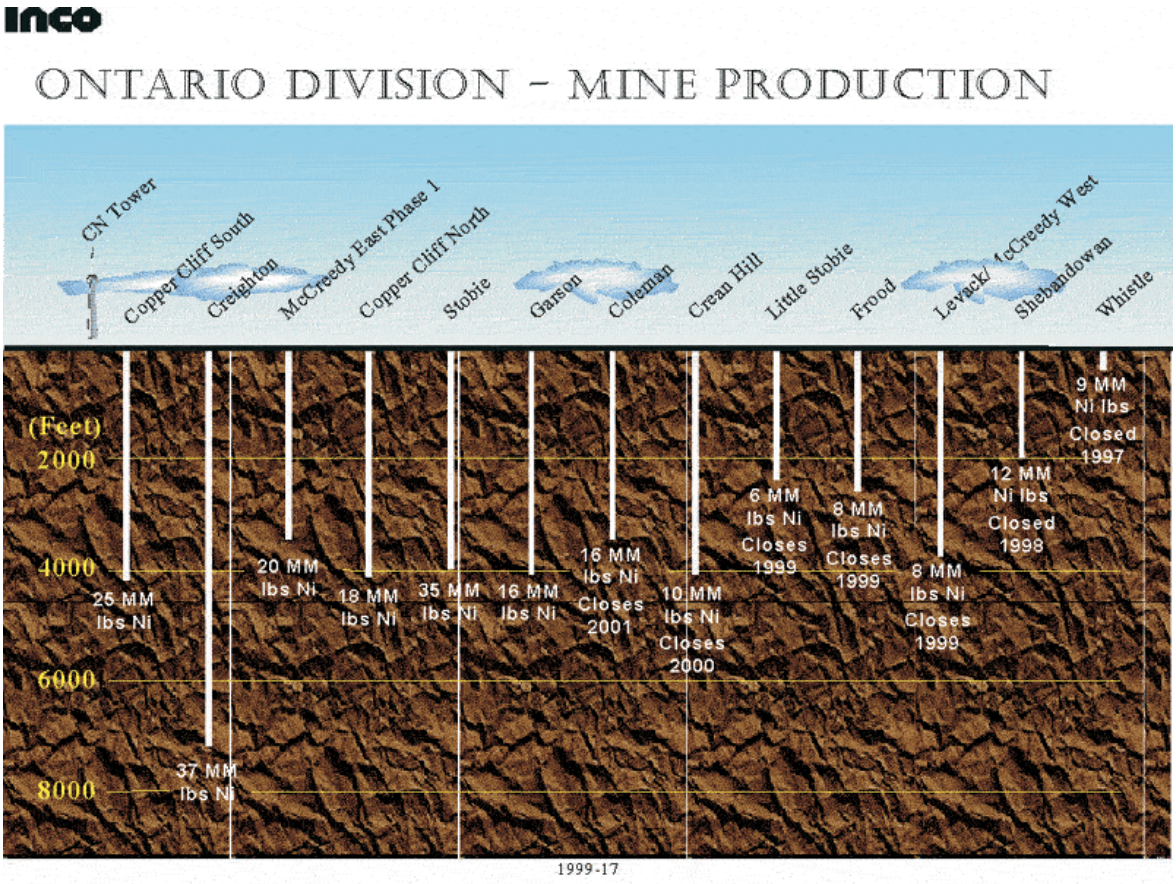
A. Exhibit 1


INCO
Ontario Division
Operations Overview
MINES
ORE
CLARABELLE MILL
CONCENTRATE
NI OXIDE & SULPHUR PRODUCTS
COPPER CLIFF SMELTER
NICKEL OXIDE
CLYDACH WALES
NICKEL
BLISTER COPPER
Ni METALLICS, OXIDES (WITH COBALT AND PRECIOUS METALS)
RESIDUE
COPPER, GOLD, SILVER
COPPER REFINERY
NICKEL REFINERY
NICKEL
RESIDUE
GOLD, SILVER SANDS
NICKEL COBALT CARBONATE
PRECIOUS METALS RESIDUE
PORT COLBORNE REFINERY
PGM CONC.
ACTON LONDON
PLATINUM GROUP METALS
COBALT
8106

A. Exhibit 2


INCO
Sudbury District Operations
N
mi 0 5 10
km 0 5 10 15
Whistle
Coleman
McCreedy East
Levack
McCreedy West
Victor
Copper Cliff
Clarabelle Mill
Smelter
Nickel Refinery
Copper Refinery
Garson
Little Stobie
Frood-Stobie
C.C.North
Creighton
C.C.South
Crean Hill
Gertrude
8114 98-08-28

A. Exhibit 3


INCO
ONTARIO DIVISION - MINE PRODUCTION
CN Tower
Copper Cliff South
Creighton
McCreedy East Phase 1
Copper Cliff North
Stobie
Garson
Coleman
Crean Hill
Little Stobie
Frood
Levack/McCreedy West
Shebandowan
Whistle
(Feet)
2000
4000
6000
8000
25 MM lbs Ni
37 MM lbs Ni
20 MM lbs Ni
18 MM lbs Ni
35 MM lbs Ni
16 MM lbs Ni
16 MM lbs Ni Closes 2001
10 MM lbs Ni Closes 2000
6 MM lbs Ni Closes 1999
8 MM lbs Ni Closes 1999
8 MM lbs Ni Closes 1999
12 MM Ni lbs Closed 1998
9 MM Ni lbs Closed 1997
1999-17

A. Exhibit 4

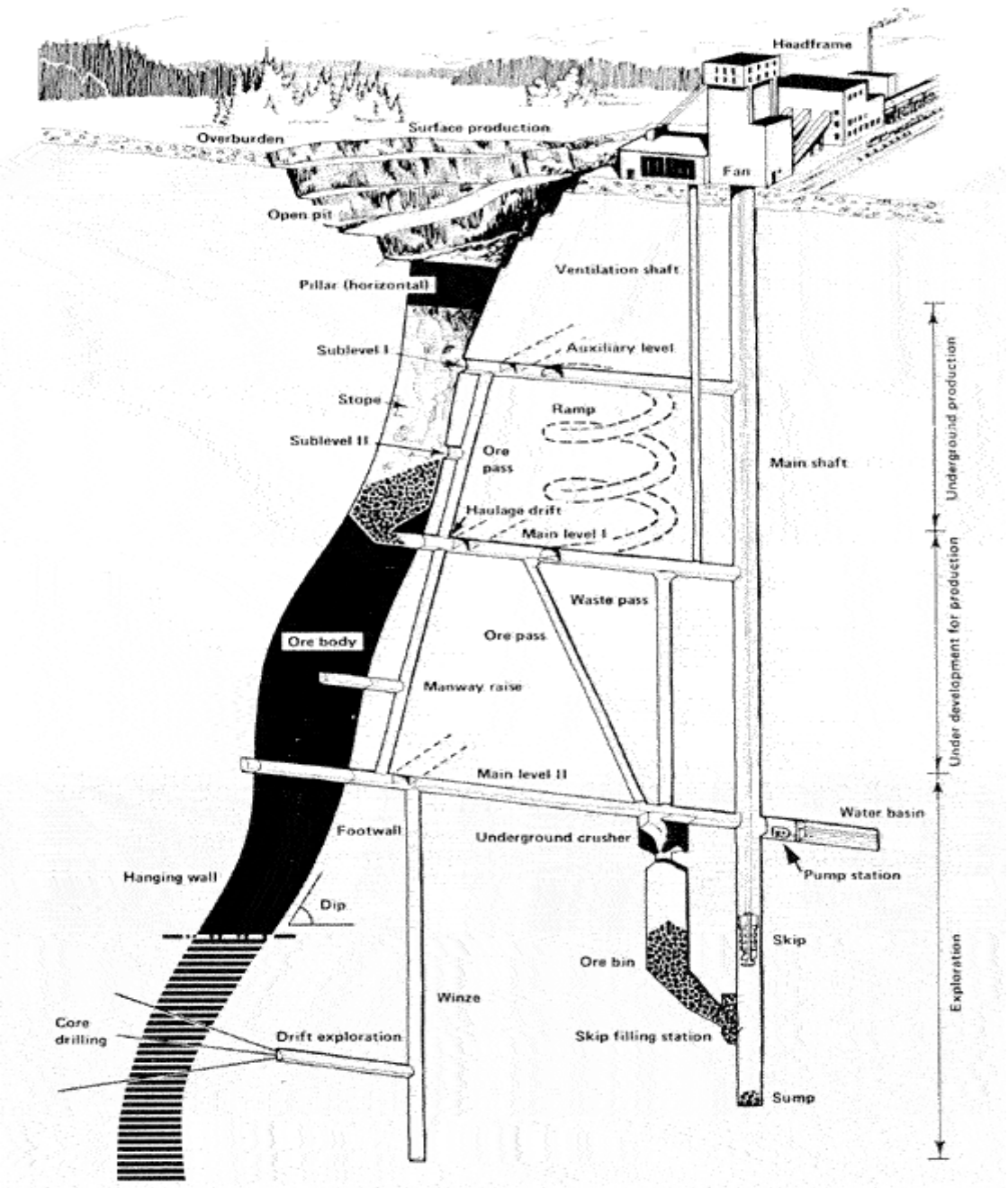
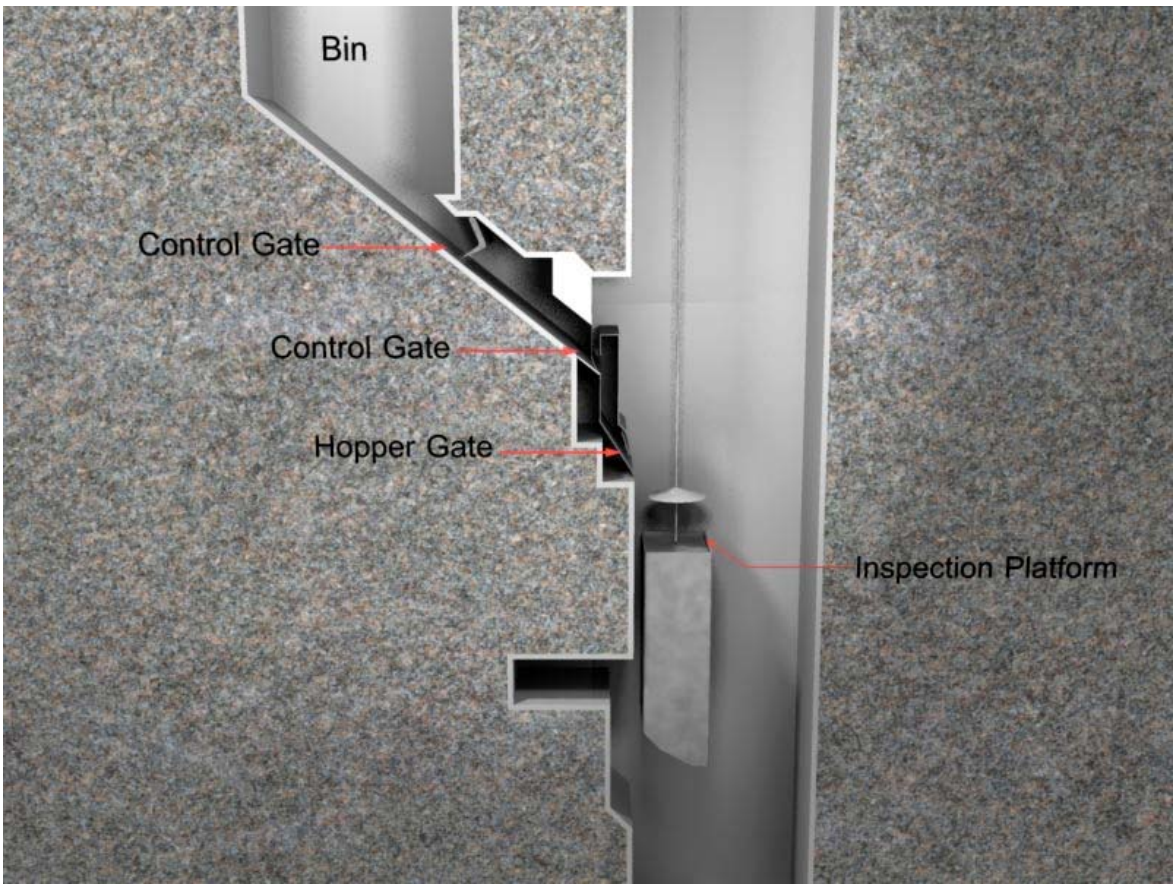


Fig. 1. Sample layout of an underground mine, identifying various mining operations and terms.

A. Exhibit 5


Bin
Control Gate
Control Gate
Hopper Gate
Inspection Platform

References:

1. Guide to the 5 Point Safety System. Web Site:
http://www.laurentian.ca/engr/people/lrudd/MASHA5POINT.htm

2. Safety Projects International Inc.
Web Site: http://www.spi5star.com/pages/fivestar.htm