**Introduction**

For many people, there is probably no greater fear than being buried alive.

On August 7, 2010, that fear came true for 33 men working at the San José mine north of Santiago, Chile. A portion of the mine collapsed, trapping them deep underground.

For more than two weeks no one could confirm if they were dead or alive. Crews were unable to enter the mine to search for them. Rescuers knew that the men were near a refuge chamber that might have protected them, but several attempts to drill small shafts to lower listening equipment were unsuccessful.

Then, 17 days after the collapse, as an eighth attempt was made, observers heard sounds of hammering deep in the Earth. The drill broke into the refuge chamber; when it was pulled up it had handwritten notes attached to it, indicating that all 33 miners had survived and were doing well.

The men were alive, but rescuing them would not be an easy task. A new shaft would have to be drilled, just wide enough to lower a capsule to the men and then bring them to the surface. Meanwhile, the men would have to be kept physically and mentally healthy until rescuers could finally pull them out.

The trapped miners and the rescue effort became a media sensation, and reporters from around the world raced to the area. This placed even greater pressure on those responsible for saving them. The Chilean government assumed responsibility for the rescue and brought in experts from several countries to assist with the rescue effort and to ensure the miners’ continued health and safety.

On October 12—over two months after the collapse—the miners emerged, one by one, from their underground prison. Over 2,000 reporters were on hand, and the rescue was televised in real time around the world. All the men appeared to be in good physical condition.

The whole story of their experience—especially the first 17 days before contact was made—may never be known. The miners have apparently agreed to keep that information to themselves. They have also agreed that the proceeds from any media interviews or docudramas based on their experiences will be shared equally among all the men.

For the rescue team, one major question remains: How will the miners cope psychologically, both with their experience underground and their newfound fame? The psychologists on the team anticipate monitoring the men for many years to come.

**To Consider**

It was a record no one wanted to set: the longest period a group of miners were trapped underground before their successful rescue. Observers agree that the Chilean miners showed incredible strength of will in surviving for over two months.

1. What personal characteristics would help an individual survive such an ordeal?

2. What advantages would being part of a group offer to those in such a situation?
THE RESCUE OF THE CHILEAN MINERS

Pre-viewing Activity
What do you think of when you hear the word miner? Make a list of the qualities you consider essential for anyone who would choose mining as a profession. As you watch the video presentation, check to see how many of the qualities on your list are demonstrated by the Chilean miners shown in the news story.

Viewing Questions
As you watch the video respond to the questions in the spaces provided.

1. After the mine collapse, how long did it take before the miners were located?

2. How many men were trapped by the collapse?

3. How long did rescuers initially believe it might take before the miners would be rescued?

4. How far underground were the miners trapped?

5. What rations did the miners survive on for the first two weeks?

6. What did astronaut Robert Thirsk suggest the miners might use to occupy their time?

7. As the miners were pulled from the mine, what surprised the Chilean health minister?

8. What did the president of Bolivia promise to the one trapped Bolivian miner?

9. How long were miners kept in hospital after the rescue?

10. Why did some of the miners return to Camp Hope for a thanksgiving service?

Did you know . . .
“Camp Hope” was the name given to the area at the mouth of the San José mine that was created by friends, relatives, and members of the media who awaited news of the miners.
11. Describe the pact that the miners are rumoured to have made among themselves during the time they were trapped.

Post-viewing Discussion
The plight and rescue of the Chilean miners was clearly a major media event in 2010, with millions around the world watching the rescue in real time on television.

1. What role, if any, do you think the media attention played in guaranteeing the successful rescue of the trapped miners? Explain.

2. Television coverage of the rescue was controlled by the Chilean government, but was permitted to take place in real time, despite the possibility that something might go wrong. Why might the government have allowed this? Would you describe that decision as a responsible one? Why or why not?

3. The San José accident has caused the Chilean government to increase its supervision of mining in the country. Do you think that media coverage of the Chilean mine disaster will have any impact on mining practices in other parts of the world? Why or why not?
THE RESCUE OF THE CHILEAN MINERS

Miners Get Trapped

Focus for Reading
On August 5, 2010, 33 miners in Chile were trapped when a portion of the mine they were working in collapsed. While a full report on the accident is yet to be completed, the mine has suffered a series of similar incidents in recent years. As you read through this description of what happened from August 5 up to the day when the miners were discovered alive, make a list of points that would be important to those who are investigating the cause of the disaster.

In the days preceding the collapse, some of the miners at the San José copper and gold mine near Copiapó, Chile, had expressed their apprehension that all was not right. The mine was moaning; things seemed to be trying to shift underground.

They had cause for concern. Chile is a notorious location for earthquake activity. On August 5, what geologists call a “seismic event” shifted a huge column of rock in the mine. The column—150 metres tall by 70 metres wide and weighing 700 000 tonnes—collapsed.

Miners ran for the exits, and several of them made it out alive. But it was quickly realized that 33 of the miners working at the time were missing. They had been at the end of an 8-kilometre-long tunnel about 700 metres underground.

Initial Rescue Attempts
Raúl Villegas, the last miner to leave the mine, reported the accident to his managers. He and a crew entered the mine in an attempt to find and free the missing miners but soon realized the collapse had made it too dangerous.

The mine management took several hours to report the incident to regional authorities. But once they did so the Atacama regional authority sent its six-member special operations emergency squad to attempt a rescue. The squad made two separate attempts to reach the men via the main entrance but were unable to do so. A second collapse hindered their efforts even further.

With the main shaft unavailable, efforts turned to the emergency exits that are intended to be available for trapped miners. These are the chimneys, or ventilation shafts, that are equipped with stairways or ladders that can be used if regular exits are blocked. Unfortunately, the mining company had failed to install these stairways, and the collapse had partially blocked the shafts.

After the failure of the Atacama squad, the Chilean government assumed leadership of the search for survivors. It brought in experts from Codelco, the government-owned mining corporation, so that another attempt could be made to reach the miners through the main opening. Codelco spent a week trying to do this, but then abandoned their efforts after continued seismic activity convinced them this was impossible.

The Probe
During all of this work, there was no evidence that any of the trapped miners were still alive. It was hoped that after the collapse the miners had been able to reach the 47-square-metre refuge chamber 700 metres underground, where some supplies and oxygen were available. It was decided to drill a 15-centimetre hole—about the width of a grapefruit—and send listening equipment down to the chamber to see if there were signs of life.
The maps of the mine provided by the company were not very accurate, and it took eight attempts before the emergency refuge was reached. As the probe approached the shaft, rescuers could hear hammering, which raised their hopes that at least some of the miners were alive.

On August 22—17 days after the collapse—the probe reached the refuge. When the drill was pulled to the surface, two notes were attached to it. One was for a miner’s wife. The other stated simply: “Estamos bien en el refugio los 33” (“We 33 are all fine in the refuge”).

Now all the rescuers had to do was find a way to keep the miners alive and then get them out.

**The Role of the Mining Company and Its Supervisors**

As the attempts to locate the missing miners increased in intensity, investigations into the company that owned the mine turned up some unsettling information. Compañía Minera San Esteban was cited 42 times for safety violations between 2004 and 2010. The mine had eight accidental deaths in 12 years. It was briefly shut down in 2007 and charged with involuntary manslaughter in the death of one miner. (The case was eventually settled out of court.)

Mining experts have noted that the San José mine uses a type of grid mining that makes companies a lot of profit but is also the most dangerous for miners working underground.

There were only 18 mine inspectors for what is one of Chile’s major industries at the time of the San José collapse. As a result, the Chilean government has set up a special commission to investigate the collapse and the work of its mining regulatory agency. Thirty smaller mines were shut down for safety violations immediately following this incident.

Compañía Minera San Esteban is financially unstable. It could not afford the rescue operation (costs were assumed by the Chilean government) or to even pay the miners’ salaries while they were trapped underground. Industry insiders expect the company will file for bankruptcy.

**For Discussion**

Because the conditions are dangerous, salaries at the San José mine are about 20 per cent higher than those at safer mines. Is this fair compensation for the miners who face the possibility of injury or death in risky conditions? Do miners who accept this kind of compensation bear any part of the responsibility if an incident such as this happens?
THE RESCUE OF THE CHILEAN MINERS

Rescuing the Miners

To Consider
The operation to rescue the Chilean miners was unlike any rescue operation ever attempted before. The effort was originally estimated to take about four months, and the miners would be under considerable stress until it was over. But every step taken in the rescue operation had to be designed to ensure the miners’ safety. While you are reading this section, create a list of the major decisions that you believe helped ensure the miners would come out alive.

The rescue operation began when drills were used to bore three small holes to deliver food and medicine to the miners. The small shafts were also used for communication so that the ongoing health of the miners could be monitored. It also made communication between the miners and their families possible.

Meanwhile a decision had to be made: what would be the best method to get the miners out? Using any of the existing tunnels was out of the question. The only possible solution was to dig a new tunnel, an operation that would be slow and create its own problems.

Creating a New Tunnel
The plan that experts came up with was to create a tunnel just wide enough to accommodate a capsule that would lift the miners, one by one, to the surface. The tunnel would be only about 70 centimetres wide. Each trip from the bottom of the mine to the top would likely take about 30 minutes.

Ultimately, three different drilling rigs were brought in to attempt to create a new tunnel. The machinery worked simultaneously, but the first to reach the miners would likely be the one used to bring them to the surface. The operations were dubbed Plan A, Plan B, and Plan C.

Plan A was to bore a pilot hole down to the miners and then widen the hole so that the escape capsule could be accommodated. This operation was expected to drop 3,000 to 4,000 tonnes of rock to the bottom of the shaft—rock that the trapped miners would have to remove. This was the first rig to go into operation.

Plan B used a second drill rig, which was the one that ultimately drilled the escape shaft for the miners. This unit worked in three stages: it drilled a 14-centimetre pilot hole; enlarged this to 30 centimetres; and then increased the width again to 71 centimetres. Once again, tonnes of falling rock had to be removed by the miners—about 500 tonnes of fine debris fell down the pilot hole every hour the drill was operational.

Plan C was a largely Canadian operation that involved the only rig that could drill a large enough hole for evacuation in one step, without a pilot hole. This type of rig is normally used for oil and gas drilling and brings its debris up to the surface rather than dropping it to the bottom of the shaft. The rig began working on September 19. Although capable of drilling much faster than mining drills, it is more difficult to aim and requires removal and repositioning if it slips off course.

On October 9, Plan B—and its widened shaft—reached the miners. Plan A was still drilling its pilot hole; Plan C was about 60 per cent complete. Choosing to go with multiple efforts had proved to be the right decision.
Fénix 2
To carry the men to the surface, the Chilean navy, with the help of NASA, designed a stainless steel capsule it called Fénix 2, or Phoenix. It was 54 centimetres in diameter and equipped with wheels to provide a smooth ride. It had its own oxygen supply, communications equipment, lighting, and an escape hatch and lowering mechanism that could be used by a miner if the capsule were to get stuck. Because of the small size, all miners had to have a waistline of 90 centimetres or less in order to escape.

The Rescue
It took until October 12 to make the final preparations for the rescue. Because the rock around the top of the new tunnel was relatively weak, a steel liner needed to be installed for about 56 metres of the shaft. A platform and winching system for raising the capsule also required construction. A trial run of the empty capsule took place on October 11, descending to within 15 metres of the end of the shaft.

An elaborate plan had been worked out for the actual rescue, and it was flawlessly put into operation. First, a rescue worker descended in the capsule and strapped in the first miner, Florencio Ávalos. Like all the other trapped miners, Ávalos had prepared for the trip to the surface. For six hours before his rescue he had been on a liquid diet designed by NASA. He wore a girdle to help control his blood pressure and took an aspirin to prevent blood clots. He also wore a pair of wrap-around sunglasses to protect his eyes from sunlight—the first he would experience in weeks.

The miners had been divided into three groups: the skilled (those best able to deal with any malfunctions during the rescue); the weak (older workers and those with medical or psychological problems); and the strong (those mentally and emotionally best able to survive the long wait for their turn in the rescue). It was in this order that they were brought to the surface.

One by one they rode the Fénix, while five more rescue workers descended to help prepare them for their escape. The full operation, including returning the rescuers to the surface, took less than 26 hours.

The final miner to ascend was Luis Urzúa, the foreman at the time of the collapse and the man who acted as leader throughout their ordeal.

Post-reading Activity
1. Prioritize your list of decisions: which ones do you feel were most important in effecting a successful rescue? Share your list of decisions with one of your classmates. Do your lists and priorities agree?

2. Do you agree with the order in which the miners were rescued? Would you have prioritized the order differently? Explain.
Focus for Reading

The survival of all 33 trapped Chilean miners is a truly inspiring story that reflects well on both the men and their rescuers. In this section we look at some of the efforts made by both groups to ensure this success. As you read this section, note that both the rescuers and the rescued had significant responsibilities in ensuring the miners’ survival.

The miners were trapped by the collapse at one of the lowest points in the mine, near a refuge chamber specially built in case of such events. The chamber is about 47 square metres and contains chairs, benches, and blankets. There are no beds, but there is a portable toilet. Surrounding the chamber are about two kilometres of tunnels that remained usable. The tunnels were about three metres wide by three metres high. The temperature at that level is a constant, humid 30 degrees. There is no lighting other than what mining machinery and their lamps could provide.

Leadership

Despite some initial panic and discouragement, the miners came together in hopes that those outside the mine were actively seeking their rescue. Foreman Luis Urzúa continued to be recognized as the group’s leader, and he and the other miners organized routines and procedures to keep the group functional as long as possible. What little food was available in the refuge was carefully rationed and shared by all the men: two spoonfuls of tuna, a biscuit and a bit of milk every 48 hours. They used a backhoe to dig for trapped water in the tunnels.

It certainly helped that the men had worked together and knew each other well. It also helped that some of them besides Urzúa fell easily into leadership roles. Mario Gomez, the oldest miner, established an underground chapel that was a great comfort to many of the men. Yonny Barrios, who once took a nursing course, stepped in to help monitor the health of the other men. All of the men continued with their roles throughout the period they were trapped underground.

Outside Help

Once the miners had been located, the rescuers were fully involved in keeping the miners as physically and mentally healthy as possible. The first order of business: getting fresh supplies to them.

All the supplies had to make their way down a hole about 15 centimetres in diameter. Supplies were delivered in plastic packages called palomas, or doves. Each packet took about an hour to make its way down the shaft.

The first items sent down consisted of glucose, hydration gels, liquid nutrients, and medicines. The imposed regimen was straightforward: to begin, water every 15 minutes, followed by glucose after six hours, and Gatorade after 12. Nutritional gels were added after 18 hours, and the men got “real” food by the fourth day.

The rescuers knew that starvation was an issue because of urine tests conducted on the men. Barrios reported that about half of the men were showing signs of dehydration and muscle breakdown. Once they had recovered and were eating normal food, the miners were kept on a diet of 2 300 calories per day and ordered to exercise at least one hour per day.
Barrios became a real assistant to the medical personnel above ground. He took blood pressure readings and urine and blood samples. He also gave the miners a series of inoculations against tetanus, pneumonia, meningitis, and influenza.

Keeping Spirits Up
The rescuers drilled a total of three small access shafts in order to be able to guarantee communication and ventilation as well as supplies to the miners.

“Eventually, all sorts of comfort goods were going down the three narrow tubes: dismantled camp beds, clean clothes, letters, movies, dominoes, tiny Bibles, toothbrushes, skin creams. The smokers were first allowed only gum and nicotine patches, but doctors eventually relented and let 40 cigarettes a day go down” (Toronto Star, October 15, 2010).

Fibre-optic cables were a real blessing for the miners, allowing them to have regular communication with family members who were at the mine to support the men. Daily contact with parents, wives, and children, though brief, helped keep spirits up.

Rescuers also provided the miners with small fluorescent lights. The men used these to set up a pattern of light and dark periods underground that matched the cycle taking place above ground.

Chilean officials leaned heavily on the advice of two groups of experts to help the miners get through their time until their rescue. One of these was NASA, which had decades of experience helping astronauts deal with the stress of living in very tight spaces. The other was the Chilean navy’s submarine force, also experts in living in isolated environments.

The advice was carefully followed. Areas were set up near the refuge chamber for specific activities, such as sleeping and entertainment. Daily routines were established. The miners were encouraged to perform creative activities, such as making videos of their experience for their families. And the miners had their own work to keep them focused—preparing for their eventual rescue.

For Discussion
Rescuers felt it was important that the miners establish a daily routine and stick with it. Based on your own experience, how important is having a routine in coping with a stressful situation? What tasks do you find most helpful?

Definition
Refeeding syndrome develops when someone who has been starving eats too much solid food too fast. This complication can cause heart failure, seizures, coma, delirium, or sudden death.
Pre-reading Reflection
It’s almost impossible to imagine what it would be like to spend more than two months underground, cut off from the rest of the world, with no guarantee that you would be rescued. And then all of a sudden your prayers were answered and you were rescued. What might the miners have been thinking in the first days after their rescue? What problems might they face, both as individuals and as a group?

Psychologists do not agree on the impact of the long entrapment on the miners. Some caution that post-traumatic stress is almost guaranteed. Others argue that most of the men, if not all, have the capacity to shrug off the worst effects of the ordeal.

In the Mine
The experience of the Chilean miners is absolutely unprecedented. No group of miners has ever survived underground for this long. Individuals placed in long-term isolation—astronauts at the International Space Station, or scientists in Antarctica, for example—receive hundreds of hours of training to prepare for their experience. And, more to the point, those individuals make a conscious choice to undergo that experience. The miners certainly did not.

We may never know the details of what happened in the mine in the 17 days before the probe located the men. Rumours did circulate that there was some friction among the men during that period, and that five of the 33 may have separated themselves from the rest of the group. But the group seems to have agreed not to speak about that period with outsiders.

Psychologists note that the fact that the group was so large could have both positive and negative effects. The size of the group would guarantee that many of its members would have skills that would help them all survive. But large groups, as we are all well aware, can lead to the development of cliques fighting for control or refusing to co-operate. If there was friction over survival tactics in the early days, it would not have been surprising to see a small group break off from the main one.

After the trapped miners were located, a veritable army of psychologists was brought in to determine their mental state and keep them as positive as possible. At first some of the men were showing signs of depression, refusing to appear on camera at the first video contact. But Claudio Ibanez, one of the leaders of the psychological team, was impressed with their overall mental condition. “Most people have deep resilience and the ability to persevere in extreme situations,” he notes. “Those miners reached for the best in themselves. Maybe if it were one man trapped down there, he would have died. But as a team, they survived” (Maclean’s, October 11, 2010).

The most important task for psychologists, however, was to ensure that the miners kept a positive frame of mind. Letters from family members were censored to guarantee they contained only good news. And a fierce argument raged over whether the miners should be told that they would have to remain underground for a long time, possibly until Christmas.

In the end, the realists won out. The full rescue plan—including the
anticipated length of time—was told to the miners on August 27 (10 days after first contact), and letters from family were passed along to the miners uncensored.

In fact, contact with the outside and with the miners’ families became a central part of the miners’ day. Daily conversations helped the miners maintain their role in their families, permitting them to give advice on the day-to-day aspects of family life.

Psychologists were also keen to see the miners given meaningful work to do, to have them participate in their own rescue. Helping set the order of rescue, keeping fit while maintaining a low weight, clearing debris that fell from the new shaft into the mine—all of these were valuable activities to keep the men focused on a favourable outcome.

After the Rescue

Once freed, the miners continued to face possible psychological problems. Post-traumatic stress disorder can take many forms but can involve panic attacks, flashbacks, and sleeping difficulties. Some of the miners might also be reluctant to talk about their experience underground. And many will not be able to go underground ever again.

According to a number of psychologists interviewed by the journal *New Scientist* (October 14, 2010), it will be important to monitor the miners’ mental health long after they are out of the spotlight. Sheryl Bishop, a social psychologist at the University of Texas, says: “The shock of how quickly they become yesterday’s news will be at odds with something that represents a significant event in their lives.” Bishop goes on to say that unless support from the Chilean government continues for some time, there is a real possibility that the miners may feel resentful, isolated, and abandoned.

On the bright side, however, the miners will also likely find that their lives have now changed for the better. They have agreed to share any monetary proceeds from telling their story, and there is considerable interest from the media. Most of the men will likely have a renewed appreciation for life and their families and friends.

One of the miners, Edison Peña, celebrated his return to freedom—and demonstrated his mental toughness—in an especially remarkable fashion. Peña kept in shape underground by daily running in the tunnels. He was invited to New York by the organizers of the New York City Marathon to observe the 2010 competition. Peña accepted the offer, but chose to compete rather than observe. He completed the course in 5:40—beating his goal of six hours.

Activity

Imagine that you and your classmates were trapped in your classroom for an extended period of time. What would help you and your group maintain a positive attitude until you could be rescued? Make a list of 10 things—behaviours, objects, activities—that would help keep you and the group upbeat until you were released. What might you personally do to assist the rest of the class to keep the group happy and focused?

Compare your list with those of some of your classmates.
THE RESCUE OF THE CHILEAN MINERS

Activity: Lessons Learned

Much of Canada’s mining now takes place in open pit mines, but there are still a number of underground mines in operation. Despite past incidents, some of which have been major disasters, the industry now has one of the best safety records in the world.

Nonetheless, there are always lessons that can be learned from the experience of others. Your task in this activity is to identify some of the lessons learned from the Chilean mine collapse and rescue, and to communicate those lessons to others.

Working in small groups, make a list of the most important lessons you think can be learned from this story. You may choose to concentrate on one aspect, such as mine and worker safety, rescue methods, or physical or psychological support for workers awaiting rescue.

Prepare a visual presentation of your ideas of the lessons that the San José experience can teach us about mining. This might be in the form of a PowerPoint presentation, short film, poster, brochure—in short, an effective tool to grab your audience’s attention.

Use the space below to list the main points your group would like to cover in their presentation.

__________________________________________

__________________________________________

__________________________________________

__________________________________________

__________________________________________

__________________________________________

__________________________________________

__________________________________________

__________________________________________

__________________________________________

__________________________________________

__________________________________________

__________________________________________

__________________________________________