



## TRAPPED! MINE COLLAPSE IN CHILE

By Ron Fridell

On August 5, 2010, the entrance to the San José copper and gold mine in northern Chile collapsed, trapping 33 miners deep inside. Were there any survivors? Hopes were slim.

Rescuers started drilling 6-inch-wide boreholes into solid rock. They were aiming for a safety chamber 2,040 feet below the ground. If there were survivors, that was where they'd be. Finally, on August 22, the first drill broke through to the 600-square-foot chamber.

The 33 men were all there! They were alive but in fragile health. Isolated for 17 days in hot, humid darkness with little food and water, the men had lost about 20 pounds each.

To get them out, rescuers would have to drill a 28-inch-wide escape hole through nearly half a mile of hard volcanic rock. And that would take weeks, maybe months. Until then, the men's health would be a serious concern.

That's why a team of four NASA scientists from Johnson Space Center in Dallas, Texas, was called to the mine. The scientists had worked extensively with astronauts, so they knew how months of isolation can damage a person's physical and mental health. They planned the men's meals and designed strategies for boosting the men's morale.



© REUTERS/SHO New

Mario Gomez was the 9<sup>th</sup> of 33 miners to be rescued on October 13, 2010.

To keep the men healthy, food and medical supplies were delivered in five-foot-long tubes through the six-inch-wide boreholes. To keep the miners' minds sharp and their spirits up, the scientists had them stick to daily schedules. Each man had specific tasks to do at specific times. And each day they talked by phone with family members.

Finally, on October 9, the drill broke through to the chamber. The escape tunnel was complete. Four days later, rescue operations were set to begin. On the surface above, the miners' families anxiously waited for their loved ones to emerge.



### Do You Know?

The machine that bored (drilled) the escape hole uses four hammers driven by compressed air. The hammers contain one of the world's hardest natural substances: diamonds.



© iStockphoto.com/  
Eugeny Terentev

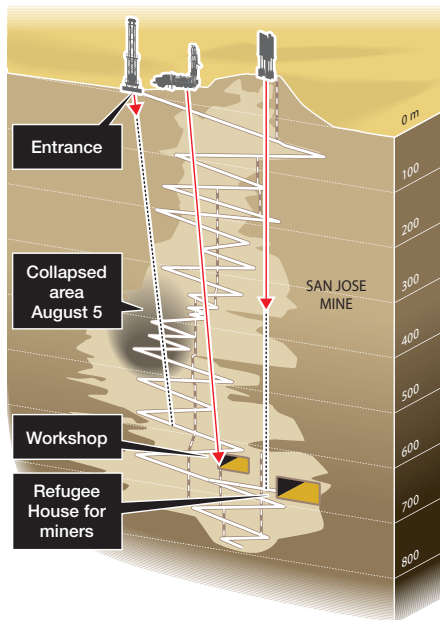
# The Journey Up

One by one, the 33 miners will be hoisted up to safety in Phoenix 1, a metal escape capsule designed by Chilean Navy engineers. The capsule is 21.3 inches wide, just big enough to hold one man.

Mine officials estimate that the capsule will take 5 minutes to be lowered from the surface. Then, 45 minutes later, the miner will be ready to ascend. After a 10-minute journey, the capsule will reach the surface. And after 68 days trapped underground, another miner will be lifted to safety.



© REUTERS/Ivan Alvarado



© REUTERS/Reuters Graphics



How long should it take to lift all the miners to safety?

## Circadian Rhythms

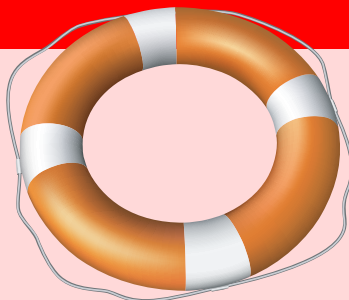
The trapped miners had to go for months without seeing the light of day. This situation is not healthy for humans. It upsets the internal body clock, a grouping of cells in the brain that helps regulate a person's daily activities.

Daylight plays a big part in controlling this internal clock. Take sleep, for instance. As night falls and your eyes take in less daylight, your body clock automatically activates genes that produce *melatonin*, a hormone that makes you feel sleepy.

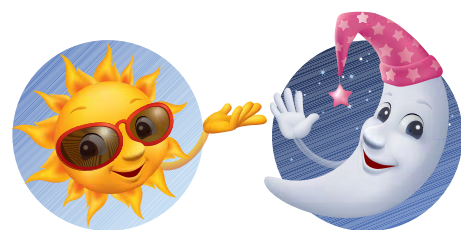
But without daylight, your body clock will have a hard time knowing when it's time to sleep or wake up. The same goes for eating, using the toilet, and other internal processes.

These processes are called *circadian rhythms*. When these rhythms get out of whack, a person can get confused, depressed, or ill. So the NASA scientists advised the miners to work and sleep according to a strict daily schedule, just like astronauts in outer space. Then their circadian rhythms would stay normal until they return to the world of daylight.

## Write About This!



News events are changing constantly. How have things changed since this article was written? Edit the article to update it with the latest news on the Chilean miners' rescue. Be sure to include how science aided in the rescue.



© iStockphoto.com/Nokke

Math Moment answer: 33 hours