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Disaster Preparedness

Due to its long experience with earthquakes and other natural catastrophes, Chile is skilled in anticipating and facing them. However, the country is not lowering its guard: a tsunami simulation exercise recently offered new lessons.

"A President must be where the problems are, where people are suffering – and not only to provide support, but to find solutions and to make sure those solutions are implemented."

President Michelle Bachelet. After the storm which ravaged the country's south-central zone. July 13, 2006

Earthquakes, tsunamis and severe weather have been a constant presence throughout Chilean history. Located on the Pacific "Ring of Fire," it is the world's most seismically active country. Beneath its territory, the Nazca and South American plates come together, a circumstance which regularly causes earth movements of various magnitudes, occasionally resulting in great catastrophes.

Historical archives record the date of May 1647 for the occurrence of the most powerful earthquake experienced in colonial times. Reducing the city of Santiago to rubble, it provoked an acute economic crisis in a country which had already been suffering from devastating droughts.

In 1906, one of the most disastrous earthquakes of the republican era almost completely destroyed Valparaíso, the country's leading port and financial center. The city was left in ruins, and 2,000 of its inhabitants lost their lives.

DID YOU KNOW?

★ **The most violent earthquake ever registered in the world occurred in Chile. With a magnitude of 9.5 on the Richter scale, it struck the southern Chilean city of Valdivia on May 22, 1960. The tsunami unleashed by the quake wiped out cities and coastal villages, demolished more than 400 kilometers of coastline and permanently altered the region's physical geography.**

★ **The frequency of earthquakes in Chile is three times greater than that of Japan.**

★ **On January 24, 1939, a sudden, violent jolt initiated an earthquake of magnitude 7.8 on the Richter scale which devastated the city of Chillán, in central Chile. Causing 25,000 fatalities in that city and 45,000 across the region, it left behind a swath of destruction in cities and towns as far as 400 kilometers away.**

Carmen Fernández, director of ONEMI, studied journalism at the University of Chile and has an advanced degree in Disaster Prevention.

So it has gone, decade after decade. Earthquakes and smaller tremors form part of the national collective identity. All Chileans are familiar with the routines of escape and – most importantly – solidarity with their neighbors. Children are taught how to react from a very young age; builders are held to strict seismic construction standards; and the risk management systems for transporting explosives and other hazardous substances are subject to constant evaluation.

Since earthquakes on land always raise the specter of similar events beneath the sea, Chile, with its 4,000 kilometers of coastline, is also prepared to face a tsunami. On October 31 of this year, the Navy carried out an simultaneous earthquake and tsunami simulation exercise in the cities of Valparaíso, Viña del Mar and Concón, in the country's central zone, with the active participation of the local inhabitants.

The initiative, conducted by the Navy's Hydrographic and Oceanographic Service (SHOA), was evaluated by international observers and UN experts. It included sound effects, volunteers working as guides, and actors who simulated panic attacks and serious injuries.

Reaction and prevention

This exercise bore no relationship with a recent documentary produced by the National Geographic Society, which virtually simulated the consequences of an earthquake in Valparaíso measuring 9.5 on the Richter scale, which would unleash a massive tsunami. The documentary did not adequately account for numerous variables, such as the type of soil and construction techniques in the area. The depiction of collapsing buildings was also inaccurate: in fact, they tend to settle on their own lower floors. For this reason, vertical evacuation is currently practiced, with people fleeing upward, since it has been demonstrated that higher floors suffer less damage.

In real life, Chile has a solid and effective prevention system, which is rapidly implemented each time the earth begins to shake or a weather disturbance approaches. Its main administrative entity is the Interior Ministry's National Emergency Office (ONEMI), established in 1974. ONEMI's functions range from measuring the magnitude of earthquakes and evaluating other natural disasters, to distributing necessary aid to those affected by a catastrophe.

After years of experience, ONEMI has moved beyond its early plans, which focused on reacting in the face of an emergency, and has broadened its duties to include effective preventive measures based on the principles of risk management. This has led to the implementation of programs such as the Comprehensive School Safety Plan and the National Civil Protection Plan.

At the same time, the institution has been working to design a proposed bill for a general civil protection law, aimed at modernizing the legal foundation of the country's disaster preparedness institutions.

For ONEMI's director, Carmen Fernández, the adoption of this law would permit diverse offices to be coordinated, thus allowing the creation of

more effective preventive measures. This "would place Chile in a leadership position, not only on the regional level, but significantly beyond the region."

The experience gained in recent years has led to the development of a set of concrete and specific methodologies. "The main characteristic of these plans is that they are adaptable and applicable according to the nature of the risks and resources of each territorial unit, whether it is within the country or abroad," explains Carmen Fernández.

In keeping with its objective of making Chile a safer and better-protected nation, ONEMI's current management places priority on developing clear awareness of the need to proactively face potential natural disasters. This means the gradual development of a culture of prevention, focused on comprehensively addressing risks and vulnerabilities.

Starting in the 1970s, all Chilean children were instructed in Operation Deyse (*De Evacuación y Seguridad Escolar*, Of School Evacuation and Safety), designed by ONEMI. The students learned how to take shelter beneath their desks and evacuate their schools in an orderly manner without panic. In January 2001, Deyse was replaced by the Comprehensive School Safety Plan, which includes the establishment of School Safety Committees in each institution, with the direct participation of all relevant actors – school boards, teachers, students, parents and guardians – and supported by a range of organizations (fire departments, the Carabineros police, public health units, the Red Cross and Scouts).

ONEMI provides ongoing advisory support and training to officials in other Latin American countries. One example is El Salvador, where the workshop-seminar "Interchange of Experiences in Natural Disasters" was held in October, with the aim of advising that country in areas related to natural catastrophes. Experts from Guatemala, Honduras and Nicaragua also participated in the event.

The National Emergency Plan of 1977 represented a groundbreaking advance for its epoch, but it started from the presumption of an existing disaster, focusing on reactions to a catastrophe. Modernizing the plan meant introducing realistic concepts of risk, defined as the probability that something will go wrong in the event of an emergency. The result was the new National Civil Protection Plan, introduced in 2002.

FACTS

Due to its geological circumstances, the segment of the Andean chain lying between the cities of Santiago and Puerto Montt has more than 50 active volcanoes.

Since Chile is a very narrow country, located along the western slope of the Andes, its rivers descend with unusual force toward the sea, making them prone to mudflows and flooding.

Santiago, the capital, lies on the San Ramón Fault, a geological deformation produced by the compression between the Nazca and South American plates. The fault runs along the entire boundary between the city and the mountains.

The pre-Columbian inhabitants of the territory which is now Chile developed an array of symbolic and religious interpretations for the earthquakes they experienced. In the Mapuche culture, for example, tremors were perceived as manifestations of a cosmic imbalance, which had to be restored through offerings and propitiatory rites directed toward the gods and the spirits of the ancestors.

Richter y Mercalli

The Richter scale, which measures earthquakes according to their violence, was defined by U.S. seismologist Charles F. Richter. A measure of the total energy released in a quake, it can be objectively measured by instruments and rises exponentially. That is, a magnitude 4 earthquake is not merely twice as powerful as one with a magnitude of 2, but 100 times greater. It is expressed in Arabic numbers.

The Mercalli scale – created in 1902 by Italian scientist Giuseppe Mercalli – measures the intensity of an earthquake according to human perception and its impact on structures. It is expressed in Roman numerals.

An earthquake has only one magnitude, but it manifests various degrees of intensity, which decrease with distance from the epicenter.

DID YOU KNOW?

★ UNESCO's website includes a link to ONEMI and Chile's Comprehensive School Safety Plan. (www.unesco.cl)

★ In Chile, firefighters are volunteers and receive no salary for their work. As in all of the modern world, they not only put out fires, but also act as a general emergency service, responding to a wide range of incidents. These may be natural or caused by human action or negligence, such as vehicle accidents, landslides or spills of hazardous materials. Chilean firefighters are trained at the National Firefighters' Academy.

Although much still remains to be done, both plans reflect a process that has been sustained over time. "During these 16 years there have been no gaps; at no time has the process stopped or moved backward. It has followed a line of progression," maintains Fernández.

Response capacity

Chile is a leader in the area of earthquake-resistant construction. Even an earthquake of magnitude 6 produces no serious damage, nor does it cause fatalities as in other countries, where magnitude 5 earthquakes can give rise to great destruction. The buildings that still collapse in Chilean earthquakes today are old adobe constructions, homes constructed from earth and stone many years ago by their owners.

The seismic construction standards applied in Chile – contained in the General Law of Construction and Urbanism – reflect a level of development similar to that of the most highly advanced countries in this area.

Regulation NCh 433-1996, Seismic Building Design, establishes various seismic zones in the country, based on their level of earthquake risk, the potential impact on buildings in the zone from quakes of various magnitudes, and the number of people who may be affected. In addition, Regulation NCh 2369-2003, Seismic Design of Industrial Structures and Facilities, recently entered into force, addressing issues not covered by the general building regulations. This standard was developed in response to the significant economic losses which may arise from damage to structures or equipment, due to the interruption or suspension of production processes.

"We are much better prepared than we were 20 years ago," notes ONEMI's director, "but still far from the goal we have set for ourselves: a profound reduction in Chile's vulnerability, which ranges from the simple risk that a household object may fall on a person's head during an earthquake, to the need to continuously improve our construction standards."

In the air and in the mountains

Other entities also struggle with the difficulties posed by Chile's complex geography.

★ **The Air Search and Rescue Service (SAR), maintained by the Air Force, works to locate lost or crashed aircraft and rescue their occupants. It uses a new satellite-assisted search method, known as COSPAS/SARSAT.**

★ **The Andean Assistance Corps (Cuerpo de Socorro Andino) is a volunteer organization specializing in search, rescue and recovery operations in mountains and other remote areas. It was founded in 1949 in response to an accident in the Andes, soon after the initiation of recreational mountain climbing in Chile.**

ONEMI's plans for dealing with forest fires, developed in conjunction with the National Forest Corporation (CONAF), have become an international model, implemented in countries such as Portugal and Spain. Recently, to support firefighting efforts in the nearly 14 million hectares making up Chile's national forest system, CONAF acquired three Dromader tanker aircraft, each capable of transporting 2,200 liters of water in a compartment behind the pilot's cabin.

With respect to the country's response capacity in the face of a particular catastrophe, the key is the coordinated system used by ONEMI. "We apply the principle of the scaled use of resources, so that systems are activated and their elements are brought together as they become needed, in accordance with the level of impact," explains Carmen Fernández.

ONEMI's management structure is based on Protection Committees, which are organized on the township, provincial, regional and national levels.

With "special effects"

On October 31, at 4:00 in the afternoon, an exercise simulating an earthquake and tsunami was carried out simultaneously in Valparaíso, Viña del Mar and Concón, with the aim of establishing a model that can be replicated in other cities around the country.

The main components of the exercise were the evacuation of

some 15,000 people from specific points of the cities to designated safety zones and the activation of emergency units (fire departments and the Carabineros police). These activities were accompanied by the sounds of an earthquake and tsunami – loud underground rumbling, glass breaking, the sounds of panic and the rushing of ocean waves into the cities – as actors simulated chaotic scenes, screamed for help from flaming buildings and even interfered with the work of rescue crews, as would happen in a real disaster.

According to ONEMI, the exercise was the largest and most complex of its type ever undertaken in Latin America. While mass evacuations have been carried out in other countries, they did not involve all of the emergency bodies making up the Civil Protection Committee (ministerial bodies, volunteer groups, academic entities, mutual aid associations, national and international organizations, municipal services, and churches and other religious organizations).

The initiative simulated an earthquake of level IX on the Mercalli scale, with a subsequent tsunami that would raze the country's central coast. The tsunami alert was given by the SHOA, sending some dozen signals to the various emergency services. Fire departments and the Carabineros police quickly warned the population to move into safety zones before the arrival of three successive waves.

The first lesson learned was the discovery of some areas of poor coordination. In response, the authorities decided to promote ongoing public education through the communications media and to develop an assistance program for the practical work of municipalities.

The SHOA is the entity which provides technical infrastructure, information and assistance to support navigation at sea and on Chile's lakes and rivers. It is also the government body responsible for the National Tsunami Alert System (SNAM), which has been in operation since 1966. For this purpose, it maintains and operates a vast network of tidal stations along the coast, as well as participating in the efforts of the Pacific Tsunami Warning Center (PTWC), based in Hawaii.

TSUNAMI DANGER ZONE

TSUNAMI EVACUATION ROUTE

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