NATIONAL DATA BANK FOR DISASTER PREVENTION AND MITIGATION (BNDPMD)

In order to achieve an effective handling of the large amount of existing data on natural disasters in Peru, to which new information, including information on technological accidents, is constantly and rapidly being added, one of the tasks of the PMDP is to organize the national data bank for disaster prevention and mitigation (BNDPMD).

In terms of the use to be made of the data, the bank has two "accounts": a natural disasters account, and a technological accidents account. The former is indispensable for the planning, design and construction of engineering projects that must be protected from extreme natural phenomena, and is useful for researchers who need quick access to information and for civil defense officials who need to prepare emergency plans.

Regarding technological accidents, which can be caused by a number of dangerous substances, precise information is required on how to combat fires and what antidotes to take if substances are swallowed or inhaled, to name just two applications. This is critical information which must be provided as soon as it is required.

In accordance with these needs, two working groups have been set up. The first comprises institutions that produce or use information on natural disasters, such as the National Civil Defence Institute (INDECI), the Centre for Seismic Research and Disaster Mitigation (CISMID) of the Civil Engineering Department of the National Engineering University (CISMID.FIC/UNI), the Geophysical Institute of Peru (IGP), the Institute of Geology, Mining and Metallurgy (INGEMMET), the Navy Directorate of Hydrography and Navigation (HIDRONAV) and the National Meteorology and Hydrology Service (SENAMHI).

The second group comprises the National Institute of Environmental Protection for Health (INAPMAS), the Volunteer Fire Brigade of Peru (CGBVP) and the Environmental Engineering Department of the National University of Engineering.

With the desired objectives clearly in mind, during the project design stage the necessary computer equipment available in the participating institutions was identified, as well as the minimum additional equipment that would be needed for the programme.

The CISMID.FIC/UNI computing centre was designated as the network hub for handling the natural disaster data. It is equipped, inter alia, with an IBM 9370 system, which includes an IBM 9375 processor; three IBM 9333 disk units, each with a capacity of 2,4000 MB; printers; monochromatic terminals; and graphic terminals, in addition to other equipment, such as two IBM 5080 computers for colour graphics and word processing equipment with laser printers.

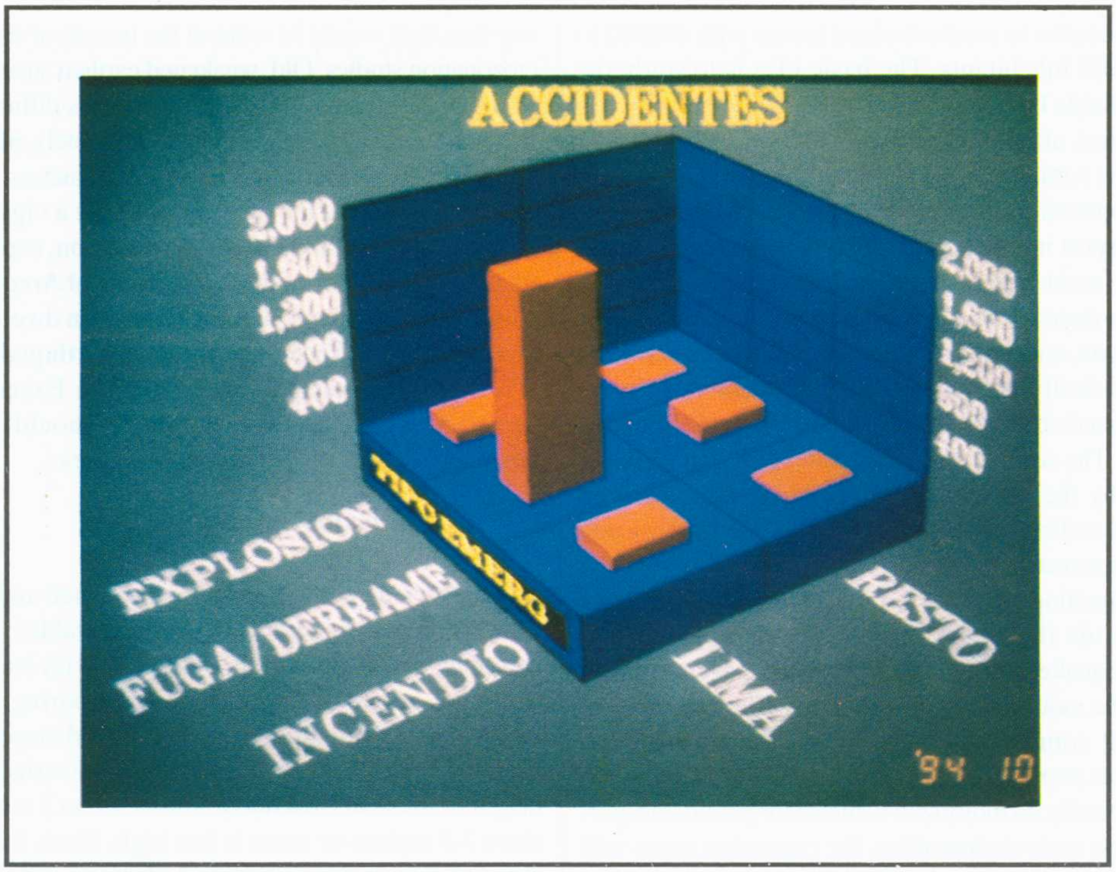
To complement the existing equipment of the participating institutions, a PC was acquired to be used exclusively for handling technological accident data and to increase the power of one of the CGBVP systems so that data on dangerous chemical substances could be stored for use in a round-the-clock response to emergencies.

Based on the above-mentioned computer equipment available in CISMID.FIC/UNI, and the operating system - which uses VM/SP (Virtual Machine/System Product) - IBM recommended STAIRS/CMS (Storage and Information Retrieval System/Conversational Monitor System) as the most suitable software for the data bank.

Some of the institutions participating in the natural disaster data bank have been organizing their own database system using PCs and other types of software, such as MICRO CDS/ISIS 2.3 (donated by WHO), DBASE III + CLIPER, and FOX PRO. To download data from those systems to STAIRS/CMS and facilitate the rapid exchange of data between the two systems, CISMID.FIC/UNI has prepared a number of programmes, such as CONVER I, which is compatible with CDS/ISIS.

Once the data programme on dangerous chemical substances has been fully implemented, it will be turned over to the CGBVP for round-the-clock use, as well as to INDECI. It will lie with INAPMAS to maintain the original programme and add new data.

Following the World Conference on Natural Disaster Reduction, held in Yokohama, Japan, in May 1994, the environmental impact of technological disasters has become and additional subject of study.



TECHNOLOGICAL ACCIDENTS IN METROPOLITAN LIMA AND THE OTHER PROVINCES OF THE DEPARTMENT OF LIMA DURING 1993. SOURCE: CGBVP. PROCESSED AT INAPMAS.

DISASTER PREVENTION AND MITIGATION IN SOUTH-WESTERN PERU

Research findings indicate that the occurrence of an earthquake similar to the one that struck the zone in 1868 would cause severe damage from seismic vibrations and tsunamis.

The strategy for reducing the medium- and long-term risks is to apply the lessons of past disasters and endeavour to reverse the current situation in developing countries, where disasters are taking and increasingly heavy toll in human life and material damage.

The most important safety problems faced by south-western Peru are:

- The chaotic growth of cities which, due to the sharp population growth, occupy highly dangerous marginal areas or interfere with natural processes, thereby intensifying the adverse impact of disasters.
- The existence of numerous adobe structures, both in the large towns of the region and in small villages, particularly in the mountains of the Department of Arequipa, structures which were weakened by the effects of past earthquakes and which are a major risk to their occupants.
- The tsunami hazard in some towns in low-lying coastal areas.

In response to these problems, microzonation studies of the two largest cities in the region, Arequipa and Tacna, were carried out. The microzonation of Moquegua had been undertaken in 1983, resulting in the development of a methodology applicable to medium-sized towns with 30,000 to 80,000 inhabitants. The basic idea is to study the available building land towards which the city can expand, after which each site is classified according to the natural hazards, it faces, the cost of urban development and of buildings and vital public services, transport infrastructure, occupancy and legal status. The most appropriate sectors are then chose in accordance with those criteria. In the case of Moquegua, one of the sectores was ruled out because its historically and culturally significant ruins were declared off-limits by the National Institute of Culture.

The seismic hazard for the typical towns selected by the PMDP was determined on the basis of expected intensities, meaning that simplified seismic microzonation techniques were employed with a view to directing the growth of such population centres towards the safest sectors. Following the 1979 earthquake, which had a particularly adverse impact on the mountains of Arequipa, its effects on several small communities with fewer than 10,000 inhabitants were studied. Bearing in mind that there are practically no motorized vehicles for public transport within such communities, the expansion zones will have to be limited to a radius of points within walking distance for the inhabitants, which drastically reduces the area to be considered. This situation prompted the development of the microzonation method for small population centres, using Aplao as the model. The lands surrounding the village within a radius of less than 2 km were considered; they were divided into sectors with similar characteristics and then classified in terms of physical safety, supporting capacity of the ground, ease and cost of installing public services and construction costs.

Plans for coping with by tsunami floods in population centres and in the largest ports along the 630 km coastline considered will make it possible to expand those communities in accordance with the studies carried out. For example, it was determined that Ilo is spreading towards the "Pampa Inalámbrica" ("wireless plain"), a safe zone whose height of 80 metres above sea-level places it well above coastal tsunami range. Zofri-Ilo, in the duty-free zone, is also safe against flooding by tsunamis.

In short, the results of complete and detailed microzonation studies for the three largest cities in the region are now known, and the zones best suited to the urban expansion of several coastal towns and towns in the interior have also been identified.

Major efforts are under way to encourage local authorities, whose mayors are in charge of civil defense in their respective districts, to develop land use plans based on the completed microzonation studies. This will facilitate safe, planned growth, and in most cases the costs of urban infrastructure, building construction and vital public services will be lower than they would be without the benefit of the microzonation studies. Old, weakened earthen structures pose a high risk to their occupants, and it is difficult to find practical ways to protect them adequately, mainly because of economic, social and cultural factors.

The gravity of the problem calls for a vigorous campaign of education and dissemination, especially in the mountains of the Department of Arequipa, where there are a large number of earthen dwellings that have been affected by previous earthquakes.

It has been recommended that the Executive Secretary of Civil Defense Region III should coordinate and direct the following activities:

Existing buildings

Earthen dwellings should be inspected and classified as either repairable or non-repairable: as an example, of the latter case, dwellings with leaning walls not joined at the corners. In repairing one-storey adobe structures, two very useful steps can be taken: proping up the roof and lowering the height of the walls to a maximum of 2.8 to 3 metres, since 3.5 metres or more is too high. Next, the remove of four or five upper rows of adobe and installing of a wooden collar beam, with the parts laid out like a ladder on its side, taking special care when joining the corners. Use of a cement mixture to reinforce the beam, is recommended, and then puting back the four or five rows of adobe and reinstalling the roof.

New housing

Those buildings which cannot be repaired will have to be replaced by appropriate new adobe structures with walls less than five metres apart, small windows and reinforcement through collar beams, the typical design of which is regularly disseminated in specially prepared brochures.

No adobe structure should be built on ground that is very moist, as seismic waves are greatly amplified on such terrain, with high-level intensity.

Cane, which is found in the lower and middle parts of several river basins, can be used as a building material. A brochure is being distributed on the prefabricated quincha system (walls and/or roofs made of rushes and mud), which is low-cost and easy to build, making it suitable for self-building programmes. Since the system of construction includes the final coating made of sand, cement and plaster, which forms an organic whole with the clay and straw foundations and weighs little, the system acquires high seismic resistance, as demonstrated by the tests carried out on a realistic scale by CISMID FIC/UNI.

The earthquake resistance standards in force in Peru provide reasonably good protection for reinforced concrete structures and for those made of reinforced bricks.