

INTERNATIONAL BOUNDARY AND WATER COMMISSION
UNITED STATES AND MEXICO

Minute No. 292

April 28, 1995
Ciudad Juarez, Chihuahua

**WORKS OF AN EMERGENCY NATURE THAT SHOULD BE
UNDERTAKEN PROMPTLY FOR TREATMENT OF SINKHOLES
THAT HAVE DEVELOPED IN THE RESERVOIR AT AMISTAD DAM**

The Commission met at 10 :00 a.m. on April 28, 1995, in the offices of the Mexican Section in Ciudad Juárez, Chihuahua to review the conclusions and recommendations developed by the Principal Engineers based on those of technical advisers from the United States and México regarding the emergency works that should be undertaken to treat the sinkholes that have developed on the Mexican side of the reservoir at the Amistad Dam and for injection of an impermeable grout curtain.

The Commissioners reviewed Commission Minute No. 235, "Division of Operation and Maintenance Costs at Amistad Dam", signed December 3, 1969, noting that the "Joint Report of the Principal Engineers Concerning the Division of Operations and Maintenance Costs of Amistad Dam", signed December 1, 1969, that forms an integral part of that Minute, stipulates:

"Should it become necessary to perform operation, maintenance, or repair work of an extraordinary or emergency nature which, if not performed promptly might result in risk of serious damage to the project, or in increased cost of its performance, the Commission shall order those works executed which it finds advisable and shall allocate them between the two countries for their performance as soon as possible, understanding that the performance by each Government of the work allotted to it, cannot be undertaken until it has made the necessary financing arrangements therefor."

Further, the Commissioners reviewed and found satisfactory, the "Joint Report of the Principal Engineers Regarding Works of an Emergency Nature that Should be Performed Promptly for Treatment of Sinkholes that Have Developed in the Reservoir at Amistad Dam", signed on February 22, 1995 by Principal Engineers Jose S. Valdez and Gilberto Elizalde Hernandez, of the United States and Mexican Sections, respectively. The Principal Engineers, in that report, described the studies and investigations performed by technical advisers from the two countries, the U.S. Army Corps of Engineers for the United States and the National Water Commission (CNA) and the Federal Electricity Commission (CFE) for Mexico, following detection of sinkholes that have developed on the Mexican side of reservoir some 265 meters from the dam embankment slope and recommended that works of an emergency nature should be undertaken promptly. Work should begin with filling of the sinkholes in a manner described in the report while the storage elevation is low, followed by work preparatory to injection of the grout curtain, installation of piezometric stations and injection in 600 meters of a grout curtain extending 300 meters to each side of Amistad Reservoir Station 7+150. The Commissioners considered that the work at Amistad Dam should be in accordance with the following framework:

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1. Fill the sinkholes in the reservoir with the use of inverted filters, depositing material to its deepest part. The CFE will perform this work immediately directly through force account.
2. Work Preparatory to Injection
 - o Instrumentation at three sections to measure groundwater levels, each integrated by three observation wells one at the upstream slope of the embankment of the dam and two between the downstream toe of the dam and the Carmina Arroyo, plus an piezometric station at the downstream toe, with bubble gages at three different depths for independent wells. In four of the six borings, samples will be taken for geology investigations purposes.
 - o Basic preliminary laboratory studies by CFE of characteristics of the grout bed and mortar tentatively selected for the injection of the impermeable curtain in the foundation.
3. Injection of an impermeable grout curtain at the rock base of the embankment between stations 6+850 and 7+450. The effectiveness of this curtain will be measured through observation wells and piezometers and will allow a definition of the need for additional grout curtains. At the same time, the need will be later evaluated for extending the grout injection zone to one side and the other of the segment indicated above. Mexico will carry out this work based on a contract to be executed by CNA with a specialized company principally covering the following:
 - o Perform six borings from the crown of the curtain through the impermeable core and the foundation to investigate the conditions of the original grout work.
 - o Drill from crown to curtain through the impermeable core and foundation rock and inject grout to a depth of about 28 meters.
4. A preliminary cost of this work, in U.S. dollars is as follows:

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|-------------------------------------|-----------------------|
| o Filling of Sinkholes | \$ 50,000.00 |
| o Work Preparatory to Grout Curtain | |
| Injection | \$ 52,000.00 |
| o Basic Preliminary Studies | \$ 35,000.00 |
| o Injection of Grout Curtain Along | |
| 600 meters | <u>\$2,600,000.00</u> |
| TOTAL | \$2,737,000.00 |

Since the exact geometry of the sinkholes is not known, it is not possible to know the exact quantities of work to perform, especially those amounts for filling the sinkholes. Thus, the CFE

will develop a detailed list of quantities of work performed to estimate the cost. The total cost of the grout curtain injection will be known once bids are solicited and the contract is adjudicated. Actual costs will be known when the work is completed.

Regarding the total costs of the referenced works, estimated at \$2,737,000.00, the Commissioners considered it appropriate that the distribution between the two countries be at 53.4 percent for the United States and 46.6 percent for Mexico. To arrive at these percentages, the Commissioners relied on the authority provided to the Commission in Minute No. 235 regarding the distribution of costs for operation and maintenance of Amistad Dam. Should the grout injection be necessary beyond that indicated, the cost of additional work would be subject of a further arrangement made through the Commission.

The Commissioners observed that each Section should make arrangements in its respective country to obtain the funds necessary to cover the costs of the emergency work. Further, they made note that since the work is in Mexico, that country would make arrangements for contracting and construction and the United States would reimburse the actual costs corresponding to the United States based on an exchange rate in effect on the date that charges are presented by the country performing the work.

At the same time, the Commissioners noted that in view of the urgency in carrying out the work, should one country obtain funding before the other, such funds may be utilized to cover the cost of filling the sinkholes and installing piezometers, with the understanding that funds provided by the United States will be administered by the Mexican Section, and that amount be credited to the United States in a final accounting of costs covered by each country.

Based on the above considerations, the Commission adopted the following resolutions, subject to the approval of the two Governments:

1. The "Joint Report of the Principal Engineers Regarding Works of an Emergency Nature that Should be Performed Promptly for Treatment of Sinkholes that Have Developed in the Reservoir at Amistad Dam", signed on February 22, 1995 by Principal Engineers Jose S. Valdez and Gilberto Elizalde Hernandez, of the U.S. and Mexican Sections, respectively, is approved and forms a part of this Minute.
2. In accordance with provisions of Commission Minute No. 235, these works are declared to be of an emergency nature, which if not undertaken promptly might result in risk of serious damage to the dam.
3. The Commissioners consider that the filling of the sinkholes, the work preparatory to the impermeable grout curtain injection and the geophysical studies have an estimated cost of \$137,000 U.S. dollars, and the impermeable curtain injection a cost of approximately \$2.6 million U.S. dollars for a total of approximately \$2.737 million U.S. dollars. The Commissioners consider that an appropriate distribution between the two countries be in the following proportion: 53.4 percent for the

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United States and 46.6 percent for Mexico. For this determination, the Commissioners utilized the powers conferred to the Commission in Minute No. 235 relative to the distribution of operation and maintenance costs of Amistad Dam, with the understanding if it becomes necessary to inject the grout curtain beyond 600 meters, the additional cost would be subject to new arrangements through the Commission.

4. The sinkhole filling and the work preparatory to the impermeable grout curtain injection and geophysical studies will be carried out by the National Electricity Commission of Mexico. The impermeable grout curtain injection will be carried out by the National Water Commission through a specialized company.
5. Each Section will make arrangements in its respective country to obtain the funds necessary to cover the costs of the emergency nature work, with the understanding that Mexico would make the contractual arrangements to perform the construction and the United States would reimburse the costs corresponding to the United States.
6. Should one country obtain funding before the other, funds obtained by that country may be utilized to cover the cost of filling the sinkholes and installing piezometers, and work prior to the impermeable grout curtain injection with the understanding that any funds provided by the United States will be administered by the Mexican Section, and that amount be credited to the United States' share of the total work in a final accounting of costs covered by each country.
7. For the purpose of administration of United States' funds and accounting for the distribution of costs, an exchange rate would be utilized corresponding to that in effect on the date that the charges are presented in an amount corresponding to the United States for the work in accordance to the distribution agreed.

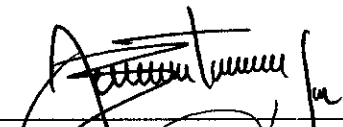
The meeting was adjourned.



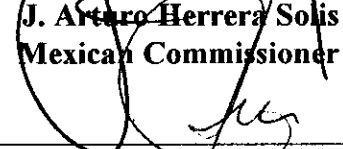
John M. Bernal
U.S. Commissioner



Manuel R. Ybarra
U.S. Section Secretary



J. Arturo Herrera Solis
Mexican Commissioner



Jose de Jesus Luevano Grano
Mexican Section Secretary