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Standardization and Measurement Services in Bolivia

Edited by:
H. Steffen Peiser
Robert S. Marvin
Joanne Mejeur

Office of International Relations
National Bureau of Standards
Washington, D.C. 20234

A Report of a Survey Conducted Jointly by the National Bureau of Standards and the Agency for International Development

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(A Report of a National Bureau of Standards/Agency for International Development Survey Conducted June 9-22, 1974)

Survey Team Director:

Orlando Donoso Torrez, Director General, General Directorate of Standards and Technology

Survey Team Members:

Yardley Beers, National Bureau of Standards, USA
Jong Wan Choi, Industrial Advancement Administration, Korea
David E. Edgerly, National Bureau of Standards, USA
Ömer Göncü, Turkish Standards Institute, Turkey
Kurt F. J. Heinrich, National Bureau of Standards, USA
H. Steffen Peiser, National Bureau of Standards, USA
Charoen Vashrangsi, Department of Science, Thailand

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Department of State
Washington, D.C. 20523

U.S. DEPARTMENT OF COMMERCE, Elliot L. Richardson, *Secretary*

Edward O. Vetter, *Under Secretary*

Dr. Betsy Ancker-Johnson, *Assistant Secretary for Science and Technology*

NATIONAL BUREAU OF STANDARDS, Ernest Ambler, *Acting Director*

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INTRODUCTION

Following the pattern established by the Governments of Ecuador, Korea and Turkey, the Government of Bolivia, acting through the Mission in La Paz of the U.S. Agency for International Development, requested the National Bureau of Standards to conduct a survey of the standardization and measurement services available to small-scale manufacturing and processing industries to stimulate the development of domestic and international trade, and to make recommendations on additional services needed.

The Survey took place from June 9 to 22, 1974, after a two-months' postponement due to political unrest. It employed the now traditional mode of operations of such surveys (Ref. 1-3). The Survey was led by a Bolivian Survey Director, Engineer Orlando Donoso Torrez, at that time the Director General of the Bolivian General Directorate of Standards and Technology (Direccion General de Normas y Tecnologia [DGNT]).

The Survey Team was composed of the following staff members of NBS:

Yardley Beers, Senior Research Scientist, Quantum Electronics Division,
David E. Edgerly, Special Assistant for International Standards Programs,
Kurt F. J. Heinrich, Chief, Microanalysis Section,
H. Steffen Peiser, Chief, Office of International Relations,

supported, as is customary, by third-country participants:

Jong Wan Choi, Administrator, Industrial Advancement Administration, Korea,
Ömer Göncü, Director, Electrical Laboratories, Turkish Standards Institute, Turkey,
Charoen Vashrangsi, Department of Science, Ministry of Industry, Thailand.

The Bolivian team consisted of eleven leaders of technology and standardization in Bolivia:

Orlando Donoso Torrez, Director General, DGNT,
Ronanth Candia Gonzales, Chief, Department of Standards,
Carlos Duran Canelas, Chief, Department of Laboratories,
Freddy Quezada Rendon, Chief, Division of Standards Development,
Jose Paredes Oblitas, Chief, Division of Quality Control,
Hernando Montaño Valle, Metallurgical Engineer,

Gregorio Bernal Yañez, Industrial Engineer,
Hugo Moldes Ontiveros, Industrial Engineer,
Javier Mantilla, Chemical Engineer,
Rolando Garces, Chemical Technician,
Emilio Rivero, Chief, Division for Transfer of Technology.

As in previous surveys, we introduced one major innovation as an experiment. We circulated a form to all organizations visited to be filled in at the host's option before the Team visits, or at least to focus the thoughts of our hosts on the type of questions relating to quality control, standardization, and measurement technology that were of interest to the Survey Team. The form and the analysis of the responses is given in Appendix I. Basically, the forms were very useful although some of the recipients were reluctant to complete them because they feared that the responses might harm their individual relationships with their own governments.

The original program (in Spanish) is reproduced in Appendix II. Arriving a few days early to finalize arrangements with the governmental, industrial and academic authorities, the NBS team leader (Peiser) had to contend with a number of unexpected problems. Two team members, one from NBS and the other from a third country, cabled their regrets. They could not take part in the Survey, but both arrived in time for the Regional Seminar on a System of Standardization and Metrology for Latin America.

In addition, continued political unrest made visits to Potosi and Sucre inadvisable and caused a delay in the departure to Cochabamba. As a result, some Team members suffered for the first few days the usual high-altitude effects in La Paz. Then, one of the rare snow storms in La Paz caused the airport to be closed on the revised departure day. An NBS team member had additional, possibly unrelated, medical problems. He did not allow their effects to interfere with his key contributions to the Survey, which were derived from his unusual linguistic abilities.

The events of and conclusions derived from the Survey were summarized during the Regional Seminar at the request of the Minister of Industry, Commerce and Tourism, Colonel Miguel Ayoroa Montaño (Ref. 4 and Appendix III). A full report of the Survey has not been published. The Survey Director must, by previous arrangement, authorize publication of the conclusions and recommendations of NBS/AID Surveys. This authorization can no longer be obtained. Thus, this report is only a descriptive statement of events for the record.

The absence of a fuller report in print does not mean that the Survey was a failure. In all the NBS/AID Surveys, the unwritten effects probably surpass in importance the written reports. In Bolivia, we

are convinced that the team survey created greater awareness of the quality control problems of small manufacturing companies and of the opportunities of DGNT to assist them. We left behind a Directorate General of Standards and Technology whose services are known and recognized more widely, especially in several provincial capitals which traditionally are not in close communication with La Paz high up on the Andes. The Team encouraged academic institutions to collaborate more closely with industry and stimulated courses to be given, industrial trainees to be accepted in colleges, and students to be given opportunities in industry. We showed Bolivian technicians that transfer of technology from the U.S.A. does not always involve high cost. Our concern for industrial safety standards made a deep impression in some places. (Dr. Beers' personal gift of a research microscope for the early detection of tuberculosis, especially of miners working deep below the surface under conditions that can be deadly to men of the high plain, was a tangible and valued contribution.) We discussed the installation of a chemical and a weights and measures laboratory which has become a reality.

Full credit for any of these developments that have occurred since the Survey should not be claimed. However, it would be equally wrong to underestimate the Survey's effects. Seven non-Bolivian specialists in various fields of science and technology reviewed and analyzed the problems of our Bolivan hosts, who, with their fuller understanding of the country, its people and its remarkable culture, interpreted to their colleagues what we had to offer. A lasting link with NBS will, in all probability, remain. NBS continues to correspond with, to receive visitors from, and to send literature and data to Bolivia's DGNT.

The Survey depended on the encouragement and advice of the USAID Mission in La Paz. Mr. David L. Jickling especially took a personal interest which is most gratefully acknowledged. The U.S. Ambassador, the Honorable William Perry Stedman, Jr., discussed the results of the Survey with the NBS team leader. With interest and understanding, he threw new light on our experiences.

The staff of DGNT was characterized by continuous and devoted enthusiasm. They see their future in commercial successes through hard work, technology and the natural resources of a largely unexplored land.

The leadership of Engineer Donoso was fully supported by the Minister of Industry, Commerce and Tourism and the several other Cabinet Members with whom the Team held lengthy and fruitful discussions. The hospitality and warmth of the people and their leaders is remarkable.

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[2] Standardization and Measurement Services in Korea, NBSIR 73-185 (U.S.), 38 pages (1973).

[3] Standardization and Measurement Services in Turkey, NBSIR 73-172 (U.S.), 85 pages (1973).

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VISITS IN THE COCHABAMBA AREA

1. Visit to Planta Industrializadora de Leche (PIL)

The Industrial Dairy Company near Cochabamba is located on the Av. Blanco Galindo. The Survey Team visited there on June 10, and was received by Ing. Luis Barron del Castillo assisted by Mr. Jaime Galindo, who joined PIL directly from being a student at the University of Cochabamba, and Dr. Agustin Saguez, the head of the PIL Laboratory. PIL is a Bolivian Government enterprise subordinated to the Bolivian Development Corporation, the CBF, Corporacion Boliviano de Fomente, ultimately under control of the Ministry of Commerce, Industry and Tourism.

PIL collects milk daily from 570 farms, of which 540 are very small. Each churn is tested for acidity and fat content at the intake point under observation of the farmer's representative. In case of rejection the farmer is informed of the reason. At its inception in 1960 PIL collected 1600 liters per day. Since then it has expanded at the rate of 13 percent per annum to its present volume of 40 000 liters per day.

The products of PIL are pasteurized milk and cream (in glass bottles), butter, and powdered milk (full fat and skimmed). Originally the capital came partly from the Bolivian Government, UNICEF, USAID and Danish equipment manufacturers through favorable long-term loans. Expansion, which is continuing with ten-year extrapolated needs in mind, is partly financed by the plough-back of profits.

Milk product tests follow the established American procedures:

> Standard Methods for the Examination of Dairy Products, American Public Health Association, 1960.
>
> Standards for Examining Milk Products, Organizacion Pan Americana de la Salud, 1960.
>
> Laboratory Manual - Methods of Analysis of Milk and Its Products, Milk Industry Foundation, Washington, D. C., 1964.

Acidity, fat content, sedimentation and methylene blue tests are made against standards. DGNT calibration services would be welcome. Existing Bolivian regulations are not held to be fully responsive to the practical needs of the dairy industry and the consumer.

The PIL laboratory is well equipped and expanding. A residual oxygen measuring Beckman spectrometer used for powdered milk has given some problems. A lactic acid-resistant floor tile is an imported innovation. Consultation and advice is freely available, especially through Danish machinery manufacturers. Preventive maintenance is excellent, important in a location where six months are required to obtain spare parts. This delay is in part said to be due to government purchasing procedures. Some spare parts are now made in Bolivia. As a result, not a day of production has been lost since 1960. New construction, especially for a large new powdered milk facility, is largely under PIL engineering supervision. Welding practice appears good, as does the safety record, although Bolivian codes are not yet available. Labor relations generally are good.

With Swiss Government help, an extension service is provided to farmers covering fertilizers, seeds, and machinery. Many items are bought or developed by PIL for sale or resale to farmers. PIL, in its area of operation, has an effective and benevolent monopoly, since it is an offense to sell milk products of inferior quality where PIL products are available. This prohibition is not, however, strictly enforced.

PIL has and will to an increasing extent have a profound effect on dairy farming in the region, on the volume of milk consumption, and hence, on the nutritional standards of the nation.

2. Visit to the Fabrica de Cazados "Manaco"

The Survey Team was received at the "Manaco" factory in Cochabamba on June 10, 1974, by Mr. Carlos Hajek, the Manager, Mr. Veverka, the Production Manager, and Reinaldo Saravia, Head of the Testing Laboratory. "Manaco" is a leading manufacturer of footwear of all types, its activities covering the processing of raw materials (leather, rubber) to the production of finished products. It was organized in 1942 as a branch of the Czechoslovakian firm BATA, but is now totally financially independent (nominally Bolivian owned) but still affiliated with BATA, now having headquarters in Canada. Present affiliation is in the form of payment of an annual technical assistance fee to the headquarters organization for which the latter provides technical advice especially with regard to new technological developments. The numerous BATA affiliated firms agree to share patents and information concerning technical discoveries and improvements, but are free to compete with each other in sales. Complete shoes are exported, for instance, to the U.S.A. and Great Britain. Uppers are exported to Canada.

"Manaco" follows ASTM standards and procedures, supplemented by detailed BATA procedures. The company has a laboratory for (a) testing raw materials, (b) shoes in intermediate stage of manufacture, and (c) finished products. A detailed list of tests is available in the notes collected by the Survey Team.

Instruments are nominally self-calibrating, following the procedures contained in the supplier's instructions. They have no independent means of calibration at the factory, though these would be welcomed. However, once in a while, comparative tests on the same samples are made at this factory and at BATA Headquarters. There has been no communication between this firm and any other Bolivian firm concerning standards and test methods.

In the questionnaire the management stated they had frequent problems with raw materials. The hides collected from tropical regions suffer from exposure to hot humid conditions in transportation and from tick punctures. It is to be noted that, in the tanning process, there seemed to be no instruments for quantitative testing; the quality seemed to be controlled by subjective judgment of the skilled operators.

In the discussion, the management was asked if the use of standard reference materials would be useful to them. At first they replied in the negative, but when further information was supplied to them by those present, they said that such SRM's would be useful.

The firm has the highest wage scale in Bolivia. Personnel are hired with the expectation that they will stay permanently and are trained accordingly. A minimum of a high school diploma is required for employment. Senior technical staff very frequently are sent to North America and Europe for training in the latest methods.

The trademark "Manaco" is protected against unauthorized use. There is no comparable protection for shoe design.

3. Visit to the Cerveceria Taquina S.A.

The brewery is located in the hills outside Cochabamba, where good water and clean air are available. It is claimed that this location assures freedom from bacterial and fungal contamination and explains the high quality of the beer. The offices are downtown. We were received by Eng. Mauricio Artero and assisted by Mr. Edward Czermak, originally from Vienna, Austria.

The raw materials for the process of brewing beer are barley, which is converted to malt (cebada), hops (hipulo), yeast, and water. The main steps are:

1. Storage, sorting, and cleaning of the barley, its germination and roasting, its degermination, and grinding;

2. Filtering, mixing, and "brewing";

3. Fermentation between 4 and 20°C, collecting carbon dioxide as a by-product, recycling of yeast, and slow post-fermentation for 30 - 70 days at below 4°C;

4. Storage, bottling, and pasteurizing.

All these processes were shown and discussed.

This brewery is a private company, which employs 135 workers and 6 technicians with degrees. It is in competition with others in the local market, particularly with companies from La Paz. Importation of beer from other South American countries is not permitted, but high-class European beers are sold in small quantities. There is little incentive for drinking foreign beer as the local product compares favorably with the best world standards. Bolivians drink much beer and are very discriminating.

Production is limited by the equipment, which is too small and largely out of date. New equipment is presently being installed, and the capacity of the plant will be expanded from 6000 bottles to 20 000 bottles per day.

Besides an increasing Bolivian market, the company plans to export within the framework of the Andean Pact. This will require some improvements in packaging as will be mentioned later.

The technical control is performed in a laboratory, but measurements (weighing at various stations, temperature control, etc.) are rather simple, and no effective standardization is performed. The most sophisticated part is the brewing section which is automated. Very simple material tests at various steps, including the end product, are performed in the laboratory. These include measurements of moisture of barley and malt, specific gravity for the alcohol content of beer, and experimental fermentation of a test batch to determine the yield of raw products. An important physical test is the sorting, with sieves, of barley. The heavier the grain, the higher the starch content will be.

There are numerous production standards, concerning parameters of production. These (temperatures, times, etc.) vary with the type of beer, and are said to be adapted to local conditions (water, climate, pressure, raw materials, etc.). The manager asserts that no universal standards exist, that their technical competence in establishing plant norms is high, and that they are not restricted by patent consideration. The brewmaster learned his trade in Austria and Germany before moving to South America. The managers assume that they are able to satisfy a very sophisticated clientele. They are cooperating on standardization of beer with DGNT and think that a certification of quality by the Government would be helpful to sales in other South American countries. The main difficulties seem to arise in the areas of raw materials and in packaging.

The barley comes in two varieties: one has two rows of grain per ear, and the other six. The two-row barley is of better quality, and all imported barley is of this type. (The quality depends on the grain size.) However, this high-quality barley requires good soil and water, and in regions where these are available, the cultivation of wheat is more profitable. Therefore, all Bolivian barley is the six-row lower grade type, which is then mixed with the imported produce (the best comes from Denmark). There is considerable loss due to insects and rodents attacking the barley in storage. Partial control is obtained by poison gas (hydrocyanic acid).

The hops are all imported from Germany and the U.S.A., and the price of hops is a substantial part of the cost of production. The technicians are sure that hops can be cultivated in Bolivia, if technical help is available. We discovered two possible channels to obtain such help: 1. A mission provided in La Paz by the University of Utah, which already provides technical help in other areas of agriculture, and 2. The Office of International Relations of the U.S. Department of Agriculture. These seem to be effective avenues of assistance to the Bolivian beer industry.

The main complaint is about the poor quality of the bottles available in Bolivia. There is only one glass factory, which uses obsolete methods. Not only are the bottles too high and narrow, but the glass thickness and, therefore, the internal volume are irregular, and there is a breakage of 2 percent in the washing and pasteurizing process. Rejection by visual inspection takes place after filling, so the beer is also wasted. Moreover, consumers complain of delayed cracking. Finally, the bottles are green instead of brown in color, which causes changes in flavor after a short exposure to sunlight. The glass plant seems unwilling and unable to change procedures, and other industries using glassware have similar problems. The Government is unwilling to force the plant - which has obtained Government credits - to modernize, fearing that the required change would produce a loss of work to well-paid workers at the glass plant. Such a loss the Government considers unacceptable. However, the bottles will definitely be unsuitable for exportation to other Andean countries once the Andean Pact becomes effective.

The cost of the beer to the consumer in Bolivia is increased by a 120 percent tax added to the production cost by the Government. From the proceeds some universities are supported.

4. Visit to the Fabrica Nacional de Conservas "Dillman"

The Dillman plant, located at 3177 Ave. Peru, Cochabamba, was visited on June 11, 1974. The Survey Team was received by Mr. Carlos Baehr and Mr. Jose Felix Flores. The Dillman Company is a small firm whose products are limited to canned meats, fruits and vegetables, and a limited quantity of fresh sausages. The Company was founded in 1921 and is a private enterprise, with no governmental subsidy, in downtown Cochabamba. However, the Cochabamba city government has asked the firm to relocate to an industrial park area outside of the city which the firm will do in about one year. The planned but delayed move inhibits replacement and expansion of facilities.

The plant employs 80 workers, 10 technicians with degrees, and 10 administrative personnel. During the canning season (fruits and vegetables), the number increases to around 250 workers. It was noted that all company employees receive on-the-job training, and several are sent to local trade schools for training as machinists. Maximum daily output is 20 000 can units. The yearly output is approximately 1 million can units, approximately one-third canned meat and the remaining two-thirds canned fruits and vegetables.

The firm has its own slaughter house. The raw materials are purchased directly by company personnel and through independent buyers. There are no grade or quality standards in the Andean countries so none is applied in selecting the raw materials for processing. Generally, precautions are taken during preparation of meat, fruits, and vegetables to remove bacteriological impurities. Basically, these procedures are based upon standards of other countries. However, sanitation could be a problem, particularly in the packing area where cleanliness is an absolute necessity to prevent contamination of the product. The firm purchases tin plate and operates a labor-intensive can-making shop for all 20 sizes used in their own production. Vertical seams are welded; top and bottom seals are provided by a rubber compound imported from Argentina. No hermatic sealing tests are applied. Moreover, there is no inspection by the firm of the end product to determine its wholesomeness. Such inspection is carried out infrequently by the Bolivian Public Health Service.

The laboratory was not visited by the Survey Team. It was merely pointed out that very limited facilities are available and that tests that are run deal primarily with bacteria count. The firm expressed a great need for government support of a plan to provide centralized laboratory facilities to industries. There were a number of small and large capacity scales in use which are calibrated by a private contractor and with the assistance of the Bolivian Railroad.

The firm is already exporting its products to Peru and wishes to expand its exports. For this reason, it has changed the labels on its products to be more in line with international standards dealing with product labeling. The Bolivian Government only requires that the country of origin and the quantity of contents (the "approximate" and not "net" quantity) be declared. The firm also has initiated steps to increase its production by increasing the supply of raw materials. In this regard, it has begun a program of encouraging the raising of pigs. Also, the firm has employed two engineers to provide technical advice and assistance to farmers in the hope of increasing the yield of fruits and vegetables.

The firm expressed concern over shortages in raw materials - principally meat and tin plate for packaging. In line with its hopes for increased exports, the firm also expressed a need for marketing data on potential export markets. Importantly, the firm recognized its obligation in supporting standardization efforts through DGNT. However, it also expressed a need for information from DGNT on fruit and vegetable standards that exist in other parts of the world. There was also a great deal of discussion on the need for adequate laboratory facilities either in Government or through an industry-wide plan of a centralized facility supported by participating firms, to provide the necessary technical facilities required to operate a modern food industry plant.

5. Visit to Cabelbol S.A.

At Cabelbol of Cochabamba, the Survey Team was received on June 12 by Jaime Jimenes, President and Manager, and Dick James, Engineer.

"Cabelbol" started in business two years ago to make wire and cable. Present products are aluminum and copper drawn down from three-eighths inch aluminum or #8 AWG copper and spun into cables, as needed. It expects to manufacture steel wire later. The smallest wire size sold is AWG #20, but Mr. James is experimenting with sizes down to AWG #30. Customers are confined to the power industry. There is no electronics industry in Bolivia.

Aluminum three-eighths inch bars come from abroad, copper from Peru, and polyvinyl chloride (PVC) from Germany or Taiwan. Problems exist in the supply of all three, but PVC is the most severe problem as it is in short supply, and the price has more than doubled in the last year. Aluminum bar is damaged in shipping and also is subject to theft. Peruvian copper contains impurities which make it impossible to draw down to #30 wire. They are hoping to do their own copper refining in a year or two from a native copper deposit. They also have problems with discoloration due to unknown causes in annealing in a carbon dioxide filled furnace.

The firm uses American Wire Gauge in specifying wire size, but their measuring equipment is barely adequate to give three significant figures. They desire greater accuracy. They have laboratory space but no instruments for electrical or elasticity measurements. They complain that much desirable test equipment is beyond their financial resources, so products are not tested. However, the demand is so great that they have never had any of their products rejected by their customers. The firm's managers welcome help from DGNT and they desire the establishment of standards. A test laboratory planned for a larger wire plant in La Paz may not become available to Cabelbol.

The plant could use a labor force of 25, but because of shortage of raw materials, production is reduced and only 13 are on board at present, even though hand winding of wire coils is labor intensive. The management consists apparently only of Srs. Jimenes and James who seem to operate on their experience and intuition. The man in charge of maintenance of dies is about to be sent to Argentina for three months for training. They need an electronics technician to maintain machinery controls, but none is available and there appears to be no local training in electronics available.

6. Visit to Industrias Electromecanicas Femco SRL

"Femco" is located at General Acha 4452, Cochabamba. The Survey Team was received on June 12, 1974, by the General Manager, Raul Artero, and the Production Manager, Humberto Munoz.

The firm was founded about nine years ago as a pilot plant in metal mechanics, an industry specifically allocated to Bolivia by the Andean Pact. At the start the firm had problems hiring trained people and has still the same problem to a certain extent. Training has to be given by the management.

The firm has five general production lines:

1. Lighting fixtures.
2. Panel boards.
3. Materials used in electrical installations.
4. Portable ceilings, corner fixtures.
5. Side line manufacturing, such as ladders, shelves, lockers, tool boxes, office fixtures, etc.

Within these major production lines, the firm produces about 400 different products. The firm uses its own designs in the production process, drawing on the experience in the U.S.A. of Mr. Artura, who operated there as a consultant.

The firm is composed of the following major departments, apart from the administrative ones:

1. Metal cutting department.
2. Metal forming department.
3. Carpentry department.
4. Plating department.
5. Tool and die making department.

The parts prepared in these departments are assembled in one section. The firm keeps a large in-process stock for assembly.

Production is planned according to the demand; very little production is done solely for stock purposes. There were no specific tests carried out on the input materials or on the finished products. However, there were very simple checks carried out, for instance, on scrap to determine steel types.

The firm imports products such as circuit breakers from the U.S.A., instrument transformers and indicating meters from Germany in its

panel board production, and rapid start ballasts and starters for lighting fixture production from the U.S.A.

There are no specific governmental regulations controlling safety and no national code for electrical installations. It was indicated that the firm was trying to follow the NEMA standards and safety code as much as possible. No one standard system of units is used by the firm. It was observed that British and metric systems were both used in different phases of production.

At this point the firm did not feel too interested in trainee programs but would prefer night school classes to be offered which could provide technical training for the people working at the plant. The firm has good relations with the labor unions. The firm was requested to provide a certificate of quality control from DGNT for an order by Santa Cruz.

7. Visit to Quimica Industrial Boliviana "Quimbol"

Quimbol was visited at Av. Blanco Galindo 10400, Cochabamba, on June 12. At this plant the Team was received by the President, Alcar M. Imero Dalene, and the General Manager, Antonio Eterovic N. The chief of the laboratory unfortunately was out of town. At first, an attorney listened in to the conversation, but withdrew when the visit proved to be non-sensitive to the prime interests of this small company which is entirely independent, relying for information on trade journals and suppliers of raw materials and machinery. Quimbol is loosely associated with a plant in La Paz operating under separate management. Quimbol employs 38 workmen, 20 clerical workers, 2 chemists and 5 other professional staff.

Quimbol produces unwrapped high potassium soap, detergents (which are replacing soap in city households), hair shampoo, and shoe polish in four colors. The sales are threatened constantly by smuggled imports. It would be idle to dismiss this problem by saying that the firm is seeking undue protection, because there are substantial import duties even on raw materials. Tallow from Argentina is subject to a raw material exportation tax of 37 percent. Local beef is not fat enough to replace Argentine tallow. Fortunately, it appears that development work by Quimbol enables tallow to be replaced by a material from the Bolivian petrochemical industry which presumably will need to be oxidized to a fatty acid. Sample quantities of such soap show an undesirable dark brown coloration without, however, any loss of real quality. Quimbol has introduced this product to the market with a discount to attract the consumer. Other raw materials are alkali from the U.S. and Britain and various detergent chemicals from many countries, which Quimbol mixes into their proprietory formulations. The market is entered under several trademarks with identical products.

Quality control follows customary chemical tests and inspection. The laboratory is adequate and records are well kept. There are presently no quality or product standards in Bolivia. Argentinian IRAM standards are consulted and often followed. Scales are maintained by private contract. Metric units are employed throughout. Some packages carry no net quantity indication.

DGNT could provide information calibration services and technical consultation on raw materials. DGNT might also be a useful link to the Ministry of Commerce, Industry and Tourism for ever-needed adjustments in trade policies.

8. Visit to Sendtex Ltd.

On June 12, 1974, the Survey Team visited "Sendtex" at Ave. Blanco Galindo, Cochabamba. The Survey Group was received by Mr. Sender Aizencang. Sendtex Ltd. is a small firm engaged in spinning and dyeing of natural cotton and some synthetic fibers. The firm was built in 1969 and is a private enterprise with no governmental subsidy. There are three plants in Bolivia producing synthetic fibers and eight producing natural cotton fibers. The cotton that is produced is consumed by the weavers of cloth in Bolivia. The firm does not export.

The firm employs approximately 168 workers. There are three professionals with technical degrees and seven persons serving in an administrative capacity. The plant operates three eight-hour shifts. It was noted that the firm trains its own employees.

Raw materials are imported principally from Germany and there appear to be no problems with obtaining the materials. It was stated, however, that the politics are such in Bolivia that it actually costs more to import the raw materials from Germany than it does to import the finished product from another nation. The firm uses equipment that has been imported from Germany, the United States, Italy, and Switzerland. The equipment is not the most modern but appeared very satisfactory for plant operation.

There is a small laboratory in the firm where tests are run on tension, uniformity, strength, and thickness of thread. The firm uses its own standards which evidently are the result of the manager's years of experience in the industry and the advice of the manufacturers of the diverse equipment employed in the plant. For example, the manager did not know of ASTM standards for diameter of thread, strength, freedom from dust, etc.

There did not appear to be any specific technical problems or needs of great concern. The problems appeared to concern economic and marketing difficulties that are said to be largely the result of government practices. For example, Peruvian manufacturers of cotton receive a 25 percent bonus from their Government for exporting their products. This bonus, added to a 15 percent tax savings by exporting, amounts to a 40 percent bonus for exporting. There are no such incentives offered in Bolivia. Moreover, the importing of products from other countries like Peru provides difficulties to Bolivian producers who must compete with such products. It was also alleged that there was much smuggling of finished garments from Peru. It was not clear how, under the above circumstances, the smugglers succeed in

competing with legal exports from Peru. However, all such questions are outside the scope of this technical survey.

9. Visit to the Empresa Nacional de Electricidad "ENDE"

On June 13, the Survey Group went for the long drive to the ENDE hydroelectric plants, where it was received by Mr. Orlando Taedio, who is the Superintendent of the plants. There are two plants, "Corani" and "Santa-Isabel", located in series at about 2 700 meters and 1 800 meters above sea level respectively. Both plants are owned and operated by "ENDE", a Bolivian Government owned, semi-autonomous organization. The plants are the first two hydroelectic power generating sites in the Corani region, where there is a potential capacity of about 300 000 kW. The two plants cost approximately 10 and 15 million dollars respectively, and are financed by IBRD, IADB and the Bolivian Government.

The water for the first plant of the series, the Corani plant, is drawn from Lake Corani which has an impounding capacity of about 82 million cubic meters. An intake tower is located at the eastern tip of the lake. The total effective height is 625.3 meters for power generation. It is achieved through a pressure pipe of carbon steel which has a diameter of 1.3 meters. A connection between the intake tower and the generating plant had to be established by a tunnel of 1 200 meters length and a diameter of 2 meters.

The intake tower of the second plant, Santa-Isabel, is located about 300 meters downstream from the first plant's discharge point. The total effective height of 840 meters is also obtained through a pressure pipe of carbon steel having a diameter of about 1.3 meters. In this case, it is laid on the ground generally following the terrain connecting the two sites.

The Corani plant is equipped with two identical parallel sets, each consisting of a turbine and a generator. Each set has a generating capacity of 13 500 kW with a water discharge rate of 2.5 cubic meters per second contributing to the total output capacity of 27 000 kW. The 10 kV current from the generator is transformed up to 115 kV for transmission. The Santa-Isabel plant has an identical system arrangement, but has a total capacity of 36 660 kW.

The turbines, generators, control and distribution panels, and transformers for both plants consist of parts from various countries, including the U.S.A., Germany, Canada, Japan, France, etc.

The Corani plant has been operating since 1966; the Santa-Isabel plant began operation only 6 months ago.

The power generated by the plants is transmitted to the Corani area, the main tin mining center, accounting for about two-thirds of the

output. The remaining one-third is transmitted to the Cochabamba area. Both plants are manned by a single superintendent, together with 1 other engineer, 2 technicians and 10 helpers. It was claimed by the superintendent that no specific difficulties have been experienced for operation and maintenance of both plants with present staffs.

Although units and parts of both plants are made in many different nations, it is said that no particular difficulties have been encountered in the operation and maintenance of the plants. This may be due to their relative newness. Extra spare parts, such as water impellers for the turbines, are well stocked.

Calibrations for the instruments are performed by reference to master standards maintained by the Bolivia Power Company at La Paz. However, any calibration services rendered by an institute such as DGNT in Bolivia would be appreciated very much. For operation and maintenance, ASTM and ANSI standards are most often referred to and used. Routine checks of parts and instruments, especially of the fine instruments, have to be more frequent than is customary elsewhere because of the exceptionally high humidity experienced in the area where these two plants are located.

10. Visit to Yacimientos Petroliferos Fiscales Bolivianos "YPFB" Petroleum Refinery and Lubricant Manufacturing Plant

The Survey Team was received at YPFB, Cochabamba, by the Superintendent, Ing. Fernando Arenas E. Explanations were given by Ing. Rene Noyen, Chief Technical Adviser. The plant is 100 percent owned by the Government of Bolivia. The refinery was first established in 1952 and the lubricant plant in 1956. A major extension of the refinery was built in 1961. The total consumption of crude oil is about 15 000 barrels per day.

The company has about 650 workers and other personnel. Most of the technicians and professional staff received their training from foreign companies in the U.S.A., Japan, and Western Europe who sold the machines. The laboratory technicians were trained in Mexico, Argentina, and the U.S.A.

The company is equipped with a Chemistry Laboratory, a Physical Chemistry Laboratory and a Process Testing Laboratory. Materials are checked according to standards. The standards used for gasoline, lubricants, and low pressure gas are ASTM, SAE and ISO and for pipe and cylinders are API and Brazilian standards respectively. The quality control in the production process and inspection of finished products are made through the use of laboratory testing and analyses. The analyses of raw materials and finished products are done by wet chemistry. New equipment, e.g., an atomic absorption spectrophotometer and infrared spectrometer, are being installed for analysis of trace elements. The physical properties such as density, flash point, pH, etc., are determined for the purpose of quality control. The octane number of gasoline is tested and lead tetra-ethyl is added to improve the quality. The raw material is usually tested on a pilot scale before it is brought into a real production line. Since the crude oil available is light, no cracking process is necessary. The process includes fractionation into gasoline with low octane number, naphtha, and base oil for lubricants. The naphtha is used for asphalt mixing. The base oil is hydrogenated for producing about 200 kinds of lubricants.

Control equipment is from the U.S.A. (Brown and Honeywell). The fractionation process is automatically operated and controlled, but the lubricant production is operated manually.

The main products of the company are gasoline, lubricating oil, kerosene and LPG. The gasoline is stored in large tanks and delivered by tank cars and pipeline. Lubricants and kerosene are packed in cans and LPG is compressed in cylinders. These products are sold under a

trademark, "YPFB", without any competitor. Almost all of the products are presently consumed in the country.

Up to the present time, the company has not requested any assistance from DGNT. All calibration and maintenance work is done through the service of equipment sellers. The company, for instance, keeps some standard weights for calibration. Metrology is not thought to be a serious problem, but the company is willing to cooperate and hoping to use the facilities offered by DGNT. The company is interested in participation in a standards committee for the determination of Bolivian standards to be used in this field.

The company faces the problem that the crude oil is light and it cannot be readily used for the production of heavy oils. A new plant will probably be built using a new process for production of thick oil for diesel engines as well as thicker fuel oil.

Many of the world's major oil companies are exploring promising geological zones of Bolivia for new oil fields under contracts with YPFB and, hence, with the Bolivian Government. The NBS/AID Survey Team had some contact with the Philips 66 team. This company is exploring a region not far from Cochabamba, and is committed to spending $4.5 million in this exploration without Bolivian participation.

11. Visit to the Cooperativa Boliviano de Cemento "COBOCE"

COBOCE has its head office at Calama 3806, Cochabamba. Ing. Jaime Mendez Q., the General Manager of COBOCE, took the Survey Team by bus from the hotel on the 2 1/2 hours' drive over dusty unsurfaced mountain roads to the cement plant which began production in 1972.

In 1970, a handful of Bolivians decided the Bolivian people wanted to share in a Bolivian industrial venture. They started by calling for capital by shares of b$200, that is US$10, collected in 20 monthly subscriptions, paid through Bolivian Credit Unions, of US$0.50! In all, 25 000 shareholders subscribed and decided to start with cement production when total Bolivian production stood at only 6×10^7 kg per year. The GEOBOL (the Geological Survey of Bolivia, Servicio Geologico de Bolivio) advised on a site, land rights were acquired, and K. R. White of Denver, Colorado, was hired to perform a feasibility study which led to an invitation to bid for a 10^8 kg per year plant. Sixteen good bids were received from 11 countries, and 1 from Pianti was accepted. Pianti is a subsidiary of Instituto de Reconstruction Industrial of Italy. Payment requirements were spread over a long period and the Bolivian Development Corporation (CBF) now joined in with a 40 percent share and acquired the right to appoint 2 out of 5 directors.

Pianti put up a well laid out small cement plant that has come up to all expectations. So COBOCE makes 10^8 kg per year of cement meeting ASTM standards out of a Bolivian production of 2.6×10^8 kg per year. The plant is located near the Cochabamba to Uroru rail line at an altitude of 2500 meters; the quarry is 1000 meters (3300 ft.) higher still, near the top of a mountain with reserve rock to last for decades, even if COBOCE follows through with present plans to at least double the capacity of the plant in anticipation of a much higher demand for cement and concrete in Bolivia.

The firm has built and maintains a 27 kilometer (17 mile) good mountain road from plant to quarry. It tends to become impassable for two months of the year during the rainy season, so a stock of rock is maintained at the plant. Transportation is by ten 1.8×10^4 kg capacity trucks also owned and maintained by the firm. The 50 kg cement bags, however, are transported by rail or syndicated truck operators. Their price is US$0.20 per bag for the three-hour haul to Cochabamba (about 4 times that price to La Paz or Santa Cruz), which can hardly be reached in 12 hours. There the sales agents receive a commission of only US$0.05 per bag selling at $2.28, not an inexpensive price. There is some loss through sub-quality paper bags. The first Bolivian paper plant is being planned in Santa Cruz.

It is the Team's observation, confirmed by COBOCE staff, that cement still is being wastefully used in Bolivia. There is inadequate control of concrete mixes. Yet COBOCE is as yet having difficulty in selling more than 75 percent of its "make". The clinker storage bay at the plant is almost full. Export opportunities are being accepted, especially to Brazil by rail, where the quality of the cement is highly praised. This judgment is borne out by laboratory tests shown to us in the small but well laid out laboratory, featuring equipment especially from Soil Test Inc.

The chemical laboratory relies almost entirely on wet analyses, for example, for blending calcium-, aluminum-, and iron-rich material from different parts of the quarry. Under these circumstances it is clearly impossible to ensure a very uniform product, yet the enthusiastic staff no doubt does remarkably well. Of course, it is easy to say that COBOCE simply "must" acquire some modern rapid analytical equipment with which a hundred times as many samples could be run for more efficient control of quarry operation and cement quality uniformity. However, with capital badly needed for expansion, who could give such advice with confidence?

Similarly a rope-way from quarry to plant surely would be far less expensive than the fleet of trucks and the road maintenance, not to speak of the inconvenience of storage of rock reserve at the plant. Besides, dropping 10^8 kg through 1000 meters every year could make a lot of electricity. Presently power is taken from the "Corani" hydroelectric plant by land transmission. Dust causes insulation problems at the transformer substation. Mr. Peiser believes a special grease is used in the U.S., and promised to find out. Mr. Göncü thought a high pressure water jet was best; at least that was the practice in Turkey. Maintenance generally is a big problem. COBOCE evidently has come to the same conclusion and has recently instituted a preventive maintenance system under the supervision of a Canadian engineer, whom the Team also met.

The Survey Team left this plant with a feeling of admiration and, incidentally, sincere gratitude for the hospitality at the plant provided by the plant manager and all his staff.

DGNT is in touch also with the two other cement plants in Bolivia at Sucre and La Paz. There are a number of basic cement standards in Bolivia.

VISITS IN THE SANTA CRUZ AREA

General Comments on Santa Cruz

The city of Santa Cruz is situated just east of the last hills of the Andes, on the western rim of the Amazon Basin. The temperatures in summer are in the high 30's; in winter, winds from the south lower the temperature frequently to about 10°C. The soil, though sandy, is fertile. Subterranean water is abundant; so is energy, since natural gas is available. The natural landscape is an open savanna with valuable wood trees in some areas. These are used for lumber and local craft objects.

The population is predominantly of European origin. Indians from the highlands move into the region in search of work, but 80 percent contract active tuberculosis.

The health situation is a serious problem. Infant mortality, which was 50 percent a few years ago, is still 15 percent. Tuberculosis and Chagas' disease are the most serious diseases. The latter is transmitted by a biting insect (vinchuca), is incurable, and manifests itself mainly through progressive vascular diseases. Tests among army recruits show that 30 percent of the population is infected. Other diseases which are endemic but not epidemic at present are yellow fever, hydrophobia, and Hansen's disease (leprosis).

The agricultural products are varied and include rice, sugar cane, cotton, vegetables (grown mainly by Japanese immigrants), and diverse tropical fruits (citrus, mangoes, bananas, pineapples, avocados, papayas, etc.). Chickens are successfully raised now, as are turkeys. The bovine stock includes European stock, a Creole (local) breed, and, lately, a Zebu-cross.

The industries are mainly related to the primary local products: sugar, textiles, canning, wood, and natural gas and petroleum. Many foreigners are seen in the hotels, mainly Americans. The roads in the surroundings of the city are presently in bad condition; however, they are being widened and repaired. A Holiday Inn hotel is under construction.

Statistics:

Surface of Dept. Santa Cruz:	370 621 square kilometers
Population:	580 000 inhabitants
Center of city:	143 000 inhabitants
Peripheral area:	20 000 inhabitants

1. Discussion with the Comite de Obras Publicas (Committee of Public Works)

The Comite de Obras Publicas at 218 Warnes Calle, Santa Cruz, Bolivia, received the NBS/AID Survey Team on June 17. The Survey Team was received by Ing. Mario Foianini Lozada, the President of the Comite. The Comite is a government entity operating under the direction of the ministry in La Paz dealing with housing and urban development. It is supported by funds derived from petroleum production in the Santa Cruz area. Such royalties approximate $600 000 per month and are continually increasing as more petroleum is found in Santa Cruz. The organization's area of responsibility is the Santa Cruz area of some 350 000 square kilometers. The principal mission of the Comite is economic planning for the Santa Cruz area. Such planning covers public utilities, street development, industry development (includes locating and attracting industry into the area), and statistical analysis of population growth rate, etc., to be used as input to the planning process. The Comite also has arrangements with other ministries in La Paz for recruiting teachers, doctors, and nurses, and builds buildings for schools, hospitals, etc. The Comite does not maintain health facilities in Santa Cruz; these are operated nationally.

The Comite is a unique organization in that it was the first attempt in Bolivia to utilize regional economic planning concepts. There are now nine of these regional planning committees. The history of the Comite is interesting. In 1963, the ministry in La Paz concerned with housing and urban development was reorganized, and the Comite was established as an independent commission with powers to operate autonomously of the local government in Santa Cruz. The head of the Comite was appointed by the President and the task of planning began. In the words of Ing. Lozada, Santa Cruz was very "primitive" at that time. In 1968, a Presidential Decree established an investment policy in Santa Cruz using the royalties from petroleum in the area. As a result of this investment, Santa Cruz has progressed at a fast pace in the past four or five years.

The staff of the Comite totals 420, of which 182 are administrative, 73 are technicians (engineers, economists, etc.) with degrees, and 165 are laborers in the soil laboratory and the water works. The organization is divided into two sections, construction and planning, each having a supervisor who reports to Ing. Lozada. It is important to note that the Comite is basically a planning commission, and, as such, it contracts out the majority of construction work (about 80 percent). It also uses consultants from inside and outside of Bolivia to assist in its planning.

With the assistance of outside consultants, the Comite has established a seven-year plan. Basically, the city of Santa Cruz is subdivided into four rings, each with zoning codes and with city water and sewerage. There is publicly supplied water and sewerage up to the second ring at the present time. The major streets in the first couple of rings have been paved, and plans are completed to pave the various outlying spurs which intersect the rings. The present population of Santa Cruz is between 150 000 and 180 000. It is estimated that as many as 800 000 could be accommodated within the four rings without overcrowding.

Outside of the fourth ring, there are plans for an industrial park and for low income housing. Consultants were employed to help identify suitable industries for the area. About 15 to 20 were recommended - primarily industries that could take advantage of local products in the area. It is planned that these industries will receive government subsidy but not be controlled by the Government.

In the planning, the Comite has employed standards from the U.S. Occupational Health and Safety Administration. However, since there are no Bolivian standards which specify various codes for buildings, the engineers of the Comite write their own building specifications, submit them to La Paz for approval, and go out for bids once approved. This is a very important area where DGNT could provide assistance.

Other problems expressed during the interview centered mainly on a lack of skilled labor. Evidently, the growth of the gross product for Santa Cruz has been around 9.5 percent to 10 percent per year, which means that skilled labor will remain in demand for some time to come. The Comite has a program of providing scholarships to graduate students in the area of public planning. There do not appear to be any problems with the supply of water or with electricity for the immediate future.

The Survey Team was very impressed with the confidence and obvious competence of Ing. Lozada and his staff. The Comite is one example of a regional planning effort that has evidently succeeded in bringing greater prosperity to Santa Cruz through sound economic planning.

2. Visit to the Soil Laboratory and Public Water Works

After the interview at the Comite offices, the Survey Team visited the soil test laboratory and the water processing plant for Santa Cruz.

The soil laboratory is a small facility located on the site where cement is processed into paving materials for street construction. The streets are paved with hexagon-shaped units that are interlocking and are about 10 to 12 inches in diameter. The tests run on soil are for construction purposes and not for agricultural purposes. The laboratory also contained a cement test machine. It was a very straightforward process and no technical problems were noted.

The water processing plant is three years old. The equipment used is American and the standards used for treating water follow norms of the American Public Health Association, the American Water Works Association and the Water Pollution Control Federation. The laboratory, on site, samples water from all parts of the region on a daily basis. The tests employ two basic devices - membrane filters and a multiple tube device. The water in the region was stated to be of good quality in its natural state. The plant adds only 2/10 ppm of chlorine, which decreases to about 1/10 ppm at the point of delivery. The only technical problems mentioned involved pressure and volume transmission equipment from Control Data Corporation in the U.S. It seems as though the one-year service contract expired on the equipment some time ago and has not been renewed. The equipment is probably faulty due to lack of adequate calibration and maintenance.

3. Visit to Yacimientos Petroliferos Fiscales Bolivianos (YPFB)

The Survey Team visited the Planta de Gas, Colpa Petroleum Gas Plant, Colpa of YPFB on June 17 at Colpa, Santa Cruz, Bolivia. The gas plant, located in Colpa about 60 kilometers north of Santa Cruz, is one of the gas plants operating around the city. The Survey Team was received and briefed by Mr. Ricardo Rivera, supervisor of the plant.

The plant has been operating without interruption since April 1972. The gas produced is mainly exported to the Argentine through a pipeline, though some gas and oil are consumed in the area around Santa Cruz. The plant was designed by the Warren Petroleum Company, U.S.A., to meet U.S.A. standards such as API codes and ASTM standards.

The construction and fabrication of the plant was executed by YPFB, the owner of the plant, although the process equipment, machines, and instruments were brought from the U.S.A.

Natural gas mixed with oil and water is pumped out of 27 production wells located around the plant and separated and processed, producing 130 million cubic feet of gas and 5000 cubic feet of condensed oil.

The plant operates 24 hours a day with 3 shifts. The operating staff consists of 1 supervisor, 1 mechanic, 1 instrument specialist, and 13 operators. Standard operational procedures established by the YPFB are followed for the plant operation.

Although the legal metrological units in Bolivia are metric, all units and standards are normally those customary in the U.S. oil business such as barrel, cubic foot, pounds per square inch, etc. Rather strong traces of the Bolivian-Gulf heritage are observed in technology, workmanship and trade. The laboratory is equipped with a gas-chromatograph and other minor testing devices for routine operation of the plant.

Calibration services for the instruments and equipment are carried out by an instrument specialist, who was not present at the time of the visit. He has about 11 years of experience in the field. Lower stages of calibration are performed at the plant site, but higher stages of calibration have to be referred to master standards maintained by the Production Department of YPFB.

None of the crew, including the supervisor, have any kind of formal technical education, although all of them have some high school education. The supervisor has 16 years of on-the-job training and experience, mostly with the former Bolivia-Gulf operation. Most of

the crew are recruited from the vicinity of the plant, but no specific training program is established for their training.

4. Visit to the Azucarero Guabira

On June 18, the Survey Team visited Guabira, the first and largest sugar factory in Bolivia.

The sugar cane is crushed, pressed and washed. The residue is presently used as fuel, but in the future, part will be used for paper manufacture. The juice is bleached with sulfur dioxide and sedimented. The sugar is centrifugally separated, dried, sieved and packed. The yeast is dried and packed for balanced animal food. The molasses is fermented. The fermented solution is distilled and sold in two grades, as industrial and "pure" alcohol.

This plant, founded in 1954, belongs to the autonomous government organization, Corporacion Boliviana de Fomentos (CBF) which is also involved with other products in Bolivia, such as PIL (see pp. 5-6 and 49-50). The Azucarero Guabira seems to be the only one making a profit, which is used to support other CBF activities. For this reason, CBF has been unwilling to transfer the sugar factory to private hands. At present, CBF is reinvestigating its structure, and the question of private ownership of the plant will probably be raised.

The Plant Manager, Eng. Hector Justiniano Paz, with whom the Survey Team had a lengthy discussion, had not received the DGNT questionnaire. In the discussion, he and the Chief Engineer, Sr. Raul Suarez, volunteered the following information.

Production is limited by the plant capacity which will soon be expanded from 3000 to 5500 tons per day of sugar cane. A joint committee of cane growers, sugar producers, and the Government (CNECA)* determines the prices of cane and sugar, and some quality specifications for each harvest period. The sugar plant is active six months each year. The molasses is collected in tanks, so that the alcohol production can be kept active all year round.

The raw material is bought by the metric ton. Sugar for export is sold in units of 60 kilograms, while the internal market products are sold by the quintal, derived from the pound but now defined as 46 kilograms. The units are 1, 1/2, and 1/4 quintal.

The plant - driven by an old-fashioned steam engine - is quite obsolete, and in parts was not too clean. However, there is a control

*Comision Nacional de Estudio de la Cana y el Azucar

laboratory, and the raw materials, intermediates and final products are tested. The norms for final products are chosen according to the desires of the buyer. They are generally those used in the buying nation.

There are fairly complete procedures for checking the weighing of both incoming trucks and the packed sugar. For the trucks, two platform scales are calibrated with standard weights in different combinations; the two platforms are compared, and loaded trucks are sent outside for comparison with other stations. For the finished product, the firm has a higher precision balance for primary calibration.

The main concern and problem is the acquisition of machine spare parts which it takes one to three years to import; their stock of spares is worth over US$1 000 000!

The DGNT could provide calibration services in the acquisition of raw materials, the processing procedures for sugar and byproducts, and for finished products.

5. Visit to the Industria Textil Grigota S.A.

On June 19, the Survey Team visited the textile company called Grigota Santa Cruz. The President, Mr. Ewaldo Fischer Hertel, and the Executive Officer, Mr. Salimon Mastinguier, received the Team.

The firm was established in 1969 to meet the demand for sugar sacks and other types of sacks. When a change in policy by the sugar companies resulted in a switch to paper bags, the demand dropped from 6 million sacks per year to 2 million sacks per year. In view of this fact, the firm sought means of exporting sacks, and they have received orders for 800 000 from Chile, Colombia and Peru. It seems that this company has a problem developing a market that will enable a profitable operation to be maintained.

The company is facing a labor problem and has difficulty obtaining qualified personnel to run their machines. They have no problem in getting information of a technical nature and are guided by ASTM, but suggest the development of Bolivian standards for their products.

The raw material is plentiful and is of good quality. It may, in fact, be questioned why such good Bolivian cotton is used for the production of sacks while poor Ecuadorian cotton is made into shirts. There was not any specific quality control on either the raw material or on the finished product. To install a laboratory to test the product is not feasible within the financial structure of the firm.

There is no uniformity in the units of measure used. The metric system is used as well as pound, quintal, and others. The firm has a preventive maintenance plan to avoid a high frequency of breakdowns. They take no specific measures to avoid fires and have not installed safety equipment in production.

6. Visit to the University of Santa Cruz

The visit on June 19 to the University Gabriel Rene Moreno at Santa Cruz started at the old building downtown, where the Team was received by Eng. Oscar Alborta, Dean of the Faculty of Technology. The Team's mission was discussed with about 15 to 20 members of the faculty, and the party proceeded to the newer buildings of the university complex built in 1968-69, where the laboratories of biology, parasitology and animal anatomy were shown. They are said to be in the most advanced state of development.

The impression of this University was not favorable. Due to political reasons, the institution was closed for a year. No students were to be seen anywhere. The building has no central air conditioning and already shows signs of deterioration. The laboratories show little or no signs of practical use. The equipment is of Spartan austerity. Besides, moisture has apparently ruined a large fraction of new instruments, such as microscopes. A brand new Mettler balance is inoperative, and the manual is lost. No servicing whatsoever is available. Other instruments apparently were ordered for the wrong voltage or frequency. The staff does not appear capable of adapting such instruments.

There are, in summary, no indications that this University can at this time be regarded as a prime center for academic learning or applied research.

7. Visit to Textiles Orientales S.A.

The Textile Company Orientales is located at 1291 Beni Esq. Charcas, Santa Cruz. The Survey Team made its visit on June 20 and was received by Ing. Pedro Ventura Sole. The plant is small, contained in 1 building about 100 yards by 60 yards. It was constructed in 1968 and 1969 with private capital and receives no government subsidy. The total plant investment is some US$1 million. The principal product is cotton bags used for packaging sugar, flour, and rice.

The company employs 135 workers, 4 supervisors with technical degrees and 15 who are administrative. The plant uses 100 percent Bolivian cotton. There is no problem obtaining this raw material. The plant capacity is 160 000 to 180 000 bags per month. The equipment used in the plant is mixed British and American. The machinery is about four to six years old. Some of the equipment is very old and has been rebuilt. The plant manager explained that he is in the midst of replacing out-dated machinery with American equipment. There is a small laboratory in the plant with various test equipment such as a dynamometer. The tests conducted of tensile strength, etc., are very rudimentary, using norms which the plant has developed through experience. For example, the plant has established a single quality of fabric that can be used for sugar, rice and flour; all that is required is to vary the length of the bags. The manager keeps informed of technical literature such as the International Textile Club Publications. The plant has a number of small capacity scales used for weighing raw materials, etc., for quantity control. The plant calibrates its own scales. The plant also uses some laboratory facilities of its sister company in La Paz.

The plant has no temperature or humidity control and is planning to install such equipment as well as suction fans to remove cotton dust. Future plans are to go to automatic weaving machines and to expand the product line. However, this will take some time as it will require purchasing dyeing machines, etc.

The manager stated that he has some contact with DGNT to inquire of standards that exist. Also, the manager had a good understanding of the implications of standardization. The manager was in favor of standardization because he felt that it would give him a better basis for competition with others who are producing an inferior product and selling it for the same price.

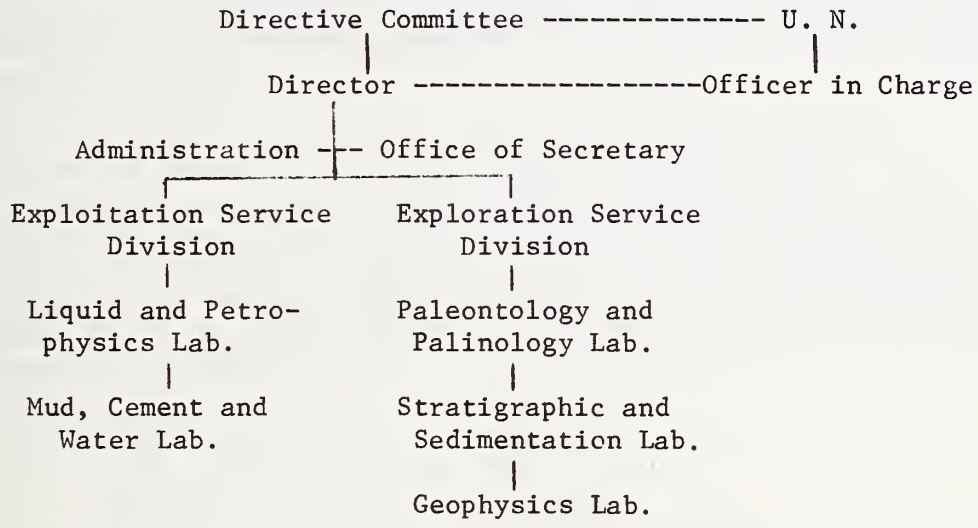
The manager stated that he has problems with replacement parts. He stated that it took about a year to obtain parts, and he did not have a good supply on hand. He also stated that he had some marketing problems because the sugar industry (which is Government operated)

decided to go to a lower cost paper bag which drastically reduced the demand for cotton bags from the plant. However, the industry has now changed back to cotton bags.

8. Visit to the Centro de Technologia Petrolera (YPFB)

The Survey Team visited the Center of Petroleum Technology (YPFB) in Santa Cruz on June 21.

The Organization Chart of this operation is of interest:



The organization was set up by the Government of Bolivia with the cooperation of the United Nations. It was financed by a government grant together with U.N. assistance for three years. It was to have started operations in 1966, but was delayed by prolonged negotiations over a proposed expansion, which was not approved. Thus, it was not until 1974 that the first phase of the initial proposal was completed. All the properties and operations of the unit will be placed under YPFB.

The principal function of the laboratories shown on the organization chart above is to assist the oil industry in the fields of exploitation and exploration. There is direct communication between the oil industry and the Center regarding implementation and practical application of the laboratory results. However, the relationship of the Center to exploration activities is not clear, inasmuch as these are conducted by foreign companies to which the Government has granted exploration concessions. The Center is increasing its capacity with a view to the future provision of these services.

The test equipment, machinery, and other instruments in the laboratories came from different countries, but the test methods predominantly make reference to U.S. standards and methods which are used worldwide by the oil industry.

Instrument calibrations are said to be carried out satisfactorily by the present staff, using instructions and standard reference materials supplied by the manufacturers. It should be noted that the Geophysics Laboratory is equipped with a Westinghouse 2500 computer. Records and other data are programmed by the computer.

The Center has 50 employees, including 18 engineers who have scientific degrees. Most of these engineers received their higher education in Argentina, Brazil, the U.S., and Great Britain.

The Center offers scholarships to university students in its fields of interest.

9. Electric Power Plant, ENDE, Santa Cruz

General Information

ENDE (National Electric Enterprise) was constructed in 1970 with a credit provided by AID. The plant has a nominal capacity of 13 MVA, and the maximum demand is near this figure. On the average, this plant has a constant demand for 12 MVA. The plant provides electric power to the city of Santa Cruz and the rural areas. The plant experiences two peak demand periods, one at night and the other in the morning.

The plant generates electric power which is distributed by a cooperative whose members are the consumers of the electricity. The distribution system was financed by the regional AID organization. An increase of the plant capacity to 22 800 kW will be financed by the World Bank. The AEG (Allgemeine Elektrizitat Gesellschaft) will provide the equipment needed for this purpose, having submitted the lowest bid. The plant expansion was necessitated by the following increases in demand.

Year	Increases
1970	68 percent
1971	30 percent
1972	20 percent
1973	15 percent

The rate of increase of demand appears to have declined. This is principally due to the saturation of demand at the present level of industrialization. It is expected that the demand will increase as the region becomes more industrialized.

The plant controls voltage within a range of $\pm$ 3 percent and frequency from 0.5 - 1 percent of the nominal values. The firm does not have the means to measure the amount of Diesel fuel supplied to them. It does have the capability of measuring the amount of natural gas supplied.

The electric power generation system in Bolivia is divided into three principal regions:

1. Central Region

In this region, the plants are principally of the hydroelectric type, Corani and Santa Isabel. A subsidiary in Cochabamba has several small plants. The regions of greatest consumption are as follows: the city

of Cochabamba, Oruro, and the mining sector. In addition to these plants, general electric power is provided by Bolivian Power and COMIBOL (Mining Corporation of Bolivia). These plants supply power to La Paz and Oruro and to the mining centers, respectively.

2. Eastern Region

In this area, ENDE provides all the electric power.

3. Southern Region

In this area, there are principally thermoelectric plants which are interconnected to permit an interchange of power.

10. Visit to the Industria de Ceramics MARGLA

The Survey Team visited MARGLA on June 21. This company is the largest producer of brick and tiles in Bolivia. They produce diverse types of brick, hollow or solid, floor tiles, and tubes for sanitary use. Their present production is in batch kilns, at 600 000 units per month. A continuous-process kiln, costing about US$250 000 is now being installed which will double the plant capacity. Demand, 90 percent from Santa Cruz, exceeds plant capacity. The group also talked with Andres Bruno, the proprietor of a ceramic plant which produces mosaic tiles for floors, and a former associate of MARGLA.

Both manufacturers believe that their procedures are basically sound; however, the work and particularly expansion of production are hampered by the lack of laboratories and standards. They feel that the soil laboratory of the Public Works Committee should be expanded to include testing of raw materials for this industry. In time, they also would like to have their own laboratories, inasmuch as the lack of local facilities makes it necessary for them to send 2 000 kilograms of clay to Italy for tests. The presence of local laboratory facilities would improve their production standards.

The managers of both firms would be very happy to receive technical information from the DGNT and to cooperate with the standardization committees. They stated that Bolivian standards should be adaptations of foreign standards. They observed that those standards which are very strict (for example, pipe porosity standards) could be prejudicial to Bolivian production. As an example, they affirmed that European standards, with fewer restrictions, are accepted in Brazil without disadvantage.

Just like other Santa Cruz companies, they have a very positive attitude toward standardization and suggest that the establishment of a regional office of the DGNT in Santa Cruz would be very beneficial.

VISITS IN THE LA PAZ AREA

1. Visit to Volcan S.A.

June 17, 1974, Dr. Beers, Dr. Vashrangsi, Ing. Paredes, and Ing. Mantilla visited Volcan S.A. where they were received by Mr. Erich Lenz, Electrical Engineer, Mr. Guillermo Pett R., and Mr. Alfred Kuser K., President.

The firm is a foundry, making castings of up to 2500 kilograms in iron, steel, and brass. The principal customers are middle-sized mining firms. There is a wide range of products, including church bells, pulleys, gears, brackets for water turbines, propellers, and even one statue.

The headquarters of the firm is in an antiquated building near the center of La Paz. It contains what appears to be ancient machinery and houses about 165 employees. We also visited a new foundry building near the outskirts of the city which is not in full operation because of the lack of heavy electrical equipment. At present, 35 workers are employed here, and eventually 65 will be employed. The firm will maintain its headquarters in the old building because of its convenience to customers.

The firm was founded in 1921. Employees are mostly sons of former employees and were trained by the firm as apprentices.

A laboratory is being set up in the new building. At the present time, many of the instruments are still in packing boxes, and the firm has no means of testing final products or raw materials. (Incidentally, their iron comes from Japan at present, and the foundry sand from Lake Titacaca). They operate solely "by experience"; yet they say they have few products rejected by customers.

They complain of increasing confusion over definitions of quantities and units. Since much of their business is making replacement parts for machines made elsewhere, they must work in both metric and customary units and often a mixture of the two. They seem to feel that DGNT is powerless to help in bringing order to the chaos.

Although they manufacture weights for scales, they have the capability of adjusting them only approximately, and they say there is no place in Bolivia which can adjust them properly. They consider this their most serious measurement problem. They say that volume of business is too small for them to consider use of computer controlled milling machines.

2. Visit to "Venado"

On June 17, Dr. Beers, Dr. Vashrangsi, Ing. Paredes, and Ing. Mantilla visited "Venado" and were received by Mr. Raul Hernandez, General Manager, Mr. Raul Cardenas, Sub-Manager, and Mr. Rene Beltran in the laboratory. The firm was founded 50 years ago as a distillery but is no longer in that business. In 1946, it started making industrial "Fleischmann's Yeast" under contract with Standard Brands. Since then, through further contracts with Standard Brands and Swiss firms, it has been manufacturing other food products such as Royal Gelatin, Royal Baking Powder, and Maggi dehydrated soups. The firm also imports Nestle Chocolate and dairy products.

They follow test procedures specified by the parent firms and are required each month to send samples of products for testing abroad to the U.S.A., Argentina, Brazil, or Switzerland, as appropriate in each individual case. Personnel are sent abroad for training as appropriate. The total work force is 90, 8 of them technical.

We visited the production facilities and what appears to be a well-equipped laboratory. Detailed production test records are kept to insure maintenance of quality. The laboratory facilities include a microscope for bacteria count of yeast, pH tests, a gasometer for checking baking soda, and numerous other instruments. The management works closely with various DGNT standards committees.

For weighing raw materials, they use scales certified once a year by the city of La Paz. They are checked also by intercomparison with laboratory scales. Packaged products such as gelatin are spot checked for weight on scales certified by the city.

The malt used for the yeast is obtained from Santa Cruz by truck.

3. Visit to Destileria Boliviana S. A.

On June 17, 1974, the Survey Team visited the Destileria Boliviana at Av. Chacaltaya 1258, La Paz.

The Team was conducted on the plant tour by Ing. Ernesto Duarte, the Chief of Production, and afterwards welcomed by the Public Relations Manager, Ing. Eduardo Valdivia. The plant was built in 1969 aiming for the production of 10 000 liters per day of alcohol. Owing to the limitation of the market, only 2000 liters per day are produced at the present time. Of the alcohol produced, 80 percent is used for production of whiskey and beverages and 20 percent is for industrial use. The company is licensed by the manufacturer in France (Marie Blizard) and in the U.S.A. (Bellows). It is a private enterprise, and most of the workers in the plant are shareholders. Therefore, everyone is said to work with full responsibility as one of the owners of the plant. At the present time, there are 50 full-time employees. Training is done by on-the-job training at the factory.

Crude alcohol is brought from Santa Cruz, and the alcohol is purified by fractional distilation. The column is composed of 65 horizontal plates which can separate the crude raw material into ethyl alcohol, methyl alcohol, acetone, etc. After fractionation, the alcohol is diluted to a strength of 60 degrees. It is mixed with ingredients and aged in oak drums for 1 to 1 1/2 months. The liquor from the drums is filtered and pumped into mixing tanks. The flavor is added according to the brands of the products. The finished product is refiltered and bottled manually, the amount of liquid fed in being determined by the level in the neck of the bottle. The finished products are Whiskey Special, Whiskey Bellow, Vodka, etc. Some products are sold under a D & B Brand; the others are under Bellow or French or other brand depending upon the licenses affiliated. About 60 percent of the products are exported to several countries of Latin America, Europe, and Asia, and to the U.S.A. Only 40 percent are consumed in Bolivia.

The water used for mixing is treated by ion exchangers which are automically controlled. Quality control is done by a laboratory which is equipped with facilities for chemical and physical analyses. Distilled fraction at a certain temperature, refractive index, color, etc., are determined according to the company's or parent company's standards. If the products do not conform to the specified standard, the manufacturing process must be stopped and the quality adjusted.

It was mentioned that the company is aiming at an increase of production for its present products and at adding new products such as cosmetics. Foreign markets are sought in many countries such as Germany, Australia, etc. The company has some difficulty in

competition with near-by foreign producers since the Government of Bolivia raised the export tax up to 18 percent. The internal market has problems of competition through smuggling and taxation, which includes production, sale and luxury taxes.

On June 22, Mr. Lonsdale, the General Manager of the Distillery, was elected President of the Chamber of Commerce. In that capacity, he was invited to the reception of the Minister of Commerce, Industry and Tourism on June 25. At that time, Mr. Peiser held a further discussion with Mr. Lonsdale, who was equally proud of his products and workers. They all owned shares in the distillery. The altitude at La Paz is a great advantage for a distillery.

4. Visit to Planta Industrializadora de Leche (PIL - La Paz)

The visit to PIL, La Paz, took place on June 18, 1974. Those participating were Dr. Beers, Dr. Vashrangsi, Ing. Prudencio, Ing. Quezada, Ing. Paredes, and Ing. Ozcui. The party was received by Ing. Alberto Catacora S., General Manager, and Kristensen Krausen Knid, a technical consultant from Denmark.

The plant is operated by the same organization that operates the PIL Plant in Cochabamba, but it is newer, having been in operation for only 22 months, and its financial support is less favorable. It has been financed by a loan from Denmark with a term of eight years and at a rate of interest that is higher than is paid on the loan to the Cochabamba Plant.

The products are also milk products, but, except for milk itself, there is a policy of avoiding duplication of products between the two plants. In addition to milk, the La Paz Plant produces cheese, yogurt, and DULCE DE LECHE. The latter is a sweet substance, tasting something like caramel but softer in consistency, used in cakes and other desserts.

At present, raw materials - milk, milk powder, and butter - are obtained from two sources: (1) World Food Program and (2) (more recently) from about 100 small producers on the Altiplano. The firm is starting to provide technical assistance to the independent producers in various ways. As part of this technical assistance program, they have a small garden on the site of the plant, where they are experimenting in growing various crops on small plots of ground.

In the long-range plan of the PIL Organization, a third plant at Santa Cruz is being considered. A goal is to make the La Paz Plant independent of the World Food Program in five years, obtaining raw materials only from its own independent producers and the Cochabamba and Santa Cruz Plants.

The La Plaz Plant packages milk in sealed plastic bags rather than bottles. Most milk is sold in one-liter bags. They have one small bag for individual servings that they are trying to sell to school children for b$1.50. To build up a market among children, they offer milk flavored with chocolate and with strawberries. Bags are dated. Samples are weighed from beginning, middle, and end of each run, but these measurements are probably meaningless because they are done on a scale of such low sensitivity that the one-liter bag gives a deflection of only one-twentieth or one-tenth of a full scale deflection.

They have two laboratory rooms, one for checking daily production and one for making long-range tests of products from the whole industry. Neither laboratory is fully equipped at present. Although they are working closely with DGNT, they are having problems with quality control, perhaps because the laboratories are not fully equipped.

The staff consists of 20 people, many of whom have been sent to Cochabamba for training. The manager has had training in Chile and Denmark.

5. Visit to Plasmar S.A.

The visit to Plasmar S.A. took place on June 18. Those participating were Dr. Beers, Dr. Vashrangsi, Ing. Ozcui, Ing. Paredes, Ing. Prudencio, and Ing. Quezada. The party was received by Ing. Edgar A. Heredia H., in charge of production, and others.

Originally, in 1966, the company produced plastic toys and then reinforced plastics for industry. After moving to the present plant, the firm changed to its present line of products: copper wire (bare and with PVC insulation), extruded plastic tubes, and corrugated polyester plastic sheets. One-half of the plant is devoted to wire production and the other half to plastics. This latter part is subdivided into portions for thermoplastics and thermosetting plastics. About 5000 square meters of floor space is available for production equipment. The firm is owned by Bolivian, Peruvian, and Swiss investors.

For the wire production, copper meeting ASTM standards is obtained from Bolivia and Peru in the form of laminating bars. Although in short supply, PVC has been obtained mainly through the friendly influence of a German scientist, who is interested in receiving data on the performance of PVC at high altitudes.

ASTM standards are used for copper wire. Two wire drawing machines capable of having wire pass through at 5000 feet per minute produce wire in all sizes down to AWG #32 starting from AWG #6. Diameters are measured to 1 mil by micrometers, but they would like greater accuracy. PVC insulation is tested by a spark tester. Electrical conductivity and tensile strength test equipment are on order. Experiments on the tin coating of copper wire are being conducted in the hope of producing telephone cable.

Rather complete laboratory facilities are available for testing the mechanical properties of plastic products. British standards for PVC tubing are used. Samples of tubing are sent to the Health Institute for tests of toxicity.

Tubing is sold mainly for mining and plumbing in buildings. Some tubing is sold for telephone installations, and some is exported to Peru.

The firm has 115 employees. Some have been instructed in quality control by DGNT. Most have had training on the site. A few have been trained abroad. There has been no close relationship with local universities, and the universities seem to have little interest in close ties except for finding summer jobs for students.

The plastics factory had an offensive odor similar to that generated when plastic material is sawed rapidly.

6. Visit to Drogueria INTI S. A.

The pharmaceutical product company, Drogueria INTI S.A., is located at Villa Loboz #1794 in La Paz. The Survey Team visited there on June 18, 1974. The team was received and guided on a plant tour by the Manager, Dr. Dietev Schilling. The plant was first built in 1948 with a small section, but as time went on production increased and the factory expanded. At the present time, the factory is a three-story building, each floor of which has an area of about 200 square meters. The raw material storage and animal cages are in another building on the opposite side of the street. The total number of employees is 250, 150 working in the factory and the rest in other buildings. It is noticeable that the workers on the production lines are women except in the maintenance and repair section. It was said that women are better than men for a neat and clean job in pharmaceutical production.

The manufactured products include aspirin and vitamins as well as inhaling ointment. The production processes are licensed from foreign companies such as Bayer, Hoercht, Brown and Nelson. Raw materials are bought from producers well known in countries like the U.S.A., Germany, and Japan. Most of the raw materials are ordered from Merk, Hoercht, ICI, Monsanto, Du Pont, Meiji, etc. About 70 percent of the materials are from Germany, 10 percent from the U.S.A. and Japan, and 20 percent from Bolivia. The water used in the process is treated by ion exchange and distillation.

Tablet products such as aspirin and vitamin C are made by mixing ingredients in a 2000 liter mixer, then the mixture is delivered to pelletting and wrapping machines. Liquid products are solutions of certain ingredients which are poured into containers of plastic or glass. The products are sold under different brand names depending upon the authorized license. There are about 350 kinds of products made and sold. During the visit, the Team saw the production lines of several products including Neurotonico, Deneumbron, Dexotone, Opixon, Mentisan, etc.

The equipment used in the production is rather old and most is manually operated. However, it is kept nice and clean. Since the market is small, production cannot be increased and automatic equipment is not suitable.

Quality control is carried out by sampling and inspection during the production process. Laboratory analyses are carried out. Properties such as pH, moisture, rotation angle of polarized light, etc., are determined. The methods of analyses are those specified in the pharmacopoeia. New medications are also tested with animals.

The company has a serious problem with glass bottles as they are green glass and vary in volume as we heard earlier in the beer brewery in Cochabamba. The competition in the market is serious since there are about 150 pharmaceutical importers in Bolivia. In addition, there is a great deal of smuggling of medicines into the country.

7. Visit to the Bolivian-American Tobacco Company S. A.

The visit to the Bolivian-American Tobacco Company took place on June 19, 1974. The party consisted of Dr. Beers, Dr. Vashrangsi, Ing. Garces, Ing. Prudencio, and Ing. Tardes. It was received by Lic. Napoleon Lopez. The firm manufactures cigarettes under license with Philip Morris. It sells under the trade names, "Colorado", "Kent", "Capitol", and "Big Ben". Most of the production is of "Colorado" cigarettes. The firm's sales are expanding rapidly, and at present it has 48 percent of the Bolivian market. There are competing firms in La Paz and Oruro. The production of "Colorado" cigarettes is 30 million a month. The firm is Bolivian owned. There are no exports.

Cut tobacco is received from the U.S.A. and Argentina, and filters are obtained from the U.S.A. Assembly and packaging is highly automated.

There is a laboratory for checking the quality of the product. Tobacco is tested for humidity. There is no test of filters, as these are assumed to meet U.S. standards. Numerous tests are made on completed cigarettes. Twenty are tested every week, and control charts of data obtained are maintained. Every month samples are sent to Philip Morris in Caracas and to the U.S.A.

There are 100 employees who are trained on the site. A 10 percent tax is levied on cigarettes in Bolivia. The firm complains of competition from smuggling.

8. Visit to RIBSA LTD.

The visit to Ribsa Ltd. took place on June 19. The party, consisting of Dr. Beers, Dr. Vashrangsi, Ing. Garces, Ing. Quesada, and Ing. Tardes, was received by the Manager, Jalucho Salome. The plant went into operation in 1967 and has 120 employees. It is primarily a knitting mill with a capacity of 50 000 pounds of fabric per month, 20 000 pounds of which are used by the firm to make garments, with the remainder sold to other textile mills in Bolivia. Threads of many different materials are used. Cotton is obtained from Santa Cruz. The synthetic types of thread are imported from abroad. Zippers made in Bolivia under the trade name "Inca" are used in many garments. Many of the products are manufactured under license of B.V.D. in the U.S.A., bear the B.V.D. label, and conform to B.V.D. specifications. Orders from abroad have been received, but limited production capacity has so far prevented manufacture of goods for export.

The knitting machinery has been imported from several foreign countries, but there have been no serious maintenance problems, as a skilled maintenance crew has been trained by the firm. The principal potential defect with thread is lack of continuity. Spools with breaks in them have to be eliminated by re-spooling. Garments are inspected at four stages in the production. If there is any non-uniformity in thread diameter, the effect is noticed by a non-uniformity of texture in the cloth, and it is rejected.

Scales are checked once a week. The firm complains of competition from smugglers.

9. Visit to Gomatex

The visit to Gomatex took place on June 19. The party, consisting of Dr. Beers, Dr. Vashrangsi, Ing. Garces, Ing. Quesada, and Ing. Tardes, was received by Abel Pacheco F. The firm, which went into production in 1966, manufactures a variety of rubber products, V-belts, conveyor belts, tubing, boots, gloves, and heels (but not tires). Its products are sold only on the Bolivian market. It has 25 employees.

It uses raw rubber produced in Bolivia and neoprene imported from Du Pont in the U.S.A. Chemicals are imported from Germany and the U.S.A. The machines have been imported from abroad. Maintenance of machines is the firm's most serious problem as there is no staff of adequately trained maintenance people, and it has not been possible to hire competent people. There is no proper training available.

The firm has a well-equipped laboratory for testing rubber products, and Ing. Garces of DGNT has used it for making measurements. There is close collaboration between the firm and DGNT. Formerly they used ASTM standards. Now they use IRAM standards from Argentina.

Sr. Pacheco, an engineering graduate of the University of Syracuse, said that his industry needs tariff protection to continue its existence.

10. Visit to the Cerveceria Boliviana National (Brewery)

On June 19, 1974, the Team was received at the National Bolivian Brewery and guided through the factory by Mr. Hans Hennig, the chief brewmaster. This factory was built 80 years ago, and it has been expanded as time went on. It has, at the present time, a total of 692 employees, of whom 442 are working in the manufacturing process. The production process is similar to that of Cerveceria Taquina S. A., which the Team visited in Cochabamba, except that the La Paz factory is about 10 times larger.

The total production is about 5.2 million liters per day, consisting of four kinds of beer, i.e., white beer, dark beer, centinario, and Pilsner. Normally the factory grows its own malt; however, there was a shortage of barley during the last three months, so the malt has been imported from Chile.

Production control of quality is carried out by sampling and laboratory testing. The extraction, germination and sugar content are determined for raw materials, and the finished products are tested for alcohol, carbon dioxide, residue, air, color, odor, refractive index and specific gravity. The company complains about the low quality of the bottles. Not only is their green color objectionable, but they are also too fragile. Breakage is as high as 20 percent.

Technicians are trained in Germany, and workers are trained at the factory. Technical problems and equipment maintenance are not serious. At the present time, the company participates in a standards committee at DGNT.

11. Visit to the Ministry of Social Security and Public Health

The visit to organizations under the Ministry of Social Security and Public Health took place at 0830 on June 20, 1974. The party, consisting of Dr. Beers, Dr. Vashrangsi, Ing. Lopez, Ing. Paredes, and Ing. Prudencio, was received by the Director, Dr. Luis Valverde Chinel. The tour of the laboratories was conducted by Dr. Antonio de la Reza.

The institution was founded in 1907 and moved into its present quarters in 1919. These quarters appear to be in the form of a large residence that has been converted to laboratory use, and various additions and outbuildings have extended the working space. The location is adjacent to two or three hospitals.

The NBS/AID Team was informed later that plans for a complete reorganization and expansion of the laboratories existed. Presently the organization is divided into a number of laboratories which appear to be almost too autonomous. It has three main functions: (1) diagnostics of contagious diseases (by laboratory methods), (2) bacterial studies of the transmission of diseases, and (3) preparation of vaccines and serums for use in hospitals. The detailed activities include the following:

Sanitary condition of food and water,
Production of drugs and vaccines,
Diagnosis of tuberculosis (through analysis of specimens),
Parasitology,
Biological diagnosis of various diseases,
Microbiology,
Analysis of domestically produced food products for nutrition content,
Control of medicines for purity, and
Vinology.

Some of the people come here for training in anticipation of being sent elsewhere (such as in the tuberculosis diagnosis project). Nearly all laboratory chiefs complained openly and at length of the lack of equipment and the lack of support or interest by the Government of which they are a part. The complaints, on the face of it, seemed justified. It was heart-breaking to see so many sincere and earnest - and apparently more or less well-trained - people try to carry out such important programs with equipment that is inadequate in quantity and obsolete. Except for two or three spectrophotometers, there was no modern equipment. In one laboratory, the centrifuge was operated by hand power (although there were motorized ones elsewhere). There is no library and no subscriptions to journals. The space for

experimental animals is inadequate. There were also some complaints of lack of staff. There was no glass-blowing facility there and said to be none in La Paz. The team saw some such facilities in Oruro. There were many people with doctor's degrees on the staff. Some laboratories had two or three. Many had studied abroad.

The nutrition work, between 1962 and 1972, had received financial support from an agency in the U.S.A. identified as ICND, and, as of 1962, it was well equipped. However, now that the grant has been terminated, there have not been sufficient funds to pay for replacement parts or expendable supplies, and several of the instruments are not operable. The head of the work, however, spoke of having had a number of papers published. The laboratory responsible for controlling qualities of food and water employs only three people. It is said to be the only one in Bolivia.

Some of the projects collect fees for their services. These are paid directly to higher authority in the Government and bring no direct benefit to the project. The U.S. practice of including an item of overhead as part of the cost and assigning part of the overhead to maintaining or updating the equipment seems to be unknown.

Rarely do the staff have meetings or lectures. While the people in the laboratory say that the equipment is in such short supply that rarely is it free, the visitor cannot help wondering if the existing equipment could not be shared more than it appears to be. Also, the visitor cannot help wondering if, in the face of inadequate support, the number of projects should not be reduced so that the surviving ones can operate at a proper level.

The projects concerned with the control of medicines and sanitary conditions for food and water appear to be the only ones concerned with standards. In the former, international standards such as those published by Merck are adopted although the lack of facilities often prevents any significant testing to see whether the drugs comply. Cooperation by the DGNT in these projects and in the general calibration of instruments would be appreciated. The DGNT questionnaire was not considered relevant and is not being filled out.

12. Visit to Manufacturas de Algordo SAID

The visit to SAID took place on June 20. The party consisted of Dr. Beers, Dr. Vashrangsi, Ing. Lopez, Ing. Cardona, Ing. Quesada and Ing. Tardes. The firm manufactures cloth and sells only to the Bolivian market. It carries out all processes from the spinning of raw material into thread to finished dyed or printed cloth. Ninety-nine percent of the raw materials are of Bolivian origin. Polyester is imported. Cotton is obtained from sources near Santa Cruz owned by the owner of the plant. The firm employs 1100 people who work in 3 shifts. It was founded 46 years ago. Most of the machinery has been imported. The firm has trained a staff of maintenace men for the machinery. There are four smaller competing firms. Raw material and intermediate products are weighed as part of the control of quality. The scales are checked periodically by an outside contractor, Fernando Zelada.

Some goods are "sanforized", and royalties of one cent per yard are paid to a U.S. firm (presumably CLUETT PEABODY). English units are used to specify thread or yarn, but finished products are specified in terms of the metric system. The firm is working with the DGNT on standards. The firm's most serious problems are social problems - those pertaining to management of personnel. The management feels that the labor force is inefficient, but Bolivian laws make it difficult to terminate the services of incompetent employees. This plant was one of several that have been visited in which there was a safety hazard through the existence of machinery driven by unguarded belts.

13. Visit to Empresa Nacional de Fundiciones (ENAF)

The tin smelting plant of ENAF, with mailing address Casilla #612, Oruro, Bolivia, was visited by the Survey Team on June 21, 1974, at 10:30 A.M. The party consisted of Dr. Beers, Mr. Peiser, Dr. Vashrangsi, Ing. Azcui and Ing. Montaño. The Team was received by Ing. Julio Penarrieta CH., Superintendent of Production, who explained the production process. Then the Team was conducted on a plant tour by Ing. Eduardo Fuentes U., the Production Engineer of the factory.

The plant is owned by the Government of Bolivia which started the operation in 1970. It has a total of 500 employees working 3 shifts a day. The plant has a production of 7200 tons of tin per year and 300 tons of alloy per year. An antimony extraction plant is being added. The majority of tin ore is refined abroad, mostly in the United Kingdom. The tin ingots have a purity of 99.9 percent. All products are exported to the U.S.A. and Europe.

Three grades of raw tin concentrate (the best is only 50 percent) are received from three different types of companies. The process involves roasting, reduction, dissolution and electrolytic refinement. Slags and residue from each step are recycled. There are many signs of technical and management problems, such as with electrode supply and quality of tin melting pots made by VOLCAN.

The laboratory for quality control is excellently managed and well equipped with modern instruments such as atomic absorption equipment, a polarograph, a spectrograph, etc., as well as wet chemistry facilities. A sample of each lot of raw material or finished product is analyzed by physical and chemical methods and the results compared. The report of analysis is sent to the main office in La Paz where determinations on quality control and similar management decisions are made. The U.S. manager greeted us very briefly. The technical production staff is credited with several innovations, but is not encouraged to undergo outside in-service training. The firm protects its know-how and presently receives no assistance from DGNT or the Institute of Investigations in Mining and Metallurgy. DGNT help in temperature measuring and weight scales calibrations would be welcome. Institute of Investigations in Mining and Metallurgy help in better quality and maintenance in tin melting pots is just one example of outside help that would benefit ENAF, but they do not appear very receptive to such assistance. During the Survey Team's visit to IIMM it appeared that this Institute was well informed about the interesting fractional tin evaporator plant of Russian origin, which is operating at ENAF but is as yet unproved. Bolivian industry will look to a progressive policy and expansion of this factory.

14. Visit to the Instituto de Investigaciones Minero Metalurgicas

At Oruro on June 21, the Survey Team visited the Institute for Mining and Metallurgical Investigations (IIMM), said to be the prime research institute in Bolivia. The field of work is certainly most appropriate for that country. Even in the absence of the Executive Director, Ing. Mario Paulsen T., and some other senior staff members, the enthusiasm and competence shown by the guides was most impressive. However, they were first to admit that IIMM is just at its beginning. A new building is badly needed and an ambitious one is planned a little way out of the city. With a portion of the building funds already available, a start on the first laboratory building is to be made this year.

Most important, however, is that by a recent decree of the Government all tin ore mined is to be subject to a 1.75 percent tax to be directly channelled into mining and metallurgical development, research and education. IIMM is due a large share of this fund. Thus, though today the library and most laboratories of IIMM are short of supplies and modern equipment, this state of affairs will soon change. Even with these present limitations, ongoing projects are well chosen, such as recovery of colloidal tin from water suspension to correct a significant loss in preparing tin concentrates.

The divisions of IIMM are too many to mention, but there is special strength in chemical analysis, ore separation, computer projects (IBM 1130) and economic feasibility studies.

A Survey Team member who had never worked in metallurgical or mining research summed up the impressions by saying: "In this Institute I would like to work." At any rate, it is an Institute with which NBS should keep in contact. The Survey Team left with sincere good wishes to IIMM.

15. Visit to the Technical University of Oruro

The visit to the University of Oruro also took place on June 21. The visiting party consisted of Dr. Beers, Mr. Peiser, Dr. Vashrangsi, Ing. Azcui and Ing. Montaño. The party first went to the Office of the Rector, Dr. Carlos Gutzman, where it was greeted by the Rector, the members of the Board of Regents, the Dean of Engineering and the Heads of the Engineering Departments. The Rector expressed the pleasure of the administration at the visit, and Mr. Peiser in turn expressed the pleasure of the party in being able to make the visit and its thanks for the cordial reception.

Then the party and many of the University staff went from the Rector's Office in downtown Oruro to the present Engineering Building some distance away. On the way, the Dean expressed his regret that the party's change in plans had cut out the Saturday visit. During this they had planned to show the new campus, which is 40 percent complete, and which is the first totally planned campus in Bolivia.

On arrival at the Engineering Building, the party was first shown the Mechanical Laboratory and numerous examples of the students' shop work. At one point, a speaker said, while standing next to three unclamped and unsupported tanks of compressed gases, that all safety regulations were enforced. Later, the goggles used in arc welding were observed to have cracked glass with portions entirely missing. Next, the party visited the electrical laboratory. The Professor of Electrical Engineering said that they had no standards of resistance or of voltage, except for meters, and the calibrations were assumed to be correct.

Then there was a meeting in the Dean's Office. Dr. Beers asked about plans of the Electrical Engineering Department. He was told that the Department plans to concentrate on power and has no immediate plans for instruction in electronics or logic circuits. However, later they hope to have a course on television. The Dean said that by a new decree of the Government, all exports of tin would be taxed 1.75 percent, the proceeds of which will go to the support of the University. Mr. Peiser expressed the hope that the University would send representatives to the Seminar in La Paz. The Dean said he expected two people would come. Ing. Montano explained in detail the objectives and plan of the Seminar. After taking leave, the party returned to La Paz.

16. Visit to the Ministry of Planning

On June 17, Ing. Donoso, Ing. Candia, and Mr. Peiser were received by the Minister of Planning, Ing. Sergio Otero Gomez, who was encouraging towards the Seminar and appreciative of the Survey. He was interested in the NBS guest worker program and gave instructions for plans to be made for Bolivia to use this opportunity. Persons of adequate technical background must be selected to benefit from such a long-term assignment to NBS.

Much more detailed discussions ensued with Dr. Armando Loayza, the Head of the Division for International Technical Cooperation. It is the task of this Division to coordinate all bilateral and multilateral technical assistance to Bolivia (amounting to about US$41 million per year) and to channel this cooperation into the priorities laid down by the National Council for Economics and Planning which had explained its "CONEPLAN" at an International Meeting in 1973, chaired and addressed by the President of the Republic, Gral. Hugo Banzer Suarez.

While greatly appreciative of the assistance given by USAID, Dr. Loayza had asked for a discussion in July with Mr. Oleson, the Director of the USAID Mission, with regard to the areas of concentration and the possibility of some support of industrial and standards work. Was perhaps the Survey and Seminar an indication of a change of emphasis by USAID? Mr. Peiser explained the concept of small regional pilot projects funded from the USAID Technical Assistance Bureau in Washington. The NBS/AID Team had come under such a project.

After further constructive discussion, it seemed unrewarding to plan an agreement directly with NBS, whose resources are limited. However, most of the work of NBS is open for all to see. If its results are of interest to DGNT and Bolivia, they would be gladly shared. Moreover, there were the standards literature and reference materials programs which would benefit DGNT without any further formality. NBS staff was always interested in discussing standards, measurements, alternative procedures and related technical choices. NBS stood ready to give some support in the areas of its expertise to programs of OAS, UNDP, etc. Dr. Loayza pointed out that the UNDP assistance with about 40 projects would become the most important technical assistance plan for Bolivia. Final signature of the DGNT project depended only on minor points still under discussion. At a later stage, it appeared that UNDP may be insistent that DGNT should have an ongoing test laboratory before the final go ahead is given. DGNT will soon meet that requirement.

17. Visit to the Ministry of Mining and Metallurgy

On June 18, Ing. Donoso, Ing. Candia, and Mr. Peiser visited the Ministry of Mining and Metallurgy.

Discussion concerned itself almost exclusively with the rich high-grade iron and manganese deposits near the Brazilian border east of Santa Cruz. Major Carlos Morales is in charge of this highest priority project, "SIDERSA". At present, a feasibility study covering modern mining operations and a steel melting and rolling mill complex for construction steel in billets, bars, conventional sections, and wire is being undertaken. The importance of analytical control is well understood. Alternative instrumentation was discussed and the supply of needed NBS standard reference materials through DGNT was offered and accepted with great appreciation by Major Morales.

18. Visit to the National Council of Higher Education

On June 18, Ing. Donoso, Ing. Candia, Dr. Beers, Mr. Peiser, and Dr. Vashrangsi were received by the President of the National Council of Higher Education, Ing. Miguel Tejada Velasco, who as a young petroleum engineer first visited NBS in 1950. The help he received with measurements and standards for the petroleum industry, he said, has remained in his memory to this day. He visited NBS again in 1965 and accepted Mr. Peiser's invitation to re-visit NBS at its new site in Gaithersburg when he is in Washington next July.

The National Council of Higher Education is a centralized institution under which all universities and practically all research institutions in Bolivia operate. The Year Book of the universities for 1974 is an impressive document. It speaks of the University of Bolivia with branches in La Paz (Mayor de San Andres, the largest), Sucre, Cochabamba, Chuquisara, Oruro, Potosi, Santa Cruz, Tarija, and Beni.

There is a large selection of courses, not all of which are offered at all campuses. A limited PhD program is being started next year.

Ing. Tejada was very receptive to having university laboratories and equipment put at the service of industry. A computerized listing of available facilities and instruments is presently being completed and will be made available to DGNT. In course work, greater emphasis will be given to measurement procedures and calibration; Ing. Tejada is considering the idea of sending a professor to NBS on a long-term assignment to prepare an advanced metrology course which he could then offer at the university upon return to Bolivia. The course would be structured to Bolivian needs in science and technology rather than to the most advanced work at NBS.

The student crisis in La Paz was, incidentally, finally settled with the appointment of a universally popular new rector.

19. Presentation of Standards Literature

On Wednesday, June 19, Colonel Miguel Ayoroa, Minister of Commerce, Industry and Tourism, received the standards literature presented to DGNT by the NBS/AID program in conjunction with the Survey. The Minister was clearly delighted and asked for summaries of the contents of many of the volumes, including especially the NBS collection on metrology (SP 300), the 33 volume set of ASTM standards, and the catalog of standard reference materials.

The meeting had full press and television coverage. All the DGNT staff were present to applaud. The atmosphere seemed almost festive, indicative of an inter-institutional friendship between NBS and DGNT that has been established.

20. The Organization of the Directorate General of Standards and Technology

Thursday, June 20, was largely devoted by Mr. Peiser to concluding the study of DGNT as an organization. Director Donoso and Ing. Garces patiently described detailed plans of the Laboratory Department. The other two departments are those of Standards and Technology. A common feature of all departments of DGNT is that 90 percent of the technical staff has received training abroad over at least part of the last 3 years.

The Standards Department, under Ing. Ronanth Candia G., started writing standards with a staff of six. Over a period of three years, the effort was increased. The outcome is the first catalog of Bolivian standards including especially standards on definitions and characterization. Over 264 experts and interested parties have contributed to the standards committees. The effort now was consciously being slowed down in favor of quality control procedures and surveillance which formed a central division of the work of the Standards Department.

The Standards Department, as well as the other departments of DGNT, emphasizes the importance of foreign contacts, not only with all similar institutions in Latin America, but equally in Europe with BSI, AFNOR, DIN, and UNES, and with such institutions as JIS and ISI in Asia.

The NBS/AID Survey Team, due to its mission, had far less contact with the Technology Department under Ing. Leon Mattes, which has R & D projects underway on 11 topics including:

a. Llama hair - the separation of thick and fine fractions is the central problem,

b. Direct reduction of iron ores,

c. Preservation and transport of tropical fruit,

d. Polymers derived from the heavy petroleum fraction; this work is being carried out in collaboration with YPFB,

e. Production and uses of compressed wood products, and

f. Growth and uses of quinoa - as a wheat substitute.

The Laboratory Department, under Ing. Carlos Duran Canelas S., was described on this occasion by Ing. O. Donoso T., assisted by Ing. Rolando Garces Perez and Jose Cortez, who had just returned from training in Peru. The equipment of the Laboratory consists essentially of US$40 000 worth of general equipment and chemical supplies purchased with Bolivian funds from Fisher Scientific. More specialized equipment is expected from the UNDP project which is to be signed on the pending establishment of a temporary ongoing DGNT laboratory. This will make two laboratory moves unavoidable, one of which will take place this year.

While the Laboratory Department is not fully active on its own ground, DGNT has been a welcome guest in other academic and industrial laboratories so that some testing work is in full swing. Moreover, the Laboratory Department has been engaged in compiling an inventory of existing laboratory apparatus and equipment in Bolivia with details of its environment, operating conditions, and possible availability for DGNT use. This list is complete for the La Paz area but the compilation was interrupted seriously for other areas by the NBS/AID Survey and Seminar.

The Survey Team gained the impression of excellent interdepartmental cooperation within DGNT, especially between the Standards and Laboratory Departments.

DGNT is well regarded not only within the Ministry under which it serves but also among academic and industrial leaders. Ing. Donoso serves on the important committee of the Academy of Science on the Technological Potentialities of Bolivia.

The closing and farewell celebrations headed by the Minister, Colonel Miguel Ayoro, were truly magnificent and deeply cordial. The outpouring of friendly feelings by all the staff to the most junior levels was genuine and an unforgettable experience to all participants.

21. Visit to the Physics Institute of the University Mayor de San Andres

Originally, Professor Manuelo Arellano was to meet Dr. Beers on June 26 and take him to the Physics Institute, the largest unit of the University of Bolivia. At the last moment, he telephoned to say that he had been called on to teach a class unexpectedly and could not meet until later. We had hoped to conclude the tour of the Institute (which is located up on a hill) and to have a conversation with the Acting Director, Ing. Ricardo Anda, and still have time to visit the main building of the University down in the valley, but because Ing. Anda was delayed, we did not have time to visit the main building. Similar appointment difficulties attended Mr. Peiser's visit on June 29.

Originally, the Institute was established to carry out cosmic ray investigations and to manage the Chacaltayo High Altitude Observatory. It has also done some ionospheric research under the sponsorship of NBS, and it would like support to reactivate this work.

The solid state work, the project upon which Arellano and someone named Guzman (who was out of the country) work with two or three students, started three years ago. Some of the work is in collaboration with the University of Campinas in Brazil, which has liquid helium facilities not available in La Paz. It is intended that the work will be in support of local industry. Attention has been concentrated on bismuth. The first year was devoted to library research, and from this year's work the publication of one or two review papers resulted.

Since then there has been some experimental work on the Hall effect and ultrasonic resonance. However, available single crystals have been too small to work, and polycrystalline samples were used. Also, no suitable magnet has been available for magnetic resonance, although one is on order.

The project needs information (and loan of equipment, if possible) on the following:

(1) Eddy current decay in bismuth,

(2) Training in the design of equipment for transfer of cryogenic fluids,

(3) Electron paramagnetic resonance, and

(4) Ultrasonic testing of materials.

At the present time there are four cosmic ray experiments in progress:

(1) Study of reactions of cosmic rays with nucleii by the photographic emulsion technique. This experiment is in collaboration with Brazilian scientists.

(2) Studies of the direction and intensities of cosmic rays in collaboration with scientists from Japan.

(3) Experiments in mines with an absorption equivalent to 300 meters of water - details unknown - in collaboration with the University of New Mexico.

(4) Correlation of neutron flux with sunspot cycle - an all Bolivian project.

In connection with (4), they were asked about possible correlation with the "Ottawa noon flux" (noise energy from the sun at 2800 MHz as measured in Ottawa), because radio conditions seem to correlate better with this quantity than with the sunspot cycle. They said they had never heard of this quantity. A promise was made to send data for the period July 1 to November 1, 1972, when there were big variations in all three.

Miscellaneous:

The Bolivian equivalent of a B.S. in physics requires seven semesters of study, and the equivalent of a M.S. degree requires nine semesters. However, the first semester contains only required courses and is common to all curricula, and, therefore, it is not listed under the individual departments. A course in quantum mechanics at the level of Schiff is required for the masters degree.

Professor Arellano had a potentiometer and standard cell. When asked how he got the standard cell calibrated, he said he did not, but he could check the consistency of his voltage measurements with Techtonix Oscilloscopes and digital voltmeters that are available.

APPENDIX I

NATIONAL BUREAU OF STANDARDS (NBS)
AGENCY FOR INTERNATIONAL DEVELOPMENT (AID)
GENERAL DIRECTORATE OF STANDARDS AND TECHNOLOGY (DGNT)

A Survey of Standardization and Measurement Services in Bolivia
(June 1974)

QUESTIONNAIRE

For Voluntary Use by Firms and Organizations to be visited

NAME OF FIRM OR ORGANIZATION_____

ADDRESS_____

P.O. BOX_____ PHONE_____

CHAIRMAN_____

EXECUTIVE OFFICIAL_____

AFFILIATED COMPANIES OR ORGANIZATIONS

PARENT_____ DAUGHTER_____

SISTER_____ NONE_____

PRINCIPAL ACTIVITY_____

NUMBER EMPLOYED:

FACTORY_____ NUMBER WITH TECHNICAL DEGREE_____

ADMINISTRATIVE_____

1. GENERAL INFORMATION

1.1. Within your production plan, does your Firm often face technical problems in:

RAW MATERIALS ☐
MANUFACTURE ☐
MARKETING ☐
AFTER SALES SERVICE ☐
OTHER (PLEASE SPECIFY) ☐

1.2. In what degree, has your Company access to technical literature?

GOOD ☐
SATISFACTORY ☐
INSUFFICIENT ☐

1.3. Technical consultation sought from:

UNIVERSITIES ☐
GOVERNMENT ☐
STANDARDS ORGANIZATIONS ☐
FOREIGN ☐
OTHER ☐

1.4. Has your Company any technical personnel specialized in:

	YES	NO
STANDARDIZATION	☐	☐
MEASUREMENT	☐	☐
QUALITY CONTROL	☐	☐

2. STANDARDIZATION

2.1. Does your Company keep relations of some nature with the office of the General Director of Standards and Technology (DGNT)?

TECHNICAL INFORMATION ☐
WORKING UP OF STANDARDS ☐
TECHNICAL ADVICE ☐
QUALITY CONTROL ☐
OTHER ☐
NONE ☐

2.2. What's the importance that your Company gives to the implementation of a general standardization plan in the country?

POSITIVE ☐
NEGATIVE ☐
NONE ☐

2.3. Within your production plan, does your Company use some technical standard?

IN THE WHOLE PROCESS ☐
PARTIALLY ☐
NONE ☐

2.4. In case of use of technical standards in your production process, please check which kind:

INTERNATIONAL STANDARD ☐
REGIONAL STANDARD ☐
BOLIVIAN STANDARD ☐
FACTORY STANDARD ☐

2.5. Standards used correspond to:

RAW MATERIALS ☐
PRODUCTS ☐
TEST METHODS ☐
UNITS OF MEASURES ☐
SAFETY ☐
QUALITY ASSURANCE CERTIFICATION ☐
CALIBRATION SERVICES ☐
OTHER ☐

2.6. Does your Company have active participation in some Committee of the General Directorate of Standards and Technology Standards?

YES ☐
NO ☐

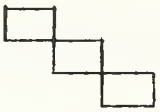
2.7. In case of participation in some Bolivian standard preparation in what degree has been used by your Company?

TOTAL ☐
PARTIAL ☐
NONE ☐

3. METROLOGY

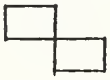
3.1 Does your Company have its own calibration services and/or test methods?

YES
SOME
NONE



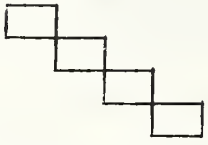
3.2 Is there any regularity in the use of a system of units during different steps of production?

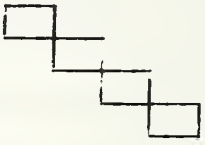
YES
NO



3.3 Is there any relation between the unit system used by your Company and the one used by:

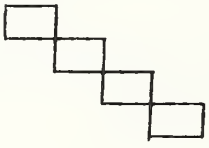
	YES	NO
RAW MATERIALS PROVIDER		
COMPETITIVE INDUSTRIES		
BUYERS		
GOVERNMENT		





3.4. What is the system used by your Company?

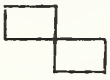
METRIC SYSTEM
ENGLISH SYSTEM
SI
OTHER



4. QUALITY CONTROL

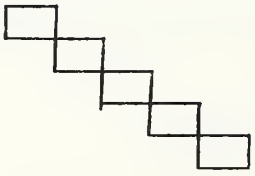
4.1 Is there a Quality Control Department in your Company?

YES
NO



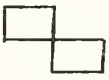
4.2. Is there any type of quality control in your Company products?

IN THE WHOLE PROCESS
IN SOME STEP OF THE PROCESS
FINISHED PRODUCT
RAW MATERIALS
NONE



4.3. Has your Company some problems derived from a lack of quality control in your products?

YES
NO



4.4. Is there any mechanism in your Company to solve consumer's complaints?

YES
NO

4.5. Do you carry out any type of research to improve the quality of your product?

YES
NO

4.6. For the quality control of your products, does your Company use some private or government laboratory in this country?

YES
NO

Comments

Some of the answers provided (such as 2.2) have little informative value since the expected answer is obvious. The questions could perhaps be rephrased. It appears that 1.5, 2.4, 4.1, 4.4, and 4.5 should be interpreted cautiously. In most cases, 4.4 may just mean that in case of complaints, the manager can be reached by telephone.

The following conclusions may be tenable:

1. All industries are based on European or American technology. Technical norms, if generated outside the enterprise, are international (2.4); in industries which use foreign equipment and/or have had direct foreign guidance, non-metric (English) units may be used (3.4) together with the metric units (SI is unknown). Technical consultations are mostly with foreign sources (sometimes equipment manufacturers).

2. Competition between Bolivian producers is not yet the most important factor in their progress. Many companies have virtual monopolies. Hence, most entrepreneurs feel that their technical problems are related to raw materials and the market (1.1), not to manufacture; only four feel that technical information is insufficient (1.2); norms are mainly of interest in reference to exportation (Andean pact, 2.4), and problems due to lack of quality control are seldom identified (4.3). Competition in several lines comes mainly from smuggled products. The difficulties in the market are summarized by the representative of Quimica Industrial Boliviana S.A.: "Unstable prices, due to smuggling and local home manufacture (of soaps), poor transportation system and changing costs of transportation".

3. Contacts with DGNT are essentially limited to the La Paz area (2.1, 2.6), and impact is as yet small (2.7). In particular, there is practically no contact with public enterprises!

4. If, as a consequence of the Andean pact, quality norms are used, this will have a beneficial effect in several areas of production. At the same time, however, in other areas where adjustment is difficult, the present deficiencies will become obvious.

SUMMARY OF ANSWERS TO QUESTIONNAIRE ON
NORMALIZATION SERVICES AND METROLOGY
BOLIVIA, June 1974

		La Paz	Oruro		Santa Cruz		Cochabamba		
			Pr.*	Pb.*	Pr.	Pb.	Pr.	Pb.	Totals
No. of Respondents			7	1	4	4	7	2	25
Question	Alternative								
1.1	1		5				5	1	11
	2				1		1		2
	3		4		3	3			10
	4		1		1		1		3
	5				1	2			3
1.2	1		4		2	2	1	2	11
	2		2	1		2	5		10
	3		1		2		1		4
1.3	1		1		2				3
	2		2	1	1	1			5
	3					1	1		2
	4		6	1	2	3	4	2	18
	5		2		1	3	1	1	8
1.4	1			1		1	1		3
	2					1		1	2
	3		6	1	1	4	5	1	18
2.1	1		2					1	3
	2		6				2	1	9
	3						1		1
	4		1		2				3
	5								0
	6		1	1	2	4	4		12
2.2	1		7	1	4	3	4	2	21
	2					1	3		4
	3					1			1
2.3	1		5	1	2	4	4	1	17
	2		2		2		3	1	8
	3								0

*Pr. - Private
Pb. - Public

Question	Alternative	La Paz Pr.	La Paz Pb.	Oruro Pr.	Oruro Pb.	Santa Cruz Pr.	Santa Cruz Pb.	Cochabamba Pr.	Cochabamba Pb.	Totals
2.4	1	4	1	3	4	5	2			19
	2									0
	3	1			1		1			3
	4	4		3	1	6	2			16
2.5	1	4	1	4	4	7	1			21
	2	7	1	4	4	6	1			23
	3	6	1	3	3	5	1			19
	4	4	1	2	2	5	2			16
	5	2	1		3	2	1			9
	6	2	1		2	1				6
	7	1	1		3		2			7
	8	1								1
2.6	1	6				2	1			9
	2		1	4	4	5	1			15
2.7	1	2				1				3
	2	1			1	1				3
	3	2		2	3	3	2			12
3.1	1	1		1	2					4
	2	4	1		1	3	1			10
	3	2		2	1	4	1			10
3.2	1	5	1	3	2	3	1			15
	2	2		1	1	4				8
3.3	1	4	1	2	3	5	1			16
	2	1		4	2	2				10
	3	4	1	4	2	2				13
	4	3	1	4	3	1				12
3.4	1	7	1	3	4	6	2			23
	2	3		1	2	1				7
	3									0
	4									0
4.1	1	7	1	3	4	4	1			20
	2			3		3				6
4.2	1	5	1	1	3	5	1			16
	2	4		1		1				6
	3	5	1	1	1	4	1			13
	4	3	1	2	2	5	1			14
	5									0

Question	Alternative	La Paz	Oruro		Santa Cruz		Cochabamba		Totals
			Pr.	Pb.	Pr.	Pb.	Pr.	Pb.	
4.3	1				2	2**			3
	2		6	1	2	2	7	1	19
4.4	1		7	1	2	3	5	1	19
	2				2	1	1		4
4.5	1		7	1	3		6		17
	2				1	2	1	1	5
4.6	1		4		4	1	2		11
	2		3	1		3	5	1	13

**Misunderstanding

APPENDIX II

ENCUESTA SOBRE LOS SERVICIOS DE NORMALIZACION Y METROLOGIA EN BOLIVIA

Programa

NATIONAL BUREAU OF STANDARDS

AGENCY FOR INTERNATIONAL DEVELOPMENT

DIRECCION GENERAL DE NORMAS Y TECNOLOGIA

PARTICIPANTES EXTRANJEROS

- Mr. William E. Andrus Jr.
  Director del Programa. Oficina de Ingeniería e Información para el Procesamiento de Normas . National Bureau of Standards. (NBS - USA)

- Mr. H. Steffen Peiser
  Jefe de la Oficina de Relaciones Internacionales del National Bureau of Standards. (NBS - USA)

- Dr. Yardley Beers
  División de Electrónica Cuántica - National Bureau of Standards - (NBS - USA)

- Mr. David E. Edgerly
  Oficina de Ingeniería e Información para el Procesamiento de Normas. National Bureau of Standards. (NBS - USA)

- Dr. Kurt F. J. Heinrich
  Jefe de la Sección de Microanálisis Superficial - División de Química Analítica - Instituto para la Investigación de Materiales. National Bureau of Standards. (NBS - USA)

- Ing. Raúl Estrada Albuja
  Director Técnico del Instituto Ecuatoriano de Normalización. (INEN - ECUADOR)

- Dr. Charoen Vashrangsi
  Jefe de la División de Ingeniería y Física. Departamento de Ciencias. Ministerio de Industria (Thailandia)

- Governor Wan Choi Ph. D.
  Oficina de Administración para el Avance de la Industria. Ministerio de Comercio e Industria. (Rep. de Corea)

- Mr. Ömer Göncü
  Director de los Laboratorios de Electricidad de Normalización de Turquía.

PARTICIPANTES DE LA DIRECCION GENERAL DE NORMAS Y TECNOLOGIA (DGNT - BOLIVIA)

- Ing. Orlando Donoso Torrez
  Ingeniero Mecánico
  Director General de Normas y Tecnología (DGNT-BOLIVIA)

- Ing. Ronanth Candia Gonzales
  Ingeniero Mecánico
  Jefe del Departamento de Normas
  Encargado de los Comités de Normalización:
  C - 5 : Maquinaria
  C - 28: Mecánica

- T.Q.Carlos Durán Canelas
  Técnico Químico
  Jefe del Departamento de Laboratorio
  Encargado de los Comités de Normalización:
  C - 7 : Química
  C - 9 : Productos Químicos para uso agropecuario.

- Ing. Freddy Quezada Rendón
  Ingeniero Agrónomo
  Jefe de la División de Elaboración de Normas.
  Encargado de los Comités de Normalización:
  C - 11 : Cueros
  C - 23 : Maderas

- Ing, José Paredes Oblitas
  Ingeniero Industrial
  Jefe de la División de Control de Calidad.
  Encargado de los Comités de Normalización
  C - 22 : Control de Calidad
  C - 24 : Caucho.

- Ing. Hernando Montaño Valle
  Ingeniero Metalurgista
  División de Elaboración de Normas
  Encargado de los Comités de Normalización:
  C - 4 : Metalúrgia
  C - 27 : Minería
  Comité COPANT C - 23 - Secretaría Técnica
  Estaño y sus Aleaciones

- Ing. Gregorio Bernal Yañez
  Ingeniero Industrial
  División de Control de Calidad
  Encargado de los Comités de Normalización
  C - 15 : Dibujo Técnico
  C - 20 : Higiene y Seguridad Industrial

- Ing. Hugo Moldes Ontiveros
  Ingeniero Industrial
  División de Elaboración de Normas
  Encargado del Comité de Normalización:
  C - 12 : Textiles

- Ing. Javier Mantilla
  Ingeniero Químico
  División de Elaboración de Normas
  Encargado de los Comités de Normalización :
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  Técnico Químico
  Departamento de Laboratorio
  Encargado del Comité de Normalización:
  C - 21 : Bebidas Alcohólicas

- Lic. Emilio Rivero
  Licenciado en Economía
  Jefe de la División de Transferencia de Tecnología.

GRUPOS DE TRABAJO

GRUPO A (La Paz)

1.	Mr. H. Steffen Peiser	(NBS - USA)
2.	Mr. W. E. Andrus	(NBS - USA)
3.	Ing. Orlando Donoso	(DGNT - BOLIVIA)
4.	Ing. Ronanth Candia	(DGNT - BOLIVIA)
5.	Ing. Gregorio Bernal	(DGNT - BOLIVIA)

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3.	Ing. José Paredes	(DGNT - BOLIVIA)
4.	Ing. Hernando Montaño	(DGNT - BOLIVIA)
5.	Ing. Javier Mantilla	(DGNT - BOLIVIA)
6.	T. Q. Rolando Garcés	(DGNT - BOLIVIA)

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2.	Mr. Ömer Göncü	(TURQUIA)
3.	Dr. Kurt F. J. Heinrich	(NBS - USA)
4.	Ing. Hugo Moldes	(DGNT - BOLIVIA)
5.	T. Q. Carlos Durán C.	(DGNT - BOLIVIA)

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1.	Dr. Yardley Beers	(NBS - USA)
2.	Dr. Governor Jong Wan	(COREA)
3.	Ing. Freddy Quezada	(DGNT - BOLIVIA)

ENCUESTA NBS/AID/DGNT

SERVICIOS DE NORMALIZACION Y METROLOGIA
EN BOLIVIA

PROGRAMA DE VISITAS

COCHABAMBA (Todos los participantes)

Lunes 10 de junio

Hrs. 8.30 PLANTA INDUSTRIALIZADORA DE LECHE (PIL - COCHABAMBA)
Productos Lácteos

Hrs. 13.30 FABRICA DE CALZADOS "MANACO"
Zapatos de cuero, goma y plástico, materiales de cuero.

Hrs. 17.30 Reunión Ordinaria.

Martes 11 de junio

Hrs. 8.00 CERVECERIA TAQUIÑA S.A.
Cerveza, agua gasificada, gas carbónico, hielo.

Hrs. 15.30 FABRICA NACIONAL DE CONSERVAS "DILLMAN"
Conservas de carne, frutas y legumbres
Fiambres, embutidos.

Hrs. 17.30 Reunión Ordinaria.

Miércoles 12 de junio

Hrs. 8.30 BOLIVIAN WIRE AND CABLE CO. S.A. "CABLEBOL"
Cables y alambres eléctricos

Hrs. 10.30 INDUSTRIAS "FEMCO" S.R.L.
Artefactos de iluminación eléctrica, materiales para instalaciones eléctricas.

Hrs. 14.00 FABRICA NACIONAL DE FIERRO ENLOSADO Y PORCELANA LTDA. "FENPO"
Artefactos electrodomésticos y artefactos domésticos.

Hrs. 15.30 QUIMICA INDUSTRIAL BOLIVIANA S.A. "QUIMBOL"
Jabones y detergentes.

Hrs. 17.00 SENDTEX LTDA.
Tejidos e hilados de algodón.

Jueves 13 de junio

Hrs. 8.00 EMPRESA NACIONAL DE ELECTRICIDAD "ENDE"
Planta hidroeléctrica de Corani

Viernes 14 de junio

Hrs. 8.30 YACIMIENTOS PETROLIFEROS FISCALES BOLIVIANOS "Y.P.F.B.",
Refinería de Petróleo y Planta de Lubricantes.

Sábado 15 de junio

Hrs. 7.00 COOPERATIVA BOLIVIANA DE CEMENTO "COBOCE"
Fábrica de Cemento.

Hrs. 17.30 Reunión de Conclusiones.

ENCUESTA NBS/AID/DGNT

SERVICIOS DE NORMALIZACION Y METROLOGIA
EN BOLIVIA

VISITAS OFICIALES

LA PAZ (GRUPO A)

Lunes 17 de junio

Ministerio de Industria, Comercio y Turismo
Secretaría del Consejo Nacional de Economía y Planificación.
Ministerio de Minería y Metalurgia

Martes 18 de junio

Ministerio de Energía e Hidrocarburos
Ministerio de Relaciones Exteriores y Culto

Miércoles 19 de junio

Consejo Nacional de Educación Superior
Academia Nacional de Ciencias

Jueves 20 de junio

Cámara Nacional de Industrias
Ministerio de Agricultura

Viernes 21 de junio

Ministerio de Urbanismo y Vivienda
Corporación de las Fuerzas Armadas para el Desarrollo Nacional.

ENCUESTA NBS/AID/DGNT

SERVICIOS DE NORMALIZACION Y METROLOGIA
EN BOLIVIA

PROGRAMA DE VISITAS

LA PAZ - ORURO (GRUPO B)

Domingo 16 de junio

Hrs. 11.25 Viaje Cochabamba - La Paz
Vuelo LAB 927

Lunes 17 de junio

Hrs. 8.30 FUNDICIONES "VOLCAN" S.A.
Repuestos y Accesorios para Minería e Industria en General

Hrs. 10.30 INDUSTRIAS "VENADO"
Productos Alimenticios

Hrs. 14.30 DESTILERIA BOLIVIANA S.A.
Bebidas Alcohólicas

Hrs. 16.30 UNIVERSIDAD MAYOR DE SAN ANDRES
Laboratorios de ensayos físicos y químicos.

Martes 18 de junio

Hrs. 8.30 PLANTA INDUSTRIALIZADORA DE LECHE (PIL - LA PAZ)
Productos Lácteos

Hrs. 10.00 PLASMAR S.A.
Plásticos para construcciones, conductores eléctricos

Hrs. 14.30 DROGUERIA INTI S.A.
Productos farmaceúticos

Hrs. 17.30 Reunión Ordinaria

Miércoles 19 de junio

Hrs. 8.30 BOLIVIAN AMERICAN TOBACCO S.A. (BATCO)
Fábrica de Cigarrillos

Hrs. 10.00 RIBSA LTDA.
Artículos de vestir

Hrs. 11.30 GOMATEX
Productos de goma

Hrs. 14.30 CERVECERIA BOLIVIANA NACIONAL
Elaboración de cerveza

Hrs. 17.30 Reunión Ordinaria

Jueves 20 de junio

Hrs. 8.30 MINISTERIO DE PREVISION SOCIAL Y SALUD PUBLICA.
Instituto Nacional de Laboratorios de la Salud.

Hrs. 14.30 MANUFACTURAS DE ALGODON SAID S.A.
Tejidos de Algodón

Hrs. 20.00 Viaje La Paz - Oruro

Viernes 21 de junio

Hrs. 8.30 EMPRESA NACIONAL DE FUNDICIONES (ENAF)
Estaño en lingotes

Hrs. 14.30 INSTITUTO MINERO METALURGICO
Laboratorios de investigación

Hrs. 17.30 UNIVERSIDAD TECNICA DE ORURO
Visita Protocolar a autoridades

Sábado 22 de junio

Hrs. 8.30 UNIVERSIDAD TECNICA DE ORURO
Laboratorios

Hrs. 14.30 Viaje Oruro - La Paz

Hrs. 18.30 Reunión de Conclusiones

ENCUESTA NBS/AID/DGNT

SERVICIOS DE NORMALIZACION Y METROLOGIA
EN BOLIVIA

PROGRAMA DE VISITAS

SANTA CRUZ (GRUPO C)

Domingo 16 de junio

Hrs. 13.45 Viaje Cochabamba - Santa Cruz
Vuelo LAB 917

Lunes 17 de junio

Hrs. 8.30 COMITE DE OBRAS PUBLICAS
Laboratorios de suelos y tratamiento de aguas.

Hrs. 14.00 YACIMIENTOS PETROLIFEROS FISCALES BOLIVIANOS (Y.P.F.B.)
Plantas de gas de Petroleo de Carandá

Martes 18 de junio

Hrs. 8.30 INGENIO AZUCARERO GUABIRA
Fábrica de azúcar y alcoholes

Miércoles 19 de junio

Hrs. 8.30 INDUSTRIA TEXTIL GRIGOTA S.A.
Fábrica Textíl de envases de algodón

Hrs. 14.00 UNIVERSIDAD GABRIEL RENE MORENO.
Laboratorios de Ingeniería Química, Medicina Veterinaria y Agronomía

Jueves 20 de junio

Hrs. 8.30 TEXTILES ORIENTALES S.A. (TEXORSA).
Hilados y tejeduría de algodón

Hrs. 14.00 YACIMIENTOS PETROLIFEROS FISCALES BOLIVIANOS (Y.P.F.B.)
Laboratorio de Investigaciones Petroleras.

Viernes 21 de junio

Hrs. 8.30 EMPRESA NACIONAL DE ELECTRICIDAD (ENDE)
Planta Termoeléctrica.

Hrs. 14.00 INDUSTRIA DE CERAMICA "MARGLA" LTDA.
Materiales de construcción y cerámica

Sábado 22 de junio

Hrs. 8.30

Hrs. 15.00 Viaje Santa Cruz - La Paz
Vuelo LAB 956

Hrs. 18.30 Reunión de Conclusiones.

ENCUESTA NBS/AID/DGNT

SERVICIOS DE NORMALIZACION Y METROLOGIA EN BOLIVIA

PROGRAMA DE VISITAS

POTOSI - SUCRE (GRUPO D)

Lunes 17 de junio

Hrs. 9.00	Viaje Cochabamba - Potosí Vuelo LAB 961
Hrs. 14.30	UNIVERSIDAD BOLIVIANA TOMAS FRIAS Visita a instalaciones

Martes 18 de junio

Hrs. 9.00	CORPORACION MINERA DE BOLIVIA Empresa Minera Unificada
Hrs. 14.50	Viaje Potosí - Sucre

Miércoles 19 de junio

Hrs. 9.30	UNIVERSIDAD MAYOR DE SAN FRANCISCO XAVIER Visita a instalaciones
Hrs. 15.00	COMITE DE DESARROLLO Y OBRAS PUBLICAS Visita personeros

Jueves 20 de Junio

Hrs. 8.30	FABRICA NACIONAL DE CEMENTO S.A. Cemento Tipo Portland
Hrs. 11.00	YACIMIENTOS PETROLIFEROS FISCALES BOLIVIANOS Planta de Refinación Mesa Verde
Hrs. 15.00	FABRICA CINTATEX S.A. Cintas, Cordones elásticos

Viernes 21 de junio

Hrs. 9.00	FABRICA CHARCAS GLORIETA S.A. Sombreros, fustes, cintas

Sábado 22 de junio

Hrs. 10.10	Viaje Sucre - Cochabamba Vuelo LAB 966
Hrs. 16.15	Viaje Cochabamba - La Paz Vuelo LAB 956
Hrs. 18.30	Reunión de Conclusiones

APPENDIX III

SUMMARY OF COMPLETED SURVEY ON STANDARDIZATION AND MEASUREMENT SERVICES IN BOLIVIA AND AN OUTSIDER'S VIEWS OF THE GENERAL DIRECTORATE OF STANDARDS AND TECHNOLOGY OF BOLIVIA

By: H. Steffen Peiser
National Bureau of Standards

I know you are wondering what ten strangers from far away countries with almost infinitesimal knowledge about Bolivia could possibly have achieved on the complex subject of standardization and measurement services in this country. I owe you some explanations about results and limitations of the NBS/AID Survey of Standardization and Measurement Services, although it is too early for a fully reasoned analysis about our conclusions and possible recommendations arising from them.

If the Survey is judged a success, it will be for two reasons. Firstly, there were the excellent preparations which Director Donoso and his colleagues have made. Activities were selected with unerring foresight of the points of interest and of the critical technical issues faced for Bolivia's progress towards its national goals in development. Secondly, we can record outstanding friendships and mutual confidence developed between the Bolivian and foreign participants from Korea, Thailand, Turkey and the U.S.A., coupled with the close cooperation which was given to us by virtually everyone of the more than 40 Bolivian organizations visited to discuss mutual technical problems and ways in which such problems can be overcome or alleviated by services provided by DGNT.

Perhaps the most striking of our impressions is an important contrast experienced by manufacturing and processing companies. On the one hand, they face a highly competitive market, serious problems of shortage of capital, an adverse tax structure, and sometimes illegal competition through smuggling across the long borders of Bolivia. On the other hand, the Bolivian organizations feel there exist sources of support and encouragement in technical matters.

We have identified eleven types of such channels of technical know-how, as illustrated in Figure 1. Not all these types of channels are or should be used by all companies, but each kind of channel we clearly identified in several organizations visited. Let me highlight just three of these types:

TECHNICAL INFORMATION LINKS IN SUPPORT OF SMALL MANUFACTURING AND PROCESSING ENTERPRISES IN BOLIVIA

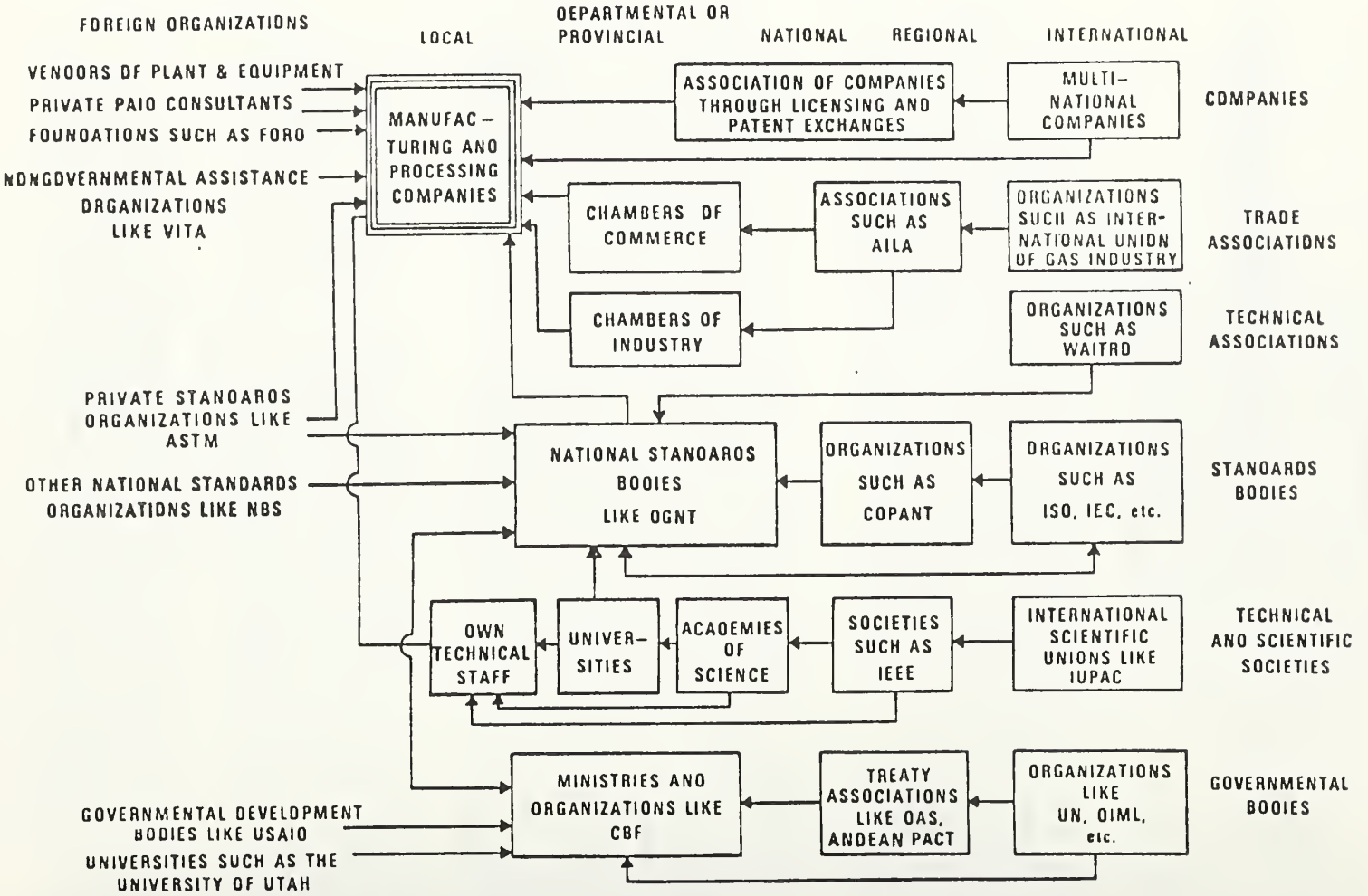

Figure 1

1) In the first type, know-how comes with the purchase of plant and equipment. The milk and cement industries, for example, obtain much up-to-date technical know-how in this way. Similarly with the procurement of laboratory equipment by institutions such as the Institute for Investigations in Mining and Metallurgy in Oruro, one obtains access to latest scientific developments. Here then is an additional argument for the purchase of the latest plant or equipment, a consideration not to be forgotten when making careful selections for applying all-too-limited capital funds.

2) Much technical information for companies comes from their own technical staff, obtained from continued contact with the outside professional world especially through technical and scientific societies. The Survey Team may well conclude that Bolivia would be well served by having national technical societies with activities in major urban centers for cross-fertilization of ideas between companies and universities. In addition, there should be more contact encouraged with regional and international societies coupled with in-service training both at home and abroad.

3) My last example of a type of technical support for companies concerns the channel through DGNT. Perhaps no other technical contact compares in importance with the potential usefulness to companies of DGNT services. Take technical information for instance. DGNT has access to enough technical information to overwhelm every technical man in Bolivian industry who is now dangerously starved of access to even the text-book literature. Director Donoso has discussed with us in detail how to channel the right information selectively to the right people, in the right places, at the right time and in the right amount. This crucial and difficult task presupposes close contact of DGNT staff with companies. From rapidly developing cities like especially Santa Cruz, it seems far to La Paz on the mountain. Let DGNT with its services never again be unknown to industrial enterprises in Santa Cruz. The Survey Team supports the request - or should it not be the demand - of that city for a DGNT man on the spot.

How then does the Survey Team view the services of DGNT to Bolivian industry?

1) As I have already mentioned, DGNT provides information services.

2) DGNT provides services to help in making correct measurements intended to govern the exchange of goods and delivery of services in trade and commerce. For example, many measurements can be improved by the use of standard reference materials, with which DGNT is in a unique position to assist. Maybe Bolivians do not care or do not realize that in the purchase of gasoline or cotton or cement they may receive one or two percent less than the nominal quantity. Even the manufacturer of weights complains that he has no way of adjusting the weights. Some purchasers of kilogram weights no doubt would prefer a light one to a heavy kilogram! Much more serious, and surely unsuspected by Bolivians, is the finding of Mr. Göncü, our team member from Turkey, that some small consumers with primarily resistive electrical appliances may pay about twice as much for their power as compared with users of primarily inductive electrical equipment.

3) There are quality control advisory services. These are to be described rather fully in a subsequent paper ("A National System for Certification and Quality Control in Ecuador" by Raul Estrada A., Session II, Paper 3). DGNT can also explain the desirability of introducing production controls at every production step.

4) DGNT operates a quality marking scheme.

5) DGNT provides test services through its own laboratories, the establishment of which is being given highest priority; and through a system of accredited laboratories in industry, research institutions, and the universities.

6) There are certification services for products especially for exports. I hope Ing. Cabrerizo will make some comment on this subject which is of special concern to the Andean Common Market region.

All these tasks place demands on DGNT and its staff for the highest technical competence, integrity, and devotion to duty. Mr. Chairman, the Survey Team has found these attributes in DGNT. The staff, in part through far-sighted training received abroad, is very well qualified. No other standards laboratory in an industrializing country is known to us as having been better staffed at its beginning.

However, I cannot escape from the duty of indicating the problems of DGNT as the Survey Team sees them. After all we have not come to Bolivia just to enjoy and to praise. We live in a hard world and good advice must include warning and anticipation. In this vein we should

make the following points although many are addressed to higher authority.

1) DGNT should cultivate great credibility and visibility in Bolivian industry, and should be cautious in attempting to direct quality control of companies like YPFB, the petroleum enterprise, in their field where they will always have the superior quality control know-how.

2) DGNT should activate quickly ambitious programs commensurate with its capable staff.

3) DGNT in its regulatory function must be careful not to interfere with the significant support services to industrial units. My point here needs an illustrative example to be understood.

   When the pharmaceutical and the brewery industry has a complaint about glass bottles, I am advocating DGNT should take the problem straight to the glass industry, not with a regulatory "stick", but rather with technical innovation and advice on how to cure color and volume uniformity problems of bottles without the plant closing and throwing its workers out of their jobs. Good quality and standards bring more work to industry. This is what DGNT is out to prove. Industrial scrap is a loss not only to the company but also to the image of DGNT.

4) DGNT, already active in support of other Ministries, should be given the opportunity to offer its knowledge of standardization procedures and measurement science to additional laboratories, for instance, the Health Laboratories.

5) As DGNT becomes more successful, it will lose more staff to industry. It should regard this not as a loss but as an opportunity and a healthy continuous process for the benefit of Bolivia.

6) DGNT should give high priority to building codes and safety standards to combat costly inadequacies.

7) DGNT might consider a limited project of listing the existence of maintenance capabilities and spare part supplies in the country, at least for instruments and laboratory apparatus.

8) DGNT, with collaboration of the National Council of Higher Education, should foster the teaching in Bolivia of quality control, standardization and measurement procedures.

The NBS/AID Team has collected a great deal of statistical information on the views of Bolivian industry which we have yet to analyze in detail. However, even before you see the results, you can feel encouraged. The great majority of Bolivian industry believes in the goals of DGNT and supports it. Consequently, the Survey Team believes that the future will see a more prosperous, self-reliant, technically competent Bolivian manufacturing and processing industry.

Mister Minister, by your invitation for an NBS/AID Survey Team to visit Bolivia, you have given us a great opportunity. It has been an unforgettable privilege to attempt to serve your country under the direction of Ing. Donoso. On behalf also of my colleagues I express our most profound gratitude.

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16. ABSTRACT *(A 200-word or less factual summary of most significant information. If document includes a significant bibliography or literature survey, mention it here.)*

A survey of standardization and measurement services available in Bolivia was carried out in June 1974 as part of a National Bureau of Standards program sponsored by the Office of Science and Technology of the Agency for International Development. The Survey Team included 4 NBS staff members, 3 third-country participants, and 11 leaders of technology and standardization in Bolivia. The Survey was made under the direction of Engineer Orlando Donoso Torrez, then the Director General of the Bolivian General Directorate of Standards and Technology.

After two days of joint activities, the Team was divided into three groups which visited various industrial, university, and government installations in the Cochabamba, Santa Cruz, and La Paz areas respectively. This report contains brief summaries of these visits and of the problems related to standards and measurements reported by the organizations visited. It also includes the results of a questionnaire distributed to most of the organizations visited in advance of the Survey.

A brief report of the conclusions and recommendations of the Survey Team is included in "Peiser, H. Steffen, and Marvin, Robert S., ed., Regional Seminar on a System of Standardization and Metrology for Latin America, NBSIR 76-988 (U.S.), 96 pages (1976)".

17. KEY WORDS *(six to twelve entries; alphabetical order; capitalize only the first letter of the first key word unless a proper name; separated by semicolons)*

Bolivia; measurements; quality control; standardization; testing facilities.

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