

FINAL REPORT  
Project P6014

ASSISTANCE TO THE MINISTRY  
OF INDUSTRY, LIBYA

for

Agency for International Development  
Contract No. AID/afr-151

IIT RESEARCH INSTITUTE

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FINAL REPORT  
Project No. 6014

ASSISTANCE TO THE  
MINISTRY OF INDUSTRY, LIBYA  
PLANNING AND IMPLEMENTING INDUSTRIAL DEVELOPMENT

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for

Agency for International Development  
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## FOREWORD

The IIT Research Institute has maintained a team of seven specialists assigned to the Ministry of Industry of the government of Libya under a contract supported jointly by the government of Libya and the Agency for International Development. This final report completes the reporting obligations under the contract AID/afr-151.

This report, summarizing the accomplishments of the IIT Research Institute team, was developed from the monthly and final reports that members of the team submitted to the Ministry of Industry and the USAID office in Libya. Thus, it incorporates the observations of each specialist relating to progress within his particular field of responsibility as well as the overall views of the effectiveness and problems encountered in this effort.

The Ministry of Industry must play a key role in developing industries and advancing the economy of Libya. The manner in which it fulfills this role depends upon the goals that are chosen and the effectiveness of its staff in achieving those goals. The IIT Research Institute team served with the Ministry of Industry during the period in which the goals were being formulated, and its influence upon the actions of the Ministry is reflected in the program being developed for the second five-year plan. Its real contribution can be fully measured in the years ahead when the programs that were instituted are accomplished.

  
Milton E. Nelson  
Research Advisor

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## I. INTRODUCTION

The Ministry of Industry has a primary objective within the Government of Libya to help the nation achieve a stable and growing economy. With the newly formed Ministry it was recognized that Libya lacked adequately trained, industrially oriented men to staff the Ministry and to provide all of the services that it should provide, and that it would be necessary to draw help from overseas to assist with these services and to provide training for a Libyan staff. Recognizing these needs, the Agency for International Development arranged an agreement with the Libyan Government whereby a team of specialists, selected to help the Ministry of Industry in some of the most important areas, would be jointly supported. IIT Research Institute was engaged to provide this help.

A three-way contract was entered into with the Government of Libya, the Agency for International Development, and IIT Research Institute, providing for a team of seven specialists to be assigned to Libya for approximately two years each and there work with the Ministry of Industry. This team would be supported by two man-years of backstopping by the Chicago office of IIT Research Institute. The members of the field staff would work with the Ministry as though they were employees of the Ministry of Industry and would sign a personal contract with the Libyan government comparable to those signed by expatriate employees. The work on the contract commenced January 11, 1964.

The positions to which the specialists were assigned represented the areas of activity in which it was expected that the Ministry of Industry would be most extensively engaged. The positions were originally defined as:

- Head of Industrial Programming and Planning Section
- Head of Industrial Production Section
- Head of Geological Section
- Head of Productivity Section

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Chemical Industries Specialist  
Plant Management Specialist  
Food Industries Specialist.

As the program proceeded, some changes in assignments were necessary to meet the changing needs of the Ministry. One of the specialists was named Head of the Laboratory Section, and the Head of the Industrial Production Section took the additional responsibility of Chemical Industries Specialist. Other specialists from Europe were contracted directly by AID for this program; a leather industries specialist, a building materials specialist, and a textile industry specialist. The Textile Industries Specialist became ill and left Libya. He was not replaced. IIT Research Institute offered to find another candidate through its European office. This was done, but no commitment was made.

One or more counterparts were to be assigned to work with each specialist in order to give assistance to the specialist in the performance of his work and at the same time to receive training in the application of these specialties. The unavailability of suitably trained Libyans made it difficult to fulfill this obligation. Where counterparts or assistants were assigned, many of them had too little training to be teachable. Sometimes the difficulty lay in the lack of understanding of the language.

Generally a good relationship existed between the specialists and their Libyan counterparts. The counterparts accompanied the specialists on field trips, served as translators, and arranged many of the details for visits and interviews. The Heads of sections usually had the Directors of these sections as counterparts who served as the primary contacts with the Undersecretary. Only one English secretary was available to the entire team most of the time. This arrangement was not adequate for the best performance of the specialists. Much of the required typing was done by the specialists at home.

The work of the specialists was oriented primarily toward the industries of the country, determining ways to help the existing

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industries, identifying new industries that might be established and making preliminary feasibility studies of them, studying ways to improve the climate for industrial development and encouraging the training of management and operators for the Libyan plants. Standards were promoted for improving and maintaining the quality and sanitation of Libyan produced foods.

It will require many years for the Ministry of Industry to develop the program and staff to fully support the aim of achieving and developing a stable economy. It is felt that through the services of the IIT Research Institute team some major steps have been taken in this direction. The groundwork has been laid for work in many areas. If the programs that have been initiated are followed through, significant results will be seen in a very short time. Unfortunately, with few exceptions, the Libyan staff is not prepared to carry on the work of the specialists and the Libyan government will have to hire expatriates to carry on the programs. IIT Research Institute would have been pleased to continue the program if suitable arrangements could have been made with the government of Libya.

This report sets forth the efforts that were made in the various sections of the Ministry of Industry and the accomplishments of the IIT Research Institute's team during their assignment in Libya.

## II. SUMMARY

Some very real accomplishments resulted from the work of the IIT Research Institute team working with the Ministry of Industry, Government of Libya, under the USAID contract. The team was able to fill many of the gaps that existed in the newly organized Ministry of Industry. As a new Ministry within the government, its program had not been fully developed, its Libyan staff was new and inexperienced. Its general objectives had been set forth, but the methods by which these objectives were to be met had not been clearly defined. The IIT Research Institute team gave support to the Libyan staff in the areas of weakness, helped them to gain confidence in themselves, and helped develop ways for the Ministry to attain its goals. A fairly substantial number of programs and projects were instituted under the direction of the IIT Research Institute team and several laws affecting the industrial sector of the country, to improve industrial standards, have been instituted.

The accomplishments were not attained without problems, frustrations, and disappointments. At times it would appear that projects were being approved and that immediate action would be taken to initiate the work. However, there seemed to be stumbling blocks to actual implementation. This was discouraging to members of the team, but can be attributed to inexperience, political and social considerations, and the reluctance of Libyan officers to take the responsibility for the commitments. As a result, many projects would remain inactive for several months. Some projects never were implemented even though they had been approved at one time. As a result, the IIT Research Institute team failed to see the majority of their projects implemented.

Even though the projects were not implemented, procedures were instituted within the Ministry by which project work relating

to existing and new industries might be accomplished. Only a few counterparts worked with the IIT Research Institute team and have profited from their association. As a consequence, only a limited number of Libyan technical staff trained by the specialist are working within the Ministry of Industry. The Ministry will have to rely on expatriate employees for a number of years to do the spade work for the establishment of new industries. It will still be necessary to contract with consultants to make feasibility studies and to set up the industries, preferably with "turn-key" plants. This procedure follows that used and recommended by the IIT Research Institute staff.

Facilities have been installed and programs initiated which will give impetus to the work of the Ministry, even though the IIT Research Institute team was unable to see the projects through. This is particularly true in the gas utilization program, in developing a petrochemical activity, and in the geological program.

The Ministry of Industry has planned to give help to industries that are already operating in Libya, both government and private, and to assist in the establishment of new industries that would aid the economy of the country. At the same time the Ministry is seeking to look after the interests and welfare of the people. The IIT research Institute team worked with the Ministry towards these objectives. The work involved a large number of tasks which included management studies, training, resource evaluation, evaluation of proposed industrial projects, management census of Libyan industries, laboratory research, development of industrial standards, review of new industry potentialities, legislation to encourage industrial development and upgrade plant facilities and operations, tariff regulations and a host of other factors. Although each team member was assigned to a specific area that would utilize his experience and training, he was called upon to undertake projects that extended beyond his areas. In some instances a whole team effort was required for a given project. The members of the team served on committees that often overlapped

several ministries and the specialists were frequently involved in the day-to-day problems of the Ministry.

The team was not without internal problems, most of which resulted from the fact that they were initially asked to work as individual consultants independent of other members of the team. They were then called upon to undertake tasks that overlapped the field of a fellow team member. This resulted in some jealousies and conflicts. The Ministry finally agreed to the appointment of a team leader who would reconcile these differences. As a result of these experiences, it is recommended that contracts that may be made in the future permit the assignment of a Head of party to whom all team members will be responsible.

Libya has been closely tied to Europe and has traditionally relied upon European consultants and contractors for the help it required. The relationship that was established between IIT Research Institute and the Ministry of Industry fostered an interest of the Libyan government in U.S. companies and consultants. U.S. consultants and engineering firms are now listed on the official bidders list and several U.S. firms have since been contracted for work in Libya.

In addition to the accomplishments that broadly affect the program of the Ministry of Industry, important project work has been instituted in each of the areas for which specialists were employed. Although these projects are reported in subsequent sections of this report, it will serve to review them briefly here.

Of all the industries considered for future development in the country, the industries which would have the greatest impact on the future of the country were identified as those that could be developed from the petroleum (gas and oil) and the mining industries. Libya has resources in both of these areas that are unexploited. The IIT Research Institute consultants worked with other groups within the government to organize a program to

evaluate the gas resources of the country. This effort culminated in an intensive study by the Institute of Gas Technology, a sister organization of IIT Research Institute. The Institute of Gas Technology made a comprehensive study of the gas resources and power requirements of Libya and recommended industries in which the gas resources may best be used for the benefit of Libya. This study has now been completed and confirms the views proposed by the IIT Research Institute team, that this is a resource upon which several major industries in Libya may be based.

The geological specialist was able to plan a program of extensive geological exploration. It was determined that there are untouched mineral resources which may be of considerable industrial interest to Libya. Six exploration programs had been contracted for by the Ministry of Industry at the time of the geologist's departure.

Aside from industries from these main resources, other new industries within the country may be relatively small, due primarily to the limited market within Libya. The possibilities of these small industries expanding materially through Magreb agreement are limited since the countries involved are endowed with similar resources, with Libya having few if any significant advantages. Yet, there are a number of industries which could be developed on a scale to meet the demand of the local market. The feasibility of these industries should be carefully evaluated to assure that they will be profitable within the Libyan economy.

The primary needs of current industries are better management practices and in many cases the modernization of antiquated plants. With such improvements most of the plants would be able to operate at a profit. In some cases the IIT Research Institute consultants have advocated the abandonment of some of the government-owned and operated plants.

Over 200 Libyan enterprises have been visited and evaluated for management efficiency, productivity, and technical competence.

Some plants meet more than the minimum standards. Others need management help--help in production techniques, in improving sanitation, and in manufacturing procedures. Remedies were proposed for government controlled industries and for private industries willing to utilize the help.

Feasibility studies were contracted by a U.S. consultant for four of the industries which were proposed by the team. Tenders have been received for studies on at least ten others.

A laboratory has been installed and organized as a nucleus of an industrial research center which can serve the interests of both government and Libyan industry. It was designed to undertake testing and technological research on new industrial programs as well as to help resolve problems of existing industries.

New laws formulated to aid Libyan industries through tax exemptions were administered by members of the IIT Research Institute team. Inspection and control functions were performed.

Proposals were made to simplify the procedures for licensing industrial firms.

Training courses, utilizing approximately 20 training films were developed for management people. The programs were not instituted formally because of the low level of education of management personnel.

Short courses were prepared and submitted to the Ministry to deal with some of the basic concepts of cost accounting, purchasing and stores systems, inventory control, materials handling, quality control and work simplification.

Sites were selected, tenders for equipment placed and construction was commenced on chrome leather tanneries in Benghazi and Tripoli. A nation-wide system of hide preservation and collection was developed to obtain hides from outlying areas of the country.

A plant was designed, machinery selected and a worker training program organized for a wool yarn spinning plant in Benghazi. This plant was integrated with a wool washing plant already in operation.

Design and specifications were made for a wool carpet and textile complex in Sebha.

The craft and arts center at Traghen was redesigned and a management program was planned for its operation.

Much attention was devoted to those food industries whose operating conditions were unsanitary and whose products were substandard. A law was passed requiring food processing industries to meet certain quality standard which forced the industries to improve sanitary conditions to meet them. The standards were developed by the IIT Research Institute team, and testing procedures were devised for the food industries laboratories.

Recommendations were made for study of more than twelve food industries. Tenders were issued for five studies, but only one had been awarded.

An interesting new date product, a date paste called "heart of date" was developed in the laboratory and tested by several food processors in the United States. Here, it received favorable acceptance. The process must be tested on a larger scale with pilot plant equipment and improvements made in the sanitation of the raw materials in order to put this product on the market.

The development of a mining law applicable to mineral resources of Libya was promoted. A lawyer, experienced in the development of mining laws was contacted, but to date no arrangement for drawing up the law has been made.

Publication of geological work in Libya was begun under the direction of the IIT Research Institute Geologist. These publications were intended to call attention to the mineral resources of the country and to encourage their development. Two had been published and eight were ready for publication when the geologist left Libya.

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The specific contributions of the IIT Research Institute team taken together account for a substantial advancement of the goal of the Ministry of Industry to improve the current industries and to lay the groundwork for establishing new, profitable industries within the country. The influence of the members of the team was even more far-reaching.

Regarding the progress of the Ministry as a whole it can be said with certainty that within the period of the IIT Research Institute contract that the Ministry has developed a much more experienced staff which is much better prepared to undertake responsibilities within the new Five-Year Plan for development within the country. Written reports from various Ministry officials leave little doubt that at least some part of this advance can be attributed to the expatriate presence in general and the efforts of the IIT Research Institute specialists in particular.

### III. REVIEW OF THE WORK OF THE IIT RESEARCH INSTITUTE TEAM

#### A. General

##### 1. Reporting Procedure

The work of the IIT Research Institute team covered most of the Ministry of Industry's activities. The members of the team were consulted and utilized to implement most of the programs that were undertaken. Monthly reports were submitted by each specialist, reviewing the details of his work. These reports were submitted to the Ministry and to the USAID office in Libya. Initially, the Ministry was reluctant to permit such reports to go outside of the Ministry and it was necessary to tailor the reports in a manner that they would not disclose proprietary information. Many other reports covering special investigations were made only to the Ministry.

##### 2. "Backstopping Services"

The Chicago Office of IIT Research Institute coordinated the work of the field staff and served as a reservoir of information upon which the field staff could draw to facilitate the work in the field. The services which the IIT Research Institute Chicago Office rendered included:

- a) Providing information on manufacturing processes, equipment, plant layout, costs, and specifications relating to industrial plants;
- b) Reviewing literature and giving up-to-date information on topics the field staff was considering;

- c) Selecting methods of analysis to be used by the field staff, especially in areas where information was not available in Libya;
- d) Gathering information on standards and specifications for manufactured products applicable to the industries of Libya;
- e) Making laboratory analyses of materials sent from Libya for which appropriate facilities had not yet been established within the Ministry of Industry;
- f) Purchasing equipment, training materials, books and library materials needed to equip the laboratory and library of the Ministry of Industry;
- g) Visiting the field staff and the officers of the Ministry of Industry to provide coordination of the work by personal association with the project. The project coordinator visited Tripoli twice during the contract period and spent approximately three weeks in Libya each visit.

The entire facilities of IIT Center, which include the Crerar Library, the Institute of Gas Technology, and the Illinois Institute of Technology as well as IIT Research Institute were utilized to serve the Ministry of Industry and backstop the IIT Research Institute field staff. The program involved the coordinated efforts of the entire organization and even drew upon information from IIT Research Institute's clients when necessary.

### 3. Field Activities

During the first months of the program, as a part of the orientation of the team, a special effort was made by the specialists to become acquainted with existing industries, the resources of the country, efforts that were being made to develop new industries, and the

policies of the government that would favor or hinder the establishment and operation of industry in Libya. An effort was made also to determine the objectives of the Ministry of Industry and the role that it would play in fostering industry in Libya and what it might do to give help and upgrade the industries that are already in operation.

After a period of orientation the team developed a list of industries which might have some chance of fitting into the Libyan economy. Subjects were then selected from this list and after approval by the Ministry, established as projects. The following list of forty-three such projects will give an idea of the variety of projects that were under consideration. These projects were each scheduled to pass through a preliminary examination, to be followed, in some cases, by feasibility studies, and in other cases raw materials studies to arrive at a determination of whether or not action should be taken to promote the industry for Libya.

- |                                      |   |
|--------------------------------------|---|
| 1. Glass Container Plant             | 13. Pharmaceutical Plant                      |
| 2. Clothing Factory                  | 14. Small Appliance Assembly Plant            |
| 3. Blanket Factory                   | 15. Set up Industrial Research Laboratories   |
| 4. Cement Plant, Homs                | 16. Tests and Standards                       |
| 5. Cement Plant, Benghazi            | 17. Research Library                          |
| 6. Lime Plant, Tripoli               | 18. Hides, Skins, and Wool Collecting - Nalut |
| 7. Lime Plant, Benghazi              | 19. Benghazi Industrial Estate                |
| 8. Cannery, Jalu                     | 20. Hides and Skin Collecting Project, Oasis  |
| 9. Fish Cannery (Tuna), Benghazi     | 21. Airborne Geophysical Mapping              |
| 10. Fish Cannery (Sardines), Tripoli |   |
| 11. Paper Products Plant, Benghazi   |   |
| 12. Animal Feed Plant                |   |

- |   |  |
|---|--|
| 22. Silica Ore, Jefren  | 34. Reduction of Power, Fuel, and Transportation Costs, etc. |
| 23. Gypsum Plant  |  |
| 24. Tripoli Tannery Expansion                                 | 35. Rug and Carpet Production Improvement                    |
| 25. Benghazi Tannery  |  |
| 26. Chemical Industry Complex                                 | 36. Current Evaluation of Possible Minerals                  |
| 27. Date Syrup and Fruit Cannery Complex                      | 37. Spinning Plant for Cotton Yarn                           |
| 28. Mapping, Sampling, Assay of Limestone - Tripolitania area | 38. Shoe Factory Improvement                                 |
| 29. Dehydration of Foods                                      | 39. Alfalfa Dehydration                                      |
| 30. Control & Inspection Exemption Certificates               | 40. Tragen Workshop Improvement                              |
| 31. Operating Manuals for Government Plants                   | 41. Construction of Gatroun Workshop                         |
| 32. Sebha Industrial Workshop                                 | 42. Kufra Iron Deposit                                       |
| 33. Industrial and Chemical Utilization of Gas                | 43. Experimental Gypsum Panels                               |

In those cases where a feasibility study appeared to be in order, tenders were called for and a number of consulting firms responded. Although in many cases a company was selected to do the work, the entire program seemed to stall at this point. Only four feasibility studies were contracted and six of the exploration studies were contracted. This relative inaction by the Libyan government discouraged many members of the team, even though they were occupied in many of the day-to-day activities of the government. It is hoped that this work will go forward in the future. Progress continued to be made on projects that could be carried on internally.

#### 4. Organization of Field Staff

The Specialist was responsible to the director of the section to which he was assigned, although in fact, the Director of the section worked as a counterpart to the Head of the section. Generally, the contact with the Undersecretary was through the Director of the section, but frequently presentations were made jointly by the Director and the Section Head, providing a direct relationship between the Undersecretary and the Specialists. In the latter stages of the program, the Head of Programming and Planning Section worked directly with the Undersecretary. Physically, the Head of a section and the Director shared the same office.

At the outset of the program, at the insistence of the Ministry, no Chief of Party for the IIT Research Institute team was appointed. Within a short time it became evident that this method of operation was unsatisfactory. The work was not being coordinated, and conflicts of interest within the team were not being resolved. After discussions with the Ministry of Industry, it was agreed to appoint a coordinator who would serve as chief representative of IIT Research Institute and who would coordinate the field work. At the same time he would serve as an arbiter of differences that developed among this staff. This arrangement improved the situation, but some of the early problems that developed were never resolved to the complete satisfaction of everybody. The joint efforts of the team are recognized in many of the accomplishments.

The review of the work of each of the Sections of the Ministry of Industry in which the IIT Research Institute specialists were involved is contained in the following pages of this report.

## B. Production Section

Dr. Laszlo Biritz, a chemist, was initially given two responsibilities--one as Head of the Production Section and the other as Head of the Laboratory Section. The installation of the laboratory was very time-consuming and required his full attention. Yet, the Production Section demanded a great deal of attention, as well. It was decided, therefore, to change responsibilities of some of the IIT Research Institute staff. Mr. Charles Schuh, who was initially appointed as Chemistry Industries Specialist was given the added responsibility of Head of the Production Section and Dr. Biritz was allowed to spend his full time with the laboratory. Mr. Schuh was well qualified for this work and his services in this capacity were appreciated by the Ministry of Industry.

The Head of the Production Section was deeply involved with projects related to existing Libyan industries as well as potential industries. This office became the focal point for all of the development projects that were being considered by the Ministry, whether they originated within the specialist staff or whether they were being proposed by domestic or foreign groups. Analyses of the projects were considered either by the Head of the Production Section or were assigned to specialists in other fields. Unfortunately, the Head of Production Section had no counterpart or qualified assistants to whom much of the work could be delegated and an opportunity to give training in this area was lost. Since the Head was also serving as a Chemistry Industries Specialist, it was necessary for him to handle directly all of the projects within the chemical industries, except where they might relate to the food or tanning industries. The Head of the Laboratories Section was often utilized to help in these areas.

The Head of the Production Section contributed heavily to the program of the Ministry of Planning in developing the parameters of the study of the utilization of natural gas which was conducted later by the Institute of Gas Technology. In relation to this study, reports were made on the following topics:

Energy Study - Economic Evaluation of Alternate Sources of Energy. May 23, 1965.

Utilization of Natural Gas in Libya. Aug. 25, 1964.

Natural Gas Distribution and Transmission Costs. October 3, 1964.

Program for Petrochemical and Chemical Industries Development. August 11, 1964.

Report on Continental Ammonia Project Proposal. May 11, 1965.

Mr. Schuh pressed hard to promote the development of natural gas in Libya. Power costs in Libya are extremely high. Such high costs discourage industries that may use substantial quantities of power. If the power costs can be lowered, the feasibility of several industries could be improved. There is at present a substantial market for liquified natural gas, LNG. A part of the natural gas diverted to this application would bring new income into the country.

Libya stands in a favorable position with regard to ammonia production. It has the natural gas raw material and energy source; it is favorably situated with regard to export market. Libya has capital for development and it has contacts with oil companies heavily engaged in petrochemical production and marketing, and to this extent has access to the necessary know-how to get started.

Ammonia derivatives, urea, ammonium sulfate, ammonium nitrate and other ammonia products are natural derivatives of an ammonium plant.

The composition of the associated natural gas in Libya could provide an almost "tailor made" ethane, ethylene and acetylene starting feed stock for the production of polyethylene and polyvinyl chloride as well as other acetylene and ethylene derivatives.

It is expected that the report of the Institute of Gas Technology will support and expand these observations.

Mr. Schuh proposed a concerted effort of all of the IIT Research Institute consultants, together with a specialist in the manufacture of gypsum products, to resolve the production problems of a gypsum plant owned by the government, which has not operated successfully since its inception. This effort had as its objective evolving a technically and economically feasible plan for the future of the plant. No action was taken on the proposal and the plant is still having difficulties.

Other government plants are also beset with difficulties in production as well as in operating at a profit. A date syrup plant was given assistance by the Food Industries Specialist, but at the same time experimental work on the development of a new product which incorporates the date meat in the product was carried out in the laboratory. The Chicago Office conducted some market evaluations of this product with food processors and found a great interest in date paste. This process must now be studied in the pilot plant and sufficient product produced for a good market evaluation. A new industry could result from these dates, which now are used for feed.

Two unprofitable plants beset with the problems of antiquated equipment were closed at the recommendation of the Head of the Production Section.

Another problem that has received consideration has arisen from the fact that several Libyan-produced products do not meet internationally accepted standards for such products. Specific cases are matches, tomato paste, macaroni, and canned fish. With the aid of the Chicago office and the Laboratory section, tests were developed to evaluate and compare the products. The Ministry of Industry could only call attention of the deficiencies to the manufacturers. Since no standards had been established, there was no way to force the manufacturer to meet the international standards. A report and recommendation "Quality Standards for Libyan Products" was made March 27, 1965, to the Ministry of Industry who was pressed to obtain a Standards Specialist to organize and manage a Tests and Standards Section.

Along with the issuance of minimum standards for various Libyan-produced products, it will be necessary to establish a system of enforcement of these standards. In any plan for establishing and enforcing standards, it is vital to get the cooperation of industry with government. Any system will break down if one obvious violator is allowed to operate without conforming to the established standards.

There are manufacturers in Libya who are as concerned about processing control as will be found in other areas of the world. Their plants maintain uniform and satisfactory quality. However, many of the smaller factories have obsolete machinery and some lack any form of control facility. Examples of these are the fish canning plants where poorly installed retorts and inadequate instrumentation and controls may lead to improper sterilization. Recommendations for improvements have been made in many cases, but very few have taken action to make the recommended improvements. It is essential to get the cooperation of industry to make any progress in this direction.

An investigation of the subject of cloud seeding was initiated as a result of a proposal by Airlibya. This subject was reviewed with the IIT Research Institute Chicago Office which obtained considerable up-to-date information on the subject and referred to several consultants in this area. A memo was prepared reviewing the findings and recommending the action to be taken. Any effort to seed clouds should be made only after the subject has been studied very carefully under the guidance of the most competent weather modification specialists. No action had been taken at the departure of the specialists.

The Tripoli City Gas Company had requested approval to increase its present gas supply and to modernize its operations. The Head of Industrial Production Section and the Head of the Laboratories Section participated on a committee formed to investigate the matter. The study, of about three months, resulted in the comprehensive report "Natural Gas and Energy Supply of Tripolitania." The final conclusion reached was that carburetted L.P.G. would be the most advisable and most economical system for the immediate future, with the ultimate conversion to natural gas whenever this became available to the city. Considerable data was compiled on the cost of conversion of household appliances in converting from the present low-caloric gas to natural gas of high caloric value. The present condition of the city gas plant and its operations will demand early action on this important matter directly affecting many thousands of residents and ultimately leading to a substantial reduction in the cost of city gas. No action has been taken on this matter.

Other projects reviewed were:

Olive Oil Refining Plant	Cement Plant
Sugar Beet Factory	Paper Products Plant
Esparto-grass Building Board Plant.	

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The Head of Production Section has suggested a few industries based on indigenous raw materials that have a definite potential in Libya, although all would be relatively small industries due to various limiting factors, principally the presently small Libyan market. Included among these industries are: olive oil, fats and oil products including castor oil, animal feeds, paper products including esparto grass products, glass bottles, and possibly other agricultural food products including beet sugar which is now being considered. There is also a potential for a leather tanning industry based upon local hides, and a textile industry based upon local wool.

The mineral potentials will be treated under the section of this report dealing with the work of the Geological section. However, it should be mentioned here that Libya has sufficient salt that it could be utilized as a basis of an electrolytic chlor-alkali plant. This would be a particularly important venture if the petrochemical program were to develop a polyvinyl chloride operation.

At this stage of development it is highly recommended that new industrial plants be contracted on a "turn key" basis; i.e., a contractor would build the plant and turn it over to the owner as an operating plant. The limited engineering capabilities dictate this plan for setting up new plants. It is generally more efficient and less costly in the long run.

### C. Laboratory Section

The Ministry of Industry wished to establish a research and testing laboratory in order to be able to better serve the industries in Libya. There were no laboratories to which industry could turn to evaluate and control the quality of its products, or to undertake studies for improvement of operations or development of new products. The industries had only limited facilities themselves, if any. There was a need for such a facility and the Ministry of Industry took the responsibility of supplying this service. It was intended that the laboratory would operate as a nucleus of a research center that would serve both government and industry on a broad scale.

Dr. Laszlo Biritz was selected as Head of the Laboratory Section and given the task of designing the research laboratories, preparing specifications for the laboratory furniture, supervising the installation of the laboratories, ordering the needed equipment and chemicals, organizing the stockroom, starting the library and initiating research programs that would benefit the industries of Libya. In addition he worked with the other IIT Research Institute specialists on problems in the chemical and related fields.

The laboratory was designed to operate within the basement section of the Ministry of Industry building in Tripoli. The furniture had to be designed to fit into the space that had been allotted. The Head of the Laboratory Section selected and prepared the layout for the furniture and the arrangements for the utilities. He also made the plans for the power, water, gas, and other facilities which would serve the laboratories. These plans were sent to Chicago where they were reviewed by several of the staff with competence in this field. Some modifications were incorpor-

ated into the laboratory plans as a result of this review.

The furniture was ordered directly from an American supplier who was able to accomodate the order in a relatively short time. While awaiting shipment, the rooms were prepared, facilities installed, and all necessary installations made to accomodate the furniture when it arrived.

A considerable amount of equipment and glassware is necessary to equip a new laboratory. While awaiting shipment of the furniture, the Head of the Laboratory Section developed a list of the basic equipment, glassware and chemicals needed by the laboratory. This list included only those items that were basic; it did not include that which might be needed for specialized laboratories. This special equipment for a food laboratory, a building materials laboratory, and such would be purchased when the special needs were required.

The home office reviewed the equipment lists and suggested modifications. The IIT Research Institute purchasing office then called for bids and placed the orders. Several suppliers were used in order to obtain the best prices for the equipment and chemicals. The amount of purchases exceeded the appropriation of A.I.D. for this purpose, so IIT Research Institute made an arrangement directly with the Ministry of Industry to make purchases from funds which the Ministry supplied.

As an adjunct to the laboratory, the Head of the Laboratories Section developed a library facility for the purpose of meeting the needs of the research work in the laboratory and of providing bibliographic data for the other sections of the Ministry. A list of needs--books and periodicals--was developed by the specialists and the supplies were purchased by the Chicago office of the IIT Research Institute.

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Several hundred books and a lesser number of periodicals were purchased. It will be necessary for the Ministry of Industry to maintain this library up-to-date if it is to be useful.

The procedure of selecting, purchasing, and shipping materials is quite time-consuming, especially when it is necessary to call for bids, as required for purchases of this magnitude. It was not until March 1965 that the first work was initiated in the laboratories.

The stockroom for the laboratories was organized in such a manner as to maintain a perpetual inventory of stock and to be able to account for the disposition of all of the equipment. A plan was proposed which would assure an adequate stock of chemicals and supplies so as to avoid unnecessary delays in the project work. The details of the plan are contained in a report to the Ministry entitled "Organization of the Stock Room and the Non-Stock Equipment and Chemicals--Related Procedures." Detailed procedures were developed for withdrawing materials, making purchases, and accounting for the use of the materials.

The organization of the laboratory had to be made flexible in order to meet the changing requirements of the Libyan industry. The limited demand for laboratory work by the various sections of industry do not at present demand a facility to accommodate each section. The laboratories were therefore designed to be as flexible as possible.

The industries which are presently in existence and can be foreseen in the near future in Libya fall within some general categories, which are largely the same categories in which the Ministry has organized its section of Industrial Production. These industries will have problems which the laboratories will be required to solve. Some of the problems will require only simple chemical or physical analyses and

others will require technological research which the laboratories should be prepared to perform. Some will be undertaken to improve the operations of existing industries and other studies will be directed toward the exploration of raw materials, the adaptation of existing processes to Libyan raw materials and the development of new processes, when necessary.

A laboratory, therefore, must have flexibility in both its organization and facilities to accommodate these situations. While various groups will be organized within the laboratories, there should be sufficient intercommunication and cooperation among the groups to permit the interchange of equipment and personnel, thus making the best use of both.

There are two quite different functions that must be carried out within the laboratory: analytical services and technological research. At some time in the future it may be desirable to divide the section into these two major categories, but for the present this is not believed desirable. It is considered better to divide the laboratory operations into the following groups:

1. Analytical

This group will serve the analytical requirements of almost the entire research organization. Routine mineralogical analyses will be undertaken here for the Geological Section. Water analysis will be made; industrial products, manufactured products, and resources will be analyzed as called for by the Production Section, by other sections, or by private industries.

The analytical group may be composed of several laboratories. Those that are considered important are:

- a. Chemical analytical laboratory
- b. Instrumental laboratory
- c. Physical testing laboratory
- d. Microbiological and foods laboratory  
(Initially, this was a part of the  
food research laboratory)
- e. Insect and insecticide laboratory  
(May also be part of the food research  
laboratory at the outset)

These are all listed separately because each requires somewhat different facilities and personnel trained in different specialties.

## 2. Foods Research Laboratory

This laboratory has as its basic function the technological research that is necessary to utilize resources in Libya or imported raw material to improve the food situation within the country.

This laboratory also conducts analytical studies on foods and biological materials. It should have full facilities for making microbiological tests, and tests for insect and pest residues in foods. It relies upon the analytical laboratory for insecticide residues and chemical contaminants that may affect the foods.

## 3. Chemical Industries Laboratories

These laboratories devote themselves largely to technological and engineering research in the chemical field. They review processes that might find application in industry in Libya. They look into the problems being experienced by chemical industries and undertake such research in the laboratories or pilot plants needed to resolve the problems. They carry out whatever research may be needed to adapt either raw materials or

processes to produce products acceptable to Libya or for export. They help to fill the gaps for experimental technical information needed for feasibility studies.

This group relies upon the analytical section for routine analytical studies.

Subdivisions within the chemical industries section consist of

Organic Chemical Research, Petrochemical Research

(This should remain as a single entity until there is enough work to justify separation into two groups.)

It involves research with materials of an organic nature such as essential oils, fats, soap, paints, varnishes, petrochemicals, and petroleum products.

Inorganic Chemical Research

This subdivision is involved with some of the basic industries such as soda ash, hydrochloric acid, sulfuric acid, and fertilizers. Very few of these industries are presently established in Libya.

Geological and Mineralogical Research

The work in this section of the Ministry initially encompasses studies in the field and surveys mineral resources. Samples are analyzed in the analytical laboratory. The results of these activities will establish feasibility of exploiting minerals resources.

The exploration will reach a stage in the future that methods of beneficiation and processing will have to be determined. At this stage the technological laboratory will begin to function.

Microbiology and Biochemistry Research

The function of this laboratory is being accommodated initially in the Food Research Laboratory. It is predicted that in the future this activity will extend beyond the realm of foods to industrial fermentations,

pharmaceuticals, waste disposal, and other industries. Plans should be made now for the day when this separate facility is needed.

#### Building Materials and Mechanical Industries

Two somewhat unrelated industrial areas are grouped together, but may be separated at a later time. Building materials research itself can be quite broad dealing with materials and structures. Because of limitations of raw materials in Libya, this activity deals largely with ceramics, cement, and natural building materials. This research activity may be subdivided as industry in this field grows.

Mechanical industries will have a place in Libya and will become evident when the industry pattern begins to fill in. Industrial development in this area could require considerable help from a research laboratory in the future.

#### The Organizational Plan

The head of the laboratories should have full responsibility for the operation of the laboratories under the direction of the Director of Industrial Research. The other sections should work through the head of the laboratories to solicit the work they want done. Usually the head of laboratories will take full responsibility. However, on occasion, a specialist from another section may be invited to participate in the laboratory project work.

Supervisors should be assigned to each laboratory when that subsection is activated. They will report to the head of the section and will have various grades of scientists and engineers reporting to a supervisor. Supervisors should serve as project leaders until adequate work is developed to assign scientists and engineers to this task.

The above discussion is intended to provide a basis for an organization that will permit the orderly operation of the laboratory. The separation of the Laboratory Section into specialized laboratories is based upon the special facilities and technical

disciplines that are needed for projects related to a given field. Some of the laboratories have been grouped for later separation when the need arises. It has been suggested that others not be activated until there is a demand.

A laboratory organization should be flexible so that it can be modified when the demand for services changes.

The Ministry of Industry is giving considerable thought and planning for future laboratories that would be of a broader nature and be a part of an industrial research center in Libya. The Head of Laboratories was asked to study this matter and give his views of the laboratory organization that might be suitable. His recommendations consisted of developing more specialized laboratories within the same general framework of the functions already incorporated within the present laboratories. The main laboratory groups would be:

- building materials laboratory
- textile-leather laboratory
- food chemistry and technology laboratory
- analytical laboratories
- geological and minerals laboratory
- project and pilot plant laboratory
- general research laboratories.

The analytical laboratory will be a service laboratory which will supply services to all other laboratories. Work would be expected to come to this research center directly from industries as well as from various government groups.

The planning of the work of the research laboratories has gone forward, but the execution of the plans has not progressed as well. This lack of progress has been due

primarily to the lack of a technical staff to carry out the work. An assessment of technical personnel in Libya revealed that there were very few people who had the capabilities to carry on the work of the research laboratories. Two technicians were responsible to the Head of the Laboratory Section, neither of which had the ability to carry on experiments without close supervision. Research programs for the laboratories or even analysis of materials had to be organized and often carried out by the Head of the Laboratory Section himself. This situation limited the amount of work that could be done. A number of Libyan students were being given training overseas, but only one was known to be scheduled to return to the laboratory. Students graduating from the University were called into service by the Ministry of Education and those who remained to be called to the Ministry did not usually have the qualifications or desire to work in the laboratories. They were usually assigned to other sections of the Ministry. The laboratories could not carry out the functions for which they were designed. As a result, the geological and other section had to send their samples to laboratories overseas for analysis.

It does not appear that the personnel needs of the laboratory can be accommodated by Libyans for several years. If the functions of the laboratory are to be carried on, it will be necessary to rely upon expatriate staff to fill the posts of the laboratory. To accommodate even the basic requirements, it would require bringing in at least ten graduate specialists and twelve experienced technicians. Libyan technicians would be interspersed in this group and would gradually replace the expatriates. It is visualized that a period of at least ten years would be required for this transition. IIT Research Institute has employed this procedure in other countries and successfully established

industrial research centers that are now satisfying the research needs of the country.

In spite of the limited personnel, progress was made on a number of interesting projects:

Analyses of geological samples.

Analyses of water samples.

Utilization of low grade dates.

Safety matches manufactured in Libya were evaluated, standard methods of testing them were instituted, and specifications for their standardization were prepared.

Several projects were conducted for the Food Industries.

Food plant sanitation studies will be treated more in detail when food industries are discussed.

Studies on gypsum were instituted.

As a consequence of the experience of the Head of the Laboratory Section in designing laboratories, the Ministry of Industry made its services available to the University of Libya to design and develop specifications for their new science laboratories. These laboratories will occupy a floor space of approximately 90,000 sq.ft. The design was completed and the laboratory specifications were prepared just prior to the departure of the expert.

The laboratories provide the basic facility around which to build an industrial standards-and-specifications program. An extensive investigation was made of this subject as it pertains to Libyan industry. Jointly, with other members of the IIT Research Institute team, a report Developing Industrial Standards, Specifications and Test Methods for Libya--A Comprehensive Report, was submitted to the Ministry of Industry for its consideration. This special report is reproduced in an Appendix to this report.

Considerable progress was achieved during the two years in which Dr. Biritz served as Head of the Laboratory Section. More project work could have been accomplished if more qualified technical staff had been available. Although Dr. Biritz decided not to remain in Libya, a competent man was provided by the United Nations as a replacement. He, too, will be handicapped until more staff can be made available.

The establishment of a laboratory is the first step towards an industrial research center which can be a significant element in improving the standards of Libyan industries and evaluating the feasibility of new industries.

D. Productivity and Industrial Management Section

Two specialists were assigned to this section, one Mr. Peter Bump as Head of the section, and Mr. Thomas Thornton as a productivity specialist. The activities of these specialists were so intermeshed that they are treated jointly in this discussion. The Industrial Training and Services Department of Ministry of Industry was made up of three sections: the Industrial Productivity and Management Section, the Industrial Training Section, and the Industrial Information Section. The Industrial Productivity and Management Section worked with industry, both private and government, to improve the standards of operation and to encourage new industries within the country. Some of the responsibilities of the consultants were as follows:

To give advisory assistance in the selection, purchase, installation and maintenance programming of machinery and equipment for industrial plants.

To provide assistance in setting up and operating of financial control systems in the government and private sector plants.

To provide assistance through productivity studies and recommend and assist in the installation of materials handling equipment, better work arrangements, work simplification programs, etc.

To recommend plant maintenance programs, especially for electric generating plants and industrial boilers.

To assist Libyan industrialists to negotiate contracts with foreign concerns for the supply of machinery, equipment, raw materials, service, etc.

To assist other Ministry departments by furnishing recommendations for the improvement of internal records.

To provide periodic inspection visits to government workshops in the desert areas of Libya, and provide supervision for construction and start-up of new workshops.

These tasks involve a wide scope of activities. In order to cover them adequately would involve a much larger staff than was available to this section. Progress with some of these tasks was rather limited during the two year period. In addition to the above responsibilities, the specialists were called upon to act on committees that treated problems both within and outside of their spheres of responsibility.

New laws were formulated in Libya for the purpose of aiding Libyan industries. The IIT Research Institute specialists sat on committees to administer these laws. Public Law No. 51 set up a control board for the inspection and control of those companies in possession of tax exemption certificates. The intent and purpose of the law was:

To give tax relief to existing local industry, so that the tax money normally paid into the government fund could be invested in improvement of plant and equipment.

To give Customs Duties exemptions to local manufacturers for raw materials, machinery and spare parts used in the manufacturer's normal operation, so that the manufacturer's products can compete with imported products.

To give Income Tax, Property Tax, and Customs Duties exemptions to new industrial plants to encourage growth and industrial development.

Only those companies which have Libyan capital investment, or have a combination of Libyan and foreign capital are eligible under Public Law No. 51. Plant inspections were to be made by the specialists two times per year.

An electric assistance law, also administered by the specialists provided that any new manufacturing plant or

any plant which has expanded its operations facilities may receive up to 1000£ per year for two years against the cost of connecting electric power to the plant building.

Any company wishing to do business in Libya has had to register for license with as many as four government offices and required six to eight months for approval. The Head of the Productivity and Industrial Management Section aided in developing a new industrial licensing law that would centralize all authority for licensing and registering of new industrial enterprises in the Ministry of Industry.

Inasmuch as one of the objectives of the Productivity and Management Section was directed towards the improvement of plant productivity, one facet dealt with training. In order to assess the training aspects that were needed, visits were made to over 200 Libyan manufacturing operations over the entire country. During these visits the character of the management as well as the production were evaluated. It was readily apparent that most of the plants were being managed by managers having no management training. Most of the plants were small and poorly operated. It was felt that the operations might be greatly improved if training programs could be instituted. In preparation for this, approximately thirty training films were acquired through the IIT Research Institute Chicago office. These films were to be used in training courses that would be given to management.

During the term of the IIT Research Institute specialists, they did not succeed in organizing formal courses for management. This was partly due to the difficulty of interesting management in these courses, partly due to the failure of the Ministry to resolve whether non-Libyan managers should be included, and partly due to the low

educational level of a high percentage of the Libyan management personnel. New graduates from the University must serve in government positions first. As a result, not many of the people with this training have yet reached the management ranks of Libyan industry.

As a consequence of this situation, the training effort has been informal and applied primarily to the government operated plants. Management training is important in Libya if Libya is not to depend upon expatriates for its management personnel.

Outlines of short-term courses (10 to 18 hours) have been prepared and submitted to the Ministry. These courses include the subjects of:

- 1) cost accounting
- 2) purchasing and stores systems
- 3) inventory control
- 4) materials handling
- 5) quality control
- 6) work simplification.

Programs of management advisory services for local businessmen were set up on an individual needs basis, but it was rarely possible to gain enough economic data to help the companies. This was due mainly to the reluctance of businessmen to reveal cost and price data to official government groups.

Although success in the training program was not as good as was hoped, better results were obtained with some of the government projects with which the Ministry of Industry was concerned. The IIT Research Institute specialists contributed to a number of projects represented by the following examples:

Sites were selected, tenders for equipment placed, and construction was commenced on chrome leather tanneries in Benghazi and Tripoli. Included was a planned and operating training program for workers and management personnel for the tanneries.

A plant was designed, machinery was selected, and a worker training program organized for a wool yarn spinning plant in Benghazi. This plant was to be integrated with a wool washing plant already in operation.

A costly and impractical citrus washing plant operated by the government of Libya was eliminated after careful analysis of the operation.

A program was developed for the centralization of date packing plants with appropriate collection and distribution systems.

Design and specifications were made for a wool carpet and textile complex in Sibha. This complex was planned to employ 150 workers.

The craft and arts center at Traghen was redesigned to give better working conditions and a management program was planned for this operation. The center at El Gatroun was similarly redesigned.

A system of hide collection from various centers throughout the country was organized. Instructions were issued to each of the centers to obtain proper treatment of the hides. Instructions were also given for proper methods of flaying to avoid cuts in the hides. This system will assure an adequate supply of hides for the tanneries.

Feasibility studies have been recommended for a blanket factory and a clothing factory.

An outgrowth of the inspection of many processing plants was the conclusion that there has been little control over food handling or food manufacturing as regards sanitation facilities for workers, medical examination for workers, inspection of product by health authorities, labeling, checking weights and measures, and food processing specifications and standards.

As a consequence the Productivity and Industrial Management section, together with the Food Industries specialist, offered recommendations for improvement. Recommendations were made as to types of controls that should be installed and where to install them. One of the drawbacks in putting the recommendations into effect is the fact that the companies lack trained personnel capable of following the instructions and insuring an improvement in safeguards for public health.

Detailed plans were developed for a small industrial estate in Misurata. Complete outlines of building units as well as specifications for buildings were furnished.

There are continual problems in the management of the government industries. It was proposed that an Industrial Holding Company, owned jointly by the Ministry of Industry and the private sector, be organized to operate these plants and any new industrial enterprises or projects that are under consideration and which are mutually agreed to be feasible or necessary to the national welfare.

Several programs have been initiated and others have been proposed by the IIT Research Institute Head of Productivity and Industrial Management Section and the Productivity specialist. It is anticipated that these programs will be continued and that eventually it will be possible to upgrade the management of Libyan industries and increase productivity.

## E. Food Industries Section

Food industries form a major segment of the industries of Libya. Their efficiency of operation and quality of product significantly affect the standard of living of the people. Some foods require no processing; they pass directly from the farm to the consumer. Others must be transformed to make them more acceptable to the consumer, or must be preserved in some way that will spread their consumption over the entire year, rather than limit their availability to the production season. As the standard of living advances, the consumer demands for more processed or convenience foods will increase. The food consumption pattern in Libya can be expected to show an increasing demand for processed foods.

Agricultural development and food processing go hand-in-hand. Because of the susceptibility of food to spoilage and deterioration, there are only a few products, such as those derived from grains, that do not rely on locally produced raw materials. Thus, plans for expanded development of the food industry are dependent on plans for agricultural and fisheries development. All other industries such as food handling, food storage, packaging, and canning are dependent on these.

Some industries that may be based on stable food materials such as wheat, beans, oil seeds and dried vegetables may be built around imported raw materials. With the increasing population in Libya and the withdrawing of farm land from production, the food industry will have to look more towards imported raw materials for its expansion.

The IIT Research Institute Food Industries specialist, Mr. Le Roy Binder, sought to assist the food industry in Libya within the above terms of reference. His efforts

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were directed towards helping the established industries and toward identifying new areas for food industries development.

Before any suggestions could be made for improving or expanding enterprises within the food industry, it was necessary to visit the industries and become acquainted with their problems. The IIT Research Institute Food Industries specialist attempted to visit all the food processing industries in Libya, both large and small. These included date packing plants, macaroni and paste manufacturing plants, dairy plants, tomato processing plants, soft drink plants, grainaries, candy manufacturing plants, slaughter houses, soap plants, bakeries, wineries, vegetable oil plants, farms and agricultural experiment stations. Such factors as sanitation of operation, management, efficiency and productivity were observed. A number of clean and well operated plants were observed. Others were of such poor condition that they should not have been operating.

One of the chief problems in the food plants was the failure to maintain sanitary conditions. It was decided that if help could be given to improve sanitary conditions of operation, a major contribution could be made to the food industry.

Sanitary processing conditions are essential to the production of good, healthful food products. In some food industries a little laxity in maintaining sanitary conditions may lead to severe outbreaks of food poisoning. The food may be contaminated with mold mycelia and insect parts unless conditions are maintained strictly sanitary. Some food poisoning outbreaks occurred while the IIT Research Institute team was stationed in Libya.

Some progress was made towards creating an awareness to the importance of maintaining sanitary conditions and proper processing conditions for foods. A law was passed dealing with food plant safety, sanitation, and food quality standards. The law required the food processing industry to meet certain quality standards or face the closure of the plant. One tomato packing plant was closed because of its failure to conform.

The standards to be followed were developed by the IIT Research Institute Food Industries specialist. Working with the Chicago office, standards utilized by the United States and Canadian food industries were accumulated as a basis for formulating the standards for Libya. Standard methods of analysis and detection were prepared for the Ministry of Industry food research laboratories and the products were analyzed in these laboratories. The tomato processing industry and alimentary pastes industries were the first for which standards were established and to which the new law was applied.

It was attempted first to obtain the participation of the industries in setting the standards. This effort was partially successful and the standards were then imposed on the industries. The standards are no more stringent than in other countries and it will be easier to export the products if the standards are complied with. The new law for standards was resisted by many of the industries affected and the company whose plant was closed brought suit against the government.

It is going to require drastic changes in operating conditions if many of the food processing plants are to comply with the standard requirements. In the long run these changes will improve the product, result in fewer rejections, and save money for the farmers and processors.

Unfortunately, the processors seemed to have no interest to utilize the services of the IIT Research Institute specialists, working with the government, to improve their operations.

The Standards must be extended to all food products if the law is to be applied to the entire food industry. A competent technical staff must be developed for the operation of the food industries laboratories.

The survey of the food industries revealed that very few of the plants had any control facilities and had no way of judging whether or not they were conforming to standards. Since it is unlikely that the plants would install more than the minimum requirements for control, the IIT Research Institute Food Industries specialist, together with the Ministry of Industry officers, decided that the food laboratories should be equipped to give maximum service to those industries requesting assistance. As a result the specialist applied much of his time to developing the laboratory. The laboratory personnel were untrained, so the methods of experimentation had to be so detailed that a person who was able to read could carry out the experiments. Accordingly, a laboratory manual was developed by the consultant to cover the experiments to be performed in the analysis of those foods for which standards had been established. Laboratory training was given to those few Libyans assigned to the food laboratory so that they could carry out the basic tasks under close supervision. The laboratory was badly in need of a much better staff that would be able to carry through with the responsibilities after the IIT Research Institute specialist left.

Some of the tasks accomplished by the food laboratory have been:

Analysis of domestic tomato paste  
Comparative quality of Libyan and  
Italian tomato paste

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Bacteriological survey at Mansura  
Canning Company  
Analyses of domestic macaroni products  
Uniformity of macaroni  
Ash content of domestic alimentary pastes  
Examination of canned sardines samples  
for possible food poisoning contamination  
Quality of Tahina (sesame seed paste).

The inflationary trend was causing concern in Libya. The Ministry of Industry was interested to know to what extent food prices contributed to the overall price increases. The Food Industries specialist was asked to obtain information on this subject. The Chicago Office worked with the specialist to develop food prices at the wholesale level in the United States. He in turn obtained the delivered and retail costs of the same foods in Libya and thus was able to show the areas in which there was profiteering in food. Local costs of production were almost impossible to obtain. The information so developed was submitted in a special report.

One function of the IIT Research Institute Food Industries specialist was to consider new food industries that might be developed within Libya. He was handicapped in this effort because the agricultural program has not been fully defined. However, a number of industries that might find a place within the food industries picture were reviewed. These industries were:

Vegetable canning  
Olive canning  
Food processing plant (tomato products)  
at the Jalo Oasis  
Fruit canning  
Dried milk processing  
Alfalfa dehydration

Canned soup processing  
Dehydrated soup mix plant utilizing local  
and imported raw materials  
Frozen fruit processing  
Frozen vegetable processing  
Milk pasteurization

These possibilities were investigated in a preliminary manner. A thorough market and feasibility study is necessary to know which of these projects should be pursued. More detailed studies were approved for five of these projects:

Food processing plant at the Jalo Oasis  
Sardine plants at Benghazi and Tripoli  
Alfalfa dehydration plant  
Animal feed mixing plant  
Dried soup mix plant

Tenders were requested and received for each of these projects, but only one has gone ahead. A contract was made for setting up the animal feed mixing plant. The others were pending at the completion of the tour of duty of the IIT Research Institute Food Industries specialist.

One of the plants that comes under the control of the Ministry of Industry produces a date syrup from low grade dates. An F.A.O. consultant was working with this plant to improve its product to the degree that it would find better market acceptance. The IIT Research Institute Food Industries specialist gave assistance to this program in studying some of the problems.

There was concern that the date syrup product did not have the typical date flavor and experiments were made in the laboratory to improve the flavor. One solution was to add artificial date flavor to the syrup to enhance the flavor. Another, was to carry out the concentration of the syrup under vacuum.

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The date variety being used for raw material was of an unedible type and contaminated with sand. The laboratory experiments demonstrated that the sand could be removed centrifugally. They also demonstrated that the pulpy meat could be retained and a new product produced, which was labeled "Heart of Date." Under vacuum concentration, a fairly light product was produced which had a good date flavor. Fairly large samples were produced and sent to the Chicago IIT Research Institute office. The samples were taken to manufacturers for testing and enthusiastic reception for the product was encountered. It is believed that there would be a substantial market for the Heart of Date in both the United States and Europe.

An examination of the Heart of Date in the Chicago laboratories, by a Libyan trainee working in the IIT Research Laboratories, revealed that the date product was contaminated with insect remnants and precautions would have to be taken in its manufacture to eliminate this contamination before it would be an acceptable product. However, the product shows sufficient promise that it should be tested on a larger scale so that a true market evaluation of the product can be made. This work could develop into an interesting new industry for Libya.

The food industries group within the Ministry of Industry needs active leadership to carry through the several programs that were begun by the IIT Research Institute specialist. The gains that have been made during this period have been the first steps towards putting the Libyan food industries on a firm footing that will enjoy the confidence of the Libyan consumers.

## F. Geological Section

The work of the Geological Section differs from the geology program of the Ministry of Petroleum in that its activities are directed towards the identification and development of mineral and water resources whereas the Ministry of Petroleum directs its activities to the exploration of petroleum resources. The potential of mineral resources in Libya are essentially unknown. Few studies have been made which identify the minerals that exist and relate the size and quality of the deposits. The Geological Section was organized to study the mineral resources and to present the information in such a way as to encourage the development of these resources. IIT Research Institute Geology Specialist, Mr. Maynard Ayler, planned and organized the work of this section and began the process of acquainting interested parties with the resources that exist.

A mining law that would spell out the rights of mining companies, prospectors, investors and government, and would describe the procedures that interested investors should follow to obtain rights, is essential to the development of the mineral resources. Mr. Ayler, early in the program, set out to promote such a law. Mining laws were obtained from several countries and they were reviewed in terms of the aspects that would apply to Libya. It soon became apparent that a lawyer experienced in mining laws would have to be consulted to work out a suitable program for Libya. Accordingly, a lawyer who has written mining laws was contacted. He made a visit to Libya and the terms of a contract with him were discussed. No action was taken on his proposal. His fees apparently were considered to be too high. The laws still need to be written and should be of the order of first importance to the Libyan government.

The IIT Research Institute Geologist recognized, within a short period after his arrival, that he had a wide open field in which to work. There were numerous projects to be done, and it was a matter of assigning preferences to those to be undertaken first. As in other sections of the Ministry, the Geology Section was made up of untrained personnel. They had received some theoretical training at the University, but were unprepared to take responsibility for field work on their own. Furthermore, the section had no equipment for doing field work, for drilling and the collection and analyzing of samples. The consultant, therefore, followed the most logical approach of utilizing the section staff to make preliminary studies to identify projects which needed study and to invite geological teams on an international basis to do the actual field work.

The IIT Research Institute specialist worked almost the full period of his assignment to get the system working. It involved calling for bids, selecting the successful bidder, and developing the contract with the successful bidder. The first two steps were relatively routine, but the "stumbling block" arose in the issuing of the contracts. Eight to ten months were sometimes required. During the last month of the IIT Research Institute specialist's stay in Libya contracts for several of the projects, which had been proposed during the first two or three months of his tour of duty, were signed.

A few relatively small contracts with a local firm were resolved in short order. This work led to some of the interesting results that were achieved by the IIT Research Institute Geologist and his staff.

In an effort to strengthen the Geological Section, Mr. Ayler proposed that the Ministry employ several expatriate geologists as assistants and technicians who

could take more responsibility in exploration and development of the mineral resources. Mr. Ayler was authorized to develop some candidates, but the program was never carried through. In the latter stages of the program the Yugoslavian Government agreed to provide Libya with a large number of geologists. The IIT Research Institute specialist was called upon to interview many of them. Very few were of the caliber that were being sought, but a team from Yugoslavia is now working with the Ministry.

One Libyan has returned from France who has good qualifications. He is working with the Geological Section and is a useful addition to it.

The IIT Research Institute Geologist took the position that Libyan resources must be made known to the public if any action was to be taken to develop them. He worked with the Ministry on a program to publish the results of the findings made by the Geological Section in a Geological Survey Bulletin that would receive wide distribution. Ten such papers were prepared. Two had already been published and arrangements were made for the publication of the others at the conclusion of the geologist's assignment. Some of the work reported in the bulletins was original work conducted by the Geological Section. Other bulletins were prepared from work that had been done previously and was contained in the files. This information had never been published. It is felt that if the publications continue, reporting the work being done by various contractors, entrepreneurs will be attracted to develop some of the resources.

The publications are as follows:

Bulletin No. 1, "Silica Sand, Jefren and Abu Ghaylah Areas, Tripolitania, Libya", by  
Maynard F. Ayler

- Bulletin No. 2, "Cement Raw Materials Deposits, Behghazi Area, Cyrenaica, Libya", by Giovanni Valencia
- Bulletin No. 3, "Phosphate Deposits of Tripolitania, Libya", by Maynard F. Ayler
- Bulletin No. 4, "Tectonics and Geomorphology of Tripolitania, Libya", by T. Lipparini
- Bulletin No. 5, "Geology of the Garian Area, Tripolitania, Libya", by A. M. Christie
- Bulletin No. 6, "Exploration of the Jefron Gypsum-Anhydrite Deposit, Tripolitania", by J. L. Gualtieri
- Bulletin No. 7, "A Geologic Report on the Iron Deposits of the Shaatti Valley Area of the Fezzan Province, United Kingdom of Libya", by G. H. Goudarzi and R. Tschoepke
- Bulletin No. 8, "Geological Exploration of the Kufra Region, April-May 1965", by W. W. Mahrholz
- Bulletin No. 9, "Saline Deposits of Marada, Pisida, and Edri Sebchas, Libya", by G. H. Goudarzi
- Bulletin No. 10, "Mineral Resources of Libya" by Maynard F. Ayler

Although several projects had been proposed, at the beginning of the fiscal year a series of fairly broad programs were proposed for execution during the fiscal year 1965-1966. Some of these were proposed during the previous year.

Geophysics in the Zillah and Jebel Fezzan areas:

This project was designed to determine the mineral discovering potential of the airborne magnetometer, A.F. magnetometer and radiometric procedures as applied to two areas in Libya potentially favorable for mineral discovery. It is expected that a survey

of this type will delimit the most favorable parts of the area so that surface field crew time can be used most effectively in the future.

#### Zilla-Jebel Fezzan Photogeology:

Photogeology will utilize aerial photographs to map the geology as exposed at the surface. This work would provide maps showing the geologic and physical detail necessary for intelligent planning of surface exploration. It may or may not supplement the aerial geophysical data.

#### Kufra-Jebel Aweynot Photogeology:

Field examinations showed that low grade deposits of iron and manganese ore are present in the Kufra-Jebel Aweynot area and it is suspected that deposits of a much larger size and better quality may be present. Exploration of such deposits should proceed in an orderly, scientific manner, rather than the hit-and-miss techniques of the surface exploration party. The photogeology will permit the planning of the scientific approach.

#### Water Research:

It should be possible to produce structural stratigraphic and water quality data that would permit determination of the total possible water potential of any particular or general area of Libya by an analysis of the well logs and water quality data in the files of the Ministry of Petroleum. This data, combined with additional data that could be developed in field studies, could yield a broad picture of the water resources in Libya. This would be a long-term study involving many geologists. It is believed that the prescribed effort would be beneficial to Libya.

#### Sebcha Studies:

A thorough examination of all of the sebchas of Libya would entail sending field crews to the sebchas to sample and chart them. The field crews would dig test pits, sample salt deposits and brines, and record sample locations accurately. The samples would be analyzed and the types and quantities of salts charted. This would identify those sebchas that have commercial possibilities as sources of industrial salts, fertilizer salts, or possibly magnesium metal.

#### Shale, Garian Area:

It is apparent that two or more beds of potentially valuable clay exist in the Abu Ghaylah and Garian area. It was proposed that this area be geologically mapped. All presently known clay pits would be sampled and the samples tested for use in all forms of ceramics, including brick and tile. The mapping should identify other areas where clay may be of better grade than is now being used. This project is looking toward a brick and tile industry.

#### Phosphate Studies:

There has been speculation that phosphate deposits, comparable to those in Tunisia, exist in Libya near the Tunisian border. It was proposed that the occurrences of phosphate in Tunisia be studied to use as a guide for an exploration program in Libya. This project was not approved by the Ministry.

#### El Regina Gypsum Studies:

A bed of crystalline, high quality gypsum is known to exist in the El Regina area east of Benghazi. It was proposed that a drilling program be organized to evaluate this deposit which might be drawn upon for the

proposed cement plant and for the Benghazi area as well as for other applications.

#### Tripoli Location of High Quality Limestone:

A drilling exploration program was suggested to locate lime deposits on the south edge of Tripoli that would be of adequate quality to manufacture lime for local use. Samples would be assayed and the properties of limestone in each sample area charted.

#### Shaatti Valley Metallurgy:

In order to answer the question once and for all, and eliminate speculation, it is proposed to make a metallurgical study of the iron ores in the Shaatti Valley and conduct a feasibility study of processing and exporting the ores. It was suggested that a competent firm be contracted to take bulk samples and make ore dressing studies to beneficiate the ore. Smelting tests would be made and the market for this type of ore ascertained. These deposits would be compared with other major iron ore deposits of the world and the feasibility of exporting the ore from Libya determined.

#### Mining Statistics:

A program to map the present mining operations was proposed. These operations would include limestone, building stone, crushed rock, plaster lime, clay, sand, salt, and other materials now operative in Libya. This data could be organized to give the first statistical mining data in Libya.

#### Libyan Shield:

An area in South Central Libya, near the Chad border, is underlain by old rocks that could be excellent hosts for mineral deposits. It was proposed that photogeology

and aerial photographs be made of this entire area. This work would be followed by preliminary ground evaluation of the most favorable appearing areas. The effort could then be concentrated on specific projects that would produce results.

Six exploration projects were accepted, submitted for tender, and contracts signed just prior to the departure of the IIT Research Institute Geology specialists. It was unfortunate that these projects could not be instituted earlier in the program so that Mr. Ayler could have assisted in their execution and development of the programs that should follow. However, it is felt that the program will open the way to geological exploration in Libya.

The following programs have been contracted. It will be noted that most of them consist of programs that were proposed for the 1965-1966 fiscal year.

1. Aerial Geophysics, Zillah and Jebal Fezzan Areas.  
This work is an aerial geophysical survey which includes magnetics, electromagnetics, and radiometrics. Since no base metal or radioactive mineral deposits are known in Libya, two areas thought to be geologically favorable were chosen for the first test survey. This contract was signed in May 1966 and should be completed June 1, 1967.
2. Evaluation of clay and limestone potential near Tripoli.  
This project was designed to give information as to the quality and thickness of clay and limestone deposits near Tripoli, that might provide raw materials for ceramics, lime, or cement plants. The project included drilling with assay of selected cuttings and ceramic tests of selected clays. The contract was signed in April 1966 and should be completed by about September 1966.

3. Evaluation of clay and limestone potential in the Gariunis area immediately south of Benghazi. A cement plant is to be built in the Benghazi area. This project was to find the needed clay raw materials, and if possible, to find limestone raw materials more favorably located than those reported in Bulletin No. 2. The clays were to be tested also for possible use as ceramic raw materials. This contract was signed in May, 1966, and should be completed by September, 1966.
4. Evaluation of the El Regima gypsum deposits 25 kilometers east of Benghazi. A bed of nearly pure gypsum at least ten feet thick is known in this area. The project consists of surveying, drilling, and chemical assay of the gypsum. The contract was signed in May 1966 and should be completed by September or October 1966.
5. Evaluation of the Pisida salt deposits. Prior work under the direction of USOM personnel indicated an extensive magnesium chloride and potassium chloride potential in the Pisida area near the Tunisian border. This project consists of drilling 54 holes on one kilometer spacing, sampling and assaying brines and cores, and making permeability tests. The contract was signed in May 1966 and should be completed in six to eight months.
6. Evaluation of the salt potential in the Giarabub area near the Egyptian border. Salt flats are known in this region. The project is to explore the area, determine the most favorable areas, then drill, sample, and assay brines and cores. The contract was signed in May 1966 and should be completed in six to eight months.

A new cement plant was contracted for to be established near Benghazi. This plant is based on the limestone supply identified and surveyed by the Geological Section. The plant is scheduled to produce 300 tons of cement per day.

There appear to be many opportunities for development from the mineral resources of Libya. Just what they are and the extent of their development can be decided only after the basic geological work has been done. It had been hoped to start a broad geological survey of Libya, but the limitations of personnel and equipment prevented launching such a program. It is hoped, as a second-best step, that the programs that have been contracted will help to launch the broader geological studies.

G. Industrial Programming and Planning Section

The Industrial Programming and Planning section was initially conceived as a section which would develop the general industrial plan of the Ministry of Industry. All other sections of the Ministry would tie into this group. As the work of this section has evolved, the Head of the Industrial Programming and Planning section actually took on the function of a general industrial and industrialization advisor to the Ministry. The position of Head of this section was originally filled by Mr. James Gardner and later by Mr. Jack Wilson, both from the IIT research Institute team.

It was essential for the Head of the Programming and Planning section to familiarize himself with the programs of the other Ministries in order to fit the program of the Ministry of Industry into the overall pattern of development of the country. He represented the Ministry of Industry on many of the interministry committees and had a major responsibility in developing the draft of the Ministry of Industry's portion of the second Five Year Plan. During the latter part of his tenure, Mr. Wilson devoted a large part of his effort to this assignment.

During the period of his service to the Ministry of Industry, the IIT Research Institute specialist has contributed to a large number of programs in which the Ministry has been engaged. Some of the programs representing the scope of work are summarized below.

Analyses and recommendations were made concerning all applications made to the Ministry for the issuance of industrial licenses.

Recommendations were made regarding the wider use of foreign Management Consultant firms. A draft of an informal Request for Proposal to be sent to representative organizations was prepared. This report was presented to the National Planning Council, was approved by the Council, and will be incorporated as a basic part of the Second Five Year Plan.

A report with recommendations on the importance of the Ministry functions as an information service for the private sector was presented to the Ministry.

Analysis and recommendations on the proposed further expansion of the Libyan Fishing Industry were made.

A report was presented on the activities of the Homestake Mining Company in exploitation of Libyan potash deposits under Ministry of Industry concession contract.

A report was submitted on the activities of Holderbank Technical Center as Consulting Engineer in establishing the Libyan Cement Company of Benghazi. This report included, as an attachment, an analysis of the marketing, economic, and technical considerations arguing in favor of doubling the capacity of the plant.

Analyses of equipment tenders submitted for a Lime Plant to be constructed in Benghazi were made by the IIT Research Institute specialist.

Analysis was made of the profitability potential for a Lime Plant proposed for Tripoli.

A report with recommendations was submitted concerning the management and administrative operation of Government Owned Industries. This report included, as an attachment, an analysis of the advantages of establishing a Government owned industrial holding company to assume ownership of these industries in joint venture with private sector investors.

A series of reports recommending development of a Libyan dairy products industry were presented. Portions of these recommendations

were incorporated in Ministry of Agriculture planning for a recently opened dairy plant.

Recommendations were made concerning new price control laws affecting machinery imports.

Recommendations relating to changes in import duties and granting of exemption from these duties to selected industries were submitted to the Ministry for consideration.

A paper was released to the Ministry of Public Information entitled "Criteria for Libyan Industrial Growth."

A paper was prepared for the Minister of Industry entitled "Comments on the Possible Role of the Kingdom of Libya in the Proposed Maghreb Joint Industrial Development Plan." This paper was read to the Parliament and to the Council of Ministers. Copies were distributed in both Arabic and English, and the Minister advised Mr. Wilson that the paper had been accepted as the basis for the official Government policy in forthcoming Maghreb meetings.

Analysis with recommendations was made on a proposed shoe factory.

Recommendations concerning possible changes in the organization of the Ministry and "streamlining" of its administrative procedures were made to the Ministry of Industry.

Several of the recommendations that were made have been acted upon and should be evident in some of the future activities of the Ministry of Industry.

As a consequence of the phasing out of the IIT Research Institute team, the Ministry of Industry has been seeking ways to fill the gap in the Ministry which was left by their departure. The IIT Research Institute specialist suggested that the Government of Libya contract with a consulting firm on a long term basis to develop a program through

which the resources might be identified and developed, and the country industrialized. It was understood as this IIT Research Institute program was terminating that this suggestion will be followed through.

This new program will help accomplish some of the goals of the Ministry of Industry, but the Ministry will continue to require expatriates for several years in the technical and engineering fields, directly attached to the Ministry of Industry.

The Head of the Programming and Planning section, Mr. Jack Wilson, will continue his services in Libya for another year under direct contract with the Ministry of Industry.

IV. APPENDIX

Developing Industrial Standards,  
Specifications, and Test Methods  
for Libya

KINGDOM OF LIBYA  
MINISTRY OF INDUSTRY

DEVELOPING INDUSTRIAL STANDARDS,  
SPECIFICATIONS, AND TEST METHODS FOR LIBYA  
- A COMPREHENSIVE REPORT -

by

L. F. Biritz

and prepared in co-operation with the  
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Tripoli, Libya  
July, 1965

IIT RESEARCH INSTITUTE

DEVELOPING INDUSTRIAL STANDARDS,  
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## I. INTRODUCTION

Very old records of human civilization reveal that standards have long been in existence to protect the interests of the consumer. As human knowledge increased and civilizations became more sophisticated, these consumer-protection standards also became more elaborate and complicated. Today we have reached the point where these standards are not only of great importance for the industrialized nations in respect of their own economies, but are also important in the international sense because of the enormous increase in international trade.

In addition to the consumer-protection standards, there have been a great number of industrial standards and specifications developed all over the world. Most of these industrial standards were adopted voluntarily by the respective industries themselves, so that they could co-ordinate their products and production, utilize similar machines, be able to interchange parts, etc. These standards, of course, vary from country to country and often cause complications in international trade.

Efforts have been made to put internationally acceptable standards and specifications into practice, starting with the adoption of the metric system in the previous century. Unfortunately progress in this direction has always been relatively slow. Lately, however, various agencies associated with the United Nations have begun to exert considerable effort in order to have such international standards formulated and accepted all over the world.

From the legal point of view, all standards belong in two categories: compulsory and voluntary. Generally, the consumer-protection standards are covered by legislation in most countries and are enforced by law. (This is particularly true for food products manufactured for human consumption.) However, this legislation and enforcement cannot be carried out without the availability of technical assistance. It is necessary to have well-equipped laboratories which are capable of carrying out a variety of testing, for standards and specifications become meaningless without such technical assistance.

Now that the laboratories of the Ministry of Industry have been completed and have started operations, it will be possible to have the necessary technical assistance for a Standards and Specifications Program. The time has arrived for needed standards and specifications to be practically introduced and established in Libya. This report is intended to show how such a program can be initiated and carried out, and in what specific areas standards and specifications are needed. The problems and difficulties anticipated are also discussed, and recommendations are made to overcome these problems.

## II. BASIC PRINCIPLES FOR INDUSTRIAL STANDARDS AND SPECIFICATIONS FOR LIBYA

It should be pointed out that the development of industrial standards, specifications, and standard testing methods is generally a complicated, time-consuming, and, therefore, expensive process. Since many well developed and established standards do exist in numerous countries, help can be found by making use of them just as they are, or with modifications. The International Organization for Standardization is also a valuable aid. Therefore, the following recommendations are made:

1. Libya should join the International Organization for Standardization as an observing member, and use internationally accepted standards wherever possible.
2. If no international standards are available, then it is recommended that an established, practical standard of another country be used (with modifications if necessary).
3. If no standards exist, only then should they be developed in Libya.

Another important point is the choice for the system of measurement; the metric system should be used whenever possible. The reason for this choice is that Libya officially uses the metric system and that the rest of the world not yet using metric measurements--the United States and England in particular --is planning to use it. Also, the conversion of a non-metric standard or specification into a metric one usually is not difficult.

## III. OUTLINE FOR THE ESTABLISHMENT AND OPERATION OF A LIBYAN OFFICE FOR INDUSTRIAL STANDARDS AND SPECIFICATIONS

### A. Organizational Setup

In order to establish industrial standards and specifications in Libya and have them successfully enforced, it is proposed that an Office for Industrial Standards and Specifications be established within the Ministry of

Industry. This office should consist of two bodies: the Executive Committee and the Administrative Office.

The Executive Committee should be composed of technical members (engineers, scientists), legal experts, and industrialists. It will decide whether or not a standard should be established, and will also prepare the technical details of all standards and specifications.

The Administrative Office, on the other hand, should deal with all matters relating to:

- 1) Introducing recommendations to the Executive Committee,
- 2) Assisting the Committee with tests and standards specifications,
- 3) Compiling test results,
- 4) Communication with industry regarding tests and standards,
- 5) Enforcement of standards.

Also, the Administrative Office must handle the paper work for the Executive Committee, and must obtain references of standards and specifications from abroad when they are needed by the specialists.

It became apparent from this organizational-functional outline that while the Executive Committee will be an interdepartmental body (perhaps with members and advisors from the outside), the Tests and Standards Office should belong to the Department of Industrial Organization and Planning.

#### B. Establishing a Standard

The practical steps that are to be taken to establish a standard must be kept as simple as possible, particularly in the beginning, if the Office of Industrial Standards and Specifications is to function well.

First, the Executive Committee will be required to meet at regular intervals. This Committee will make all final decisions concerning a standard. The Administrative Office will be only the executive body and administrative apparatus for the Committee.

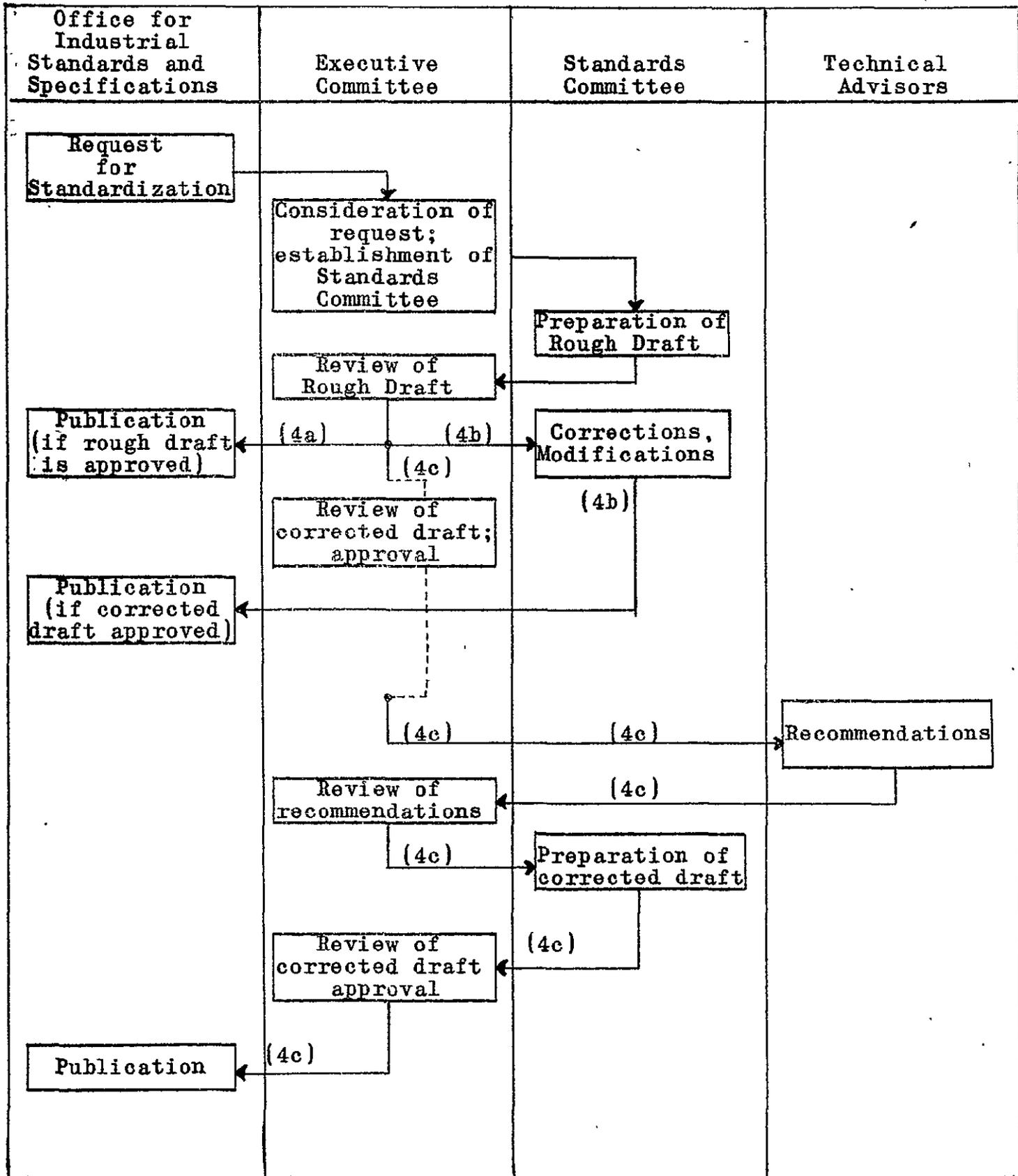
The mechanism for establishing a standard would then follow, approximately, the following route:

1. An individual, organization, or office with a good reason makes a recommendation for the establishment of a standard (or specification) by filling out a form, and filing it with the Office of Industrial Standards and Specifications.
2. The Executive Committee studies these recommendations at its next meeting and takes the following actions:
  - (a) decides whether or not to establish the recommended standard;
  - (b) determines when to establish the standard;
  - (c) if the standard is to be established immediately, designates a Standards Committee to prepare the rough draft for the standard, and determines the ~~time~~ limit for the rough draft.
3. After the rough draft is prepared, it is submitted to the Executive Committee for approval.
4. After a review of the rough draft by the Executive Committee:
  - (a) the rough draft is accepted and sent to the Administrative Office for publication;
  - (b) the rough draft is returned for corrections or modifications to the Standards Committee, after which it is reviewed again by the Executive Committee. (This procedure should be repeated as often as is necessary). After approval of the final version, it is sent to the Administrative Office for publication.
  - (c) the decision is made that recommendations are needed from outside advisors. (This may be necessary in cases where no specialists are available in Libya). After the Executive Committee reviews the opinion of the outside advisors, it is returned to the Standards Committee with specific recommendations for the preparation of the final draft. The final form is then approved by the Executive Committee and sent to the Administrative Office for publication.

An outline of this procedure is shown in Chart I.

CHART 1

STEPS TO BE TAKEN FOR THE ESTABLISHMENT OF A STANDARD



#### IV. GENERAL PRACTICAL CONSIDERATIONS FOR QUALITY STANDARDS IN LIBYA (C. H. Schuh)

The ultimate purpose of establishing industrial standards and specifications in Libya is, first, to guarantee uniform quality of products and, secondly, to help improve quality wherever necessary and possible. In order to achieve this, present Libyan products must be evaluated and then compared with competitive imported products of high quality. To ensure a successful laboratory testing program, the following suggestions are made:

##### A. Sampling

In order to get a correct evaluation of a particular product presently produced in Libya, it is necessary to first get a representative sample of that product. Considering tomato paste, for example, it would not be correct to take one single can of tomato paste from the factory and determine its quality in the laboratory as compared to a can of tomato paste taken out of the production of a manufacturer known for producing a high quality product. A more representative average sample should be obtained by taking a number of cans of each of the products. The Libyan sample might be obtained by taking several cans of the product from the shelves of several different stores, as well as from the plant, and the analyses of all the samples would then be combined and averaged. The same procedure should be used for the high standard quality product with which it is being compared.

##### B. Testing

The testing in the laboratory would be conducted according to standard testing procedures, and the results would show how the Libyan product compares with the selected high quality product. In food products, there is one important quality test which is not absolute, and that is the flavor and taste-appeal quality. Flavor and taste appeal are matters of individual opinion; however, they can be rated on the basis of the average reaction of selected groups of individuals. The absolute chemical and physical properties of the product will of course have a direct bearing on taste appeal.

##### C. Uniformity

In addition to obtaining the average quality of the product, it is also important to know the range of fluctuations in test results obtained for the various samples taken which go to make up the average. This range of

fluctuations should be as narrow as possible in addition to the average being good. In other words, uniformity is just as important as a good average quality.

#### D. Continuance of Tests

Tests on a specific product should be repeated at specific intervals of production, and particularly after any suggested manufacturing changes have been adopted and put into practice.

#### E. Upgrading Quality

Upgrading recommendations are readily made on the basis of the absolute tests once a minimum standard has been set. This can be based on generally accepted minimum standards or on the basis of a particular product selected for its known high quality.

#### F. Cooperation of Manufacturers

Manufacturers of products to be tested should be instructed to cooperate in supplying representative samples to the MOI laboratories and utilizing the analytical services of the MOI for realizing a maximum upgrading of their products. On the other hand, the MOI can do a great service for industry by making known those products that are of high, uniform quality and by protecting those industries that are producing quality products. For manufacturers producing sub-marginal quality products, the MOI laboratories can make up-grading recommendations and conduct a product testing program designed to upgrade the quality of their products.

#### G. Products to be Tested

There will no doubt be a tendency to overload the laboratories with many samples for analysis, some of which will not be properly selected and identified samples. By eliminating these, the laboratories will be confined to productive activities. Presently, tomato paste products are being tested and other food products will follow directly. Also, products of other industries such as matches, soap, paper, cement, gypsum, minerals, and raw materials are scheduled.

#### H. Personnel

With the present personnel, only a very limited volume of analytical work is possible. For a period of time, only the analytical results of tests conducted by the specialists

themselves should be accepted. Only after the trainees have demonstrated that they can produce consistent check results for known samples, should their results be accepted for specific tests.

## V. SPECIFIC INDUSTRIES REQUIRING STANDARDS AND SPECIFICATIONS

This discussion has dealt only with generalities up to this point, but in the following chapters the specialists will discuss their individual areas and the need for establishing standards in these areas.

### A. Food Products Other than Edible Fats and Oils (L. J. Binder)

In the normal sequence of events, food standards are developed by governmental agencies with the full knowledge, if not always the full consent, of members of industry. To protect the public health and welfare certain standards are made compulsory and legally enforceable by law. Others are voluntary and mutually recognized by all manufacturers to be beneficial to the industry. Both compulsory and voluntary standards are usually administered by governmental agencies. Enforcement of compulsory standards results from governmental inspection, sampling, and analysis of all products covered by compulsory regulations. Voluntary standards are developed by governmental agencies as an aid to industry and governmental inspectors and analytical laboratory services are made available at the request of individual members of industry.

#### 1. Type of Food Standards

Compulsory standards generally fall into the following major categories:

##### (a) Standard of Identity and Composition

A standard of identity is the primary standard governing any manufactured products. This is particularly true of food products which, in general, are complex in nature. The importance of the standard of identity is emphasized by the fact that this standard, which defines a given product, forms the basis of all legal and contractual literature concerning the product.

(b) Food Additives

Normally under the law any substance which may be expected to become a component of a food in producing, manufacturing, packing, processing, transporting, or holding the food is considered a food additive. No new additive may be used in or on food until the promoter of such additive submits to a government regulatory agency convincing evidence of its safety when tested on animals. If evidence clearly demonstrates that the material is a safe component of food under the proposed conditions of use and if it will not promote consumer deception, the governmental agency in authority issues regulations specifying how it may be used.

(c) Standards of Packaging

Standards concerned with packaging materials, packaging processes, etc., are in this group.

(d) Standards of Sanitation

Unsanitary or filthy food plant conditions are sufficient causes for the condemnation of food products emanating from a plant harboring such conditions. A food is illegal if it is filthy, putrid or decomposed. A food is illegal if it is prepared, packed, or held under unsanitary conditions whereby it may have become contaminated with filth. Standards of filth for food products must be severe. Not only must the product be free of filth, but the product must not be prepared in an environment which may result in contamination with the aforementioned filth.

Compulsory food standards should not be confused with voluntary food grade standards by which the product of a given food industry may be brought into uniformity and upon which are based methods of quality control, sales and load transactions. These standards result in the application of grade designations such as Grade A, Grade B, Grade C, etc. Compliance with voluntary grade standards does not, however, exempt a product from conforming to compulsory standards.

## 2. Misbranding and Adulteration

Misbranding and adulteration must not be tolerated under the law. Food labels must not be false or misleading in any particular. Labeling is misleading not only if it contains false statements, but also if it fails to reveal material facts. Damage or inferiority in a food must not be concealed in any manner. No substance may be added to a food to increase its bulk or weight or make it appear of greater value than it is. A food must not be sold under the name of another food. A substance recognized as being a valuable constituent of a food must not be omitted or extracted in whole or in part, nor may any substance be substituted for the food in whole or in part. Food containers must not be so formed, made, or filled as to be misleading.

## 3. Recommended Approach

The development and administration of commodity standards in Libya may be assigned rationally according to the nature and activities of the various governmental ministries. The Ministry of Industry, for example, should logically develop quality standards for manufactured products in Libya with authority to inspect all factories, request and obtain samples for laboratory testing, and report violations of established law regulating the quality of Libyan products to the Ministry of Justice. The Ministry of Industry should develop voluntary grading standards and, by all means available, obtain the co-operation of Libyan manufacturers in upgrading and standardizing the quality of industrial products. Matters of sanitation should reasonably be the responsibility of the Ministry of Health in co-operation with the various municipal health agencies. Standards for raw agricultural commodities should be developed by the Ministry of Agriculture. In certain cases where agricultural commodities are used as raw material for manufacturing processes, standards should be developed co-operatively by both the Ministry of Agriculture and the Ministry of Industry.

## 4. Laboratory Testing and Personnel

With respect to foods, both compulsory and voluntary standards depend largely on laboratory tests and testing methods.

Compliance with food standards is determined accurately only if a sufficient number of samples of the food products are examined. Each batch of the finished product must be analyzed. If production is continuous, a calculated number of samples are taken for analysis for each unit weight of product manufactured. This means that technical personnel must be available on a continuous basis in the Food Technology Laboratory to produce analytical results in sufficient quantity and continuity to effectively regulate the domestic manufacture of food products in Libya.

In terms of numbers and quality, the Food Technology Laboratory of the MOI needs the immediate services of two experienced laboratory technicians graduated from a university or college of good standing in the technical field, with at least two years of experience which includes chemical analysis. These laboratory workers would be primarily responsible for producing analytical data which would be used by the food industries specialist to draw valid conclusions with regard to compliance of domestic food products with Libyan food standards.

In the normal operation of a food analytical laboratory each analyst becomes completely familiar with the analytical procedures applicable to a particular kind of food. However, initially, the two laboratory technicians required by the Food Technology Laboratory will have to become familiar with the analytical procedures of many foods and, due to lack of personnel, some sacrifice will have to be made in the quantity of samples taken for analysis from each batch of food manufactured. Eventually, the Food Technology Laboratory will need the services of a Home Economist who will specialize in food preparation and taste testing. The services of a microbiologist will be needed for sanitation and vitamin assay. Additional personnel will be needed for research and product development. However, these needs will be expressed in detail at a future time.

## B. Edible Oils and Fats (E. Edler)

### 1. Scope

Edible oils play an important role in the Libyan economy, for their production is a major industry and their consumption is a major portion of the average Libyan's diet. These reasons make it essential for

all edible oils sold in Libya to be of good quality, and this is particularly important for olive oil, which is the oil produced and used in the largest quantity.

## 2. Problems

It is a known fact that most of the olive oil produced locally is of poor quality, and the main reasons for this situation are (a) the lack of information concerning the olives grown in Libya and the oil produced from them, and (b) poor processing techniques used by the local manufacturers. The establishment of quality standards for olive oil would ensure the quality of marketed products and would yield important information about the necessary improvements needed for the presently used manufacturing operations.

## 3. Standards

The standards for olive oil, and fatty oils in general, should be those used by other major oil producing and manufacturing countries. These standards determine the quality in terms of:

- (a) specific gravity
- (b) color
- (c) clarity
- (d) free fatty acids
- (e) iodine number
- (f) saponification number
- (g) etc.

Proper labeling is also important. For example, oil which is sold as olive oil should be a pure product, unadulterated with other oils. Exact labeling practices must be made compulsory.

## 4. Technical Personnel Required

In order to have all the necessary testing and analyses carried out properly, at least one experienced technician is needed immediately. (There are hundreds of analyses to be carried out.) If quality control is to be combined with development work and process research, at least one additional experienced laboratory worker is also required.

C. Mineral Oils and Mineral Oil Products (E. Edler)

1. Scope

Mineral oils play the most important role in the Libyan economy. Apart from the production of crude oils, the different products from mineral oil (bottled gas, gasoline, kerosene, diesel fuel, lube oils, asphalt, etc.,) are necessary to keep a modern industrial economy running. For this reason it is imperative to check finished products as well as it may be necessary at times to evaluate crudes produced and exported.

2. Problems

Though crude mineral oils and products derived from them are of major importance for Libya, there exist at present neither quality standards nor adopted standard methods for testing these materials, with the exception of those used internally by the producing and marketing oil companies.

One should consider gasoline as an example. Because of the hot climatic conditions in Libya, careful control is required concerning such properties as oxidation stability and gumming tendency, etc., so as not to cause engine damage or poor performance. Similar considerations hold true for lubricating oils and greases. Asphalt and tar used in construction are other important materials, since the softening and melting points of these materials become very critical for satisfactory performance in climates which have hot daytime temperatures.

3. Standards and Standard Methods for Testing

The standards to be used should be based on those adopted by the countries which consume a majority of the mineral oil products. Howes specifications might be modified to meet local conditions.

4. Technical Personnel Required

In order to be able to carry out quality control, at least one experienced technician is needed as soon as possible. A special laboratory for this purpose must also be equipped.

## D. Building Materials Standards

(O. Berger)

### 1. Scope

The building materials producers comprise the major consumer industry in Libya. Consequently, the prime purpose of establishing standards is to protect the consumer against inferior materials. On the other hand, the local producer will eventually profit from upgrading the quality of his products; through higher uniformity and better quality he will be able to compete more favorably with imported products.

### 2. Requirements

The first step must be the selection of the most suitable standard specifications together with the appropriate standard test procedures. These specifications should fulfill two basic requirements:

- (a) They should be strict enough to prevent the sale of inferior quality products, but they should not prevent the development of a reasonably wide range of quality levels and price levels for each type of building material;
- (b) They should be detailed enough to cover all essential properties which influence application and performance of the product in actual use.

Test procedures are a basic requirement for the successful application of standard specifications and a few simple rules should be followed in their selection.

- (a) The test results must be representative for the property to be measured.
- (b) The test results must be reproducible.
- (c) Whenever possible, the results should be expressed by numbers.
- (d) The experimental procedures should be as simple as possible, so the most important ones can be used for quality control in plant laboratories.

### 3. Enforcement of Standards

In the building materials field in particular, the enforcement of standards will depend on the active co-operation of industry. Manufacturers and contractors should be represented in standardization committees. It is also recommended that compliance with the standards should be made voluntary for the first two years, after which time the standards should become compulsory for the industry. During the initial two-year period a number of steps can be taken to convince the manufacturers that compliance with the quality standards is in their own best interest.

- (a) Compliance with the standards should be made compulsory for all government construction.
- (b) Periodical publication of test results from government laboratories, listing the manufacturers whose products meet the standards.
- (c) Education of the consumer by explaining the value of standards to architects and contractors, and possibly to banks, loan institutions, and insurance companies.

Another essential tool in enforcing standards is the use of a team of inspectors. The inspection frequency for each manufacturer should be not less than once every six months.

It shall be the responsibility of the laboratories of the MOI to carry out all the required tests on the samples collected by the inspectors and to publish the results of these tests. The figures should include information about the number of tests performed, the average results, and the standard deviation as a measure of uniformity of quality. The laboratory personnel shall also be available to advise the industry in setting up their own quality control tests and inspection procedures in line with the requirements of the specifications.

In order to carry out these obligations, the building material laboratory should be staffed with not less than one graduate in chemistry or ceramics and a trained laboratory technician.

It will also be necessary to make a major investment in testing equipment. The nature of the machinery required will depend on which testing procedures are selected. Consequently, the equipment should not be ordered before specifications and test procedures are established.

4. List of Groups of Construction Materials  
Requiring Standardization

(a) Materials Requiring Immediate  
Standardization

- (1) Hydraulic and Non-Hydraulic Binders:  
Cement, lime, gypsum plasters for  
general purpose and specialty appli-  
cations, with and without additives.
- (2) Mineral Aggregates:  
For concrete and non-bituminous high-  
way materials, including light-weight  
aggregates.
- (3) Concrete and Mortars:  
For all types of construction work,  
(buildings and highways).
- (4) Steel for Reinforced and Pre-Stressed  
Concrete
- (5) Building Stones:  
Natural stone blocks, ceramic brick  
materials for masonry units and roof-  
beams, concrete blocks, floor tiles,  
paving brick, sewer brick, wall tiles,  
all types of marble, etc.
- (6) Manufactured Masonry Units:  
Wall elements, prefabricated units,  
building panels from all types of raw  
materials.
- (7) Bituminous Materials:  
For road and highway construction and  
for roofing materials.
- (8) Acoustic Materials:  
Such as ceiling tiles and plasters, etc.
- (9) Building Wood
- (10) Paints, Varnishes, Lacquers, and Pigments.

(b) Materials to be Considered for Standardization Later

- (1) Metal Plates, Tubes, Pipes, Strips:  
Mostly steel, including welding rods.
- (2) Aluminum Roofing
- (3) Pipes and Drain Tiles:  
Made from clay, ceramics, concrete with or without reinforcement.
- (4) Asbestos Cement Products:  
Pipes, shingles, siding, etc.
- (5) Ceramic Products:  
Refractories, glass and glass products, whiteware.
- (6) Thermal Insulation:  
Fibrous or plastic foam, concrete foam, etc.
- (7) Building Constructions
- (8) Fire Tests

E. Leather and Leather Goods (J. Hietaniemi)

1. General

Every country with a highly developed leather industry has established quality standards for the various leather products. For this reason, large leather producers generally maintain their own laboratories while smaller companies jointly establish a central laboratory for quality control of their raw materials and end products. In this way it is possible to maintain uniform quality through control of the manufacturing process and the raw materials utilized.

2. Areas of Standardization and Control

(a) Raw Materials

Standard procedures must be developed for testing of each type of tannery chemical and supplies. In order to maintain sufficient control over the

tanning process, a representative sample of each shipment or lot must be submitted by analysis before the material is used.

(b) Locally Produced and Imported Leather

The following properties, among others, should be tested:

fatty substances  
mineral substances  
chromium compound  
vegetable matter  
total loss at washing  
tanning value  
acidity  
tensile strength  
stretch  
rupture resistance  
water absorption  
water repellence  
air permeability  
bending stress and fatigue characteristics  
abrasion resistance

Tests should be carried out at least once every six months for locally produced leather at each producer.

Imported leather requires more frequent testing in order to eliminate sub-standard quality. Preferably, a representative sample of each shipment should be submitted for testing.

3. Requirements of Personnel

For present Libyan needs, one experienced tannery technician could carry out the necessary work. Half of his time would be sufficient for this purpose, and the rest of the time could be devoted to development work.

F. Textile Standards (P. L. Bump)

1. Scope

Sheep are raised in large quantities in Libya and the wool and textile industry--although presently carried out on a small scale--is potentially very important. However, in addition to locally manufactured products, a

great number and variety of textile materials are imported. Since there are no existing standards in Libya, the customer does not have the protection as in other countries when buying textile products, and the establishment of such textile standards is very much recommended.

## 2. Tests

Since textile products are very complex and their testing complicated, it should start gradually. As the need for a particular standard arises, it should be worked out accordingly. First of all, it should be required that all textile products sold are clearly marked, describing the composition of the material, both qualitatively and quantitatively. Other tests and standards, such as gauge, weight, tensile strength, dye fastness, water proofing, would be also developed.

## 3. Personnel

To carry out this work, an experienced textile technician is needed. It would occupy approximately half of his time, while the other half could be utilized to carry out development work, particularly on the utilization and improvement of the locally produced wool and finished materials.

## G. Safety and Plant Standards (T. Thornton)

### 1. Safety and Accident Prevention

These are of vital interest to the Libyan economy because of the ultimate loss to both the employer and the injured employee resulting from industrial accidents. The compensation received by the employee never equals his earnings, and in some cases he may be permanently disabled.

The costs to the employer are enormous. In the U.S., for example, the yearly cost of accidents to industry is well over two billion dollars, including medical and hospital expenses, death benefits, and workmen's compensation. Also included is the indirect cost of damaged equipment and materials and production delays.

A need exists for the setting up in Libya of industrial safety standards. This in turn necessitates a program of education and training for the managers

and workers of manufacturing plants and finally an inspection procedure is required to insure that the standards are being adhered to.

The success of any safety and accident prevention program depends upon the degree that industrial management accepts and actively promotes the fundamental principles involved. They must realize that to prevent accidents, money must be spent to provide safeguards for the worker, to plan and design safe operating processes and procedures, and to provide an adequate organization and staff to carry out the detailed work of safety and accident prevention. Experience in other countries shows that every pound spent on safety returns a big dividend and in the long run results in increased production and decreased costs.

The chain of command in a safety program passes from manager to supervisor to worker. These last are a vital link and each must be sold on the benefits of working safely.

Mention of a few of the elements that must be dealt with in a safety and accident prevention program will indicate the broad scope of the work:

Safeguarding of machines and work places; fire prevention and control; specialized problems in certain industries such as electrical and chemical manufacture, welding hazards, personal protective equipment and clothing, eye, and respiratory protection; safety inspections; investigation of accidents; educational activities; publications and visual aids; first aid training; safety conferences; motor vehicle driver training; and statistical records and reports.

## 2. Industrial Hygiene

This plays an important and supplementary role in the industrial economy. Mentally and physically healthy workers do more and better work through the decrease of absenteeism and labor turnover. Therefore, it is to the interest of all concerned--labor, management, and government--to participate in a program to improve the health of the Libyan workers.

Some of the aspects of industrial hygiene to be considered are:

Worker fatigue; posture in relation to work efficiency; handicapped workers; health education; the establishment of a healthful work environment as affected by water supply, sewage disposal, toilets and dressing rooms, temperature and ventilation control; sanitation, housekeeping, illumination and noise control; nutrition; health of the worker's family; and recreation.

Experienced people will be required to initiate an industrial safety and hygiene program in Libya. Standards must be developed, training courses for management and workers must be prepared, and inspection procedures must be initiated. We would estimate foreign staff of three for safety and accident prevention, plus two for industrial hygiene, plus Libyan staff to be trained to take over eventually.

### 3. Regulations

Where hazardous or unhealthy conditions exist, regulations can be set up by government to insure public health and safety. As examples can be mentioned steam boiler codes, transport and handling of explosives, sanitation in food processing and handling, protective measures in hazardous industries such as mining, heavy construction, etc.

## VI. REFERENCE LIBRARY OF EXISTING STANDARDS

When a new standard is to be established, the first step is to search the literature for standards already existing and published elsewhere. The time necessary to prepare a rough draft can be considerably shortened if a copy of the standard is already at hand. The best way to accomplish this is to maintain an excellent reference library of other countries' published standards, and new ones should be received as soon as they are published.

There is another advantage of having a good standards reference library. It will often occur that some material will require urgent testing and evaluation. If such standard test methods are available, the tests can be carried out immediately, while on the other hand long delays will result until the required test methods are found, ordered, and received.

## VII. PERSONNEL REQUIREMENTS FOR THE STANDARDIZATION PROGRAM

There are considerable personnel needed for carrying out a successful standardization program. The technical personnel and the administration has already been discussed previously, but there is also need for inspectors and legal experts.

### A. Administrative Personnel

There is the need for an administrator experienced in standardization matters to be the Head of the Libyan Office for Standards and Specifications. He should have the help of an assistant at a later date, when the standardization program will proceed at a more accelerated pace and will become more involved.

### B. Inspectors

Without inspectors who will collect samples, visit factories, and carry out field tests, no program can be successful. There is need for at least eight (8) inspectors in the beginning (but only after the needed laboratory personnel is available):

- 4 - food products
- 2 - building materials
- 1 - textiles and leather
- 1 - general, special.

These inspectors should be under the supervision of the Head of Standards Office. He should utilize them as advised by the experts of the Production Section of the Department of Industrial Research, and as complaints from the outside warrant.

## VIII. INTERNATIONAL CO-OPERATION

It has been pointed out previously, that wherever possible, internationally accepted standards should be used. However, this type of standards is limited, although progress is made by the United Nations. A much more practical and imminent goal is to have standards and specifications common at least on a regional basis.

A close economic co-operation of the Maghreb countries is being sought and a Regional Research Center will be established soon. One of the activities of the Research Center will be to promote and organize a common standardization program. Libya should take a definite and active part in this program.

The following approach is suggested:

1. Whenever the need arises for a specific standard in Libya, the Research Center should be contacted first to find out whether any one of the other countries already has such a standard in existence. If so, then the same standard should be accepted by Libya also.
2. If no standard exists in any of the other countries, the Center's recommendation should be followed when developing the specifications.
3. When the specifications are finished and the standard is ready for publication, it should be first submitted to the Research Center for comment and approval. Although the recommendations should be followed when practical, they should not be binding or mandatory.
4. The finished and published standard should be filed with the Research Center, so that the other countries can utilize it when their need for such a standard arises.

If co-operation on a broader basis (i.e., all Arab countries) becomes feasible, the same principles should apply.

#### IX. SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

The time has definitely arrived to start a standardization program in Libya. Although mainly needed to increase the quality of consumer goods, it is also to assure uniformity in industrial specifications all over the country, and when possible to co-ordinate this uniformity on an international basis. In order to have an effective standardization program in operation soon, a Libyan Office of Standards and Specifications must be established immediately. Also, the necessary supporting personnel such as technicians and inspectors must be provided.

Wherever and whenever possible, internationally accepted standards and specifications should be used, and international co-operation pursued.

Finally, to make the Libyan Office for Standards and Specifications really effective, it should be made semi-autonomous with its actions regulated only by the Executive Committee. The Ministry of Industry itself should largely have an advisory role. This way the Office could operate in the manner most beneficial to all the people and the country as a whole.