THE ASSESSMENT OF REQUIREMENTS FOR AN INDUSTRIAL POLLUTION CONTROL PROGRAM IN TUNISIA

Contract Number: 664-0300-S-00-2005-00

Project Number: 664-0300

Contractor Report

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INDUSTRIAL POLLUTION CONTROL IN TUNISIA

April 30, 1982

BACKGROUND

Faced with between 10% and 20% unemployment, Tunisia has undertaken a program of increasing industrialization. Cement, food processing and phosphate industries are expanding while relatively new plants have been completed for the production of textiles and fertilizers, the assembly of cars, trucks, and tractors, and the refining of oil. While owned and sponsored by the Central Government, these factories produce goods with some hazards balancing; through a governmental Office of Environment Quality Control and Industrial Standards and an increasing concern with pollution control in the industrial sector.

Rapid overall economic growth in Tunisia has been based at least in part, on growth of industrial capacity, much of which has occurred in the coastal urban areas and in a limited number of localities. Many of the basic industrial plants (such as cement, steel, paper, phosphate) are of older design. In addition to lacking environmental considerations in their original design, they often operate inefficiently and permit considerable release of pollutants to the air, surface water and possibly ground water. In several locations industrial pollution is a serious hazard to human health and/or to the stability of the ecosystem. Industrial pollution, together with urban wastes, is also bringing about the deterioration of some beaches and other touristic attractions, thereby threatening a major element of the Tunisian economy.

As in many Middle Eastern and other countries, Tunisian awareness of industrial and municipal pollutants developed in the 1950's and a series of laws were passed to regulate air and water wastes. There is no solid wastes law. There is a requirement that all industrial wastewater be pretreated before being emptied into a sewer drain, however few factories would qualify and even then the request to use a sewer drain may be denied or made too expensive to implement. Mostly the laws are not enforced, generally for lack of specific information on the levels and effects of pollution and often because of a lack of qualified and interested personnel.

With the Stockholm Conference and a renewal of interest in the environment during the 1970's have come a better framework of knowledge of the effects of pollution and an understanding of the requirements for Tunisian pollution controls to be tailored to the individual needs of the country. No longer is Tunisia as closely tied in its desire for pollution controls to France or other developed countries. Tunisian professionals have a sufficient understanding of the consequences of industrial pollution to develop laws and international agreements for their own environment. What they generally lack is specific experience with the installation and use of equipment and devices which have been developed to reduce industrial (or other) pollution.

USAID commenced in 1980 a program of assistance to the Government of Tunisia, designed to enhance the pollution control efforts in the nation. The initial project was implemented through the Central Laboratory at Gabes, Mr. Ridha Bouhalila, Director, where the laboratory was provided with instruments for the measurement of air and water pollutants, and the staff was trained, both in Tunisia and in the United States, in measurement techniques and in the operation of the laboratory equipment.

A Tunisian Office of Environment, Quality Control, and Industrial Standards was created in the Ministry of National Economy, with a mandate to regulate industrial pollution. Officials of the Ministry of National Economy and the Ministry of Planning and Finance have agreed with USAID that assistance should be given to this new office, in utilizing the technical resources which have been developed.

A program was initiated for an USAID assisted pollution control project to provide long-term technical advice to the Environment Office in administrative and technical aspects of the development and implementation of a regulatory program to control industrial pollution. This assistance is to be provided through the use of an intermittent technical advisor to review current information on pollution from existing and proposed industrial plants in Tunisia as a basis for determining which plants will require detailed surveys by industry specific specialists in pollution control. Engineers from the industry members of the International Environment Forum will be sponsored through the World Environment Center to visit Tunisia and prepare preliminary designs of alternatives in pollution control at Tunisian factories. They will document the pollution control alternatives for each industrial plant. The surveys will develop estimates of the cost and effectiveness of alternative levels of control, from which the advisor can assist Government personnel in the development of discharge standards and control technology specifications by industry or by plant; whichever will yield the maximum national benefit with available resources. Advice will be given within the analysis and regulatory program design, and during the development of incentives and enforcement programs in implementing the regulatory activities. Assistance will also be given in developing recommendations for the design of an administrative unit within the Government of Tunisia to implement a regulatory program for pollution control.

An important aspect of the advisor's functions is to develop linkages between Tunisian and American professionals and institutions so as to assure continuing access by the Government of Tunisia and by private industry to the most appropriate technology for pollution control in Tunisia. The advisor will help establish contacts with the U.S. Environmental Protection Agency, industrial associations, technology clearing centers, control equipment suppliers, and key industrial firms with control problems similar to those found in Tunisian industry.

Another element is to develop a series of factory pollution audits of key industrial facilities selected by the Office of Industry and assisted by the American advisor. Each survey will be carried out by a pollution control specialist experienced in control technologies appropriate to the industry being examined and in value engineering of control systems to work together with Tunisian engineers in the analyses.

The pollution control audits will assess the magnitude of the problems in the facilities examined and develop preliminary cost effective estimates of alternative levels and approaches to pollution controls specific to the facility. As the surveys are made on the sites having the greatest actual or potential adverse health and environmental impact, the cost and effectiveness data resulting will assist the Government of Tunisia in the selection of that combination of control levels which together would achieve the maximum benefit with available resources. This assistance will occur both in the immediate future through use of the data developed for near-term decisions and in the longer term through those skills developed by Tunisian analysts and engineers by working with the specialists in the plant audits and with the long-term advisor.

The surveys will assist the Government of Tunisia in the development of an industrial pollution control program most appropriate within the Tunisian economy as well as a national approach to pollution control.

THE FIRST ACTION

The project was unaugurated on April 2, 1982 with travel by the intermittent consultant to Tunisia for discussions with the AID mission and Tunisian Government representatives. Visits were made to examine the pollution control needs of four factories, and the external characteristics of several other factories were viewed. Documents were collected from AID and from Tunisian sources for examination and duplication. A visit to New York City permitted discussions with the World Environment Center and the International Environment Forum concerning the provision of pollution engineering advice from U.S. industries. Brief reporting and planning visits were made to the Washington D.C. Office of the Environmental Advisor for the Near East Bureau, both before and after the trip to Tunisia.

TUNISIAN DISCUSSIONS

The current project is designed to support the industrial pollution control interests of Mr. Ali Ben Gaied, Director, Department of the Environment, Quality Control and Industrial Standards of the Ministry of National Economy. This Ministry

adopted a stretegy for the protection of the Tunisian environment in April 1974. The strategy calls for particular attention to be paid to drainage into Lake Tunis, industrial pollution control, improved nutrition, and control of desertification. Industrial pollution control was accepted as being particularly important in the chemical industries of Gabes and Sfax, the lead production plant in Tunis, mines and processing plants at Zriba, Hamman and Djedida, the paper factory at Kasserine, the textile plants, the cement plant at Bizerte and the electric power plants. Also of priority concern under international agreements was the prevention of pollution in the Mediterranean Sea from oil, chemicals and sewage.

Reports were examined from a pollution related project by Dr. A. F. Bartsch, who advised concerning the development of the Central Laboratory in Gabes. Well qualified and experienced measurements laboratories are essential in meeting the basic need for information on water and air quality and for use in determining the course of action to be taken by the Tunisian Government. Environmental quality objectives are often met by establishing standards or norms for levels of various industrial toxins and other pollutants. These regulated substances can only be properly considered in relation to known release quantities, as measured at a competent laboratory. Such standards can then be met by adjusting production levels, by considered selection of a locality for the siting of factories, by altering the design or output details, by controlling the type of fuel used, by providing counter-measures through installation of pollution control equipment or perhaps least desirably, by enforcement of standards by legal means.

The Central Laboratory and other similar facilities are essential to the acquisition of accurate data on the points of origin within the factory and the release concentration levels of liquid, solid, and gaseous wastes. Monitoring of performance of pollution control efforts must include the proper collection and handling of samples as well as the use of standards and other controls to assure accuracy of the measuring instruments.

A report of Dr. Gerard A. Rohlich has described his visits to the paper factory at Kasserine, phosphate mines at Moulares and Redeyef, the cement plant, fluorides plant and phosphates plants at Gabes, the steel mill at Menzel Bourguiba, a sugar mill at Beja, and others. Dr. Rohlich reported on the need for a national policy and plans for industrial pollution control. He recognized the potential for performance of the National Commission for the Protection of the Environment, in the coordination of the several aspects of pollution control represented in the different ministries. Recommendations were made by Dr. Rohlich for the passage of an air pollution control act, the establishment of a pollution data management system, the adoption of flexible numerical standards

for pollution control with geographic adaptation of norms, and the employment of additional professional personnel in environmental quality and pollution control.

Dale Mansky of the Food and Drug Administration Office in Kansas City has studied the concentration of metals and contaminants in Tunisian workers, and a report to AID (Dail Gibb) should be available by the end of May.

Mr. William Yake assisted the Central Laboratory with a survey of pollution from some factories in Gabes, particularly the plant of Industrial Chemicals Maghribines. His report on "Wastewater Generation from a Sulfuric/Phosphoric Acid Plant" includes some on the concentration of wastes from the monoammonium phosphate plant (Ressource Tunisie).

An annex volume from a UNEP report at the Embassy provided a survey of pollution problems and useful data from some Tunisian industries, "Industries Chemiques, Maghrebines," "Penarroya Tunisie," "Societe Nationale du Cellulose," "Ciments Artificiels Tunisiens," "El Fouledh," "Les Industries Textiles," "La Societe Tunisienne Electricite Generale," "Industries Chemique du Fluor," "Societe Industrielle D'Acide Phosphorique et D'Engrais," and "Societe Tunisienne D'Engrais Chemiques."

Representatives of the National Industrial Fuel Efficiency Service, Ltd. visited Tunisia and studied ten factories in 1981. Their reports include some data concerning "Les Ciments de Bizerte," "L'Acierie d'El Fouledh," "Societe Tunisienne du Sucre," "Briqueterie de Fouchana," "Ciments Artificiels Tunisienne," "Compagnie de Phosphates de Gafsa, Metlaoui," "Societe Nationale Tunisienne de Cellulose," "Les Ciments de Gabes," "Briqueterie d'El Hamma," and "Societe Industrielle D'Acide Phosphorique et D'Engrais."

Mme. Saida Zouiten, Assistant Science and Technology Officer, AID, Tunis, had file copies of the principal Tunisian pollution control laws, "Loi No. 74-73 du 3 Aout 1974, Portant Creation de L'Office National de L'Assainissement (O.N.A.S.)," "Loi No. 75-16 du Mars. 1975, portant promulgation du code des eaux," "Decret No. 78-972 du & Novembre 1978, modifiant et completant le decret No. 75-201 du 29 Mars 1975, portant institution des redevances d'assainissement," "decret No. 79-768 du 8 Septembre, reglementant les conditions de branchement et de deversement des effluents dans le reseau public d'assainissement," "Decret du 25 October 1932 (25 djoumada II 1351)," "Drrete du 14 Decembre 1956 reglementant les appareils de production, d'emmagaginage ou de mise en eouvre des gaz comprimes liquefies ou dissous," "Decret du 12 Juillet 1956 (3 doul hidja 1375), portant reglement pour les appareils a pression de gaz," "Arrete' du Ministre des travaux Publics du 24 Mai 1957 (24 Chaoul 1376), reglementant dansles appareils a'vapeur et a' pression de gaz, la soudure a'

bords fondus sur fer ou acier." "Decret No. 68-88 du 28 Mars 1968, concernant les Establissements dangereux insalubres ou incommodes." There is also a Chapter (6) of the Labor Code, "Es Establissements Dangereux, insalubres ou incommodes."

What was not immediately available were the copies of international agreements for pollution control, to which Tunisia is a signatory. The Department of the Environment, Quality Control and Industrial Standards has sent out a detailed questionnaire to Tunisian factories. Replies were obtained from "Societe Granuphos" in Sfax, "Societe Industrielle D'Acide Phosphorique et D'Engrais" in Sfax and Societe Tunissienne de Levure" in Beja.

Visits were made by I. E. Wallen, Saida Zouiten and Bouraoui Darmoul (or Nessima Rejeibi at Penarroya) to four factories, "Societe des Industries Textiles Reunies, Bir Kassaa," "El Fouledh," "Penarroya Tunisie," and "Tanneries Megissieres du Magheb." Reports of these visits are attached to this report, (Annex I.). Superficial external examinations were also made by Dr. Wallen and Ms. Zouiten of several factories, "Societe Nationale Tunisienne de Cellulose," "Societe Tunisienne du Sucre," "Les Ciments du Bizerte," "Usine de Traitment du Spath fluor du Zriba," "Enterprises Tunisienne des Activities Petroleum," "Les Ciments Artificiels Tunisiens," and "Societe Miniere et Metallurgique du Tunisie, Kalaa Khasma."

ORGANIZATIONS INTERESTED IN POLLUTION CONTROL

The National Commission for the Protection of the Environment in Tunisia has a permanent secretary, Mr. Mostapha M'Nif, and reports to the Prime Minister. The Commission has an "oversight" responsibility for the environment in Tunisia, however it has not met, except for organizing purposes, and it does not appear to have accepted a clear mandate for action. In the absence of a functioning formal committee, I suggested that an informal committee of working staff meet to exchange views as needed. Mr. Ben Gaied said that this might be done.

The Ministry of National Economy employs a Director General of Industry, Mr. Monce F. Belaid, with broad responsibility for industrial production including the maintenance of old plants and the annual licensing of new and old ones. He may have files or brochures on industry performance and capabilities. He operates an Industrial Studies Center. All industrial proposals, new, expansion or remodelling, are reviewed by the Directorate of Industry, including the Environment Office. Perhaps as many as 100 arrive during a week. The usual cause for questioning is poor location. Appeals may be made. The Chairmen of the Boards of Directors of Government owned factories (most) are appointed either by the President or the Prime Minister or by the Minister

of National Economy. The promotion of industrial expansion is a primary goal of the government. Subsidies are available for the establishment of industrial plants outside Tunis. There are five zones and the most remote areas are the most highly subsidized. Businesses locating in Tunis receive no subsidy. Raw materials available include agricultural crops (cereals, olives, dates, grapes, citrus fruits, vegetables, almonds), oil and natural gas, phosphates, iron, fluorides, barite, lead, silver, zinc, cement, and esparto (alpha) grass (for paper). Exports of phosphoric acid and phosphates are expanding. Production of cement, processed foods, textiles, oil, metals, fertilizers, and automotives (assembly) is expanding.

Within the General Directorate for Industry the Director of Environment, Quality Control and Standards, Mr. Ali Ben Gaied, has responsibility for identifying the effects of industrial pollution on the environment, carrying out and reviewing environmental impact studies, noting ecological changes as a result of human activities, assisting the factories in the resolution of pollution problems, assuring that wastes treatment equipment is installed, treating industrial sewage, and the establishment of appropriate industrial environmental controls. Mr. Bouraoui Darmoul is responsible for regulations and standards development and application in industry. It will be very important that Mr. Ben Gaied have full access to highly qualified laboratory measurements in order to devise appropriate standards. A mechanical engineer, Mr. Dali is a development technology expert. Ms. Nessima Rejeiba is a pollution control engineer. Dr. Bechir Ammar, a former Professor, advises Mr. Ben Gaied concerning the paper plant at Kasserine.

Allowable levels of chemicals in wastes are now considered in relation to the French pattern (Cedex, 1976). No standards have been adopted, but an air pollution law is being planned.

The Ministry of Equipment is responsible for production and distribution of potable water and for operation of the sewerage system of Tunis through O.N.A.S., the Office Nationale de L'Assainissement. O.N.A.S. is headed by Tahar Dalouaa. In the Ministry O.N.A.S. is supervised by General Engineer, Mr. Fethi Gama. O.N.A.S. collects a sewer tax from industries, but may discourage industry from connection with municipal sewers because of the problems of industrial waste purification. The law requires pretreatment of industrial wastes, since untreated wastes may cause sewerage problems. O.N.A.S. responds to pollution complaints from the Governors, but has no technical officers in the Governorates.

The Ministry of Health and Nutrition employs a Director of the Environment, Mr. Sakok Atallah, and concerns for Occupational Safety and Health are newly organized under a Director of Worker Medicine and Occupational Diseases, Dr. Abdelaziz Ghachem.

Dr. Ghachem is also a Professor of Occupational Health and Safety at the University of Tunis. A form of workman's compensation is operated by all factories having 40 or more employees through the purchase of insurance. Tunisian law provides that all factories having 40 or more workers and apprentices must provide a briefing on health hazards at the time of employment, and they must pay all medical expenses for on-the-job diseases or injuries. Dr. Ghachem must administer this law and associated decrees.

On April 7, 1982 Dr. Ghachem told Mr. Darmoul, Ms. Zouiten and Dr. Wallen that the French practice in identification of occupational problems is followed directly in considering worker compensation. The worker's health Directorate has two medical doctors on permanent employment and about 40 part-time physicians along with one engineer, three hygiene technicians, and helpers.

At the factories, medical officers must be utilized, and annual or more frequent physical examinations are required. A Hygiene Committee must be established, and this must meet at least once each three months. The Committee must include the Plant Manager, the Safety Officer, a Nurse, a Social Services Assistant, and two Union members. The Tunisian Trade Unions are strong on a factory by factory basis. They negotiate pay supplementals based on the degree of risk. They participate with the Ministry of Social Affairs in the establishment of acceptable levels of risk. Prices and wages are set by the Government.

Workers come to Dr. Ghachem for determination of the level and health hazard of pollutants inside their bodies. Although Medical Officers from the Ministry of Health and Nutrition and from the Ministry of Social Services may make unscheduled on-the-spot inspections, their reports go only to the factory management. These doctors do not take instruments inside the factories. When a complaint is received (usually from trade unions) the Directorate must send a study team (doctor, engineer, technician, etc.) and report appropriate action to the management.

There is a plan to strengthen the occupational health and safety laws during the coming (6th) five-year plan, particularly to include a provision for more training. Factories are anticipated to be required to purchase instruments for the measurement of internal pollutants.

The Ministry of Social Affairs gathers data on the incidence and types of occupational diseases as well as data on occurrence of regular diseases.

The Ministry of the Interior has a Director of the Environment, Dr. Nadhir Hamada.

The Ministry of Agriculture has a Director of the Environment, Ms. Hedia Baccar. Although the agriculture role probably should be to assess the effects of pesticides and fertilizers on agricultural crops, irrigation and fishery resources, there have been problems with recommendations for zero discharge. Some compromise may be necessary between irrigation's needs for water and the release of industrial quality wastewater for reuse.

At the Municipality of Tunis, Mayor Zakaria Ben Mustapha has employed a Director of Hygiene and Environment, Dr. Youssef Gtari. A medical graduate of the University of Tunis with degree specialization in Occupational Health and Hygiene, Dr. Gtari has been with the City for 1½ years. Working along with O.N.A.S., he believes that air pollution and noise are severe problems and must receive attention from a regulatory standpoint. (Dr. Mounir Sefi is Director of Hygiene.)

About one month ago Dr. Gtari acquired a mobile laboratory with city money for air pollution measurements. He has taken a few measurements of CO and NOx and hopes to establish six stations for permanent monitoring. He has had no particular training in quality control nor in the use of instrument standards. I promised to get information for him on the International Monitoring Program from Nairobi (UNEP) and also suggested that he could get such information from the UNDP office in Tunis. He plans to add instruments for SOx and hydrocarbons in the near future.

Dr. Gtari has some noise measurement devices from Denmark. The Company (Brea) is expected to give additional training on noise measurement to him and selected assistants. I suggested that the EPA Office of Noise be contacted (by Lintner?) and information be sent to him at this address: Dr. Gtari, J. Youssef
Direction Hygiene and Environement
32 Rue d'Allemagne
Tunis, Tunisia

The Mayor requested that, as a part of this project, AID provide an expert on urban pollution, especially knowledgeable in mobile sources or air pollution and noise dimunition. He would make recommendations to the City, concerning appropriate actions to be taken.

The University of Tunis has established a fairly well qualified laboratory for measurement of pollutants, and provides both education and special training courses in occupational diseases and hygiene. The Departments of Biology (oceanographic section) and Chemistry, along with the Medical School, are involved in pollution studies, especially the effects of metals on the environment.

The Ministry of Planning and Finance allocates funds for all purposes including pollution control, and has shown considerable interest in the reduction of pollution at the factories.

The World Bank has planned to pay for engineering designs to improve the energy situation in ten factories, mostly due to poor housekeeping. If the pollution survey reports are submitted in time, they would consider support of pollution control designing in the same plants. Their tentative schedule is to start work in the fall of 1982.

POLLUTION CONTROL PRIORITIES

The goal of the Tunisian Government and of AID is to reduce industrial pollution within the limited available resources. In order to accomplish this, the actions taken in pollution control must be general in coverage for all of industry and at the same time specific to real industrial problems. The worst pollutional problems should be identified for environmental protection, however a broad range of alternative types of actions in the factories with the predicted effects of each proposal should be identified for management.

Pollution control becomes progressively and geometrically more expensive as a zero discharge ultimate goal is approached. The last 10% of protection may cost ten times the total expenditure for the first 90% of protection. A series of goals should be set with sufficient time for each in order to achieve affordable pollution control. Funding must be made available for pollution control equipment. The present industrial sewerage tax or the establishment licensing/tax might be rededicated for that purpose, or general appropriated funds could be used.

Because funds are limited, a comparative audit is particularly needed of the pollution control needs of all of the larger factories. The audit surveys should provide data in a similar format, suitable for comparison of the pollution potential of a broad assortment of industrial facilities (food processing, metals handling, manufacturing, tanneries, textiles, paper, cement, oil exploitation, etc.). A format for water pollution surveys must include information on the sources and quantities of water used, the types and quantities of waste water, and basic information on the factory and its processes and procedures.

Certain selected information exists in Tunisia. Ideally all factories should respond to a detailed questionnaire, and then all information could be cross checked during visits to each factory by experienced observers.

Almost every responsible governmental unit has developed information leading to the selection of priorities for action in pollution control. The Ministry of Health (Dr. Ghachem) reported that the most severe problems with workers are those of (1) mine workers, (2) lead workers, (3) welders, and (4) construction workers.

He believed that nearly all industries will require some activities in pollution control. Dr. Ghachem stated that typical problem areas in industrial production include (1) noise and heat, (2) chemicals, (3) open wiring, (4) unmarked pits, (5) failure to use masks with innalation of dust, and (6) open machinery.

As far as AID's information goes, the "most polluting" industries are cement plants, the steel mill, brick factories, the oil refinery, the sugar mill, phosphate processing and lead production.

Messrs. Ben Gaied and Darmoul believed that sufficient information in the form of detailed studies of the needs in pollution control has been gathered for the sugar refinery, a battery plant and the petroleum refinery. They believed that the two studies already completed at the paper factory and a study of the steel mill are partially adequate, with mercury, sodium hydroxide and chlorine remaining at the paper factory, and dust control still needed at the paper mill.

A list of priority companies for pollution control audits and action is appended (Annex II) to this report as envisioned by Messrs. Ben Gaied and Darmoul.

Information is being gathered concerning problems at these and other Tunisian factories to add to the list from which priorities can be selected. From a 1979 Guide to Tunisian Industries which is entitled, "Made in Tunisia," the attached list (Annex III) of larger Tunisian industrial establishments (excepting financial institutions) has been compiled. The industries listed were generally those having some potential for pollution and having a capital investment of more than 200,000 Dinars.

At the meeting in New York, the World Environment Center wanted commitments from ten to fifteen companies to provide up to two experts each to provide for surveys and reports of pollution control alternatives for Tunisian factories. As of April 13, only four companies had responded to the W.E.C. request for an expression of interest. It was agreed that a single pollution control specialist trip should be made at the time that Dr. Wallen returns to Tunisia on May 15, by a company volunteer to advise concerning the yeast factory. Dow Chemical Company has tentatively agreed to provide the "guinea pig."

In accordance with Mr. Ben Gaied's wishes, it is planned to make the reports for his use only in order to avoid improper publicity of the survey reports after their preparation. The survey engineers can do their work properly in the factories only if, as expected, a translator and ground transportation will be provided by the Tunisian Government.

Follow-up plans have been described in a State Department cable.

ANNEX I

COMPANY: El Fouledh, Societe Tunisienne de Siderurgie

PEOPLE: Abou Baker Zaak, Production Director General
Aouana Moncef, General Director

DATE VISITED: April 6, 1982

PRODUCTS AND PRODUCTION RATES: 21,728,000 tons production in 1980 - highest ever. (18 million 1979, 13 million 1978). Blast furnace, construction steel = reinforcing extruded wire, cast steel, rolled steel, welded structures, galvanized iron, small quantity of copper coated wire for internal use in welding.

SALES: Not available

PROCESSES: Blast furnace, 2 L.D. converters, 3 continuous casting machines, 2 rolling mills, wire drawing plant, welded structure plant, galvanizing plant, pusher furnace, ladle (poche) heating. Ore comes from Tunisia with about 15% scrap and currently about 8% imported (from Mauritania). Mostly high quality ore.

EMPLOYEES: 2400. 3 shifts

WASTEWATER DISCHARGE POINT: Lake Bizerte

PROCESS OPERATIONS

HOUSEKEEPING: Reasonably good, but a lot of process scrap around factory. Needs attention.

WATER CONSERVATION: May use too little water for cleanliness.

EQUIPMENT AGE AND CONDITION: Plant of French construction. Machines from several countries. Major repairs three months underway after 20 years. Blast furnace was closed at visit. Wire drawing machines send out red-hot iron rather unpredictably into open areas of plant. Equipment operation generally rather hazardous. Should be better after renewal is completed.

WATER QUANTITY: About 150 m^3/hr. recirculated. About 15 m^3/hr. HCl neutralization is released to lake. Boiler water is pumped from underground into 7800 m^3 reservoir. Lake water used for cooling (quantity not given). About 3000 m^3/day to cooling tower.

ENERGY: Mazout (Lourds #2); Electricity; Coke

FUTURE PLANS: To increase production and to burn coke gases to reduce air pollution.

CHEMICALS USED: Hydrochloric acid, sulphuric acid, calcium oxide, iron, coke gases, copper, zinc plating wastes, chlorine, salt.

MISCELLANEOUS:

1. Have some disposal problems with salt and chlorine.
2. No significant use of worker protection equipment.
3. Lake Bizerte is salt water approximately equal to sea water, used for artificial oyster and mussel production. Large ships can dock near factory.
4. Prevailing westerlies blow air effluent across lake. No large housing area near the factory.
5. Power plant is 3-4 Megawatt size, releases some sulfur dioxide.

WATER USE

PRETREATMENT: Boiler water softened. Use chlorine for drinking water.

PRIMARY USES: Cooling.

SEGREGATED COLLECTION: Water from ore washing process area is recycled. Power plant water goes through cooling tower.

EXISTING TREATMENT: Waste HCl water is neutralized with CaO and evaporated.

PLANNED TREATMENT: Building gas reburner to destroy coke gases during this shutdown period. Plant to go to 1200° in copper heaters. (This will conserve 30 kg. of coke per ton of iron). Would like ideas on better neutralization of Hydrochloric, sulfuric acids.

DATA AVAILABLE: None seen.

AVAILABILITY OF LABORATORY: Only quality control.

LAND AVAILABLE: Could accommodate wastes disposal facility, if needed.

TOXIC SUBSTANCES: Metals, acids, coke gas constituents.

SOLID WASTES DISPOSAL: Granulated solids to highway and fill use.

EQUIPMENT OPERATION: Plant being worked on for next three months.

CONCLUSIONS/RECOMMENDATIONS

1. Should provide assistance in audit of water pollution problems.
2. Need assistance in selection and use of safety equipment.

3. Modernization should take care of several of the problems.

VISITORS: I. E. Wallen, Bouraosi Darmoul, Saida Zouiten

COMPANY: Societe des Industries Textiles Reunies. Bir Kassaa.

PEOPLE: Fethi Meziou, Director
Ali Sanaa, Head of Workshop

DATE VISITED: April 6, 1982

PRODUCTS AND PRODUCTION RATES: Five process lines 18 million meters (5000 tons) of cloth in 1981. Expect 20 million in 1982. Dyed and printed cloth produced from gray cloth woven in Tunisia. Blended polyester and cotton.

SALES: Produce cloth that is sold by another of the Sogitex holdings. Factory is one of five large holdings of Sogitex.

PROCESSES: Washing, bleaching with sodium hydroxide and sodium hypochlorite. Sizing, dyeing and printing, washing, add optical brighteners, finishing, drying and packing for sale. Some cutting in preparation of bolts.

EMPLOYEES: 700. 3 shifts. Closed Saturdays noon to Mondays.

WASTEWATER DISCHARGE POINT: All wastewater into receiving pond on site. Piped partway to sea and permitted to flow onto land surface.

PROCESS OPERATIONS

HOUSEKEEPING: Relatively clean operation. Water directly to floor drains. Machines noisy but mostly neat.

WATER CONSERVATION: Appear to use plenty of water. Would like to recycle, but need to treat wastewater for reuse.

EQUIPMENT AGE AND CONDITION: Factory built in 1965, mostly from German equipment - some Netherlands, French machines. Apparently well maintained.

WATER QUANTITY: 4000 m^3/day - city purchased. Major water consumer in area.

ENERGY: Mazout (Lourd #2 oil). Electricity. 3 boilers each about 2 tons/hour.

FUTURE PLANS: No immediate plans for expansion.

CHEMICALS USED: Sodium Hydroxide, Sodium Hypochlorite, "white spirit" (white gasoline?), optical brighteners, organic dyes, chrome dyes, detergent, finishing chemicals, Naphtha, sulfur, dyes, phosphates.

MISCELLANEOUS:

1. Plant has barrel washing operation to reuse barrels within the plant. Dye wastes mixed with other water.
2. Would like to reuse especially the 40% of the water used in washing/bleaching.
3. Direct, reactive and vat dyes all used.

WATER USE

PRETREATMENT: Boiler water only.

PRIMARY USES: Washing, bleaching, process uses, barrel washing.

SEGREGATED COLLECTION: All goes to common pond on site could be intercepted at buildings.

EXISTING TREATMENT: None

PLANNED TREATMENT: Would like to recycle bleach and wash water (about 1600 m^3/day).

DATA AVAILABLE: COD 500-1000; pH 12. Analyzed by Central Laboratory and by ONAS. Reports not received.

AVAILABILITY OF LABORATORY: Quality control only.

LAND AVAILABLE: Have plenty of land for waste control facility.

TOXIC SUBSTANCES: Many dyes, optical brighteners and process chemicals may be hazardous.

SOLID WASTES DISPOSAL: Removed by city. Settlings from waste pond dumped on site.

EQUIPMENT OPERATION: No waste treatment equipment.

CONCLUSIONS/RECOMMENDATIONS

1. Two studies of wastewater disposal have been made (Canada - Okeefe and a Tunisian study). Neither gave a solution to the problems at the factory.
2. With both a large initial water cost and a potentially large charge for sewerage, it would appear that recycling would be worthwhile. Company Director wants engineering study.
3. Company is interested in suggestions concerning noise reduction.

VISITORS: I. E. Wallen, Bouraosi Darmoul, Saida Zouiten

COMPANY: Penarroya Tunisie, Societe Miniere et Metallurgique de Tunisie

PEOPLE: Mr. Menaouar, Technical Director

DATE VISITED: April 7, 1982

PRODUCTS AND PRODUCTION RATES: 50 kg. lead bars, 99% pure. Silver bars 99+% pure, lead antimony, concentrated zinc. 26,000,000 tons in 1980 (19,200,000 tons lead) (7,000,000 tons silver). Zinc generally lost to atmosphere (5%). Some gold as impurity in silver.

SALES: $\frac{1}{4}$ lead used in Tunisia, 3/4 exported. Silver mostly exported to U.K.

PROCESSES: Melt ore (2/3 Morocco, 1/3 Tunisia) in oil furnaces and remelt in coke furnaces to refine by temperature differential, cast into forms. Silicon, calcium oxide and iron used as catalysts.

EMPLOYEES: 480. 4 shifts.

WASTEWATER DISCHARGE POINT: Recycle water for washing. Use wastewater from other industrial plants in area. No discharged water.

PROCESS OPERATIONS

HOUSEKEEPING: Open storage of ore-reprocessed wastes, solid waste. Very dusty in dry summer condition. Open type of operation always dirty. Very old factory.

WATER CONSERVATION: Probably should use more water.

EQUIPMENT AGE AND CONDITION: Factory built 1911 and almost never closes. Maintenance can usually be completed without using much of two weeks "scheduled" shutdown to continue production. Except for new stack recovery equipment, the operating equipment looks quite old.

WATER QUANTITY: 2-3 m^3/day added to replace evaporated water.

ENERGY: Coke, oil, electricity.

FUTURE PLANS: Would like WEC/IEF audit of possible clean-up of areas of factory.

CHEMICALS USED: Heavy metals, coke burning chemicals.

MISCELLANEOUS:

1. In 1982 installed about 600,000 Dinars worth of air pollution control equipment. About 10 tons/day of solid wastes are precipitated from the stacks and can be recycled. The principal visable dust from the stacks is removed however, they still have significant measurable release of particles 1.4 mg/m^3. The equipment is to be accepted in June and efficiency should be somewhat increased (once .07 mg/m^3 particlates).
2. Pollution control equipment was installed by:
   Applications Economic Industrielles
   Genevet and Compagnie
   37, Boulevard Malesherbes
   75008, Paris, France.
3. Leakage and waste are severe problems at the factory.
4. Workers start at 120 Dinars/month.
5. Before installation of the pollution control equipment they had 18-25 cases of lead poisoning per month. In February and March, 1982 there were 8.7 cases. They hope this will be reduced further as the pollution control equipment is adjusted.

WATER USE

PRETREATMENT: Use wastewater from other factories directly.

PRIMARY USE: Wash water.

TREATMENT: None.

DATA AVAILABLE: Air pollution data from equipment manufacturer. Instrumentation to be installed at factory.

AVAILABILITY OF LABORATORY: Minimal facilities. Air pollution capability to be increased.

LAND AVAILABLE: Adequate building space.

TOXIC SUBSTANCES: Heavy metals in air.

SOLID WASTES DISPOSAL: City collection.

EQUIPMENT OPERATION: Air pollution equipment to be operated.

CONCLUSIONS/RECOMMENDATIONS

1. Company would like air pollution audit after June delivery of equipment, and suggestions for further steps to reduce air pollution problems.

2. With age of factory, much safety equipment and worker safety attention is needed.

VISITORS: I. E. Wallen, Saida Zouiten, Mme. Rejeibi

COMPANY: Tanneries Megisseries du Maghreb

PEOPLE: M'Zoughi M'Zabi, President, General Director
Abdel Waswed, Plant Manager
Taha Saiem

DATE VISITED: April 8, 1982

PRODUCTS AND PRODUCTION RATES: 2000 tons goats/sheep and 8 tons cowhides/day of finished leather.

SALES: Leather to shops for conversion to retail products.

PROCESSES: Dewooling, liming, pickling, tanning, dyeing, painting, cutting, stamping, finishing of hides. Wool is washed and dried for sale and used as stuffing in mattresses, furniture, etc.

EMPLOYEES: 220. 2 shifts.

WASTEWATER DISCHARGE POINT: Sewer pipe to agricultural area.

PROCESS OPERATIONS

HOUSEKEEPING: Very good for a tannery. Floors wet and dirty in dewooling area, but generally reasonably neat elsewhere. Daily removal of 2-3 tons of solid wastes (scrap) to dump.

WATER CONSERVATION: Use about right at visit.

EQUIPMENT AGE AND CONDITION: Nearly new (French, German, Spanish, Italian). Plant started limited operations from 1976 to 1980 completion. Equipment fairly well maintained and operating.

WATER QUANTITY: About 1200 m^3/day.

ENERGY: Mazout (Lourds #2). Electricity.

FUTURE PLANS: Plan to expand, however they are worried about availability of hides.

CHEMICALS USED: Chrome tannins, saponified oils, metallic dyes, paints, disinfectants, antiseptics.

MISCELLANEOUS:

1. National Center for Leather and Shoes has studied the pollution problem and suggested solutions. The data is held in the Tunisian Environmental Service.
2. A second study is being made by the Environmental Service within the next 12 weeks.
3. They could use a U.S. expert in about 6 months to audit the factory as long as U.S. standards were not required to be applied to production.

4. Two boilers produce steam for the plant.
5. Odors are not bad. Not associated with slaughterhouse.
6. This is a privately owned factory.

WATER USE

PRETREATMENT: Treat city water for boilers.

PRIMARY USES: Process water.

SEGREGATED COLLECTION: None.

EXISTING TREATMENT: None.

PLANNED TREATMENT: Studying possible treatment for reuse of water in agriculture.

DATA AVAILABLE: In Environmental Services file.

AVAILABILITY OF LABORATORY: Being built for water analysis on site.

LAND AVAILABLE: Should be enough for treatment.

TOXIC SUBSTANCES: Tannins, chromium, dyes, paints.

SOLID WASTES DISPOSAL: Daily 2-3 tons to city dump.

EQUIPMENT OPERATION: Good (new).

CONCLUSIONS/RECOMMENDATIONS

1. U.S. expert could suggest alternatives in purifying water for reuse.

2. Dye containers are washed to be reused but at another factory of same owner.

3. Many chemicals are stored in the warehouse and used without much attention to possible hazards.

VISITORS: I. E. Wallen, Bouraosi Darmoul, Saida Zouiten

ANNEX II

COMPANIES SELECTED FOR PRIORITY CONSIDERATION
IN POLLUTION CONTROL
by
Messrs. Bel Gaied and Darmoul

1. Societe Tunisienne de Levure, Beja (yeast from sugar products). Phosphoric acid and air pollution are problems. Need to clean up for reuse of the wastewater in irrigation.

2. Societe Nationale Tunisienne de Cellulose, Kassarine (paper products from alpha grass). Sodium hydroxide wastes in black liquor, mercury from electrolysis plant. Want to reuse the water for Eucalyptus tree irrigation.

3. El Fouledh, Societe Tunisienne de Siderurgique, Menzel Bourguiba. (Steel from Tunisien and Moroccan ores and scrap). Air pollution from blast furnace and power plant. Gases from burning coke are to be recycled, dust is problem.

4. Societe des Ciments de Gabes, Gabes. (Cement, clinker production). Electrostatic filters do not work properly. Air pollution.

5. Industries Chimiques Magrebines, Gabes. (Sulfuric acid, phosphoric acid, triple superphosphate, calcium phosphate production). Wash water, acids, sulfur oxides, fluorine, gypsum are problems, as is dust.

6. Societe Industrielle D'Acide Phosphorique et D'Engrais, Sfax. (Sulfuric acid, phosphoric acid, triple superphosphate) Acids, fluorine gas and dust are problems.

7. Compagnie de Phosphates et du Chemin de Fer de Gafsa, Metlaoui. (Phosphates). Washing phosphates, dust, fuel handling are all problems. Mines at Metlaoui, Redeyef, Moulaires, Mdilla.

8. Penarroya Tunisie, Societe Miniere et Metallurgique de Tunisie, Tunis. (Lead and silver production from ores). Dust and heavy metals housekeeping are problems.

9. Les Ciments de Bizerte, Bizerte. (Cement, clinker, gravel). Electrostatic filters do not work properly.

10. Les Ciments Artificiel Tunisiens, Tunis. (Cement, hydrated lime). Electrostatic filters do not work properly.

11. Industries Chimique du Fluor, Gabes. (Aluminum fluoride). Hydrofluoric acid, gypsum, calcium fluoride are lost.

12. Ressources Tunisie, Gabes. (Monoammonium phosphate). Monoammonium phosphate dust and washwater, phosphoric acid, ammonia are problems.

13. Societe Granuphos, Sfax. (Phosphate fertilizers, ammonium sulfate, potassium chlorate). Problems from dust, combustion gases, ammonia. Water is recycled.

14. Societe Tunisienne D'Engrais Chimiques, Gabes. (Superphosphate). Problems from fluorides, dust, high water temperature.

15. Tanneries Megisseries du Maghreb, Tunis. (Leather from goat, sheep and cowhides). Waste water should be purified for use in irrigation.

16. Tannerie Moderne de la Manouba, Manouba. (Tanning, finishing, specialty leather products). Waste water.

17. Societe des Industries Textiles Reunies, Bir Kassaa. (Dyeing, printing, finishing cloth). All water goes into pond and out without treatment.

18. Societe des Industries Textiles Rounies, Ksar Hillal. (Spinning mill). Dust noise problems.

19. Offshore Drilling

20. Slaughterhouses

21. Cheese Production

22. Olive Oil Production

23. Paints and Inks Production

ANNEX III

LARGER INDUSTRIES IN TUNISIA

Societe des Mines de Djebel Djerissa - iron ore
Djerissa 1,406,760 D.

Societe Tunisienne D'Expansion Miniere 1965 - lead, zinc fluorospar, mercury, barium metallic acids. 5,605,000 D.

Penarroya Tunisie 1967 - zinc mine at Fej Hassen Ghardimaou, production Tunis. Lead, silver finishing. 1,326,500 D.

Compagnie des Phosphates et du Chemin de fer de Gafsa 1897 - Mines at Metlaoui, Redeyeb, Moulares, Mdilla. Production S. Khammamou. Phosphates. 30,000,000 D.

Les Carrieres Tunisiennes 1929 - sand, gravel, crushed rock. Quarries La Kharroaba, Beu Arrous Tunis production K. Ben Ammar. 608,000 D.

Societe des Materiau de Carriere - sand, gravel, crushed rock. Quarry at Jebel Oust - production T Nabli. 400,000 D.

Societe Tunisien de L'Electricite et du gaz - 1962 - electricity, gas. 46,646,436 D.

Societe Tunisienne des Petroles Mory S.A. - bottled gas, storage of petroleum, marine supplier. Sfax. 300,000 D.

Societe de Recherche et D'Exploitation des Petroles en Tunisia. 1948 - production and drilling of oil. Factory between Douleb and Tamesmida. 15,120,000 D.

Societe Nationale de Distribution de Petrole - oil distribution. La Goulette, Sfax, Bizerte. 1,450,000 D.

Societe Nationale D'Exploitation et du Distribution des Eaux, 1968 - potable water. Tunis. 15,680,580 D.

Societe Italo Tunisienne D'Exploitation Petroliere. 1961. Drilling and production of oil. El Borma. 5,000,000 D.

El Fouledh, Societe Tunisienne de Siderurgie, 1965 - steel mill, blast furnace, rolling mill, billets, galvanizing. Menzel-Bourguiba. 5,909,920 D.

Societe de Fonderie et de Mecanique, 1964 - carbon steel, manganese, cast iron, copper plating. Tunis. 1,029,128 D.

Ateliers Mecanique du Sahel, 1962 - cutting tools, electric hand tools, brass, screws. Sousse. 2,000,000 D.

Societe de Construction Industrielle et Navale, 1930 - steel ships construction, repair, general mechanical work, factory construction. Sfax. 750,000 D.

Societe Generale Industrielle, 1946 - copperworks, metal framing. Tunis. 1,200,000 D.

Atelier de Construction Metallique du Gabes, 1976. Mechanical and metallic construction. Gabes. 1,500,000 D.

Societe Tunisienne D'Emballages Metalliques, 1965 - tin ware. Tunis. 1,470,000 D.

Poulina, 1967 - chicken and bird cages, feeders and pens, windows, air conditioning. Tunis. 500,000 D.

Les Grands Ateliers du Nord, 1975 - bird pens, cages, industrial construction, factory equipment. Tunis. 700,000 D.

Societe Tunisienne de L'Accumulateur, 1958 - electric batteries of lead. 2 factories, Tunis and Sousse. 1,080,000 D.

Societe de Materiel Electrique, 1963 - electrical cables, coaxial cables. Tunis. 500,000 D.

Societe Tunisienne des Lampes, 1969 - light bulbs. Tunis. 300,000 D.

Compagnie Tunisienne D'Electronique, 1965 - television, radios, scales, subcontract work. Tunis. 665,550 D.

Le Confort, 1969 - refrigerators, air conditioners, gas coolers, industrial air conditioning. Tunis. 1,850,000 D.

Sotacer, 1965 - stoves, hot plates, radiators, tanks, transformers, subcontracts. Menzel Bourguiba. 573,750 D.

Societe Industrielle de Carrosserie Automobile et Materiel Elevateur, 1970 - weights, vans, rails, trailer hitches, hydraulic equipment. Tunis. 800,000 D.

Tunisacier, 1976 - metalworks. 1,100,000 D.

Societe Industrielle D'Appareillage et Materiel Electrique, 1976 - electrical computers. Z. I. Grombalia. 550,000 D.

Societe Tunisienne Construction et de Reparation Mecanique et Navale, 1963 - shipyard. Menzel Bourguiba. 2,380,000 D.

Societe Tunisienne D'Industrie Automobile, 1961 - assembly cars, trucks. Sousse. 1,650,000 D.

Compagnie Tunisienne de Navigation, 1959 - maritime repair and transport. Tunis. 10,000,000 D.

Societe Nationale des Chemins de fer Tunisiens, 1956 - railway and repair. Tunis. 21,153,109 D.

Societe Regionale de Transport du Gouvernorat de Sfax, 1963 - manufacture and repair of vehicles. Sfax. 1,197,000 D.

Le Moteur - sale and repair of vehicles. Tunis. 1,500,000 D.

Societe Nationale de Motoculture, 1969 - agricultural machinery construction and repair. Tunis. 2,000,000 D.

Les Ciments Artificiels Tunisiens, 1932 - cement, hydrated lime. Djebel Djelloud. 1,102,500 D.

Les Ciments de Bizerte, 1950 - cement, lime clinker, gravel. Bizerte. 14,598,283 D.

Cimenterie Algerotunisienne, 1974 - cement. Tadjerouine. 20,000,000 D.

Societe des Ciments de Gabes - cement. Gabes. 11,000,000 D.

Ciment Amiante Tunisie, 1976 - asbestos cement pipes. Bizerte. 1,500,000 D.

Societe des Industries Cimentieres du Centre, 1976 - cement pipe. 1,200,000 D.

Les Platres Tunisiens, 1976 - plaster. Meknassi. 600,000 D.

Ceramique Tunisienne Les Oliviers, 1930 - bricks, plaster. Tunis. 600,000 D.

Union Generale, 1947 - ceramic bricks, "rough walling". Djemmel. 1,400,000 D.

Ceramique Tunisienne Jendouba, 1967 - bricks, tile, "rough walling". Jendouba. 1,000,000 D.

Ceramique Tunisienne (Briqueterie D'El Hamma), 1967 - bricks, "rough walling". El Hamma. 1,000,000 D.

Ceramique Tunisienne, 1930 - bricks, tile, "rough walling". La Manoubia, Tunis. 1,000,000 D.

Ceramiques Tunisienne Fouchana - bricks. Fouchana. 1,000,000 D.

Briqueterie A. M'Henni, 1974 - bricks. Zeramdine. 1,100,000 D.

Societe Industrielle Commerciale D'Ouvrage en Amiante Ciment, 1961. Jebel Jelloud, Tunis. Pipes moldings, asbestos cement. 1,000,000 D.

Societe Tunisienne LaFarge. Tunis. Mosaic tile, cement tile, marble metallurgy, prefabricated cement. 732,000 D.

El Anabib, 1967. Tunis. Molded cement pipes to order. 2,000,000 D.

Omnium des Materiaux Semi-Prefabriques. Tunis. Prefabricated cement. 2,000,000 D.

Faienceries Tunisiennes, 1967. Tabarka. Crockery. 600,000 D.

Manufacture Tunisienne de Ceramique, 1967. Zarzouna, Bizerte. Ceramic fixtures for sanitation. 1,100,000 D.

Societe de la Marbrerie Centrale, 1968. Tunis. Marble. 679,480 D.

Societe Tunisienne de Verrerie, 1963. Dishes, pots, pans, bottles. 1,250,000 D.

Constructions Henri Ducassou et Compagnie, 1977. Tabarka. Public and private construction. 7,378,000 F.F.

Crausot Lovie Enterprises, 1960. Construction of factories. 14,655,000 F.F.

Spie Batignolles, Societe Parisienne Pour L'Industrie Electrique. Electric Installation. 108,400,600 F.F.

Ikdam, 1960. Tunis. Electricity and air conditioning central construction. 750,000 D.

Grandes Travaux de L'Est, 1920. La Goulette. Pipes and pipe laying, public works, art objects. 1,500,000 D.

Enterprises Morillon Corvol Courbot (Succursale). Sfax. Public works. 28,455,000 F.F.

Societe Eau et Assainissement, 1925. Tunis. Installation of water and sewage lines. 49,900,000 F.F.

Compagnie Generale D'Enterprises Maritime, 1973. Tunis. Dredging. 880,000 D.

Saipem-Spa. Tunis. Oil exploration. 25 Billion Lira.

Tunisia Oil Field Contractors, 1977. Oil and industrial steel pipes. 1,000,000 D.

Esso Standard Tunisie, 1903. Sfax. Asphalt waterproofing. 830,970 D.

Societe Shell de Tunisie, 1927. La Goulette. Lubricants, agricultural products. 500,000 D.

Societe Tunisienne des Industries de Raffinage, 1960. Zarzouna, Bizerte. Petroleum refineries. 3,212,500 D.

Societe Industrielle D'Acede Phosphorique et D'Engrois, 1947. Sfax. Phosphoric acid, triple superphosphate. 3,330,000 D.

Alkimia. Gabes. Sodium tripolyphosphate. 2,100,000 D.

NPK Engrais Sat, 1961. Sfax. Triple superphosphate. 2,930,000 D.

Societe Tunisienne Industrielle de Produits Chemiques et Engrais. Tunis. Organic fertilizers, lime, insecticides, fungicides. 100,000 D.

Industries Chimiques Maghrebines, 1962. Ghannouch (Gabes). Concentrated phosphoric acid, sulfuric acid, powdered and granulated triple superphosphate. 8,000,000 D.

Societe Tunisienne D'Engrais Chimiques (STEC), 1968. El Afrane, Djebel Djelloud, Tunis. Simple superphosphates, ammonium nitrates, pesticides and potash. 1,200,000 D.

Societe des Engrais Phosphates et Azotes, 1975. Gabes. Concentrated phosphoric acid, diammonium phosphate. 16,500,000 D.

Granuphos. Sfax. Hyperphosphate granules. 670,000 D.

Industrie Chemique Du Fluor, 1973. Gabes. Aluminum fluoride. 2,200,000 D.

Resources Tunisie, 1973. Gabes. Monoammonium phosphate. 1,200,000 D.

Societe Tunisienne de Phosphate Bicalcique. Gabes. Bicalcite of phosphorus. 1,600,000 D.

Societe Tunisienne D'Oxygene et D'Acetylene, 1956. Sfax, Tunis, Djebel Djelloud. Compressed gases, medical aids. 2,000,000 D.

Pharmacie Centrale de Tunisie, 1961. Tunis. Pharmaceuticals and medicines. 763,588 D.

Societe Laboratoire Industrielle des Produits de Parfumerie, 1964. Tunis. Perfumes, cosmetics, insecticides, toiletries. 300,000 D.

Firestone Tunisie, 1966. Menzel Bourguiba. Tires. 520,000 D.

Societe Industrielle D'Ouvrages en Caoutchouc, 1970. Sfax. Tubes, rubber hoses, rubber products. 600,000 D.

Comptoir Nationale du Plastique, 1958. Sousse. Molded, extruded plastic articles. 812,500 D.

Plastic Tunisie, 1958. Tunis. Plastic articles. 690,000 D.

Coplacel, 1963. Tunis. Plastic, cellulose products. 420,000 D.

Societe Nlle du Plastique. Tunis. Plastic containers, p.v.c. tubing, coating for electric wires, sheeting. 210,000 D.

Polyplast, 1971. Tunis. Polypropylene bags, polyvinylchloride tubes. 220,000 D.

Societe Gabesienne D'Emballages, 1976. Gabes. Kraft paper and polyethylene bags. 450,000 D.

SOTIM, 1968 Sfax. Polyurethane foam. 700,000 D.

Societe Tunisienne des Peintures S.A., 1936. Tunis. Paints, varnishes. 500,000 D.

Societe Industrielle de Peinture, 1971. Sfax. Paints. 200,000 D.

Societe Industrielle de Fabrication des Colles et Derives S.A., 1966. Sfax. Industrial glues, leather finishers, textile finishes, petroleum products. 260,000 D.

Societe Tunisienne D'Industrie Laitiere, 1961. Tunis. Milk, yogurt, butter, cheese. 2,600,000 D.

Societe Tunisienne D'Industrie Laitiere, Centrala Laitiere, 1968. Sfax. Milk, pasteurized, dried candy. 2,600,000 D.

Tunisie Lait, 1974. Sidi Bouali. Milk, cheese, yogurt. 1,600,000 D.

Office Nationale des peches, Usine de Couserves de Mahdia, 1958. Mahdia. Preserved fish, fish oil, tomato paste, fish steal canned fruits. 281,262 D.

Office Nationale des Peches, Usine du Conserve de Sidi Daoud, 1958. Sidi Daoud. Preserved fish, fish oil, tomato paste, canned fruits. 281,262 D

Surgeles Taieb Khalfallah et Compagnie. Sfax. Frozen fishes, crustacean, fruits and vegetables. 250,000 D.

Minoterie Semoulerie de L'Avenue Sadok Bey, 1913. Tunis. Corn and wheat flours. 498,429 D.

Minoterie Centrale, 1938. Tunis. Flour mill. 349,200 D.

Societe Tunisienne D'Industrie Meuniere, 1952. Flour mill. Djebel Djelloud. 501,000 D.

Minoterie des Arcades, 1902. Tunis. Flour mill. 460,000 D.

Compagnie Tunisienne de Semoulerie. Djebel Djelloud. Flour mill. 260,000 D.

Societe Tunisienne de Production Alimentaire, 1973. Sfax. Corn and flour mills. 750,000 D.

Les Grandes Moulins de Nabeul. Nabeul. Flour mill. 360,000 D.

Societe Meuniere du Centre S.A. Sousse. Flour mill. 320,000 D.

Compagnie Africaine des Pates Alimentaires, 1928. Tunis. Foods from wheat pastes, couscous. 250,000 D.

Societe Franco-Tunisienne D'Alimentation, 1940. Tunis. Couscous, wheat, dried vegetables. 377,600 D.

Societe Tunisienne de Production Alimentaire, 1967. Sfax. Wheat based foods. 750,000 D.

L'Appetissante. Bejaoua-Gerant. Biscuits, cookies, cakes. 250,000 D.

Establissement Abdelmoula, 1960. Tunis. Olive oil, soap and refined products. 420,000 D.

Societe Industrielle Oleicole Sfaxienne, 1960. Sfax. Olive oil and seeds, artificial butter, soap. 400,000 D.

Comptoir Tunisien de Graisses Vegetales et Animales. Tunis. Animal and plant foods and olive oil refining. 314,000 D.

A. Majoul et Compagne Conserves S.A.R.L. Tunis. Tomato paste, fruits and vegetables preserved. 300,000 D.

Societe Industrielle de Conserves Alimentaires. Medjez El Bab. Tomato paste, canned fruits and vegetables. 220,000 D.

Societe Tunisienne D'Industrie Laitiere, 1961. Tunis. Tomato paste, vegetables, juices, canned fruits and vegetables. 2,600,000 D.

Societe Tunisienne de Sucre, 1960. Beja. Refined sugar from beets and cane molasses. 3,400,000 D.

Grande Fabrique de Confiserie Orientale, 1937. Tunis. Candy, chewing gum, bon-bons. 200,000 D.

Societe Tunisienne de Chocolaterie. Tunis. Chocolate. 405,000 D.

Sidpad, 1962. Tunis. Packaged and bulk ice cream, baby foods. 335,800 D.

Office des Cereales - Usine D'Aliments Composes, 1962. Bir Kassaa. Poultry and animal feeds. 7,646,258 D.

Societe de Nutrition Animale S.A., 1975. Tunis. Feed grains for livestock. 360,000 D.

Societe Frigorifique et Brasserie de Tunis (Agence de Bizerte). Zarzouna. Frozen foods. 2,080,000 D.

Societe Tunisienne de Levure, 1968. Beja. Yeasts, sugar, vanilla, bicarbonate. 250,000 D.

Compagnie Generale des Salines de Tunisie, 1949. Megrine, Sousse, Sfax. Food and industrial salt. 1,200,000 D.

Societe des Stations Thermales et des Eaux Minerales. Enfidaville, El Ksour, Karbous. Mineral water. 220,000 D.

Societe Tunisienne de Boissons Gazeuses, 1948. Tunis. Carbonated drinks, syrups. 1,350,000 D.

Societe Frigorifique et Brasserie de Tunis (Agence de Sfax). Sfax. Frozen foods, carbonated drinks. 2,080,000 D.

Societe General D'Alimentation. Tunis. Carbonabed drinks, beer. 1,500,000 D.

Agro-Combinat Thibar, 1903. Thibar. Wine and liquors. 342,829 D.

Union des Caves Cooperatives Viticoles de Tunisie. Tunis. Wines and champagne. 327,400 D.

Cooperative Viticole de Grombalia, 1948. Grombalia. Wine and wine bottling. 457,500 D.

Societe Frigorifique et Brasserie de Tunis, 1889. Tunis. Beer, carbonated drinks, frozen foods. 3,200,000 D.

Regie National des Tabacs et Allumettes, 1891. Tunis. Cigarettes, cigars, snuff, matches. 3,050,000 D.

Societe Industrielle des Textiles. Ksar Hellal. Spinning mill. 4,000,000 D.

Sotumatex, 1942. Tunis. Woolen thread, wool blankets, acrylic and cotton fiber, flannels. 550,000 D.

La Lainiere de Hadjeb el Aioun S.A.R.L., 1968. Hajeb el Aioun (Kairouan). Industrial wool and synthetic fiber for rugs. 310,000 D.

Filas, Filature du Sud, 1971. Sfax. Cotton thread. 300,000 D.

Filature Centrale de Tunisie S.A., 1974. Tunis. Thread, carded cotton, polyester-cottoncloth, polyester-rayon cloth. 925,000 D.

Cotonniere de Filature et de Tissage, 1976. Touza. Cotton thread. 200,000 D.

Societe de Filature et de Tissage de Tunisie, 1959. Tunis. Cloth of all kinds, natural and artificial. 366,000 D.

Manufacture Tunisienne D'Exploitation Industrielle, 1959. Menzel Salem (Tajerouine, Le Kef). Wool cloth, new and rewoven. 850,000 D.

Union Tunisienne D'Emballage et de Conditionnement, 1959. Tunis. Rough cloth, burlap bags, tents, ropes. 202,500 D.

Comptoir Textile du Centre, 1960. Sayada. Cotton cloth, polyester draperies, wool cloth, table cloths, handkerchiefs. 260,000 D.

Societe Monastirienne des Textiles, 1963. Monastir. Weaving of wool, cotton and polyester, artisan threads. 1,800,000 D.

Societe Generale de Tissus Eponge, 1966. Monastir. Cloth towelling thread. 420,000 D.

Societe des Industries Textiles Reunies, 1968. Moknine. Weaving of cloth from rayon, acetate, polyester and mixtures. 2,500,000 D.

Matex, 1969. Sfax. Cloth. 300,000 D.

Societe de Teinturerie Tissage et Confection (Anciens Etablissement Benmussa), 1971. Tunis. Traditional furnishings. 208,500 D.

Societe de Tissage Velours, 1976. Monastir. Furnishings. 240,000 D.

Societe Industrielle des Textiles, 1977. Ksar Hillal. Blue denim, polyester, cotton cloth. 4,000,000 D.

Societe des Industries Textiles Reunies, 1964. Bir Kassaa. Bleaching, dying, printing of cotton, wool and synthetic cloth. 2,500,000 D.

Societe de Finissage Textile. Tunis. Finishing. 250,000 D.

Centrale Tunisienne des Tissages, 1966. Tunis. Linens for bath, table, broadcloth. 200,000 D.

Societe de Promotion des Industries de Confection, 1961. Menzel Bourguiba. Blue jeans, blouses, work and sport clothes. 500,000 D.

Societe Tuniso-Allemande de Confection, 1964. Tunis. Ready-to-wear, umbrellas, jeans. 220,000 D.

Lee Cooper, 1973. Ras Jebel. Jeans. 300,000 D.

Societe Tricotage et Confection. Tunis. Knitted clothes. 200,000 D.

Societe Tuniso-Americaine pour L'Exportation. Sousse. Work clothes. 600,000 D.

Compagnie Industrielle de Bonneterie, 1959. Tunis. Ready-to-wear, leather, slips, sport clothes. 750,000 D.

Societe Industrielle de Lingerie, 1964. Sfax. Hosiery, mattress cloth, laces, lingerie. 200,000 D.

Sogemo, 1966. Tunis. Bathing suits, housecoats, pajamas. 360,000 D.

Manufacture Maghrebine de tricotage, 1973. Menzel Bourguiba. Men's, women's, children's sox, tights. 280,000 D.

Bacotex, 1974. Jemmal. Underclothing, pajamas, t-shirts, robes, skirts. 230,000 D.

Societe Tunisienne de Lingerie Indemaillable, 1974. Tunis. Brassieres. 370,000 D.

Societe Nord Africaine de Confection, 1965. Tunis. Stitched ready made clothes. 300,000 D.

Somotric, 1974. Tunis. Knits, robes, hose. 241,000 D.

Les Freres Abdelmajid et Bechirel Gongi, 1963. Ksar Hellal. Lace, braids, fringes, curtains, hose, knits, underclothing. 420,000 D.

Stufit, 1940. Tunis. Jute, rope, polypropylene lines, ropes, cloth, sacks. 500,000 D.

Atilier de Preparation D'Eponges, 1958. Tunis. Towels for export. 281,262 D.

Tannerie Moderne de la Manouba, 1958. Manouba. Tanning, finishing, specialty products. 350,000 D.

Societe des Megisseries Tunisienne, 1972. Hajeb El Ayoun. Dewooling, tanning and finishing of leather. 200,000 D.

Manufacture Maghrebine de Valises, 1963. Tunis. Suitcases. 350,000 D.

Bata Tunisienne, 1935. Tunis. Shoes. 800,000 D.

Societe Industrielle de Chaussures. Sfax. Shoes. 200,000 D.

Societe Industrielle et Commerciale de Chaussures, 1967. Sfax. Shoes, plastic. 300,000 D.

Societe de Developpement de L'Industrie de la Chaussure, 1977. Tunis. Leather shoes, parts. 600,000 D.

Societe Tunisienne de Production Industrielle, 1959. Sfax. Canvas shoes, plastic shoes. 300,000 D.

Societe Tunisienne de L'Industrie du Bois, 1960. Tunis. Wood panels, doors, laminated plywood. 600,000 D.

Societe du Bois et Derives. Tunis. Plywood, polystyrene, wall board. 350,000 D.

Tunisie-Contreplaque, Borgonova, 1977. Tunis. Laminated plywood. 251,000 D.

Enterprise Kossentine Freres, 1970. Tunis. Wood joining, housing, sand transport. 200,000 D.

Societe Nationale du Liege, 1962. Tabarka. Paneling materials, shells, gravel, fill, housing insulation. 500,000 D.

Compagnie Internationale D'Equipement de Meubles et D'Exportation 1956. Menzel Bourguiba. Furniture. 225,750 D.

Skanes Meubles, 1962. Monastir. Furniture. 500,000 D.

Meublatex, 1972. Between Sousse and Hammam. Furniture, boats. 330,000 D.

Office Nationale de L'Artisnat Tunisien, 1959. (197 workshops) Handicrafted products. 3,000,000 D.

Meublacier Tunisie, 1950. Metal furniture. Tunis. 200,400 D.

Societe Nationale Tunisienne du Cellulose, 1957. Kasserine. Paper from pulped Alpha grass. 5,210,590 D.

Societe Tunisienne de Papier Alfa, El Warak, 1968. Kasserine. Many kinds of paper-kraft, duplicator, embossed, carbon, etc. 400,000 D.

Societe Tunisienne D'Imprimerie et de Cartonnage, 1960. Tunis. Cartons. 400,000 D.

Imprimerie Officielle de la Republique Tunisienne, 1876. Tunis. Printing, typo or offset. 1,150,000 D.

Comptoir Tunisienne D'Imprimerie et de Papeterie, 1961. Tunis. Printing, fabrication of stencils, carbons, inks, ribbons. 300,000 D.

Societe D'Arts Graphique D'Edition et de Presse, 1966. Tunis. Newspaper production. 600,000 D.

Dar Assabah, 1969. Tunis. News and magazine production. 320,000 D.

Centre Industriel du Livre, 1959. Tunis. Books, pamphlets, other works. 650,000 D.

La Nationale Edition (Ancienne Imprimerie Nasra), 1967. Tunis. Printing. 250,000 D.

Dar El Amal, 1977. Tunis. Editing publishing. 200,000 D.

Satpec, 1962. Tunis. Films, equipment. 600,000 D.

Ennagham, STD., 1968. Tunis. Records. 250,000 D.

Tunisie Nederland Belgique Diamants, 1977. Ksour Essaf, Mahdia. Diamond cutting. 500,000 D.

La Brosse, 1967. Tunis. Brooms, brushes, aerosols, cosmetics. 200,000 D.

Societe Nationale des Transports, 1963. Tunis. Bus services. 4,978,462 D.

Societe Regionale de Transport de Sfax, 1963. Sfax. Bus services. 1,197,000 D.

Societe des Transports du Sahel. Sousse. Bus services. 400,000 D.

Societe des Transports de Marchandisea. Tunis. Trucking. 883,770 D.

Societe Tunisienne de Transport. Tunis. Bus service. 240,000 D.

Gabes Chemie Transport. Tunis. Phosphate transport. 250,000 D.

Societe Nlle de Transport de Kerkennah, 1976. Sfax. Marine transport. 250,000 D.

Tunis Air. Tunis. Airplane service. 7,200,000 D.