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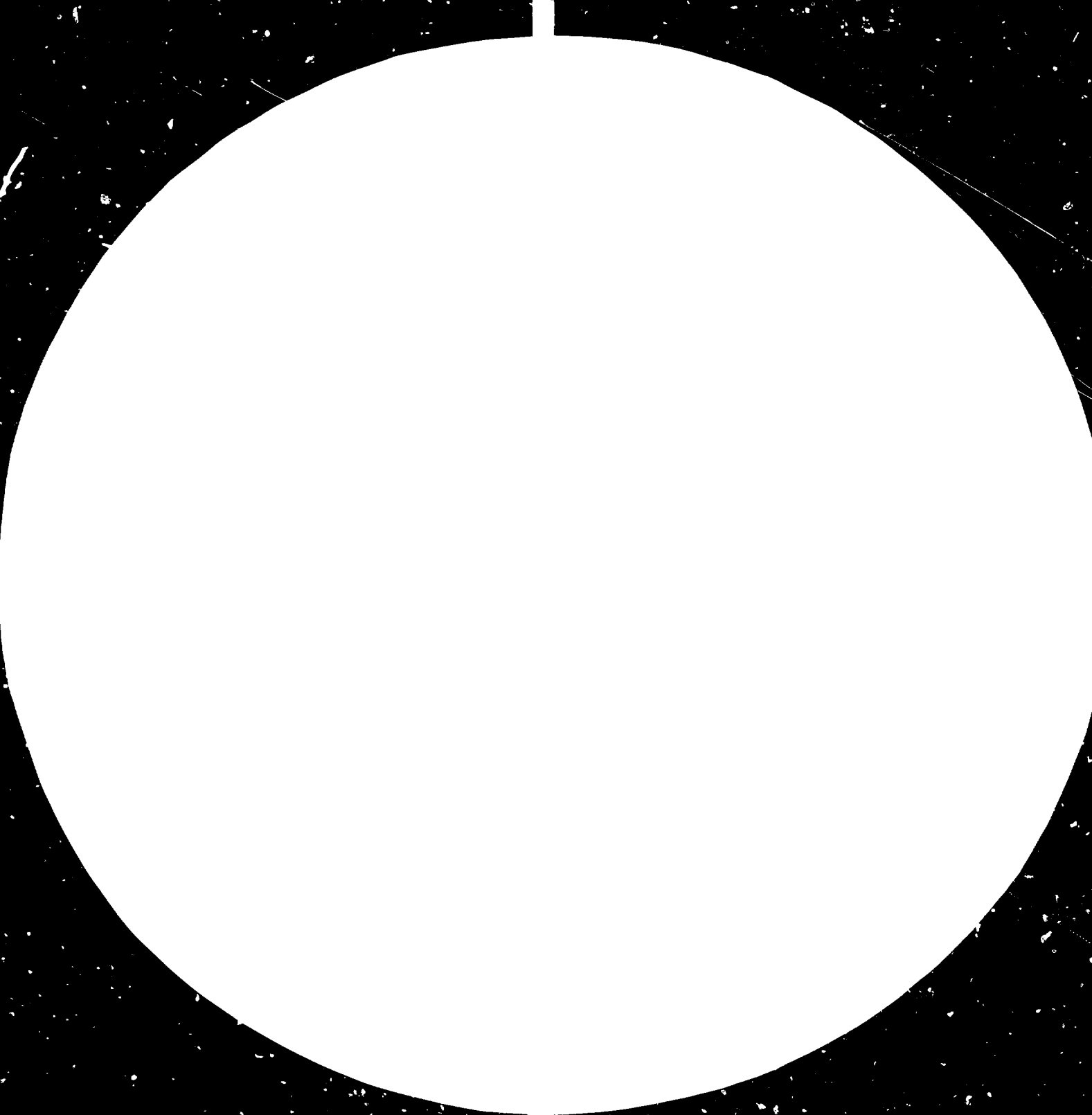


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CONSOLIDATION OF THE MEXICAN INSTITUTE FOR ASSISTANCE TO THE INDUSTRY

DP/MEX/78/011

MEXICO

Technical report: Metal containers for food *

Prepared for the Government of Mexico
by the United Nations Industrial Development Organization,
executing agency for the United Nations Development Programme

Based on the work of Ramon Catala, consultant on metal containers for food

United Nations Industrial Development Organization
Vienna

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C O N T E N T S

1. SUMMARY

The Mexican Institute for Assistance to Industry (IMAI) created in 1977 by the Mexican Government has recently been absorbed by Laboratorios Nacionales de Fomento Industrial (LANFI).

This Institution is consolidating its activities in the field of Packaging Technology, initially assigned to the IMAI, through a cooperation project with the United Nations Industrial Development Organization (UNIDO).

Actually and as a result of this project the institution has the human resources and basic equipment necessary to make studies in the metal packaging technology field.

The personnel assigned to The Metal Packaging Group have a good theoretical background in different general disciplines necessary for their work, but they do not have a deeper knowledge in specific subjects and especially lack practical training in the use of laboratory equipment. Furthermore a better appreciation of the possibilities for applying the equipment to the solution of practical problems is still missing.

To solve this problem a basic course: "Food Metal Packaging Technology" was presented, devoting special interest in personnel training and in the use of different laboratory techniques intended for quality control of food metal containers.

With the purpose to consolidate the know-how acquired by the personnel, a research project has been proposed, related to the quality and compatability of canned food and metal packages manufactured in Mexico. This project, besides contributing to complement the studies of the Metal Packaging Group will present interesting information about the Mexican food industry and the quality of locally manufactured metal containers.

Additionally, other complementary activities of interest were developed, in collaboration with the Comité Consultivo Nacional de Normalización de Envase y Empalaje, and in participating in a Quality Control of Food Metal Packaging Seminar intended for industrial technicians. This Seminar gave an excellent opportunity for industries manufacturing food packages and preserving food to learn about LANFI opening possibilities for future cooperation.

2. INTRODUCTION AND DESCRIPTION OF THE MISSION.

The Mexican Institute for Assistance to Industry (IMAI) was created in 1977 by the Mexican Government with the purpose to fulfill specialized functions of information, training of personnel, standardization, quality control and applied research in the field of packaging technology.

With the purpose to develop and consolidate the activities of the Institute, the Mexican Government and the United Nations Industrial Development Organization (UNIDO) set up a cooperation program (DP/MEX/78/011) which is being carried out at present.

After the start of the UNIDO project, IMAI has been absorbed by the "Laboratorios Nacionales de Fomento Industrial" (LANFI). These Laboratories were created in 1948 with the objective to "create, develop, adopt, transfer and implement industrial technology".

In accordance with these objectives, the activities initially assigned to IMAI will bring excellent development to LANFI, once the consolidation is completed and LANFI will follow the established plans.

Since the beginning of the UNIDO project several experts have worked in different aspects of it which comprise Packaging Technology. The plan initially foreseen for the author was the following job.

JOB DESCRIPTION

Post title:	Consultant in the Production of Metal Packages
Duration	One month
Date required:	June 1981
Duty station:	Mexico City, with travel as required.

Purpose of Project

To consolidate the activities of the Mexican Institute for Assistance to Industry from the technical and performance points of view, with regard to its basic activities in the field of packaging. Particular emphasis is placed on the enlargement and specialisation of the Institute's technological capabilities in order to fulfill its role of providing the country with such permanent services as packaging information, standardisation, training, design, applied research, testing and quality control and in giving advice on the development of appropriate packaging industries.

Duties

The activities of the expert will be agreed upon in co-operation with the national counterpart personnel and co-ordinated by UNIDO's project manager in the field. The expert will be assigned to the Mexican Institute for Assistance to Industry (IMAI) and will specifically be expected to:

1. Make a general evaluation of how appropriate the metal packages are which are presently being used in the country.
2. Make an appraisal of raw materials, techniques and equipment used in the country for the manufacture of plastic packages, both from the technological and economic points of view.
3. Study the present national capacity for the production of metal packages and compare it to the demands foreseen for the next ten years.
4. Work out an overall plan for the expansion of existing manufacturing plants for metal packaging materials and packages and/or for the establishment of new ones in order to satisfy the national demand for the next ten years. Prepare a pre-feasibility study concerning this respect.

5. Work out a tentative programme for the recycling of metal packages in the country and for the possible substitution of imported raw materials.

6. Give ad hoc advice on other matters related to the technology of metal packaging, if and when requested by the national counterparts.

The expert will also be expected to prepare a final report, setting out the findings of his mission and his recommendations to the Government on further action which might be taken.

Qualifications

Packaging technologist with a university degree or equivalent experience; specialisation in the manufacture and utilisation of metal packages.

When I started the program several experts had been previously assigned to the same area - Metal Packaging Technology.
I wish to mention the work done by Mr. Warren Parkinson obtaining basic information concerning the production of packages in Mexico; by Dr. Chaim Mannheim about technological aspects of packages and packaging and by Mr. David Reznik in the

training of personnel in analytical methods of cans and canned foods. Some of the subjects initially assigned to this expert have been carried out by others. Therefore, in agreement with the Project Co-Manager Luis Fernando Ceribelli Madi we proposed the following Job Description:

JOB DESCRIPTION

1. Prepare and present a Food Packaging Seminar to the LANFI staff.

2. Prepare a study on the essential tests that are being used in the laboratory and introduce new methods for the evaluation of food metal containers.

3. Make a general evaluation of the food can testing equipment already existing in the Institute, the new equipment ordered and train the LANFI staff in use of the equipment.

4. Train personnel in the solution of corrosion problems of food cans, oriented to industrial areas.

5. Prepare a Research and Technical Project about the present use of the metal packages for food in Mexico in order to identify the main problems existing in this area.

6. Visit food and packaging industries and related organisations in Mexico for orientation of the program in LANFI.

7. Participate in a Quality Control Seminar on Metal Packages used for Food, intended for the Mexican Industry.

3. DESCRIPTION OF WORK PERFORMED.

According to the program, the following activities were carried out:

3.1 Food Metal Packaging Seminar for the LANFI staff

LANFI's personnel belonging to the different groups of work related with food packaging have an excellent theoretical background in the basic disciplines, necessary for the execution of their jobs, however, they have a lack of know-how in some specific areas.

One of these subjects concerns the Metal Packaging Technology about which they have partial knowledge but not an overall understanding of the same.

With the purpose of remedying this deficiency an internal Seminar "Food Metal Packaging" was scheduled. In this course different aspects of the subject were covered including: production of primary materials (i.e. steel plate) handling of cans in the making and canning factories; a thorough explanation of the reasons and practical aspects of corrosion and quality control of packages. Texts of all subjects covered were delivered to the participants.

The Seminar was presented during 18 hours (6 sessions of 3 hours each) from July 20 to July 31. The list of participants is given in Annex I.

3.2 Training of the Metal Packaging Group in the methods for the evaluation of package quality and its compatability with products.

The work carried out within the UNIDO program together with the previous work of experts has provided LANFI with the necessary background and equipment to perform the majority of the necessary analyses for metal packaging studies. The Metal Packaging Laboratory is well staffed and equipped to fulfill its mission although some specific pieces of equipment are still missing.

However, the laboratory personnel is not yet sufficiently skilled in the use of most of the equipment. For this reason the training of personnel in proper laboratory techniques received great importance and considerable time of this expert was devoted to it.

During my stay in Mexico a theorical-practical Seminar for technicians of the Mexican Industry (see point 3.4)

was scheduled. In this Seminar the theories of package manufacture and of corrosion were reviewed and pertinent package quality control methods were elaborated. The list of laboratory tests prepared and/or reviewed is given in Annex II.

The following tests were chosen for practical laboratory exercises of the Metal Group.

- Sealing compound weight
- Porosity of tin coating using SO_2
- Lacquer adherence by Scotch tape
- Electrotest for lacquer adherence
- Dissolved metals in canned product (Sn, Fe, Pb)
- Degree of package corrosion

The group was familiar with most other tests (i.e. tin coating weight) but some details needed elaboration.

The Metal Packaging Group should now be ready to start development work, give technical assistance and carry out investigations related to food metal packaging.

In order to complete the basic equipment of the metal laboratory it is recommended to acquire the following equipment and materials:

- Equipment for the determination of lacquer film thickness.
- Equipment for the determination of the pressure resistance of cans.
- Nitrogen tank and gas purification equipment.
- Die-stamping press for the preparation of tinplate samples.
- Electrical battery for wet mineralization of food.

3.3 Preparation of a research project to be carried out by the Metal Packaging Group

As was shown in 3.2 the Metal Packaging Group has now the basic know-how and equipment to carry out practical work.

The next step should be the consolidation of this know-how and its application for the benefit of the Mexican packaging industry as well as for food packers.

For this purpose nothing will be better than to carry out a technological investigation which will apply the know-how acquired to a study of importance to the Mexican industry.

Dr. Chaim Mannheim had suggested this idea a year ago and LANFI had a general project scheme but without any detailed plan. My work consisted in detailing this idea, making the Metal Packaging Group and responsible of the same, conscious and prepare the project.

The project "Quality and Compatibility evaluation of Food Metal Packages and canned foods manufactured in Mexico" has the following basic objectives:

1. To evaluate the present situation of the metal packaging manufacturers and the Mexican Food Packaging Industries
2. To evaluate the quality and suitability of the packaging presently used by the Mexican Industry
3. To study the food-package interaction of products which are of major interest to local industry and consumers.

For the practical realization the following three consecutive and independant steps are proposed:

1. Evaluation of the quality of locally made canned foods and study the defects due to corrosion.

2. Quality evaluation of the packaging material

3. Shelf-life studies of canned foods of greatest interest to the local consumers.

A complete scheme of the proposed investigation is given in Annex III.

3.4 Seminar: Quality Control of Metal Food Packages.

During my stay in LANFI, in cooperation with Dr. Mannheim and Luis Madi, a theorical and practical Metal Packaging Quality Control Seminar for industrial technicians was prepared.

I participated in this Seminar giving two lectures as well as in the preparation of the practical part as shown in 3.2 The above mentioned program of the Seminar is given in Annex IV.

The participants of the Seminar were 27 technicians representing a wide number of the Mexican Industries including canners, food packaging makers as well as 6 members from LANFI.

In my opinion the Seminar was very important and successful for LANFI since the participants obtained an excellent impression

of the Institute and were conscious of the possibilities for cooperation in the future.

3.5 Other Activities.

During my stay in LANFI I was invited to participate in two working sessions of the Comité Consultivo Nacional de Normalización de Envase y Embalaje, (July 17 and 31).

In these sessions the Standard "Metal-Packages - Test Methods for determination of the tinplate quality related to corrosion resistance" was discussed.

I actively participated in correcting some mistakes in the proposal and in suggesting alternative wordings which were approved and incorporated into the standard.

Another activity included in the job description were visits to food and packaging industries and other organizations with he purpose of orientating the LANFI program. This activity was not carried out since it was considered more important to work with the LANFI staff in the laboratory due to the short time available.

4. RECOMMENDATIONS

4.1 The Metal Packaging Group already has now a good theorical background as well as a practical know-how of the different techniques necessary to carry out work in this field. It is recommended to consolidate this know-how in an experimental study as outlined in Annex III.

With this study the personnel will complement its training and will obtain information of interest about the present situation in the Mexican Industry related to metal packages as well as canned foods.

4.2 Due to the personal characteristics of the Group, it is recommended that every member acquires some specialization in a certain technique or in a group of techniques, but maintains at the same time a close collaboration with other members so that all persons will be able to perform any function necessary.

Duplicity of efforts and the creation of isolated sub-groups must be avoided through the participation of all members of the group in the entire work program and in taking decisions.

4.3 Due to the specialized academic training of the Metal Packaging Group it is recommended that close collaboration with the Food Group of LANFI be intensified so that they can find and complement their know-how in this field.

4.4 The materials and equipment presently available to the Metal Group can be considered in general adequate but the acquisition of some small additional equipment to complete the necessities (see 3.2) is highly recommended.

In advanced laboratories elsewhere electrochemical polarization techniques are used for metal packaging and corrosion studies. However, it is not recommended, at this moment, to introduce these techniques to LANFI but rather wait until all other techniques are properly absorbed and consolidated.

4.5 It is recommended to consider, as soon as possible, sending members of the Metal Group for advanced training towards a masters degree in laboratories specializing in this field abroad. This training is necessary not only in order to acquaint the staff with advanced scientific knowledge in their field but also to provide them with very much needed leadership qualities and organizational techniques. Furthermore,

short periods of training in selected industrial establishments would be of great benefit.

4.6 It is very important to intensify the relationship with the Mexican food packaging manufacturers as well as food packers by giving seminars and specialized courses, as well as by accepting specific investigation and/or technical assistance projects on different aspects.

A N N E X I

LIST OF PARTICIPANTS IN THE FOOD METAL PACKAGING SEMINAR

Q. F. B.	Cecilia Rojas De Gante
Q. F. B.	Lourdes Osnaya Suarez
Q. F. B.	Laura Paredes Lorea
Q. F. B.	Brisia Gabriela Rodríguez
Q. F. B.	Elsa Austria
Quim.	Ma. Elena Arellano
Quim.	Daniel Landeros
Ing. Q.	Leonel Tamayo
Ing. Q.	Carmen Liceaga
Ing. Q.	Olga Arce León
Q. F. B.	Adriana Urrutia
Q. F. B.	Nuri López
Q. F. B.	Ninfa Rodríguez
Ing. Q.	Miguel Quijano

ANNEX II

LIST OF LABORATORY TESTS PERFORMED AND/OR REVIEWED

1. Analysis of package conformity.
   - 1.1 Visual analysis
   - 1.2 Double seaming
   - 1.3 Sealing compound weight
2. Quality control and evaluation of plain tinplate
   - 2.1 Tin coating (free and alloy layers)
   - 2.2 Chromium coating (TFS)
   - 2.3 Porosity
   - 2.4 Tin crystal size
   - 2.5 A.T.C. test (alloy tin couple test)
   - 2.6 Sulphur staining resistance
3. Quality control and evaluation of lacquered tinplate
   - 3.1 Type of lacquer
   - 3.2 Film thickness
   - 3.3 Adherence
   - 3.4 Continuity (porosity)
   - 3.5 Sulphur staining resistance
4. Evaluation of the corrosion in canned products
   - 4.1 Headspace gas analysis

4.2 Dissolved metals in canned products (Sn, Fe, Pb)

4.3 Degree of corrosion

A N N E X III

RESEARCH PROPOSAL

TITLE: Evaluation of quality and compatibility of Food Metal Containers made in Mexico.

OBJECTIVES:

1. To know the present situation of metal containers and canned foods made by the Mexican Industry.

2. To evaluate the quality of the cans and their compatibility with foods made by the Mexican Industry.

3. To study the problems of package-product interaction for several foods which are of interest to the Mexican Industry.

JUSTIFICATION:

The manufacture of tinplate for cans in Mexico does not cover the requirements of the local food industry making it necessary to import such materials in large quantities which are claimed to be of higher quality.

Generally, the lack of information concerning quality of packaging materials of national or foreign origin, gives rise to frequent

corrosion problems with the consequent loss of money and good will.

The proposed study can provide information necessary to improve the quality of canned foods in Mexico.

PROJECT DESCRIPTION:

The project comprises three consecutive and independent steps:

1. To evaluate quality of canned foods and their effect in the corrosion of metal cans in the Mexican Industry.

2. To evaluate the quality and compatibility of the metal containers used in Mexico.

3. To make shelf-life studies in several canned products of interest to the local industry.

The details of above steps are as follows:

1. Evaluation of the quality of canned foods and their effect on corrosion of metal cans in the Mexican Industry.

1.1 To obtain information concerning the problems in food manufacturing industries specially related to:

- Type of manufactured products
- Overall quantities produced
- Special canned products quantities produced
- Container suppliers - Problems
- Frequent problems which occur in the industry

LANFI has available some of this information from previous studies but it will be necessary to complete this information by inquiring and/or visiting the various industries.

1.2 To obtain a wide sample products representing those prepared in Mexico.

It is advisable to study the majority of canned foods manufactured by the local food industry, or at least to have a good representation of the main products consumed.

Different representative labels from each product should be studied (minimum 50% of the ones in the market) taking 5 units from each group.

Samples can be acquired in the market and also by obtaining them directly from the factories. (The factory may not provide the best representative samples, but will collaborate and be interested in the project).

1.3 Analysis of the products.

Take a sample of a minimum of 3 cans from each product group and make the analyses of every can as follows:

The can:

- Shape and dimensions
- External aspect
- Vacuum and headspace
- Seaming conditions
- Can Material Characteristics:
  - Tin coating weight
  - Lacquer type
  - Lacquer film thickness
  - Internal corrosion of the can visual

The canned product:

- Net and drained weight
- pH
- Acidity
- Odour, colour and taste (sensorial)
- Sn, Fe, Pb contents

1.4 Presentation of Results.

The results obtained should be incorporated into a report containing the following information:

- List analysed products
  - List of manufacturing companies of each product
  - Production quantities
  - Prices
- Results of analysed samples of each product (without specifying importance)
- Global results, statistic study
- Critical analysis of laboratory results
- Review of problems detected. Metal polution levels.
- Conclusions and recommendations

Note:

The Metal Packaging Group has the necessary background and equipment to fulfill the proposed work. However, before starting the above study it is advisable to practise all the analyses concerning packaae and food and to collaborate with the Food Group to assure proper analysis of canned products.

2. Evaluation of the quality and compatibility of tin cans.

2.1 To obtain information concerning the metal container industry especially related to:

- Primary materials used. - Quantities and origin.
- Type of manufactured containers.
- Relative proportion and use
- Frequent problems

LANFI has some information available for this study, but it is necessary to complete this information through inquiries and/or visiting industry.

2.2 To obtain representative samples of the materials used.

It is considered necessary to have a wide range of samples of the different containers manufactured by the Mexican Industry.

Samples can be acquired directly from factories which participate in the project and which will receive results.

Factories should send several groups of containers (minimum 10 containers/group) indicating origin of materials, quality characteristics and intended use.

Several sheets of tinplate of different available types should also be requested.

2 3 Analyses

Take a sample from each group sufficiently large to make triple analyses of different containers as following:

Plain tinplate containers:

- Conformity tests
  - . Dimensions
  - . Container aspects
  - . Seams
- Tinplate evaluation tests
  - . Free and alloyed tin coating
  - . Porosity (SO_2)
  - . Tin crystal size
  - . A.T.C. test
  - . Chromium Coating (TFS)
  - . Sulphur staining resistance

Lacquered tinplate containers:

- Conformity tests.

  Same as indicated for plain tin cans.

  Evaluation test
  - . Free and alloyed tin coating
  - . Lacquer type
  - . Lacquer film thickness
  - . Adhesion
  - . Porosity ($Cu\ SO_4$)

. Electrotest

. Sulphur staining resistance

For these tests the Metal Packaging Group will use the methods outlined above but before starting the study LANFI 's personnel should train itself in the above methods.

2.4 Results

The report should contain the following information:

- Tinplate types found
- Origin
- Relative use
- Results on the analysed samples
- Overall results
- Critical analysis of the results
- Problems detected
- Conclusions and recommendations

Note:

If LANFI has the suitable personnel, both of the above mentioned steps can be done simultaneously.

3. Shelf life studies on several canned products of interest to local industry.

Once the quality of the metal is obtained and the corrosion problems in canned products are known, a shelf-life study of some canned products in Mexico can start.

It is not recommended to start this step before the other two steps are completed and the information is properly evaluated.

Therefore, based on consumption and production volumes, products like chile, tomato, sardines, tuna fish and foods prepared with beans, etc, should be studied.

For the study of each product different types of containers should be selected, for the compatibility tests mentioned in point 2.

Different storage conditions should be used for the shelf-life study and products should be evaluated several times during at least one year of storage. Test should be carried out according to above mentioned scheme.

Results obtained will enable a better understanding of the corrosion mechanism and enable improvement of Mexican metal containers and canned foods.

Note:

For additional information make studies with plastic and glass containers in cooperation with the Food Group.

A N N E X IV

PROGRAM OF THE SEMINAR: "QUALITY CONTROL OF FOOD METAL PACKAGING"

OBJECTIVE:	Offer the theoretical background of quality control techniques used in the Metal Packaging Industry and give some practical exercises in selected tests.
INTENDED FOR:	Chemical Engineers, Chemists Biochemical Engineers, Metalurgical Engineers, Chemical Pharmacobiologist, and technicians in charge of carrying out quality control and development work in the can manufacturing industry as well as in the food canning industry.
DATE:	August 5, 6 and 7, 1981
SCHEDULE:	9:00 to 13:00 and 15:00 to 18:00 hrs.
PLACE:	LANFI auditorium Av. Industria Militar 261, Mexico City
LECTURERS:	ONUDI-LANFI Group Ing. Luis F. Ceribelli Madi,

Dr. Ramón Catalá

Dr. Chaim Mannheim

Quim. Daniel Landeros

Ing. Leonel Tamayo

Ing. Ma. Elena Arellano

Ing. Carmen Liceaga

PROGRAM.

August 5

9:00	-	9:30	Register
9:30	-	9:45	Inauguration Dr. Juan Antonio Careaga Director General LANFI
9:45	-	10:00	Recess
10:00	-	10:30	Introduction Ing. Luis F. Ceribelli Madi - ONUDI
10:30	-	13:00	Main metal materials and packages used for packaging food products and future tendencies. Dr. Ramón Catala - ONUDI
13:00	-	15:00	Recess
15:00	-	17:00	Shelf-life of food products in metal containers. Dr. Chaim Mannheim - ONUDI

August 6

Selected tests for quality control of tinplate, blackplate. chrome coated plate, lacquered plate, cans and canned products.
ONUDI-LANFI Group.

9:00	-	11:00	Theory
11:00	-	11:30	Recess
11:30	-	12:30	Laboratory I
12:30	-	14:30	Recess
14:30	-	15:30	Laboratory II
15:30	-	16:00	Recess
16:00	-	17:00	Laboratory III
17:00	-	18:00	Round Table

August 7

Selected tests for quality control of tinplate, black plate, chrome coated plate, lacquered plate, cans and canned products.
ONUDI-LANFI Group.

9:00	-	11:00	Theory
11:00	-	11:30	Recess
11:30	-	12:30	Laboratory I
12:30	-	14:30	Recess
14:30	-	15:30	Laboratory II
15:30	-	16:00	Recess
16:00	-	17:00	Laboratory III
17:00	-	18:00	Conclusions and Clausure