FIELD REPORT

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PEACE CORPS SEMINAR/WORKSHOP ON SOLID WASTE

QUITO, ECUADOR

WASH Field Report No. 371
July 1992

WATER AND SANITATION for HEALTH PROJECT

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WASH Field Report No. 371

PEACE CORPS SEMINAR/WORKSHOP ON SOLID WASTE

Quito, Ecuador

Prepared for Peace Corps/Ecuador
under WASH Task No. 346

by
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RELATED WASH REPORTS

Reflections on a Long-Term Program for the Management and Collection of Solid Waste in the Metropolitan Zone of Port-au-Prince. By Philip Roark et al. June 1991. WASH Field Report No. 337. (Available in English and French)

Market Survey of Solid Waste Management, Port-au-Prince. Vols. I and II. By Philip Roark et al. February 1991. WASH Field Report No. 319. (Available in English and French)

Assessment of Solid Waste Management in Port-au-Prince, Haiti. By Roman Semkow and Menajem M. Bessalel. January 1990. WASH Field Report No. 292.

ABOUT THE AUTHORS

Menajem Bessalel has more than 30 years experience in civil engineering. He has previously worked in solid waste management in Ivory Coast, Zaire, and Haiti. As an independent consultant, Mr. Bessalel has worked for a variety of engineering and development firms, as well as the World Bank, USAID, and other international development organizations. He is fluent in Spanish and French.

Dr. Mercedes Torres is a psychologist with over 20 years experience in the field of workshop design, facilitation, and training. She has been a WASH consultant for many years, providing technical assistance to a long-term project entitled WASHED. This project is designed to strengthen the ability of the Ecuadorian Ministry of Sanitary Works (IEOS) to fulfill its mandate of providing water and sanitation to rural communities in Ecuador. Under this activity, Dr. Torres has assisted in the design and implementation of workshops of many types, including training of trainers, management development, and project monitoring. Dr. Torres, a citizen of Ecuador, currently lives in Quito. Her mother tongue is Spanish; she is also proficient in English and French.

CONTENTS

EXECUTIVE SUMMARY iii

1. INTRODUCTION 1

1.1 Background 1
1.2 Objectives 1
1.2.1 Overall Objective 1
1.2.2 General Objectives 1
1.3 Terms of Reference for the Initial Phase 2
1.4 Terms of Reference for the Final Phase 2

2. METHODOLOGY 5

2.1 Work Methodology 5
2.2 Methodological Orientation of the Seminar/Workshop 5

3. PREPARATION OF THE PROGRAM AND DAILY SCHEDULES 7

3.1 Activities in Ecuador 7
3.1.1 Meetings and Field Trips 7
3.1.2 Preparation of the Program for the Seminar/Workshop 7

4. THE SEMINAR/WORKSHOP 9

4.1 Goals and Objectives 9
4.2 Participants 9
4.3 Site of the Seminar/Workshop and Facilities Support 9
4.4 Methodology and Design 10
4.5 Individual Sessions 10
4.6 Special Participant Activities 12
4.6.1 Environmental and Financial Analysis 12
4.6.2 Consultations with Respect to Specific Problems 12

5. PARTICIPANT EVALUATION 13

6. CONCLUSIONS AND RECOMMENDATIONS 15

6.1 Conclusions 15
6.2 Recommendations 15
6.3 Recommendations with regard to Future Seminar/Workshops 16

APPENDICES

A. List of Persons Interviewed 17
B. Questionnaire on Solid Waste Management 19
C. List of Participants 21
D. Course Evaluation 23
E. Program for the Seminar/Workshop 25
F. Group Report 37
G. Expectations and Commitments 41
H. Group Tasks 43
I. Daily Schedule for the Seminar/Workshop 47

EXECUTIVE SUMMARY

Background

In developing its environmental programs, the Peace Corps/Ecuador (PC/E) requested technical assistance from the WASH Project in preparing and conducting a seminar/workshop. The purpose of the seminar/workshop, which was held in Ibarra, Ecuador from April 6-10, 1992, was to present subjects of a technical and practical nature related to the collection, treatment, and disposal of solid urban waste.

Objective

The objective of the seminar/workshop was to consolidate the knowledge, skills, and aptitudes of its participants, as well as to provide them with new knowledge to allow them to identify new concepts in the design, application, and supervision of the various components of solid waste management.

Preparation of the Seminar/Workshop

The WASH Project assigned two consultants, a facilitator and an instructor, to this task. The facilitator made two trips to Quito, the first on February 2, 1992 and the second on March 29, 1992.

During the first trip (and first phase of the seminar/workshop), the consultants performed tasks related to the preparation and preliminary design of the program. During the second trip (and second phase), they prepared the final design of the seminar/workshop and carried out the workshop.

During the first phase, the team made several field trips and consulted on a number of occasions with technical personnel responsible for solid waste management in three secondary cities. The purpose of these visits was to determine the technical and operational level at which solid waste collection and treatment tasks were performed in each of these cities.

In Quito, the WASH technical team, with assistance provided by the Municipal Directorate of Sanitation in Quito, prepared the preliminary design for the program as well as the daily schedule for the seminar/workshop. In preparing the program, the consultants took into account the potentially low levels of technical capabilities of the participants.

During the week prior to the seminar/workshop, the team met to discuss and review the preliminary design that had been previously prepared. The design revisions took into account the estimated material and time necessary for each activity.

Participants

In attendance at the seminar/workshop were four doctors, one economist, one *licenciado*, one architect, and 11 engineers. The engineers included the director of solid waste operations from Quito and two of his assistants. It should be mentioned that two of the participants were politicians (the president of the city council and a city council member). With the exception of those mentioned, all other participants were responsible for solid waste management in secondary cities. Five volunteers from the Peace Corps in Ecuador also participated in the seminar/workshop.

The Seminar/Workshop

During the seminar/workshop, both instructional and practical activities were carried out. During the periods designated for practical exercises, all participants took part in exercises related to the theoretical instruction previously provided. They then applied the instruction received in the practical and theoretical sessions in their respective cities. This methodology provided positive results for each of the participants involved in solid waste management.

Participant Evaluation

The participant evaluation indicates that participants were satisfied with the instruction received in the seminar/workshop. Those who had prior experience felt that some of the topics discussed did not meet their needs with regard to new material. Some indicated a need for more information.

Conclusions

With the exception of the three participants from Quito, most of the participants had no prior experience in solid waste management. Because of the limited technical capability of most participants, the instructor had to downgrade the technical presentations to a level much lower than necessary to present subjects in the area of solid waste, especially financial analysis.

The technical level of the group was quite varied. This situation created difficulties, as some of the technical subjects presented required prior explanations of basic mathematical concepts. Additionally, four of the participants from the Peace Corps had difficulties understanding some of the material since they did not have sufficient technical knowledge of Spanish.

It was concluded that the conference would have produced more effective results had it been conducted by two technical instructors taking turns presenting the various topics.

The above-mentioned difficulties notwithstanding, all participants were able to work through the problems involving the collection, treatment, re-use, and disposal of solid waste.

The group participated actively in the theoretical sessions, and on several occasions participants were present prior to the beginning of classes and remained after the classes had concluded.

The participants showed no particular interest in subjects related to financial management and analysis, however, since these components are handled directly by the municipal government.

Recommendations

Based on an evaluation of the comments provided by the participants, as well as on the technical perceptions of the instructor, it is concluded that additional training will be necessary in order for participants to obtain a better understanding of:

- sanitary landfills and the re-use of solid waste, especially for composting
- the relationship between the various urban infrastructure services
- the impact of community participation on solid waste management

Recommendations with Regard to Future Seminar/Workshops

In order to obtain better results in the future, it will be necessary to conduct seminar/workshops in sites where participants can receive not only technical instruction but also practical instruction in the field.

Participants should have similar levels of technical competence. The participation of individuals not involved in the technical areas to be covered in the seminar/workshop, particularly politicians, should be avoided.

Chapter 1

INTRODUCTION

1.1 Background

In developing its environmental programs, the Peace Corps/Ecuador (PC/E) requested technical assistance from the WASH Project in preparing and conducting a seminar/workshop. The purpose of the seminar/workshop, which was held in Ibarra, Ecuador, was to present subjects of a technical and practical nature related to the collection, treatment, and disposal of urban solid waste.

1.2 Objectives

1.2.1 Overall Objective

The overall objective of the seminar/workshop was to consolidate the knowledge, skills, and aptitudes of the participants, as well as to provide them with new knowledge to allow them to identify new concepts in the design, application, and supervision of the various components of solid waste management.

1.2.2 General Objectives

The general objectives of the seminar/workshop were as follows:

- to motivate participants to engage actively in the seminar/workshop
- to broaden participants' general understanding of the management and technical aspects of solid waste
- to increase participants' knowledge of various aspects of the process of solid waste collection
- to understand, conceptualize, and evaluate technical procedures involved in re-use and recycling
- to understand, analyze, and apply technical knowledge in the field of sanitary landfill design
- to analyze and identify alternatives for solving management problems from technical, administrative, and financial standpoints
- to provide sufficient instruction to enable participants to develop their own action plan in certain priority areas of solid waste: collection, recycling, design of sanitary landfills, management, and finance

1.3 Terms of Reference for the Initial Phase

PC/E's ultimate objective was to conduct a seminar/workshop on the collection, treatment, and disposal of urban solid waste for technicians from the municipal governments of secondary cities. With this objective in mind, WASH scheduled an initial mission to study existing conditions and prepare the design for the seminar/workshop program.

The tasks to be carried out during the planning phase included the following:

- meetings with personnel from WASH and the Peace Corps office in Washington
- meetings with staff from the Peace Corps office in Ecuador
- meetings with individuals from the National Directorate of Sanitation and Directorates of Sanitation from the municipal governments of secondary cities (Appendices A and B)

The primary objectives of these meetings were as follows:

- to identify the topics to be presented during the seminar/workshop
- to identify, in the field, methods used in the collection, treatment, and disposal of solid waste in garbage dumps or sanitary landfills
- to prepare the program and establish the date for conducting the seminar/workshop
- to prepare a report covering the initial mission

1.4 Terms of Reference for the Final Phase

The tasks to be carried out during the final phase included the following:

- review the design of the seminar/workshop developed in the preceding phase
- present, during the seminar/workshop, technical and practical explanations of the following subjects:
  - basic concepts of the technical components of solid waste management
  - collection of solid waste
  - re-use of solid waste
  - sanitary landfills
  - concepts of solid waste management
  - concepts of solid waste financing
- work, through practical exercises, in each of the above subjects
- discuss with the participants from each city any problems related to each subject

- hold a session in which participants divide into two groups to apply the concepts learned
- evaluate the participant evaluation questionnaires and include them in the process of developing conclusions and recommendations for future seminars of a similar nature

Chapter 2

METHODOLOGY

2.1 Work Methodology

This task included the following activities:

- meetings with program consultants to plan the work to be performed in accordance with the terms of reference provided by the WASH Project
- meetings with representatives of the Peace Corps in Washington and Quito and of the WASH Project in order to broaden the overall concept of the program and define the basic elements necessary for planning the seminar/workshop
- a series of interviews with individuals involved in solid waste management in the Directorates of Sanitation in various cities in Ecuador
- preparation of a draft plan for the seminar/workshop and for the corresponding actions and decisions to be made
- analysis of the seminar/workshop plan with the organizations involved (Peace Corps and Directorate of Sanitation of the municipal government of Quito)
- development of the general seminar/workshop plan, together with other important aspects of its implementation

2.2 Methodological Orientation of the Seminar/Workshop

The seminar/workshop used a participative and experiential methodology in accordance with the principles of informal adult education.

The learning process included the following stages:

- an introduction to data that will generate the participative learning cycle
- a critical analysis on the group's part
- access to scientific or technical generalizations
- application of theoretical knowledge to real-life situations

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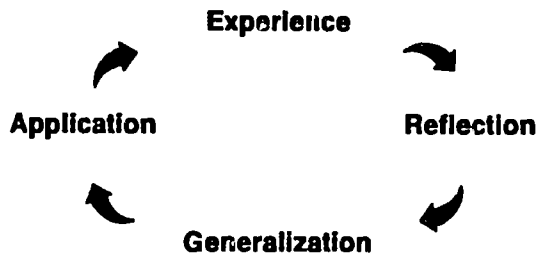
The four stages of the adult learning cycle are summarized below.



The role of the instructor was to "facilitate" the process by using a variety of creatively designed techniques and skills in accordance with the nature of the topic, the objectives of the session, the time available, the support materials provided, and the location of the topic on the day's agenda. All of these variables were taken into account in the microplanning activities for each of the seminar/workshop's sessions.

To sum up, training included case studies, role playing, games, brief lectures, slides, questionnaires, individual and/or group work, and "consolidating" sessions.

This educational model was meant to allow both participants and instructors to share the responsibility for their own learning.

Chapter 3

PREPARATION OF THE PROGRAM AND DAILY SCHEDULES

3.1 Activities in Ecuador

3.1.1 Meetings and Field Trips

The meetings and activities carried out during the first phase of the seminar/workshop (February 3-7) were as follows:

- discussions with the Peace Corps APCD for Rural Infrastructure, PC/E
- meetings with authorities from secondary cities and the directors of sanitation from Quito, Ambato, Riobamba, and Santo Domingo de los Colorados
- tour of the cities visited to observe firsthand the status of solid waste collection
- visits to sanitary landfills (garbage dumps) in all of the cities visited

3.1.2 Preparation of the Program for the Seminar/Workshop

In preparing for this activity, the consultants began with the initial program developed by the Peace Corps/Municipal Directorate of Sanitation of Quito and the needs identified by the directors interviewed during the visits made to the municipalities of Ambato, Riobamba, and Santo Domingo de los Colorados. (Details of the subjects discussed and the daily schedule for the program are included in Appendix I.)

Chapter 4

THE SEMINAR/WORKSHOP

4.1 Goals and Objectives

The seminar/workshop's ultimate objective was for the 16 participants from the secondary cities and the five Peace Corps volunteers to understand and be able to carry out activities related to solid waste management.

By the end of the seminar/workshop, it was expected that participants would be able to carry out the following tasks:

- assess the status of solid waste management in their respective cities
- determine the amount of solid waste produced
- design collection routes and a collection system based on the characteristics of the city and the rate of population growth
- determine the equipment necessary for collecting garbage
- understand the importance of re-using solid waste, particularly of reducing solid waste to be dumped in sanitary landfills to the smallest volume possible
- design a labor-intensive plan for producing compost
- design a manually operated sanitary landfill and calculate its cost
- understand the concept of financing and prepare a cost flow chart for determining the parameters to be used in setting rates

See Appendix H for more detailed descriptions of group tasks.

4.2 Participants

The participants at the seminar/workshop included four physicians, one economist, one *licenciado*, one architect, eight engineers with no prior experience, three experienced engineers from the municipality of Quito, and one nonprofessional (Appendix C).

4.3 Site of the Seminar/Workshop and Facilities Support

The seminar/workshop was held in the Hostería Chorlaví hostel, located approximately three kilometers from Ibarra and 150 kilometers north of Quito. The hostel offered all the facilities and support necessary for conducting the seminar/workshop.

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4.4 Methodology and Design

As previously mentioned, the methodology of the seminar/workshop was experiential in nature and was based on the principles of the adult learning cycle. Special attention was devoted to ensuring that participants would intervene actively in the sessions and assume responsibility for their own learning.

The seminar/workshop began by developing an understanding of the importance of solid waste management in the development of urban communities and of the way in which it relates to a better standard of living.

The following sessions provided instruction and practice in all of the topics included in the seminar program.

4.5 Individual Sessions

Program design was based on the sequential presentation of the concepts of collection, treatment, and disposal of solid waste. Discussions were held on the various aspects of community participation. The program was implemented in six units, which follow (further details can be found in Appendix E).

Unit I

Unit I introduced the principles of management and the concepts necessary for carrying out assessments in urban areas. Included were concepts designed to assist in evaluating the services provided by the municipality.

Practice: Participants performed an assessment of their own cities. For purposes of conducting this task, they were divided into five groups. The cities represented in each group shared similar characteristics. Each group selected a spokesperson to describe the assessment of its city.

Material provided: Material containing a description of each of the elements in the unit was distributed to participants.

Unit II

Unit II introduced the technical concepts required to calculate the production of solid waste based on the type of waste involved and the rate of the city's population growth. It also covered certain issues involved in designing collection routes and estimating equipment needs.

Examples: The instructor presented practical examples of general cases for each of the elements in the unit.

Practice: The participants collaborated in solving the problems provided in the instructor's examples and subsequently designed solid waste collection systems for their cities. The design exercises included a consideration of population growth and the impact of an increase in the standard of living on the production of solid waste.

Material provided: Material containing a description of the topics covered in the unit was distributed to participants.

Unit III

Unit III introduced the technical concepts involved in the re-use of solid waste. These concepts included a description of the re-use, recycling, composting, and the manufacture of charcoal briquettes.

Example: The instructor presented a technique for producing compost using the labor-intensive method.

Practice: Participants took an interest in learning about methods and opportunities for recycling used motor oil and re-using paper, rubber tires, aluminum, tin cans, and other waste.

Material provided: Technical material describing the manual production of compost and charcoal briquettes was distributed to the participants.

Unit IV

Unit IV introduced the concept of manually operated sanitary landfills.

Examples: Sample exercises were completed using data provided by the participants.

Practice: Each of the participants designed a sanitary landfill for his own city.

Material provided: The participants received literature explaining the design of solid waste landfills.

Unit V, Part I

Unit V, part I introduced definitions and elements of solid waste management. This session covered supervision, inspection, and control methods.

Practice: Participants held general discussions of the management problems they each experienced.

Material: No literature was distributed for this unit. Instead, participants took notes on the material presented on the flipcharts.

Conclusion: It was concluded by session's end that the municipal system does not have in operation a responsible management system for handling solid waste.

Unit V, Part II

Unit V, part II introduced financial concepts of solid waste management.

Examples: Participants determined the cost of a manually operated sanitary landfill, applying the appropriate financial concepts. Data were provided by participants from two cities.

Material: No literature was provided for this unit. Instead, participants took notes on the material presented on the flipcharts.

Conclusion: It was concluded by session's end that the respective municipal organization charts contain a position for an individual to assume responsibility for financial matters. Accordingly, participants showed no particular interest in this area.

Unit VI

Participants had an opportunity to apply what they learned in the seminar/workshop to prepare two reports on the environment and financing (see Appendix F).

4.6 Special Participant Activities

4.6.1 Environmental and Financial Analysis

The participants divided into two groups and presented an overview of current problems in the areas of environment and financing, as described in Unit VI, above.

4.6.2 Consultations with Respect to Specific Problems

Prior to the initiation of morning activities as well as during the evening hours, some of the participants discussed with the instructor specific problems occurring in their own particular city.

Chapter 5

PARTICIPANT EVALUATION

At the conclusion of the seminar/workshop, a questionnaire containing five questions was distributed to the participants. (For results by participant, see Appendix D.)

The questions were as follows:

1. *Evaluate the usefulness of the conference.* Participants were to answer this question using the following scale:

   5, very useful; 3, useful; and 1, not very useful.

   More than half of the participants felt the seminar/workshop was either very useful or useful; about a quarter said the seminar fell somewhere between useful and not useful.

2. *Evaluate the content of the program of study.* Participants were to answer this question using the following scale:

   5, very appropriate; 3, appropriate; and 1, somewhere between appropriate and not appropriate.

   Nearly three-quarters said that the program of study was between very appropriate and appropriate; only one or two thought it was inappropriate.

3. *Evaluate the effectiveness of the methodology used.* The scale used for this question was:

   5, very effective; 3, effective; and 1, not effective.

   More than three-quarters felt the methodology was somewhere between very effective and effective, with the remainder grading it between effective and not effective.

4. *Which of the sessions was most useful to you? Which was least useful? Why?*

   The answers to this question were tabulated as follows:

Most Useful	
Sanitary landfills	63%
Management	47%
Assessment	37%
Recycling	37%

Collection	32%
Financing	26%

Least Useful

Collection	15%
Management	15%
Recycling	15%
Financing	10%
Sanitary landfills	5%

5. *Please add any other comment or suggestion as to how to improve this event in the future.*

The participants offered the following additional comments.

Use real data from Ecuador	40%
Improve course presentation	10%
Invite local engineers	10%
Provide documents to be studied prior to the beginning of the course	10%
Use specific cases	10%
Use two instructors	10%
Improve instructional expression	5%
Send questions concerning topics prior to the event	5%
Show films	5%

See also Appendix G for participant expectations and commitments.

Chapter 6

CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

With the exception of the three engineers from Quito, most of the seminar participants had no prior experience in solid waste management. Because of the limited technical capability of most of the participants, the instructor had to downgrade the technical presentations to a level much lower than necessary to present topics on solid waste, especially financial analysis.

The technical level of the group was quite varied. This situation created difficulties, as some of the technical subjects presented required prior explanations of basic mathematical concepts.

Four of the participants from the Peace Corps had difficulties understanding some of the material since they did not have a sufficient knowledge of technical Spanish.

The conference would have produced more effective results if it had been conducted by two technical instructors taking turns presenting the various topics.

The above-mentioned difficulties notwithstanding, all participants were able to work through the problems presented involving the collection, treatment, re-use, and disposal of solid waste. The participants did not show much interest in subjects related to financial management and analysis, however, since these components are handled directly by the municipal government.

6.2 Recommendations

Based on an evaluation of the comments provided by the participants as well as the technical perceptions of the instructor, it is concluded that additional training will be necessary in order for participants to obtain the following knowledge:

- a better understanding of sanitary landfills and the re-use of solid waste, especially for composting
- a better understanding of the relationship that exists between the various urban infrastructure services.
- a better understanding of the impact of community participation on solid waste management

6.3 Recommendations with Regard to Future Seminar/Workshops

In order to obtain better results, it will be necessary to conduct seminar/workshops at sites where participants can receive not only technical instruction but also practical instruction in the field. Additionally, participants should have similar levels of technical competence. For that reason, participation by individuals not involved in the technical areas covered in the seminar/workshop, particularly politicians, should be avoided.

Appendix A

LIST OF PERSONS INTERVIEWED

Quito

- *Peace Corps/Ecuador*

Dr. Robert Drickey, Director

Mr. Jeffrey M. Bakken, PTO

Mr. Napoleón Cevalios, APCD Rural Infrastructure

- *USAID/Ecuador*

Mr. Kent Yamashita, Department of Health

Mr. James Stein, USAID/RHUDO

- *Ministry of Public Health, Ecuadorean Institute of Sanitary Works*

Ing. Daniel Polo Yépez, National Director of Environmental Concerns

Ing. Patricio Sánchez, Engineer

Ing. Luis Ambato, Engineer

- *Municipal Directorate of Sanitation*

Ing. Patricio Gómez Zaldumbide, Director of Sanitation for the Department of Quito

Ing. Francisco de la Torre, Assistant Director for Environmental Sanitation

Ing. Marcelo Castillo, Director of Waste Collection and Street Sweeping Routes

Ing. Borosilov Castro, Director of the Transfer Station

Ambato—Department of Sanitation of the Municipality

Dr. Ana Molina, Director of the Department of Sanitation

Lic. Jorge Naranjo, Director of Waste Collection and Street Sweeping

Riobamba--Department of Sanitation of the District

Dr. Byron Arias, Director of the Department of Sanitation

Ms. Ana María López, Technologist

Santo Domingo de los Colorados

- *Empresa de Agua Potable (Safe Water Enterprise)*

Mr. Milton Silva, Manager

- *Department of Municipal Sanitation*

Dr. Javier Silva Cruz, Director

- *Municipality*

Mr. Jorge Ortiz, City Councilman (Member of Board of Directors)

Appendix B

QUESTIONNAIRE ON SOLID WASTE MANAGEMENT

Name: _____

Position: _____

Date: _____

Municipality: _____

How large is your collection area? _____

How many permanent residents live in your area? _____

How many transient residents live in your area? _____

Do you know how much solid waste is produced by those residents? _____

If so, how much? _____

What percentage of the solid waste generated daily do you estimate is removed from the source of generation? _____ %

What type of equipment do you use for collecting and transporting solid waste?

_____

_____

How old is most of your equipment? _____ years

How many shifts per day do you use your vehicles? _____

How many workers are employed in the collection and transfer of solid waste in each unit?

_____

What amount of solid waste is collected and transferred daily? _____

How many days a week is that amount collected and transferred? _____

What is the municipal budget for solid waste management? _____

What percentage of the municipal budget does this amount represent? _____%

Approximately what percentage of the average salary is covered by solid waste management?

_____%

Do you dispose of solid waste in:

open garbage dumps? _____

sanitary fills? _____

elsewhere? _____

Are there large amounts of solid waste accumulated in streets or empty lots?

_____

If so, where? _____

On a typical workday, what percentage of the equipment is not in working order or is in the shop for servicing? _____%

How much time is the equipment out of service?

for minor repairs? _____

for major repairs? _____

Is there a certain type of waste that presents problems with regard to collection or disposal?

_____

If so, please specify: _____

_____

_____

What recycling opportunities do you feel are technically, economically, and financially feasible? _____

_____

_____

What are your greatest difficulties in carrying out garbage collection, transportation, and disposal activities? _____

_____

_____

_____

What are your expectations with regard to this seminar/workshop? _____

_____

_____

What areas do you feel will be of greatest interest to you? _____

_____

_____

Note: If you require more space for any question, use a separate sheet of paper.

Appendix C

LIST OF PARTICIPANTS

City or Organization	Delegate
Ibarra	Dr. Rosario Trujillo Mr. Julio Visarrea (economist)
Ambato	Lic. Jorge Naranjo
Riobamba	Ms. Ana María López (technologist)
Latacunga	Dr. Nelfor Vela
Girón	Dr. Francisco Mendieta
Santa Isabel	Ing. Angel Pasato
Santo Domingo	Dr. Xavier Silva
Quito	Ing. Patricio Gómez Ing. Borosilov Castro Ing. Milton Guerrero
Puyo	Ing. Fabián Chávez
Azogues	Ing. Johny Rosales
Fundación Natura	Dr. Carlos Landín*
Piñas	Prof. Wilson Romero
Loja	Mr. Eduardo Samaniego
Peace Corps	Mr. Mark Purcell (architect) Ing. Javier Ramos Ing. Diane Lindsay Ing. Roy Kornbluth Ing. Kevin Miller

* Was replaced after the first day

Appendix D

COURSE EVALUATION

Grades by Participant

Participant	*Questions* 1	2	3	*Average* (on a scale of 1 to 5, with 5 being the highest mark)
1	3	3	2	2.7
2	4	4	3	3.7
3	3	4	3	3.3
4	2	4	1	2.3
5	4	4	3	3.7
6	2	2	2	2.0
7	4	5	3	4.0
8	4	4	4	4.0
9	4	4	3	3.7
10	5	5	5	5.0
11	5	5	4	4.7
12	1	2	3	2.0
13	5	4	5	4.7
14	2	3	2	2.3
15	2	3	2	2.3
16	3	4	2	3.0
17	4	4	3	3.7
18	4	4	3	3.7
19	5	4	4	4.3
Average	3.5	3.8	3.0	3.4

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Overall Grades by Question

Grade (with 5 being the highest)	*Questions* 1	2	3
5	21%	16%	11%
4	37%	58%	16%
3	16%	16%	42%
2	21%	11%	26%
1	05%		05%

Profession of Participants

Profession	*Number*
Doctors	4
Economists	1
Licenciados	1
Architects	1
Engineers without experience	8
Engineers with experience	3
Nonprofessional	1

Appendix E

PROGRAM FOR THE SEMINAR/WORKSHOP

A.1 Program for the Seminar/Workshop

The program for the seminar/workshop was divided into six units covering the following subjects:

Unit I - Introduction and Orientation to the Seminar/Workshop

Unit II - Solid Waste Collection

Unit III - Recycling and Re-use of Solid Waste

Unit IV - Sanitary Landfills

Unit V - Management

Unit VI - Solid Waste Management and Its Applicability to Concrete Situations

A.2 Content of Each Activity

Unit 1

Subject: Introduction and Orientation to the Seminar/Workshop

Date: Monday, April 6, 1992

Time: 8:30 a.m.—12:30 p.m.

Objectives:

At the conclusion of this unit, participants will be able to:

1. Work together to create a pleasant work environment;
2. Establish work standards and give their approval to the operating structure of the seminar/workshop;
3. By means of a participative process, reach an agreement with respect to the objectives, expectations, subject matter, and daily schedule of the seminar/workshop; and
4. Obtain a general overview of the managerial and technical problems involved in "solid waste."

Activities:

1. Welcome remarks and introduction of the training team (10 minutes)
2. General information on administrative and logistic models and establishment of norms (10 minutes)
3. Statement of objectives and order of the day (5 minutes)
4. Self-introduction dynamics: "Personal Data Sheet" (40 minutes)
   - Explanation of the interview guide:
     - Name
     - Place of work (city, number of inhabitants, region, topography)
     - Job responsibilities
     - Knowledge and/or experience that could be contributed to the group
     - Expectations for this seminar/workshop
   - Groups of five exchange information
   - Representatives from each group give the presentation in the plenary session on behalf of the other group members
   - In the plenary session, instructor records on flipcharts:
     - Expectations of the group
     - Individual commitments to share with the group
     - Characteristics of the cities (inhabitants, region, topography)
5. Presentation and discussion of objectives, topics, and tentative daily schedule (30 minutes)
   - Presentation and in-depth explanation by means of dialogue with participants
   - Comparison of objectives and topics with the expectations expressed by the participants
   - Approval by consensus
6. Introduction to the subject: a real-life experience regarding a problem involving solid waste (20 minutes)
   - Exhibition of photographs
   - Presentation of the story

- Reflection and discussion

  10:30 a.m. break (30 minutes)

7. Explanation of general aspects of solid waste management (50 minutes)
   - Educational talk (10 minutes)
   - Distribution of printed material on the subject
   - Reading and discussion in small groups (25 minutes)
   - Plenary session to record comments and/or clarify questions (15 minutes)
8. Case study: "A Real City" (50 minutes)
   - Case study
   - Task
   - Introductory explanation of the following aspects:
     - Context in which the case occurred
     - Periodic use of the material during the course of the seminar
   - Work assignments in small groups:
     - Formation of groups
     - Explanation of the tasks: Based on the assessment table presented in the preceding activity and on the reading of the case study, participants were asked to answer the following questions:
       1. Identify the problems experienced by the city and possible solutions.
       2. What are the city's priorities?
       3. What resources are available to reduce the volume of garbage?
   - Discussion and analysis in the plenary session
     - Discussion of results in small groups
     - Discussion of analytical questions
   - Conclusions
9. Evaluation by objectives (5 minutes)

   TOTAL: 4 hours

   Lunch (12:30—2:15 p.m.)

Unit 2

Subject: Solid Waste Collection

Date: Monday and Tuesday, April 6 and 7, 1992

Time: 2:15 p.m.—5:30 p.m. and 8:30 a.m.—12:30 p.m.

Objectives:

At the conclusion of this unit, participants will be able to:

1. Identify and analyze the various aspects involved in the process of solid waste collection;
2. Apply this knowledge to the search for alternative solutions vis-à-vis the concrete problems existing in their environment.

Activities:

1. Statement of objectives and order of the day (5 minutes)
2. Technical presentation on solid waste collection (90 minutes)
   - Technical explanations
   - Real-life examples
   - Dialogue between instructor and participants

   Note: Theoretical explanations were supported by printed materials and slides

   Break (15 minutes)

3. Group assignments aimed at analyzing the various aspects of solid waste generation and collection and transfer stations in the participants' home cities (45 minutes)
   - Formation of groups with representatives from cities having similar characteristics
   - Analysis and discussion of:
     - Generation
     - Collection
     - Transfer stations
   - Preparation of summary
4. Plenary session to present results of group assignments and generalize with respect to the basic learning process (conclusions and/or recommendations) (Tuesday, April 7, 8:30 a.m.)

5. Case study: Identifying appropriate means for collecting solid waste (60 minutes)
   - Explanation in the plenary session of procedures for estimating collection equipment
   - Group assignments: Based on the information found in the case study analyzed on the preceding day, participants engaged in the following activities:
     - Determining the best equipment for collecting garbage in each zone
       - Truck with compactor—15 m^3
       - Truck without compactor—8 m^3
       - Tractors—bins—5 m^3
     - Calculating the amount of transportation equipment necessary to collect garbage in zones (I, II, III, and IV) given the difficulties involved in reaching the sanitary fill.
       - Condition 1—Speed of the vehicle to the sanitary fill at 30 km/h
       - Condition 2—Increase the time estimated in condition 1 by 10 minutes
       - Condition 3—Increase the time estimated in condition 1 by 20 minutes
       - Condition 4—Increase the time estimated in condition 1 by 30 minutes
   - Plenary session for presenting the results
6. Developing action plans for solid waste collection in the participants' respective cities (90 minutes)
   - General instructions and distribution of work guides
   - Formation of groups by similar types of cities
   - Work assignments in small groups

Break (30 minutes)

7. Plenary session for presentation of results of work assignments (60 minutes)
   - Presentations by each group
   - Comments on each presentation
8. Evaluation of the unit (5 minutes)

Lunch (12:30—2:15 p.m.)

TOTAL: 7¼ hours

Unit 3

Subject: Recycling and Re-use of Solid Waste

Date: Tuesday, April 7, 1992

Time: 2:15 p.m.—5:30 p.m.

Objectives:

At the conclusion of this unit, participants will be able to:

1. Understand, conceptualize, and evaluate technical procedures for re-use and recycling;
2. Increase their knowledge so as to be able to respond in the future to problems involving re-use and/or recycling as detected in their cities.

Activities:

1. Statement of objectives and order of the day (5 minutes)
2. Introduction to the subject: Informative talk (15 minutes)
   - General information on the re-use and recycling of solid waste
   - Importance of re-use and recycling for environmental conservation
3. Discussion of composting in the plenary session (20 minutes)
   - Building on personal information and/or experience, instructor obtains from participants any knowledge they may have of the subject
   - Recording the information on the flipcharts
   - Organizing the information based on a dialogue between participants and instructor
4. Participative reading to elaborate on information on composting (30 minutes)
   - Formation of groups of five each
   - Discussion and analysis of an article on composting
   - Questions and/or comments regarding the article
5. Plenary session to increase knowledge of technical aspects of the production of compost (60 minutes)
   - Comments on the article
   - Questions and answers

- Information on the manual procedure for producing compost and its benefits

Break (15 minutes)

6. Discussion of the production of charcoal (15 minutes)
7. Case study: Calculation of production costs (recycling) (45 minutes)
   - Explanatory talk in the plenary session on the procedure for calculating production costs
   - Work assignments in small groups aimed at reviewing once again the case study:
     - Exercise involving calculation of costs using the figures provided in the case study
     - Results discussed among groups and with the instructor
   - Individual work assignments:
     - Exercise in calculating production costs using data from the participants' own cities
     - Verification of the results of some of the exercises
   - Plenary session to consolidate observations and/or comments
8. Evaluation of the unit (5 minutes)

TOTAL: 3¼ hours

Unit 4

Subject: Sanitary Landfills

Date: Wednesday, April 8, 1992

Time: 8:30 a.m.—4 p.m.

Objectives:

At the conclusion of this unit, participants will be able to:

1. Understand, analyze, and evaluate the need for a sanitary fill as an indispensable component of the urban service system;
2. Design a sanitary fill based on concrete data from the participants' cities.

Activities:

1. Statement of objectives and order of the day (5 minutes)

2. Introduction to the subject: Informative talk on sanitary fills (5 minutes)

3. Gather information on the process of collection and treatment of solid waste in each of the cities, using as a guide the assessment scheme presented and analyzed on the first day of the seminar/workshop (60 minutes)

   - Individual presentation
   - Organization of the information on flipcharts

4. Plenary session for analyzing basic common problems as presented in the above procedures (20 minutes)

Break (30 minutes)

5. Technical lecture on the design of sanitary fills, costs, and establishment of rates (60 minutes)

   - Presentation
   - Real-life examples
   - Informal dialogue
   - Spontaneous groups to submit questions

6. Work in homogeneous groups to design a sanitary fill based on data and prior knowledge of the participants' respective cities (75 minutes)

Lunch (12:30—2:15 p.m.)

7. Plenary session to present group assignments (90 minutes)

   - Presentation
   - Comments

8. Evaluation of the unit (15 minutes)

Break (15 minutes)

TOTAL: 6 hours

Unit 5

Subject: Management

Date: Wednesday and Thursday, April 8-9, 19[illegible]

Time: 4 p.m.—5:30 p.m. and 8:30 a.m.—5:30 p.m.

Objectives:

At the conclusion of this unit, participants will be able to:

1. Understand and conceptualize the management process from the technical, administrative, and financial standpoints;
2. Carry out an assessment of the status of management in each city; and
3. Develop clear guidelines for preparing the budget for their respective cities.

Activities:

1. Statement of objectives and order of the day (5 minutes)
2. Case study: Assessment of the actual status of management (90 minutes)
   - New review of the case study
   - Participative preparation of the assessment by using the diagram analyzed during the first unit and the material described in the case study

   Note: The participants were assigned the task of preparing the assessments of their cities based on the case study and the previously used diagram (Thursday, April 9, 8:30 a.m.)
3. Plenary session for presenting one or more assessments (30 minutes)
   - Presentation
   - Analysis and comments
4. Participative talk on collection, recycling, and sanitary fills from the perspective of supervision, inspection, and management control (90 minutes)

   Each subject will be presented by means of the following procedure:
   - Theoretical explanation
   - Analysis and use of instruments employed in the management process
   - Dialogue to provide clarification and/or comments

Break (30 minutes)

5. Work in homogeneous groups to analyze and select management procedures and instruments in accordance with the actual situation (60 minutes)
6. Plenary session for consolidating results generated by the groups (30 minutes)
   - Presentations

- Comments
- Conclusions and/or generalizations

Lunch: (12:30—2:15 p.m.)

7. Case study: Financing (60 minutes)
   - Informative talk on financing
   - Analysis of costs presented in the case study
   - Exercises on cost calculation based on the line items presented in the case study
   - Plenary session for presentation of conclusions
8. Questionnaire to determine the willingness of the community to implement the changes necessary to apply management principles to the problem of solid waste (100 minutes)
   - Brief, informative talk on the importance of this type of instrument
   - Analysis of two sample questionnaires
   - Conceptualization of basic points to be considered when preparing a questionnaire

Break (15 minutes)

   - Group work assignments aimed at developing a draft questionnaire
     - Organization into five groups
     - Defining the task based on the basic elements indicated above
     - Performing the task
9. Evaluation of the unit (15 minutes)

Note: The participants were assigned the task of reviewing the assessment activities carried out during the seminar with a view toward preparing the final report on their respective cities.

TOTAL: 10½ hours

Unit 6

Subject: Solid Waste Management and its Applicability to Concrete Situations

Date: Friday, April 10, 1992

Time: 8:30 a.m.—1 p.m.

Objectives:

At the conclusion of this unit, participants will be able to:

1. Clarify the origin of problems involving solid waste management and identify potential solutions;
2. Apply the instruction received to solving concrete problems in their cities.

Activities:

1. Statement of objectives and order of the day (5 minutes)
2. Discussion groups and reflection on the following subject matter:
   - Financing
   - Environment (spontaneous interest groups) (60 minutes)
   - Formation of two groups
   - Distribution of a questionnaire with information-generating questions
   - Performance of the task
3. Plenary session for consolidating conclusions and/or recommendations

   Break (30 minutes)
4. Work in pairs to prepare reports on the participants' cities (120 minutes)
   - Explanations of material to be included in the reports
   - Consolidation of reports
   - Gather reports together and comments on them
5. Quantitative evaluation using a previously designed questionnaire

   TOTAL: 4½ hours

Appendix F

GROUP REPORT

Date: April 10, 1992

Subjects: Environment and Financing

Environment

The cleaning of public places is the primary responsibility of municipal governments. This cleaning should be carried out in streets, parks, public squares, and avenues.

Cleaning: three phases

- street sweeping
- garbage collection
- final disposal

If service is deficient, the initial impact is visual in nature. This can be aggravated even more in the absence of an efficient garbage collection service capable of preventing accumulation of solid waste in the various sectors of the city, which in turn leads to contamination of the environment. The ultimate consequences of insufficient service are water pollution, clogging of the sewers, proliferation of flies and rodents, and an increase in the mortality rate from infectious-contagious diseases.

The greatest impact on the environment is caused by the deficiency in the ultimate disposal of solid waste throughout Ecuador. Garbage is left out in the open, often along the banks of rivers and streams, which are natural places to dump garbage. This contributes to an increase in pollution of the air, water, and land beyond the city limits because the city itself is already polluted.

Contamination of the land is harmful to agriculture because of the proliferation of rodents that damage crops. It also endangers the livestock industry, as animals of all types graze in the garbage heaps, thus acquiring infectious-contagious diseases that are subsequently transmitted to human beings when the animal is eaten as food.

In addition, garbage dumps are created without any technical assessment and are capable of contaminating the water table, especially in the coastal areas, where it is located only a few meters beneath the surface. Also in danger of contamination are sources of water used for irrigation and human consumption, such as rivers, ponds, lakes, and natural runoffs.

In these areas, atmospheric pollution is caused by the production of gas, smoke, and foul odors from decomposing garbage.

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- *Recommendations*

It is the obligation of municipalities to carry out programs for promoting sanitation and educating the general public in this regard. It is therefore recommended that the appropriate officials take the following action:

- make executive-level authorities aware of the importance that should be given to sanitation programs submitted for financing by municipalities;
- distribute municipal ordinances to the general population and to the industrial, commercial, tourist, and artisan sectors in order to secure their support;
- improve technical abilities at the municipal level through training courses in this area;
- promote the construction of sanitary fills at the municipal level; and
- optimize services at the municipal level through the reorganization of collection routes, organization charts, supervision, etc.

Financing

- *General Considerations*

1. No municipality has yet determined the cost of providing solid waste management service.
2. Annual budget funds **are not** based on the requirements of the urban sanitation system but rather on an allotment process having no technical basis.
3. Technically developed rates have not been established in any city.
4. There is no budget for updating and increasing mechanical or manual equipment, including implements for day workers.
5. None of the organizations charged with solid waste management is self-financing. Their costs must be absorbed by the municipalities, thus increasing the municipal deficit.
6. Loans for municipal projects should be ranked immediately below justificatory loans, as there are cases in which the budget does not meet established needs.

- *Conclusions*

1. Each unit requires a management organization adapted to the actual prevailing situation.
2. The department of solid waste requires administrative and financial independence (in order to be able to function as an enterprise).

3. There are no properly trained technical personnel in the area of solid waste management.

4. Solid waste is not accorded the importance it deserves by the government.

5. The municipalities require a technically optimal selection of personnel.

6. The new **tariff system** needs to be redesigned with a view toward achieving self-financing.

7. A **fee collection system** needs to be redesigned.

- *Recommendations*

1. In small municipalities, provide training for the individual charged with providing service in order to improve the system; in medium-sized municipalities, contract a technician.

2. Use income generated from the application of technically prepared rates to cover expenses of the Department of Environmental Sanitation.

Appendix G

EXPECTATIONS AND COMMITMENTS

The group identified the following expectations with regard to the seminar/workshop:

- to broaden technical and administrative knowledge in the area of solid waste
- to share work experiences with fellow participants
- to apply the new knowledge acquired to the search for solutions to concrete problems in the various municipalities

Personal Commitments to Share Experiences with the Group

Some of the participants committed themselves to sharing their personal experiences on the following subjects as acquired in their places of work:

- general overview of solid waste in the country
- design of transfer stations
- management of personnel in charge of collecting solid waste
- reality of the problems faced by the Directorates of Sanitation

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Appendix H

GROUP TASKS

Group Tasks

Group Task #1

1. At each table, appoint a coordinator-rapporteur.
2. Members of the group will introduce themselves in accordance with the interview guide (small groups).
3. The coordinator will introduce fellow participants to the main group.

TIME: 15 minutes

Self-Introduction Guide

- Name
- Description of the city in which the participant works (name, region, topography, number of inhabitants)
- Job responsibilities
- Knowledge and/or experiences that the participant can contribute to the group
- Expectations of the seminar/workshop

Group Task #2

1. Form groups with representatives of cities having similar characteristics.
2. Appoint a coordinator-rapporteur.
3. Analyze and discuss:
   - Generation
   - Collection
   - Transfer stations in their respective cities
4. Prepare a summary on the flipchart.
5. Present the results of group work to the general group.

TIME: 45 minutes

Previous Page Blank

Group Task #3

Using the data provided in the case study, carry out the following activities:

1. Determine the best equipment for collecting garbage in each of the zones:
   - Truck with compactor—15 m^3
   - Truck without a compactor—8 m^3
   - Tractors—bins—5 m^3
2. Estimate the transportation equipment necessary to collect garbage in zones I, II, III, and IV, given the difficulties involved in reaching the sanitary fill.
   - Condition 1 - Speed 30 km/1 h
   - Condition 2 - Speed 30 km/1 h 10 min
   - Condition 3 - Speed 30 km/1 h 20 min
   - Condition 4 - Speed 30 km/1 h 30 min

TIME: 40 minutes

Group Task #4

1. Form homogeneous groups.
2. Appoint a coordinator-rapporteur.
3. Prepare an action plan for collection of solid waste (use the work guide).
4. Prepare a flipchart depicting the action plan.
5. Present the plan in the plenary session.

TIME: 20 minutes

Group Task #5

1. Form groups of five.
2. Read and discuss an article on composting.
3. Prepare questions and/or comments on the article.
4. Present comments in the plenary session.

TIME: 30 minutes

Group Task #6

1. Form groups of five.
2. Carry out a cost-estimating exercise based on the data provided in the case study.
3. Verify the results with the other groups and with the instructor.

Individual Work Assignments

1. Carry out exercise to calculate production costs using data from the participants' own cities.
2. Verify the results with the other members of the group.
3. Verify the results with the main group.

TIME: 45 minutes

Group Task #7

1. Form homogeneous groups.
2. Based on the data and knowledge of the participants' own cities, design a sanitary fill.
3. Present the fill design for analysis in the plenary session.

TIME: 75 minutes

Group Task #8

1. Form homogeneous groups.
2. Analyze and select
   - Procedures
   - Management instruments (forms) in accordance with the actual prevailing situation
3. Prepare a report.
4. Present the report in the plenary session.

TIME: 60 minutes

Group Task #9

1. Form groups of five
2. Develop a questionnaire to detect the willingness of the community to make changes in the area of solid waste management.
3. Present the questionnaire to the general group.

TIME: 60 minutes

Group Task #10

1. Form two groups: Financing and Environment.
2. Appoint a coordinator-rapporteur.
3. Analyze and discuss in each group the questions distributed.
4. Prepare a summary to be delivered and presented in the plenary session.

TIME: 60 minutes

Group Task #11

1. Form small groups with representatives from each city.
2. Prepare a report based on the work performed during the seminar/workshop together with other related documents.
3. Submit and present the report in the plenary session.

TIME: 120 minutes

Appendix I

DAILY SCHEDULE FOR THE SEMINAR/WORKSHOP

"Solid Waste"
Peace Corps/WASH
April 6-10, 1992
Hostería Chorlaví
Ibarra

Day 1 (April 6)

8:30 Introduction and Orientation to the Seminar/Workshop

- Presentation
- Expectations of participants
- Analysis of objectives, subjects, and schedule

Case study: Overview of the technical and managerial problems in the area of solid waste management

- Photographic exhibition
- Reading and analysis in small groups
- Individual and group reflection
- Analysis in the plenary session

12:30 Lunch

2:15 Solid Waste Collection

- Presentation—dialogue
- Real-life examples (audio-visual material): Design of routes, street sweeping, special waste
- Generation, collection, and transfer in each city (analysis in small groups)
- Presentation and analysis of the results in small groups

Day 2 (April 7)

8:30 Solid Waste Collection (continuation)

- Action plans for solid waste collection in each city (work assignments in small groups)
- Case study: Estimation of collection equipment (cost)
- Practice in cost estimating

12:30 Lunch

2:25 Recycling and Re-use of Solid Waste

- General information (analysis)
- Conceptualization

Composting: Analysis of personal experiences and new bibliographic information (small groups)

- Broadening technical knowledge of the preparation of compost and charcoal
- Case study: Production costs (recycling)

Day 3 (April 8)

8:30 Sanitary Fills

- Educational talk on the conceptualization of the various components
- Practice: Assessments of cities
- Plenary session: Analysis of common problems
- Design process: Costs and establishment of rates
- Practice: Calculation of costs using data from each city (group work assignments)

12:30 Lunch

2:15 Practice (continuation of calculations)

Practice: Design of a sanitary fill

Day 4 (April 9)

8:30 Management

- Case study: Assessment of management

- Practice: Preparation of the assessment of the participants' own cities (work assignments in pairs and/or small groups)
- Participative talk: Supervision, inspection, management control
- Practice: Analysis and selection of procedures in accordance with the actual situation (work assignments in small groups)

12:30 Lunch

2:15 Financing

- Case study: Cost analysis and calculations
- Practice: Cost calculations and budget (small groups)

Day 5 (April 10)

8:30 Reflection and Discussion Groups

- Financing
- Environment
- Plenary session for final consolidation
- Quantitative and qualitative evaluation of the seminar/workshop

12:00 Lunch and closing session of the seminar/workshop