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PROARCA SIGMA Final Report

Increased Use of Less Polluting Technologies
[Sistemas de Gestión para el Medio Ambiente]



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PROARCA SIGMA FINAL REPORT

INCREASED USE OF LESS POLLUTING TECHNOLOGIES

[SISTEMAS DE GESTIÓN PARA EL MEDIO AMBIENTE]

DISCLAIMER

The author's views expressed in this publication do not necessarily reflect the views of the United States Agency for International Development or the United States Government.

TABLE OF CONTENTS

Executive Summary	i
Acronyms and Abbreviations	iii
Glossary of Terms	vi
1.0 Introduction and Project Overview	1
1.1 Background	1
1.2 Project Intermediate Results:.....	1
1.3 SIGMA Implementation Strategy	2
1.4 Partner Organizations.....	2
2.0 SIGMA Achievements	5
2.1 Project Overview	5
2.2 Achievements	5
3.0 Success Stories	11
3.1 Solid waste action planning results in cleaner town and promotes private enterprise development.....	11
3.2 Establishment of a DCA mechanism enables private sector to finance clean production initiatives.....	12
3.3 National Clean Production Center (CPC) Network Strengthened with Public-Private Partnerships, Technical and Financial Assistance, and Capacity Building.....	13
3.4 USEPA Technical Assistance to SIGMA Leverages Additional Project Funds to Achieve More Impact.....	14
3.5 Improving operation and management of wastewater treatment plants through wider technical assistance mechanisms.....	15
3.6 Public and Private Sectors Cooperate to Save Jobs and Improve the Environment in Condega, Nicaragua.	15
3.7 Leveraging additional institutional and financial support for project activities extends SIGMA’s reach and results in greater impact	16
3.8 Development of potential waste recycling markets in Central America.....	18
4.0 Lessons Learned	19
4.1 Municipal.....	19
4.2 Private Sector	20
5.0 Achieving Project Goals	21
5.1 Indicators.....	21
5.2 Contract Deliverables.....	24
6.0 Administrative/Financial Management	26
6.1 Financial Management.....	26
6.2 Meeting Contractual Requirements	26
6.1.1 Contract Administration	26
6.1.2 Technical Documents Submitted to Development Experience Clearinghouse.....	27
6.1.3 Expenditure Tracking by Country.....	27
Attachment 1. Municipal Sector: Achieving USAID Program Indicators	29
Attachment 2. Private Sector: Achieving USAID Program Indicators (List of Industries Which Adopted Improved Management Technologies or Practices [IR 4.2])	34
Attachment 3. Status of Loans for the Regional Clean Production DCA	37
Attachment 4. USAID Contract Deliverables	38
Attachment 5. Summary of SIGMA Training Activities	41
Attachment 6. Listing of SIGMA Consultants and Subcontractors	44
Attachment 7. CD of all SIGMA publications	

EXECUTIVE SUMMARY

The USAID Central American Regional Environment Program, better known as *Proyecto Ambiental Regional para Centro America* (PROARCA), promotes the effective regional stewardship of key natural resources in support of sustainable development. Since 1996, PROARCA has supported the Central American Commission on Environment and Development's (CCAD) agenda, focusing on conservation and natural resources management in the region.

PROARCA's focus during its second five-year phase expanded to include improvement of environmental management in the Mesoamerican Biological Corridor (MBC). PROARCA II was originally structured into four components, with a fifth component added in 2003. PROARCA II's objectives were to:

- 1) Improve the management of protected areas;
- 2) Promote environmentally sound products and services;
- 3) Harmonize environmental policies;
- 4) Promote the use of less polluting technologies in the municipal and private sectors; and
- 5) Provide additional financial resources to organizations in the region interested in participating in the four components listed above, through a competitive grants program administered by CATIE.

USAID contracted ARD, Inc. to administer the fourth component, Increased Use of Less Polluting Technologies (or using its Spanish title and acronym, *Sistemas de Gestión para el Medio Ambiente* [SIGMA]), from October 2001 through March 2005, through the Integrated Water and Coastal Resources Management IQC. Project activities began in November 2001.

SIGMA has had a significant impact in increasing the awareness and technical knowledge in clean production and municipal waste management in Central America. Its successes can be measured both quantitatively and qualitatively. One yardstick to measure SIGMA achievements includes the deliverables listed in the USAID contract with ARD and the Intermediate Results indicators. SIGMA met or exceeded its goals for both the Program Indicators and Contract Deliverables, described in this report in Section 5 and the Attachments.

SIGMA's achievements can also be described by the individual comprehensive actions which significantly contributed to greater regional, national and local capacities and interest in clean production and environmental management, and through its achievements, success stories, and lessons learned documented in Sections 2, 3 and 4 respectively.

SIGMA's major achievements include:

- **The development of an effective communications and dissemination unit** for all components of PROARCA in general and SIGMA in particular, which will be continued with USAID funding through the administration of CCAD in El Salvador;
- **The development of a cadre of technical experts in clean production and municipal waste management** through capacity-building efforts with SIGMA partners using a combination of training activities, demonstration projects and focused technical assistance;
- **The construction of two wastewater treatment plants** in Livingston, Guatemala and La Unión, El Salvador using innovative, low-cost technology, which serve as demonstration projects for other municipalities, not only in construction, but in the operation and maintenance of the plants; and

- **The development of technical documentation** (technical manuals, guides and best practices based on demonstration projects, research and municipal and industrial plant evaluations), which will serve as a technical resource for future activities in the region.

SIGMA has documented several success stories, which highlight its impact in the region and which can be replicated throughout Central America. These include:

- **Solid waste action planning assistance** on a regional basis to several municipalities in the Estelí area of Nicaragua;
- **Establishment of a clean production Development Credit Authority (DCA)** with accompanying technical assistance for the private sector; the DCA has assisted individual industries to secure financing and has educated banks about the economic benefits of clean production;
- **Development of a regional clean production network** that serves as a mechanism for interchange of technical expertise and as a means to disseminate information throughout the region;
- **Improvement in the management of wastewater treatment plants in the region**, through a series of evaluations and training events with government officials provided by USEPA;
- **Development of a series of national industrial waste studies** to evaluate the potential markets for reuse and/or resale with the eventual objective of establishing a regional waste exchange program;
- **Leverage of institutional and financial resources for SIGMA activities** by building on national and local ongoing activities and securing both international and national financial support;
- **Utilization of USEPA expertise** in short-term focused technical assistance to support SIGMA project initiatives; and
- **Promotion of municipal and private sector cooperation** in the resolution of an environmental problem caused by a local tannery in Condega, Nicaragua.

While implementing the SIGMA project, ARD identified a number of lessons learned that would be of direct benefit for future donor activities:

- Local partners provide points of entry for rapid startup and smoother implementation.
- Development assistance may be better focused on providing technical assistance, training and capacity building instead of construction projects.
- The participatory planning methodology in solid waste management from Estelí, Nicaragua should be replicated to other municipalities and *mancomunidades*.
- There must be a balance between clean production economic incentives and government regulations.
- A sectoral or “industry cluster” approach channels resources to achieve tangible results.
- Clean production goes beyond the green agenda.

Finally, a common objective for all SIGMA activities was to assure sustainability through the continuation of clean production and environmental management activities after the life of the project. Specific examples include:

- Strengthening partner organizations through periodic capacity-building activities;
- Designing operation and maintenance requirements of the newly constructed wastewater treatment plants in Livingston and La Unión, and then training local staff on these processes and procedures;
- Conducting SIGMA exit briefings for USAID bilateral missions to summarize SIGMA work and introduce partner organizations to USAID technical staff; and
- Identifying success stories which can be replicated by other organizations’ work in this field.

ACRONYMS AND ABBREVIATIONS

ACEPESA	<i>Asociación Centroamericano para la Económica, la Salud, y el Ambiente</i> (a Costa Rican NGO)
AECI	<i>Agencia Española de Cooperación Internacional</i> (Spanish Agency for International Cooperation)
AIDIS	<i>Asociación Internacional de Ingeniería Sanitaria y Ambiental</i>
ALIDES	<i>Alianza para el Desarrollo Sostenible</i> (Alliance for Sustainable Development)
AMAZURLI	<i>Autoridad para el Manejo Sustentable de la Cuenca del Lago de Izabal y Río Dulce</i>
AMHON	<i>Asociación de Municipios de Honduras</i>
AMUNIC	<i>Asociación de Municipalidades de Nicaragua</i>
ANACAFE	<i>Asociación Nacional del Café</i>
ANAM	<i>Autoridad Nacional del Ambiente, Panamá</i>
ANDA	<i>Administración Nacional de Acueductos y Alcantarillados</i>
ANDA	<i>Asociación Nacional de Acuicultores de Nicaragua</i>
ANDAH	<i>Asociación Nacional de Acuicultores de Honduras</i>
APM	<i>Áreas Protegidas y Mercadeo Pro Ambiental</i> (PROARCA II program)
APROCAFE	<i>Asociación de Productores de Café</i>
ASIGOLFO	<i>Asociación de Municipalidades del Golfo de Fonseca, El Salvador</i>
BCIE	<i>Banco Centroamericano de Integración Económica</i> (Central American Bank for Economic Integration)
BEST	Belize Enterprise for Sustainable Technology
CAPAS	Central American Protected Areas System (PROARCA I)
CARE	Cooperative for American Relief Everywhere
CATHALAC	<i>Centro del Agua del Trópico Húmedo para América Latina y el Caribe</i> (Water Center for the Humid Tropics of Latin America and the Caribbean)
CATIE	<i>Centro Agonómico Tropical de Investigación y Enseñanza</i>
CCAD	<i>Comisión Centroamericana de Ambiente y Desarrollo</i> (Central American Commission on Environment and Development)
CEDES	<i>Consejo Empresarial Salvadoreño para el Desarrollo Sostenible</i>
CEDHESO	<i>Consejo Empresarial Hondureño para el Desarrollo Sostenible</i>
CEDSAL	<i>Consejo Empresarial de Desarrollo Sostenible para América Latina</i>
CEGESTI	<i>Centro de Gestión Tecnológica</i>
CEMCODES	<i>Consejo Empresarial Costarricense para el Desarrollo Sostenible</i>
CEPIS	<i>Centro Panamericano de Ingeniería Sanitaria y Ciencias del Ambiente</i>
CIDA	Canadian Agency for International Development
CIFI	<i>Corporación Centroamericana para el Financiamiento de la Infraestructura</i>
CLIPS	<i>Comisión Local Intersectorial de Plaguicidas</i>
COMURES	<i>Corporación de Municipalidades de la República de El Salvador</i>
CONADESCO	<i>Comisión Nacional de Desechos Sólidos, Guatemala</i>
CONCAUSA	<i>Declaración Conjunta entre Centroamérica y Estados Unidos</i> (Joint Central America-USA Declaration)
CONEP	<i>Conejo Nacional de la Empresa Privada</i> (Panama)
COSTAS	<i>Manejo de Zonas Marino Costeras</i> (PROARCA I Project)
CPC	Clean Production Center
CPML	<i>Centro de Producción más Limpia</i>
CST	<i>Certificación de Sostenibilidad Turística</i> (Certification of Sustainable Tourism)
CU	Communications Unit
DANIDA	Danish International Development Agency

DCA	Development Credit Authority
DEMUCA	<i>Fundación para el Desarrollo Local y el Fortalecimiento Municipal e Institucional de Centroamérica y el Caribe</i>
EHP	Environmental Health Project
EIA	Environmental Impact Assessment
EMA	Environmental Management Accounting
EMS	Environmental Management System
ERIS	<i>Escuela Regional de Ingeniería Sanitaria de la Universidad de San Carlos</i>
EU	European Union
FECAICA	<i>Federación de Cámaras de Industria Centroamericanas</i>
FEMICA	<i>Federación de Municipios del Istmo Centroamericano</i>
FHIS	<i>Fondo Hondureño de Inversión Social</i>
FIIT	<i>Fundación Interamericana de Investigación Tropical</i>
FIS	<i>Fondo de Inversión Social, Guatemala</i>
FISDL	<i>Fondo de Inversión Social para el Desarrollo Local, El Salvador</i>
FODESTUR	<i>Fomento al Desarrollo Sostenible Mediante El Turismo en Centro América</i>
FUNDECOOPERACION	<i>Fundación para el Desarrollo Sostenible, Costa Rica/Holanda</i>
FUNDEMAS	<i>Fundación Empresarial para la Acción Social</i>
FUSADES	<i>Fundación Salvadoreña para el Desarrollo Económico y Social</i>
G-CAP	Guatemala-Central American Programs (USAID)
GEF	Global Environment Fund
GTZ	<i>Gesellschaft für Technische Zusammenarbeit (German Agency for Technical Cooperation)</i>
IADB	Inter-American Development Bank
ICAP	<i>Instituto Centroamericano de Administración Pública</i>
IFC	International Finance Corporation
INCAE	<i>Instituto Centroamericano de Administración de Empresas</i>
INDES	<i>Instituto Nacional de Deportes de El Salvador</i>
INFOM	<i>Instituto Nacional de Fomento Municipal (Guatemala)</i>
IPAT	<i>Instituto Panameño de Turismo</i>
IR	Intermediate Result
ISDEM	<i>Instituto Salvadoreño de Desarrollo Municipal</i>
ISO	International Standard Organization
ITCR	<i>Instituto Tecnológico de Costa Rica</i>
JICA	Japan International Cooperation Agency
LEPPI	Local Environmental Policy and Programs Initiative (PROARCA I)
MAMBOCAURE	<i>Mancomunidad de las Cuencas de La Botija y Guanacaure</i>
MARENA	<i>Ministerio del Ambiente y Los Recursos Naturales, Nicaragua</i>
MARN	<i>Ministerio de Medio Ambiente y Recursos Naturales</i>
MBC	Mesoamerican Biological Corridor
MIF	Multilateral Investment Fund
NGO	Nongovernmental Organization
NPR	National Pollution Prevention Roundtable
ODC	Office of Development Credit
ONUDI	<i>Organización de las Naciones Unidas Para el Desarrollo Industrial</i>
OPS	<i>Organización Panamericana de la Salud</i>
PASA	Participating Agency Service Agreement
PCI	Project Concern International
PML	<i>Producción más Limpia</i>
PNUMA	<i>Programa de las Naciones Unidas para el Medio Ambiente</i>
PROARCA	<i>Programa Ambiental Regional para Centroamérica (USAID's Central American Regional Environment Program)</i>

PRODEMTHON	<i>Programa de Fortalecimiento Municipal y Desarrollo Local</i>
PRODOMA	<i>Programa de Pequeñas Donaciones de Manejo Ambiental</i>
PROGOLFO	<i>Proyecto Regional de Conservación de los Ecosistemas Costeros del Golfo de Fonseca</i>
PROMUNI	<i>Programa de Financiamiento Municipal</i>
PROSIGA	<i>Programa de Modernización de los Sistemas de Gestión Ambiental</i>
PYMES	<i>Pequeñas y Medianas Empresas</i>
RRACSA	<i>Red Regional de Agua y Saneamiento de Centro América</i>
SDC	Swiss Agency for Development and Cooperation (COSUDE)
SGA	<i>Sistemas de Gestión Ambiental</i>
SICA	<i>Sistema de la Integración Centroamericana</i> (Central American Integration System)
SIDA	Swedish Agency for International Development
SIGMA	<i>Sistemas de Gestión para el Medio Ambiente</i> (preferred regionally over the English project title)
SO	Strategic Objective
TASTE	Toledo Association for Sustainable Tourism and Empowerment
TNC	The Nature Conservancy
TTO	Technology Transfer Office USAID
TRIGOH	<i>Trinacional Golfo de Honduras</i>
UACI	<i>Unidad de Adquisiciones y Contrataciones Institucionales</i>
UCA	<i>Universidad Centroamericana</i>
UMA	<i>Unidad Municipal Ambiental</i>
UNDP	United Nations Development Program
UNEP	United Nations Environmental Program
UNIDO	United Nations Industrial Development Organization
USAID	US Agency for International Development
USEPA	US Environmental Protection Agency

GLOSSARY OF TERMS

Clean Production: an integrated preventive strategy, which is applied to processes, products, and services with the goal of increasing efficiency and reducing risks to humans and the environment. As applied to processes, clean production includes conservation of raw materials, water and energy; reduction of toxic materials, including reducing the quantity as well as the toxicity as measured by quantity of emissions and residues, which are deposited in the water, atmosphere and environment. With regard to products, the objective is to reduce the impacts throughout the life cycle cost analysis of the product, from its extraction as a raw material until the final disposition as a residue, promoting designs which are compatible with the needs of future markets. (United Nations Industrial Development Organization).

Environmental Management System: plans, management systems and the organization and actions that a municipality or industry uses to manage and interact with the social and natural environment with the objective to minimize the negative and maximize the positive impact over it. One of the most well known systems is ISO 14000 (Nicholas Cheremisinoff, 2001; Green Profits. Butterworth, Boston.)

Integrated Management: implies planning and executing actions, envisioning the long-term results, costs and secondary impacts of these actions; and then coordinating these actions with other related actions (for example, municipalities and industries that can address a common problem, such as integrated solid waste management, considering options to reduce material use, recycling, re-use of materials, and final disposition of waste in the long term).

Mancomunidad: a group of municipalities, which join to work on solutions of common problems such as solid waste management. A *mancomunidad* can also be a quasi-regional government or special district for specific needs.

Pollution Prevention: the prevention or reduction of the contaminant at the point of origin, not in the final process. Prevention of contamination occurs when raw materials, water, energy and other resources are used more efficiently; when toxic substances are substituted for less toxic substances; and when toxic substances are eliminated altogether from the production process. To reduce these dangerous substances from the production process improves the operation efficiencies, protects public health, improves the economy and conserves the environment. (US National Pollution Prevention Roundtable definition).

Regional and subregional demonstration projects: a series of activities that can be developed with a group of industries from one sector, including sector analysis, plant evaluation, environmental audits, training, application of clean production best practices, support in securing financing for recommended improvements, support to environmental management certification, development of case studies, clean production guides, monitoring the experience and dissemination of the results.

Ruta del Maíz: an initiative promoted by a consortium of Central American NGOs, *Grupo 7*, to work in the development of a tourist route in Central America, particularly with small- and medium-sized community-based industries, and which offer services that attract tourists who are interested in the rich culture and natural beauty of the region.

Sectors of Intervention: the productive sectors selected by SIGMA at a regional level to develop activities of environmental management, clean production, and pollution prevention, including coffee, dairy, shrimp, slaughterhouses, tanneries and tourism.

Sustainability: the aspect of an activity which is designed to consider the social, economic, and environmental impacts, and achieves its objectives because it has a means of maintaining itself economically, environmentally and institutionally.

Sustainable Technology Transfer: activities related to the organizational capabilities and knowledge, which make possible the application of environmentally friendly technologies developed internally as well as externally, which provides an efficient management for changing technology. (Developed for the SIGMA technology transfer manual, “*Manual de Transferencia y Adquisición Tecnología Sostenibles*”).

I.0 INTRODUCTION AND PROJECT OVERVIEW

I.1 BACKGROUND

PROARCA is the regional environmental program for Central America, funded by the United States Agency for International Development (USAID). It was created by the Joint Central America-USA Declaration (CONCAUSA) established in December 1994 to support the Alliance for Sustainable Development (ALIDES), and signed by the Central American governments in October 1994. CONCAUSA was renewed and expanded in June 2001.

Since 1996 and through two phases, PROARCA has supported the Central American Commission on Environment and Development's (CCAD) agenda. CCAD is part of the Central American Integration System (SICA). During its first five years, PROARCA focused on conservation and natural resource management in the region. PROARCA expanded its focus in 2001 to include improvement of environmental management in the Mesoamerican Biological Corridor (MBC). PROARCA II was originally structured into four components, with a fifth component added in 2003. PROARCA II's objectives were to:

- 1) Improve the management of protected areas;
- 2) Promote environmentally sound products and services;
- 3) Harmonize environmental policies;
- 4) Promote the use of less polluting technologies in the municipal and private sectors; and
- 5) Provide additional financial resources to organizations in the region interested in participating in the four components listed above, through a competitive grants program administered by CATIE.

The fourth component to promote less polluting technologies for the municipal and private sectors (*Sistemas de Gestión para el Medio Ambiente* [SIGMA]) was an expanded and restructured component of activities under the original PROARCA. PROARCA I worked with municipalities under the Local Environmental Policy and Programs Initiative (LEPPI), as well as conducting environmental evaluations (CEGESTI), working in the tourism industry (Ruta del Maíz) and other limited efforts to promote and improve environmental practices by the private sector. SIGMA was awarded to ARD, Inc. as a task order under the Integrated Water and Coastal Resources Management IQC in October 2001, and project activities commenced in November 2001.

The fifth component, *Programa de Pequeñas Donaciones de Manejo Ambiental* (PRODOMA), funded two grant cycles in February and April of 2004, for approximately \$1,300,000, of which seven grants were given to SIGMA partners to achieve SIGMA objectives. After 2005, no further grant funding will be available.

I.2 PROJECT INTERMEDIATE RESULTS:

The USAID G-CAP Strategic Objective 6 (SO6), Improved Environmental Management in the Mesoamerican Biological Corridor, defined the objectives of PROARCA II (listed above). The fourth component focused on the achievement of Intermediate Result 4 (IR 6.4), Increased Use of Less Polluting Technologies, addressing the municipal and private sectors to promote its objectives. This result has cross linkages with the Mission's IR 2 (IR 6.4, Expanded Market Access for Environmentally Sound Products and Services) and IR3 (IR 6.3, Harmonized Environmental Regulations). In addition, SO6 included a crosscutting competitive small subgrants program that was available to regional, national and local organizations that submitted proposals that would contribute to the achievement of any of the four Intermediate Results.

Within SIGMA, the objective of promoting the use of less polluting technologies was achieved by:

- Assisting municipalities in the management of domestic waste, through the promotion of low-cost, low-maintenance solid waste and wastewater integrated management systems. Lower level results were the development of financing options, the establishment of institutional arrangements, and the formulation of viable technical solutions for solid waste and wastewater management by municipalities or *mancomunidades*.
- Assisting private sector entities in specific industry clusters (e.g., dairy, tanneries, tourism, coffee, shrimp packing and others) to adopt environmental management systems in production processes and services delivery activities. Lower level results included increased access to financing for improved environmental management practices and processes; increased understanding and acceptance among private sector management of improved environmental management; and increased access to improved technologies and procedures.

The full set of the intermediate results is presented in Figure 1.1.

I.3 SIGMA IMPLEMENTATION STRATEGY

Activities were designed to achieve IR 4 under the task order, focusing on municipalities and private firms that generate pollution that directly affects the Mesoamerican Biological Corridor in four major watersheds—the Gulf of Honduras, the Gulf of Fonseca, the Mosquito Coast, and the region called Amistad-Cahuitta-Río Cañas. The SIGMA implementation strategy was similar in both the municipal and private sectors, which was to:

- Assess the individual sectors, regardless of industry sector or municipal waste origins.
- Develop demonstration projects, case studies and/or evaluations of individual processing plants to provide technical data and information by which best practices of clean production and waste management can be developed.
- Prepare technical documents based on existing local and regional technical expertise, supplemented by data and information from SIGMA case studies and evaluations, and use these technical documents for individual capacity-building activities, and for broader dissemination activities such as participation in technical seminars in the region and publication on the PROARCA website.
- Assist municipalities and private industries to access financing by demonstrating the economic benefits of self-financing and/or assisting entities to prepare investment packages, which are then submitted to lending institutions or other donor organizations for financial support.

SIGMA's success in achieving its objectives through this strategy can be demonstrated in the accompanying information (see Attachments) on individuals trained, technical documents prepared and disseminated, and the number of institutions receiving training and technical assistance leading to individual financing of clean production and environmental management initiatives.

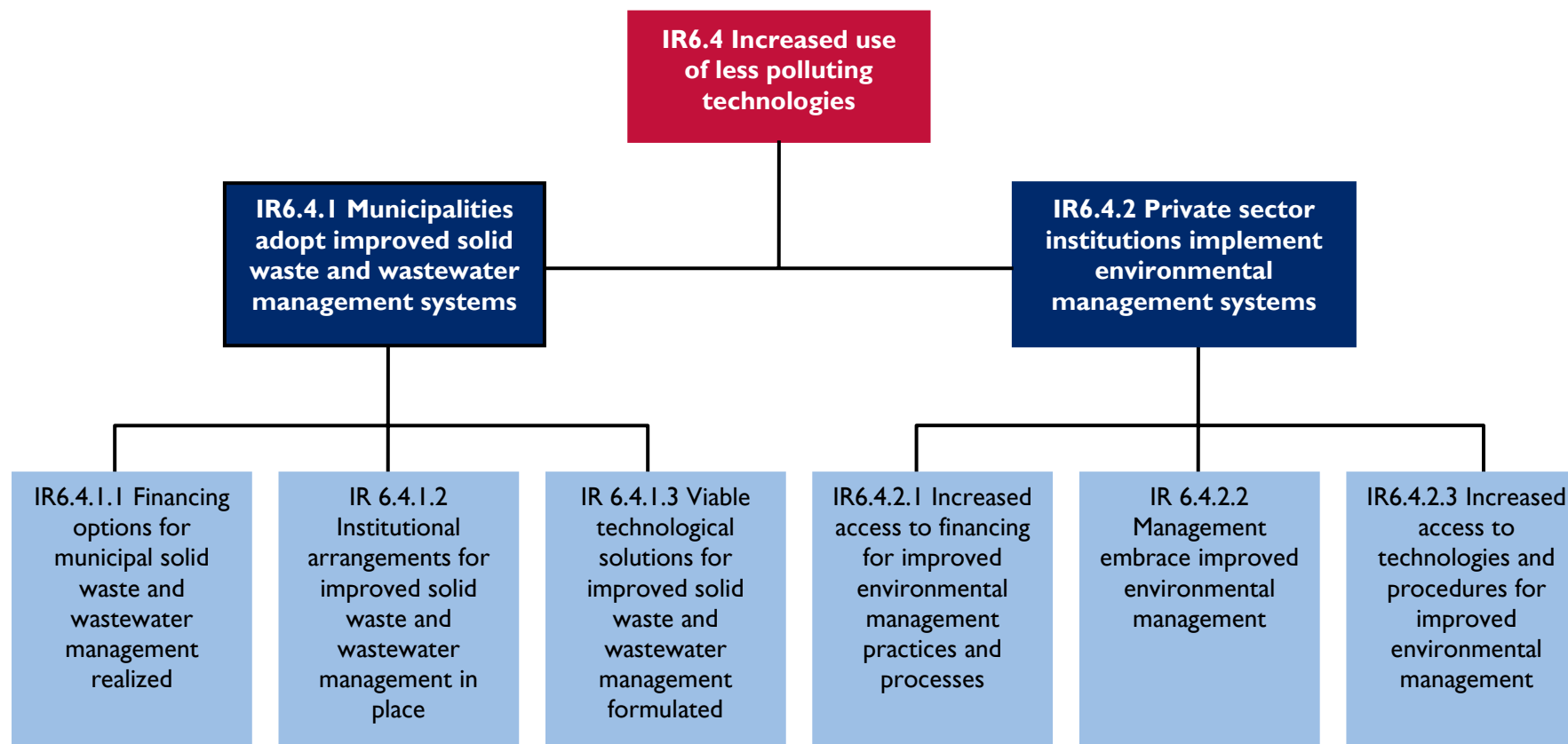
I.4 PARTNER ORGANIZATIONS

The SIGMA strategy to partner with regional, national and local organizations is one means of ensuring sustainability. Throughout project implementation, the degree of success is directly related to the extent to which we enlisted and empowered local, national and regional partner organizations. Key partners that contributed significantly to our success and sustainability are shown in Table 1.1. A list of subcontractors and consultants who supported project activities is included in Attachment 6.

Table I.I. KEY PARTNERS

Municipal Sector	
Regional	<ul style="list-style-type: none"> - RRACSA (<i>Red Regional de Agua y Saneamiento Centroamericano</i>) - PCI (Project Concern International) - FEMICA (<i>Federación de Municipios del Istmo Centroamericano</i>) - CEPIS (<i>Centro Panamericano de Ingeniería Sanitaria y Ciencias Ambientales</i>) - SDC (Swiss Agency for Development and Cooperation) - AECI (<i>Agencia Española de Cooperación Internacional</i>)
National	<ul style="list-style-type: none"> - ERIS (<i>Escuela Regional de Ingenieros Sanitarios, Universidad de San Carlos</i>) - CARE Nicaragua & El Salvador - ANDA (<i>Asociación de Acueductos y Alcantarillado</i>) El Salvador - INDES (<i>Instituto Nacional de Deportes</i>) El Salvador - INFOM Guatemala, INIFOM Nicaragua, ISDEM El Salvador, and IFAM Costa Rica - Ministry of Environment in El Salvador & Guatemala - Peace Corps Guatemala - FISDL (<i>Fondo de Inversión Social para el Desarrollo Local</i>) El Salvador & FHS (<i>Fondo Hondureño de Inversión Social</i>) - COMURES (<i>Cooperación de Municipalidades de la República de El Salvador</i>), AMUNIC (<i>Asociación de Municipalidades de Nicaragua</i>) and AMHON (<i>Asociación de Municipios de Honduras</i>) and UNGL (<i>Unión Nacional de Gobiernos Locales – Costa Rica</i>) - SEGEPLAN (<i>Secretaria de Planificación</i>)/SINAFIP (<i>Sistema Nacional de Financiamiento de la Preinversión</i>), Guatemala - ACEPESA (Costa Rican NGO) - PRODEM HON (NGO working in municipal strengthening in Honduras) - BEST (Belize) - IPAT Instituto Panameño de Turismo
Local	<ul style="list-style-type: none"> - Municipalities: La Unión, Santa Rosa de Lima, and Pasaquina, El Salvador; Condega, Estela, Totgalpa, and Jalapa, Nicaragua; Livingston, Guatemala; and Punta Gorda, Belize - Municipality of Livingston (Guatemala) - La Unión Mancomunidad (ASIGOLFO) (El Salvador) - MAMBOCAURE (Mancomunidad Guanacaure and La Botija watersheds) (Honduras) - AMASURLI (Guatemala) - CEDES (Consejo Empresarial Hondureño) Honduras
Private Sector	
Regional	<ul style="list-style-type: none"> - BCIE (<i>Banco Centroamericano de Integración Económica</i>) - CIATEC tannery consultants (Mexico) - FECAICA (<i>Federación de Cámaras de Industria Centroamericano</i>)
National	<ul style="list-style-type: none"> - ANDA (Nicaragua) and ANDAH(Honduras), Shrimp industry associations - Clean production centers in Nicaragua, Costa Rica, El Salvador, Guatemala, and Honduras - DCA participating banks Banco Cuscatlán (El Salvador), Bancentro (Nicaragua), Panabank (Panamá), Banco LAFISE (Costa Rica), and BAMER Banco (Honduras) - Universidad Don Bosco (El Salvador) - ANACAFE (<i>Asociación Nacional del Café</i>) and IHCAFE (<i>Instituto Hondureño del Café</i>) - NGOs associated with Rainforest Alliance - FIIT (Guatemala) and ICADE (Honduras)
Local	<ul style="list-style-type: none"> - FEDECOVERA, Federación de Cooperativas de las Verapaces - Asociación de Turismo de Puerto Viejo (Costa Rica) - Asociación de Turismo Bocas del Toro (Panamá)

FIGURE I.1. PROARCA SIGMA INTERMEDIATE RESULTS



2.0 SIGMA ACHIEVEMENTS

2.1 PROJECT OVERVIEW

This project has had significant impact in Central America. First, it created a **greater awareness** within private sector organizations, NGOs, and government organizations for the need and means to implement better waste management and clean production initiatives. Second, it contributed significantly to an **increase in technical resources** available through the documentation of demonstration project results, evaluations and other research. These resources have contributed to the preparation of a series of technical documents and best practices, and a technical resource library for future clean production and municipal waste management actions. The process by which these documents were prepared has both assured that the technical information is accurate and helped to educate participating organizations and technical experts on the subject. Finally, SIGMA **developed a technical capacity** within many of its partner organizations, and within government organizations, particularly the Ministries of Environment, to address issues of clean production and waste management.

Through these three achievements of creating greater awareness, developing new technical documents, and building technical capacity, SIGMA assisted to improve both regional environmental management and the human and natural environments.

SIGMA achievements follow, providing further details on the project's impact in the region.

2.2 ACHIEVEMENTS

Specific achievements of the project include:

- 1. The Communications Unit developed an effective communications and dissemination network.** The PROARCA SIGMA Communications Unit provided general communications and dissemination support to the first four components of PROARCA, and specifically to SIGMA activities through the preparation of technical documents and training materials. First, the Unit established a PROARCA corporate identity by developing the PROARCA logo, uniform business cards and publications. These actions unified the components, giving PROARCA greater public presence and recognition. The Communications Unit also developed the PROARCA website and prepared quarterly bulletins, which reported on the activities and products of the respective components. In addition, the Communications Unit provided assistance to APM and PRODOMA in the preparation of promotional materials and reports. The Unit, staffed by a Communication Specialist and Webmaster, developed an attractive and user-friendly website, which gained national recognition as the best association website in Guatemala in 2004.



Second, the Communications Unit prepared and published technical documents, multimedia didactic materials for SIGMA and numerous CD summaries of the SIGMA work, which gave the SIGMA technical staff valuable and effective dissemination instruments to promote clean production and waste management.

During the life of project, the Communications Unit published 10 PROARCA bulletins, 25 technical documents, such as technical manuals, guides on best practices, technical studies and several case studies

of demonstration projects, and technical assistance to municipalities and the private sector. Materials were published in paper copy for distribution at seminars and technical conferences and were posted on the PROARCA website (www.proarca.org) in a downloadable document format. This valuable dissemination effort gained appreciation for SIGMA by its partner organizations, national governments and business associations as an important technical resource for clean production and municipal waste management practices in the region.

2. **SIGMA provided training to build the capacity of partner organizations, government entities and private consultants.** SIGMA organized and implemented 61 training events throughout the life of the project. These activities created a greater awareness of clean production and municipal waste management in the region. In addition, it is our belief that training activities within partner organizations and for consultants will continue to foster clean production and waste management initiatives after the life of the project.

Training activities were based on the results of SIGMA demonstration projects, the preparation of technical guides, and technical studies. In this manner, technical manuals, best practices and other types of technical information were drawn from experiences and realities in Central America. Training events provided assistance in accessing financing, institutional strengthening and capacity building. All training activities took place between October 2002 and December 2004. In total, 2,056 participants received training from SIGMA through these 61 separate training events. The chart below summarizes these training activities.

TABLE 2.1. SUMMARY OF SIGMA TRAINING ACTIVITIES

Sector	Access to Financing	Institutional Strengthening & Capacity Building	Total Participants
Private	180	720	900
Municipal	304	713	1,017
Private & Municipal		139	139
Total			2,056

A detailed list of training activities, total number of participants and locations is provided in Attachment 5.

The following subjects were covered in the training activities:

Private Sector

- Methodologies for clean production and environmental management: evaluation procedures, identification and analysis of improvements and principles of environmental audits;
- Clean production indicators: developing indicators to measure industry environmental performance;
- Energy efficiencies: application of best practices in energy use, air conditioning, combustion efficiencies and heat recuperation;
- Life cycle analysis: development of an inventory of materials, determination of environmental impact and application of the life cycle analysis;
- Technology transfer: technology transfer processes as they apply to clean production technologies;
- Rational use of pesticides: methods to reduce or eliminate the use of agro-chemicals in pesticide control; and

- Clean production initiatives in shrimp packing, coffee processing, dairy processing and tourism: discussion of clean production best practices by sector based on demonstration projects and environmental evaluations.

Municipal Sector

- Solid waste management: principles of good municipal solid waste management including recycling and composting with community participation;
- Wastewater management: principles of operation and maintenance of wastewater treatment plants;
- Management of sanitary landfills: operation and maintenance of medium- and small-scale landfills;
- Biological water quality monitoring: practical guide to measure water quality through the monitoring of macro invertebrates;
- Operation and maintenance of wastewater treatment plants: focused on sustainable operation of existing wastewater treatment plants;
- Solid waste collection vehicle route optimization: subregional workshops which introduced methods to increase efficiencies of solid waste collection; and
- Preparation of environmental projects to access financing for municipalities: workshops at regional and subregional level to assist municipalities prepare investment plans and link them with financial institutions.

3. **Construction of two wastewater treatment plants.** Under the SIGMA contract, two wastewater treatment plants were built for the municipalities of La Unión, El Salvador and Livingston, Guatemala. These two projects serve to demonstrate applications such as the:

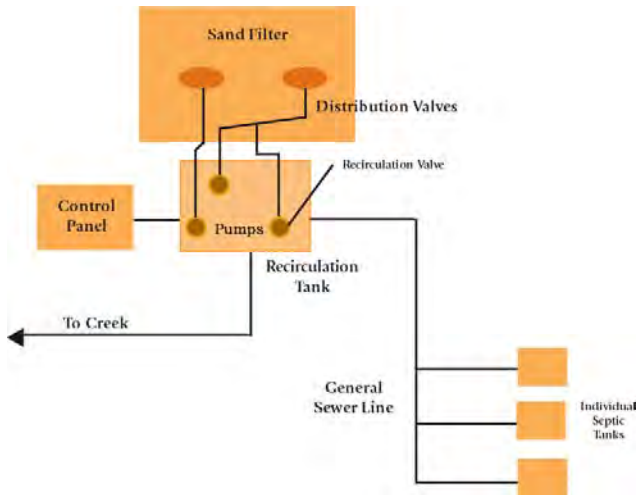
- Recirculation sand filter design for secondary treatment, with low operation and maintenance costs—an appropriate application to serve small communities in low-lying, environmentally sensitive areas with space limitations;
- Wastewater re-use application in La Unión;
- Decentralized primary treatment through individual or shared septic tanks to settle out the solids, permitting the use of smaller sized sewer lines; and
- Use of a geo-membrane for the plant foundation in Livingston.



Schematic of treatment plant design used in both Livingston and La Union

Construction of these plants was a continuation of the LEPPI municipal support through PROARCA I and were not planned as part of the ARD task order response, but were added to our Annual Life of Project Plan at the request of USAID G-CAP.

The La Unión plant, built by Project Concern International (PCI) under a subcontract to ARD, was constructed to process the waste from the newly constructed municipal market and to irrigate the local soccer field. Effluent processed is equivalent to serving 75 families. The construction cost of the plant was \$175,000.



Livingston System with Septic Tanks

The Livingston plant, built by Multiservicios del Norte of Guatemala, under subcontract to ARD, can serve up to 133 families. The cost of plant construction was approximately \$246,000, of which SIGMA financed \$195,000, and the remaining funds and resources were provided by the Municipality of Livingston and the Spanish Agency for International Cooperation (AECI).

Both plants are currently operating and administered by the respective municipalities of La Unión and Livingston. These plants serve as demonstration projects for potentially sustainable wastewater treatment in the region. Further monitoring and evaluation of the

performance, operation, and maintenance, however, will be required over time to completely understand the full potential of this technology for the region.

SIGMA emphasized with these beneficiary municipalities the need for good operation and maintenance of the system plus the development of a mechanism to charge for wastewater treatment services. Both elements form part of an effective technical, institutional and financial sustainability strategy, which is lacking with many other municipal wastewater treatment plants in the region.

4. **Development of Technical Resources.** SIGMA has diligently documented the various demonstration projects, case studies and technical studies conducted throughout the life of the project. The results are an impressive compilation of technical documents, which are now available in print through partner organizations and on the PROARCA website. The publications include:

- a. **Ten PROARCA Bulletins**, called Acciones, cover activities for all components of PROARCA.
- b. **Publications on SIGMA activities**- A selected group of one page handouts on SIGMA results were prepared and published, which include:



- SIGMA institutional description in English and Spanish,
- Summary of SIGMA work in municipal solid waste management,
- Regional Clean Production DCA including technical assistance to bank and industry representatives,
- Case study of La Unión wastewater treatment plant in the Gulf of Fonseca, and
- Case study of Livingston wastewater treatment plant in the Gulf Honduras.



of

c. Municipal Sector Publications

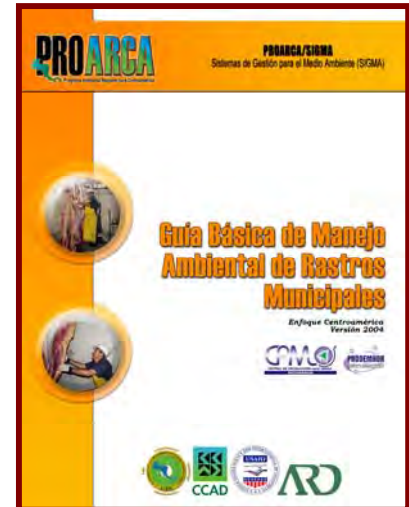
Financial

- Guide for Administration of Financial resources (*Guía para gestión de recursos financieros municipales*),
- Directory of Financial Resources (*Directorio básico de fuentes de financiamiento municipal*) (2004), and
- Guide for Calculating Costs for Municipal Services (*Guía para determinar resultados financieros y tasas por servicios municipales, en enfoque en manejo de residuos sólidos*).



Technical

- Municipal Solid Waste Management Guide (*Guía para el mejor manejo de residuos sólidos municipales*);
- Basic Guide for Preparing and Producing Organic Fertilizer (*Manual básico para la elaboración y producción de abono orgánico*); and
- Directory of Solid Waste Recyclers by country, published by SIGMA:
 - Guatemala (prepared by Peace Corps Guatemala),
 - Nicaragua (prepared by AMUNIC),
 - Costa Rica (prepared by ACEPESA),
 - Honduras (prepared by PRODEMTHON/AECI/AMHON), and
 - Panama (prepared by Municipality of Panama);
- Practical Guide for Operating Daily Cells in Small and Medium Sized Sanitary Landfills (*Guía práctica para la operación de celdas diarias en rellenos sanitarios pequeños y medianos*);
- Guide for Recycling and Reuse of Tires (*Guía práctica para municipalidades sobre re-uso de llantas*);
- Municipal Guide on Wastewater Management, (*Guía para el mejor manejo de aguas residuales municipales*);
- Guide for Improved Environmental Management of Municipal Slaughterhouse Wastes (*Guía para el manejo ambiental de residuos de rastros municipales*);
- Practical Guide to Monitor Water Quality from Wastewater Treatment Plants (*Guía práctica de monitoreo de procesos de tratamiento de aguas residuales*); and
- Operation and Maintenance Manual for the Livingston wastewater Treatment Plant (*Plan de saneamiento municipal de Livingston, Departamento e Isabal*).



d. Private Sector Publications

Financial

- Manual for Preparing Investments for Clean Production (*Manual de gestión crediticia para proyectos de inversión en producción más limpia en Centroamérica*), and
- Costing Guide for Coffee Beneficiarios (*Guía de Costos de beneficiado de café*).

Technical

- Inventory of industrial waste and potential markets:
 - Costa Rica - *Reporte Nacional de Manejo de Materiales* (2003),
 - El Salvador - *Estudio para la Evaluación Mercadológica de los Desechos industriales* (2004), and
 - Guatemala – *Reporte Nacional de Manejo de Residuos Sólidos* (2005);
- Report on Pesticide Use in the Gulf of Fonseca, (*Contaminación por plaguicidas en cuencas hidrográficas que desembocan en el Golfo de Fonseca*),
- Clean Production Best Practices Manual for the Dairy Industry (*Manual de buenas prácticas operativas de producción más limpia para la industria láctea*),
- Clean Production Manual for Best Practices in Coffee Processing (*Manual de buenas prácticas operativas de producción más limpia en el sector de beneficiado de café*),
- Clean Production Best Practices for the Tourism Sector (*Manual de buenas prácticas operativas de producción más limpia en el sector turístico hotelero*),



- Clean Production Manual on Best Practices in Industrial Slaughterhouses (*Manual de buenas prácticas operativas de producción más limpia para la industrias de mataderos*),
- Clean Production Manual on Best Practices in Shrimp Processing Plants (*Manual de buenas prácticas operativas de producción más limpia para procesadoras de camarón*), and
- Calendar 2004 “La Empresa Eficiente.”

SIGMA has distributed these publications to its partner organizations which will use them to provide training and technical assistance after SIGMA’s completion. For the private sector, the principal partners that will utilize this information are the national Clean Production Centers (CPCs). For the municipal sector, publications were distributed to regional organizations such as FEMICA, ERIS, OPS, and RRACSA. In addition, all documents will continue to be accessible from the PROARCA website whose operation is being transferred to CCAD, as well as national organizations such as COMURES in El Salvador and INFOM in Guatemala.

3.0 SUCCESS STORIES

Success stories are well-presented summaries of activities undertaken in the field projects that can be used to frame, highlight and/or give greater meaning to what SIGMA has done. The aim is to provide more refined feedback to clients and partners as to what is especially notable about how and what we have accomplished in a given project. ARD believes that the following success stories meet this definition.

3.1 SOLID WASTE ACTION PLANNING RESULTS IN CLEANER TOWN AND PROMOTES PRIVATE ENTERPRISE DEVELOPMENT



Garbage collection in Pueblo, Nuevo, Nicaragua

The lack of technical and administrative knowledge in rural municipalities in Central America has resulted in poor solid waste management practices. Since 2003, SIGMA supported CARE Nicaragua technical assistance efforts to seven municipalities in the Estelí area to promote and execute environmentally sound solid waste management initiatives. This assistance resulted in a cost-effective methodology to educate and involve municipalities and community groups in improved solid waste management practices.

CARE Nicaragua technical assistance emphasized community participation through local workshops in each municipality. Workshop participants included representatives from local government, Municipal Environmental Committees, NGOs and the private sector where solid waste problems were defined and prioritized based on its importance and environmental impact. Action plans were developed and prioritized, which included such actions as the:

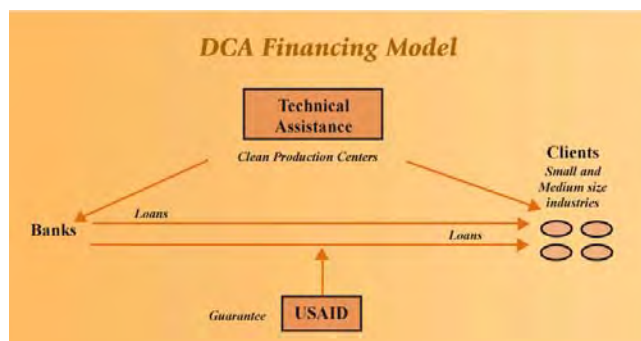
- Identification of solid waste collection routes;
- Evaluation of existing informal garbage dumps;
- Community clean up days in which 1,500 students and citizens cleaned up 97 cubic meters of solid waste;
- Closure of illegal garbage dumps in Condega, Palacagüina, Pueblo Nuevo and Totogalpa;
- Construction of trenches to establish a manual sanitary landfill; and
- Establishment of a solid waste collection pick up in Totogalpa, which has since become a small business enterprise.

This initiative demonstrates how focused solid waste technical assistance to a group of small municipalities can first generate community awareness of the need for effective solid waste management, and then stimulate and direct community and municipal actions to incrementally improve the overall solid waste management of the municipality, and to position it to responsibly access external funding for solid waste management.



Sanitary landfill in Santa Rosa de Lima, El Salvador

3.2 ESTABLISHMENT OF A DCA MECHANISM ENABLES PRIVATE SECTOR TO FINANCE CLEAN PRODUCTION INITIATIVES



SIGMA is supporting the potential DCA clients through technical assistance from the Clean Production Centers

SIGMA assisted USAID to organize and negotiate with five Central American national banks to participate in a \$10 million Development Credit Authority (DCA) for clean production financing. Banks supporting clean production investments with their own funds reduce their risk because the US Treasury shares the risk of default by 50%. This regional DCA was the first of its kind and allowed the USAID Mission in Guatemala (G-CAP) to develop one DCA document that could be signed by all five banks.

SIGMA technical support to individual industries to prepare investment plans and bank representatives to educate them on the benefits of

clean production was provided through the CPCs and independent consultants. CPC staff also received technical training to improve their consulting technical assistance capabilities. Since clean production technologies are new to the region, the training demonstrated to the bank analysts the economic feasibility as well as the environmental advantages available to industries through these actions. The five banks include:

- Banco Cuscatlán, El Salvador;
- Bancentro, Nicaragua;
- Panabank, Panama;
- LAFISE, Costa Rica; and
- Bamer, Honduras.

A three-pronged strategy of bank training, technical assistance to industries through the CPC technical staff, and the capacity building of clean production staff has produced more interest and action by industry.

By project completion, SIGMA supported 17 industries to prepare investment plans for funding under the DCA. Currently, 15 loans are under consideration by the five participating banks, of which two have been approved. One loan was funded under the DCA mechanism, whereas the other was funded and partially subsidized by the Ministry of Agriculture in Panama.

Additionally, 10 more industries are now preparing investment plans for DCA support. To further assist industries secure loans for clean production beyond the DCA, a database of financial resources by country was developed and is currently available on the PROARCA website. Reference materials produced by SIGMA to assist in DCA implementation include:

- A promotional brochure describing the DCA mechanism;
- An environmental cost accounting manual on clean production principles; and
- A training guide for bank officials that sensitizes them to clean production and how to develop the loan package for the interested borrowers.

DCA Clean Production Model

Objective: promote development investments where there is currently no specific financing, and thus credit incentives for lending institutions focus on clean production and environmental management processes and certification.

DCA guarantees loans: 50% of loan losses.

Technical assistance fund: SIGMA provided pre-investment financing to industries.

Loan Funds: provided from participating banks' own resources.

Loan Guarantee Amount: \$10 million

Maximum loan guarantee: \$5 million

DCA: 2003-2008

Cooperating Organizations: BCIE

A list of industries that have submitted investment plans or plan to do so is provided in Attachment 3.

3.3 NATIONAL CLEAN PRODUCTION CENTER NETWORK STRENGTHENED WITH PUBLIC-PRIVATE PARTNERSHIPS, TECHNICAL AND FINANCIAL ASSISTANCE AND CAPACITY BUILDING

In the private sector, SIGMA has focused its capacity building efforts and regional networking on the national CPCs. Initial support was received from United Nations through the United Nations Industrial Development Organization (UNIDO) and the United Nations Environmental Program (UNEP), prior to the initiation of the SIGMA program. SIGMA has continued to build on this base over the life of the project.



Clean Production Staff in Central America

Our training activities concentrated on increasing the clean production technical capabilities of the CPC staff and independent consultants working with them. Also, training has focused on selected industries, such as dairy and coffee processing, shrimp packing, tourism and slaughterhouses. As the regional network of CPCs became stronger and more active, the centers began to use each other as technical resources through the interchange of experiences and personnel. Each center began to specialize in selected industries or industry clusters such as dairy, tanneries, tourism, and coffee processing, among others. Concrete examples demonstrating the interchange of resources include:

- The Nicaraguan CPC is specializing in best practices for slaughterhouses and assisting clean production centers in Honduras and Guatemala to conduct slaughterhouse evaluations in their countries.
- Guatemala is specializing in best practices for coffee benefices and assisting Honduras to conduct their own evaluations.
- Nicaragua and El Salvador are working jointly on a clean production best practices guide for shrimp packing.
- Directors from Costa Rican and Nicaraguan CPCs are assisting Panama to develop a strategic and business plan to establish a CPC in Panama.

Finally, capacity building has extended beyond CPC staff to a network of independent consultants in each country, thereby producing a cadre of technical qualified experts who can work intermittently with the CPCs to increase their capabilities and outreach possibilities.

Further successes for the CPCs, located in Guatemala, El Salvador, Nicaragua, Honduras, Costa Rica and Panama, include not only being the focal points for clean production activities in the respective countries, but also having the ability to serve as networks for interchange of experiences and ideas in clean production on a regional basis. Such networks will be the means of promoting clean production, disseminating SIGMA manuals and best practices guides, thereby ensuring sustainability of clean production practices throughout Central America.

The Clean Production Network for Central America is well positioned to support any potential passing of free trade agreements between the US and Central America. The trade agreements calls for environmental initiatives and consideration which industries must address. The CPCs could assist with:

- Developing and promoting incentives and other flexible and voluntary mechanisms in order to encourage environmental protection;
- Promoting best practices leading to sustainable management of the environment;
- Facilitating technology development and transfer as well as training to promote the use of proper operation and maintenance of clean production technologies; and
- Fostering partnerships to address current or emerging conservation and management issues including training and capacity building.

3.4 USEPA TECHNICAL ASSISTANCE TO SIGMA LEVERAGES ADDITIONAL PROJECT FUNDS TO ACHIEVE MORE IMPACT

The US Environmental Protection Agency's (USEPA) technical assistance through a Participating Agency Service Agreement (PASA) agreement with USAID under IR 3, has been particularly effective in providing additional technical support to SIGMA activities. EPA experts have provided short-term assistance in the following areas:

- Technical assistance in a pesticide management training course in Choluteca, Honduras;
- Training course on biological monitoring of water quality in Livingston, Guatemala;
- Soil mechanics technical assistance in the construction of the wastewater treatment plant in Livingston, Guatemala;
- Training in the operation and maintenance of wastewater treatment plants for Salvadoran government employees;
- Evaluation of existing wastewater treatment plants in El Salvador and Guatemala;
- Technical assistance to plant operators in La Unión and Livingston in the construction and operation of the two wastewater treatment plants;
- Assistance in solid waste management, both as technical expert in the regional solid waste management workshop in San Salvador and review of the solid waste guides;
- Co-financing the technical experts from Mexico to evaluate the tannery in Condega, Nicaragua;
- Presentation on clean production and relationship to ISO 14000 at the clean production workshop in Belize; and
- Expert from the University of Georgia in waste management from slaughterhouses.

Because EPA is known more for its technical assistance capabilities rather than its field implementation capabilities, ARD decided to provide the key management and direction needed to achieve successful deployment of the vast resources of this organization. Keys to success were setting clear expectations

provided through specific scopes of work, which describe deliverables and the person to which each consultant is responsible; and regular monitoring and evaluation of field activities over the life of project. Communication channels between SIGMA technical staff and USEPA's US-based management were excellent, and was reinforced periodically by involving USEPA in field visits and in preparation of SIGMA's annual work plan.

3.5 IMPROVING OPERATION AND MANAGEMENT OF WASTEWATER TREATMENT PLANTS THROUGH WIDER TECHNICAL ASSISTANCE MECHANISMS

The poor operation and maintenance of many wastewater treatment systems are problematic throughout Central America, resulting in deficient or nonfunctioning systems. SIGMA addressed this problem through a series of initiatives to improve the sustainable operation of these infrastructure investments.

First, SIGMA developed a guide for wastewater management, which has a strong emphasis on operation and maintenance tips for municipal operators. The guide was developed with the assistance and review of USAID and USEPA technical specialists.

Second, SIGMA sponsored a regional workshop which focused on the sustainable operation of existing wastewater treatment plants, relying on the close cooperation and support from SDC and regional water and sanitation organizations: OPS (Pan-American Health Organization) and RRASCA (*Red Regional de Agua y Saneamiento de Centro America*). The workshop highlighted problems of sustainability of wastewater treatment plants common in the region, and spawned discussions on municipal policy issues. Key issues discussed: 1) who provides the service? 2) can the ownership of the plant be empowered better to handle performance improvements? 3) would lagoon systems serve better as an optimal system for municipal wastewater treatment? and 4) would simplified sewers be worth promoting along with re-use of wastewater?

Third, SIGMA organized the training of wastewater inspectors in El Salvador with strong support from the Ministry of Environment and assistance from USEPA experts. Training included diagnostic evaluations of three existing wastewater treatment plants: El Pedregal, La Libertad and Santiago Nonualco in El Salvador. ANDA, the national organization responsible for administering wastewater treatment plants in the country, and who participated in the evaluations, took immediate action based on the field evaluations, creating dramatic efficiency improvements.

Finally, with support from the PROARCA small grants program, PRODOMA, SIGMA supported a three-country evaluation of 10 wastewater treatment plants, which were either not operating or in poor repair. Project Concern International, with cooperation from USEPA experts, evaluated plants in Honduras, El Salvador and Nicaragua. The result of this effort is was developed as a best practices guide for wastewater treatment plant operators. The final report to PRODOMA was presented in March 2005.

Actions to improve plant efficiencies by focusing on operation and maintenance concerns have proven to be a cost-effective means to put into operation or greatly improve the efficiencies of existing infrastructure, develop best practices for operation of plants, and create greater awareness of the need for sustainable wastewater treatment plants.

3.6 PUBLIC AND PRIVATE SECTORS COOPERATE TO SAVE JOBS AND IMPROVE THE ENVIRONMENT IN CONDEGA, NICARAGUA

The SIGMA private and municipal sectors coordinated efforts to successfully resolve an environmental problem caused by a local tannery, which had gained national notice as a very large polluter. To assist in solving this environmental problem, SIGMA invited the Nicaraguan Clean Production Center to meet with

the Deputy Mayor of Condega. Through the Deputy Mayor's contacts, the Nicaragua CPC staff met with the tannery owners, and through municipal influence with the Ministry of Environment (MARENA), helped to defer MARENA proposed actions to shut down the tannery, thus allowing the company to take remedial action.

SIGMA supported the Nicaragua CPC's efforts by contracting a clean production specialist for tannery from Mexico (CIATEC) to assist with the environmental evaluation. Based on the evaluation, the CPC prepared an action plan to reduce the pollution, which was presented and negotiated with MARENA. With a specific plan of action and support from the municipality, MARENA agreed not to shut down the tannery.

As of September 2004, the tannery had implemented, totally or partially, approximately 80% of the recommended actions. Specific actions included reduction in chemicals, use of water and energy in the tanning process. If all actions are taken (at a cost of \$160,000) the tannery will recover its investment in approximately seven months through savings in the plant operation, and drastically reduce pollution from its processes.

The continuation of the operation of the Condega tannery provided economic benefits either directly or indirectly to over 200 people in the community. This joint effort demonstrated how municipal and private sector interests can be served to promote improved environmental management and maintain the economic interests of the community.

3.7 LEVERAGING ADDITIONAL INSTITUTIONAL AND FINANCIAL SUPPORT FOR PROJECT ACTIVITIES EXTENDS SIGMA'S REACH AND RESULTS IN GREATER IMPACT

SIGMA's work with its partner organizations produced effective, co-managed and co-implemented actions in environmental management through institutional and financial support from the partners. Because of limited project funds, and through a proactive strategy of working to leverage nearly \$1 million in additional funds for critically needed activities, ARD was able to extend its project reach. By identifying ongoing activities either at the local or national level, SIGMA was able to leverage the resources of other development groups to supplement its outputs.

Institutional support for SIGMA efforts included the following:

- AECI provided technical assistance in the construction Livingston wastewater treatment plant in Guatemala.
- CARE Nicaragua's community development activities with seven municipalities in the Estelí Area provided the basis for solid waste management action planning.
- Peace Corps Guatemala, AMUNIC Nicaragua, ACEPESA Costa Rica, PRODEM HON Honduras, and the Municipality of Panama prepared recycling buyer directories for their respective countries which were printed by SIGMA.
- The ANAM and CONEP clean production experience was used as a basis for the Panamanian CPC's clean production business plan.
- The Canadian Agency for Development Assistance (CIDA) worked with the agricultural sector in Olancho, Honduras to introduce clean production methodologies to six dairy processors.

SIGMA leveraged over \$990,000 additional funds from local, national, and international partner groups, including:

Guatemala	
• Spanish Cooperation for Livingston wastewater treatment plant	\$30,000
• Municipality of Livingston for its wastewater treatment plant	\$20,000
• CPC Guatemala contributed to course in energy efficiencies	\$2,000
• PRODOMA, CPC Guatemala for coffee <i>beneficios</i>	\$20,000
• PRODOMA, CPC Guatemala for tourism demonstration projects	\$25,000
El Salvador	
• USAID/EGAT, Water IQC Team in Washington to supported construction of wastewater treatment plant in La Union, El Salvador under a core task order to ARD under the Water IQC	\$80,000
• CARE El Salvador contributed to residuals workshop in San Salvador	\$5,000
• JICA El Salvador contributed to residuals workshop in San Salvador	\$2,500
• CPC El Salvador contributed to course in energy efficiencies	\$2,000
• JICA, support for solid waste demonstration project in La Union (ASINORLU)	\$50,000
• Pasaquina Municipality, renovation of sanitary landfill	\$3,220
Nicaragua	
• Japanese Embassy purchase of truck for solid waste management in Estelí	\$30,000
• PRACC/EU, pilot SWM and environmental education project for Estelí	\$45,000
• PRODEL, supported 2 composting cooperatives in Jalapa	\$3,000
• PRODOMA, CARE Nicaragua assisting municipalities in solid waste management	\$30,000
• DANIDA, Municipality of La Trinidad constructing sanitary landfill	\$21,000
Panama	
• USAID Panama for the operation of a CPC	\$300,000
• IADB contributed to Clean Production indicators course in Panama	\$3,000
• Panabank DCA loan to PROLACSA with SIGMA investment plan assistance	\$100,000
• Panabank NonDCA loan to MASADA with SIGMA investment plan assistance	\$20,000
Honduras	
• SDC contributed to wastewater workshop in San Pedro Sula	\$5,000
• OPS contributed to wastewater workshop in San Pedro Sula	\$3,000
Belize	
• BEST contributed to Clean Production workshop	\$2,000
• PRODOMA, TASTE, Belize for construct alternate septic tank designs	\$25,000
Costa Rica	
• CPC Costa Rica contributed to Life cycle cost analysis workshop	\$2,000
Regional	
• Fundacooperacion for tourism demonstration in Costa Rica-Panama	\$5,000
• CIDA demonstration project in dairy processing	\$5,000
• ONUDI support for manual on technology transfer	\$3,500
• Cuscatlan, Bancentro, and Panabank support for calendar	\$3,000
• PRODOMA, PCI conduct three country evaluation WW treatment plants	\$80,000
• PRODOMA, CEGESTI for technology transfer study	\$37,900
• PRODOMA, CPC Nicaragua Dairy best practices dissemination	\$30,000
Total	
	\$993,120

3.8 DEVELOPMENT OF POTENTIAL WASTE RECYCLING MARKETS IN CENTRAL AMERICA

Since 2002, SIGMA has financed studies on the potential for reuse and recycling of industrial waste and their marketability, producing key assessments in Costa Rica, El Salvador and Guatemala. The clean production centers in Costa Rica and Guatemala conducted the studies in Costa Rica and Guatemala, while Universidad Don Bosco conducted the Salvadoran study. In each study, a select group of industrial residuals (e.g., oils, lubricants, aluminum, batteries, tires, paper, glass, polypropylene, and others) were identified based on the importance as a waste and the potential markets for re-sale. In August 2004, these studies were presented at the SIGMA-sponsored regional conference in San Salvador on industrial and municipal waste management. This conference attracted waste market experts from the US, Bolivia, Chile and Colombia, among others. The conference resulted in an agreement to promote national waste exchange markets in all countries in Central America with the eventual objective of the creation of a regional waste market system. The benefits of waste exchange centers were presented at the conference, including:

- Economies of scale,
- Reduction of imports of primary materials,
- Creation of employment through the processing of the industrial residuals,
- Reduced demand on the municipal sanitary landfills, and
- Creation of the technical assistance to provide alternative uses of residuals which have a greater economic value.

A proposal to support this waste market effort was prepared and submitted to CCAD for consideration by donor organizations. The SIGMA project supported the studies that demonstrated the real economic potential of such an endeavor and the regional conference provided the forum for international experts and national organizations in Central America to evaluate the best approaches to create a regional system. The development of national and regional waste exchange programs will be continued through CCAD support.

4.0 LESSONS LEARNED

In Central America, clean production initiatives in the private sector are relatively new. Whereas waste management initiatives are not new to municipalities, there are two constraints to proper management. First, waste management efforts have been addressed in a piecemeal fashion, focusing mostly on the infrastructure development and little on the operation, maintenance, and cost recovery; second, there are very few municipalities with knowledgeable technical employees, and a dearth of qualified professionals able to provide technical assistance to these same municipalities. While implementing the SIGMA project, ARD identified a number of lessons learned that would be of direct benefit for future donor activities. In this section, we describe the lessons learned by the municipal and private sectors, respectively.

4.1 MUNICIPAL

- 1. Local partners provide points of entry for rapid startup and smoother implementation.** As demonstrated in the success stories and capacity building efforts of SIGMA, the work with partner organizations was fundamental. For regional programs, even national programs, understanding and working with local partners was the key to SIGMA effectiveness. The organizations either worked with the potential SIGMA client groups, or had an interest in the municipal waste management and needed technical assistance. The knowledge these organizations had of local sociopolitical and environmental settings, and the experience of local organizations in related community development enabled SIGMA to “ramp up” faster and more effectively. In addition, the participation of local partners provided SIGMA with day to day management, support, monitoring and follow-up to demonstration projects. The involvement of these organizations also created a cadre of organizations which will continue SIGMA initiatives.
- 2. Development assistance may be better focused on providing technical assistance, training and capacity building instead of construction projects.** SIGMA was charged with building two wastewater treatment plants at a cost of approximately \$200,000 each, plus the level of effort by ARD staff to design, manage and support these activities through the completion. The design, construction and supervision of the plant construction by local subcontractors lasted almost the entire life of the project. Both plants were successfully constructed and operations and maintenance manuals were prepared, as well as a strategy for cost recovery for operations and maintenance. In the medium term, the plants are projected to be successful. However, the question that needs to be posed is: Would the funds dedicated to those two plants have had a greater impact in the region if they had been used either to develop technical documents and training initiatives as part of the capacity building efforts of SIGMA, or to focus on improving the operations and maintenance of existing wastewater treatment plants. Perhaps, based on the effectiveness of training activities throughout the project life, the construction expenditures and staff LOE could have been better allocated to capacity building, small demonstration efforts, and technical document development and dissemination.
- 3. The participatory planning methodology in solid waste management from Estelí, Nicaragua should be replicated to other municipalities and *mancomunidades*.** The participatory solid waste planning methodology piloted with CARE Nicaragua over a 1.5 year period should be replicated in other areas. It was a cost-effective means to work with municipalities, provide cost effective, technical assistance, but not capital infrastructure support, to large groups. It stimulated strong community-municipal-private sector alliances to develop feasible plans to address solid waste management through recycling efforts, basic solid waste collection, and composting initiatives. It also resulted in a number of demonstration projects, strengthened local capacities to manage solid waste and to direct their own development. The CARE Nicaragua assistance strengthened local municipal associations

(*mancomunidades*), and the municipalities' abilities to access external financing, and resulted in many measurable improvements in solid waste management in most of the participating municipalities.

4.2 PRIVATE SECTOR

- 1. There must be a balance between clean production economic incentives and government regulations.** The SIGMA project strategy in working with industries to adopt clean production initiatives has focused on economic incentives by adoption of best practices that made economic sense. The economic benefits involved savings for companies in their industrial processes and/or gaining access to new markets that demanded environmentally-friendly production. Whereas economic incentives still are a strong motivation for industries, a more accelerated adoption of clean production would be through a more balanced approach of incentives and government environmental policies requiring stricter environmental standards. The “carrot and stick approach” together would also promote greater “voluntary” actions by industry. Faced with future environmental mandates, industry is more likely to adopt these voluntary actions.
- 2. A sectoral or “industry cluster” approach channels resources to achieve tangible results.** SIGMA developed its approach to assist industries by working with individual sectors so as not to dilute its efforts across too many industrial sectors, given limited project funding over 3.5 years. The demonstration projects, best practices, environmental evaluations, and dissemination of the results were all conducted for specific industry clusters. Trade associations in coffee, shrimp, dairy production, tourism, and tanneries were the means of dissemination and capacity building. This approach has proven to be an effective and successful strategy.
- 3. Clean production goes beyond the green agenda.** The SIGMA clean production project was created as part of the Central American environmental program, PROARCA. Whereas clean production definitely benefits the environment, SIGMA contacts through USAID and national government organizations tended initially to focus exclusively on developing partnerships with environmental organizations. Over the life of the project, however, our staff realized that clean production is more than a green issue. It touches upon commercial, human health, socioeconomic and financial issues as well. To a certain extent at project inception, the PROARCA team with their green agenda preferred that ARD channel resources to mostly environmental organizations and professionals, without considering other agendas in the brown arena or professionals that were not involved in environmental activities per se. With concurrence from USAID, SIGMA project staff adjusted the suite of partners to cover a wider range of regional, national, and local municipalities and private sector entities, NGOs and universities to develop a more holistic and comprehensive approach to the issues at hand. The key lesson is that clean production requires an interdisciplinary approach when working with national and local governments, which should include government organizations and associations which represent not only the environment, but industry, health, and financial issues.

5.0 ACHIEVING PROJECT GOALS

ARD contract performance was measured through Program Indicators established by a USAID independent consultant and Contract Deliverables outlined in the USAID contract with ARD in our Performance Monitoring Plan (PMP). All indicators and deliverables were met or exceeded. Those indicators that were particularly significant in exceeding USAID objectives were:

- Entities which implemented improved environmental management. The target was 55 and SIGMA delivered 103; exceeding the target by 190%;
- Households affected by municipal waste management effort. The objective was 4,000 , however, SIGMA affected over 23, 000 households; exceeding by 500% the stated target; and
- Training of private sector representatives. The target was 250 people trained; SIGMA trained 900 participants, or over 400% of the goal for the private sector with over 2,000 participants trained by the entire program.

The following reports on SIGMA progress in meeting the Program Indicators and Contract Deliverables.

5.1 INDICATORS

IR	Municipal and Private Sector	Achievement March 2005	Program Targets
4	Number of municipalities and private sector entities implementing improved environmental management	Private 83 Municipal 20	55

IR 4. Municipalities and private sector entities implementing improved environmental management.

In the private sector, the SIGMA strategy was to promote industries to adopt clean production best practices by developing a series of training and pilot activities, which demonstrated the economic and environmental benefits of these practices. In all, 83 industries took some form of action. Actions taken were a result of demonstration projects in coffee, dairy, shrimp and slaughterhouse industry clusters, as well as those industries which participated in the use of the “*la empresa eficiente*” calendar. Actions included reduction in water use, chemicals, process changes, and more efficient energy use. A list of industries taking action are provided in Attachment 2.

In the municipal sector, assistance to individual municipalities was provided through a variety of technical assistance and training activities, the most intensive of which were in three areas, Estelí, Nicaragua, Choluteca, Honduras, and La Union, El Salvador. Actions taken by approximately 20 municipalities varied from the construction of wastewater treatment plants, organized clean up days, closing illegal dumpsites, constructing septic tanks with advanced treatment and pilot projects through the University of San Carlos, Guatemala, with different types of wastewater treatment plants. One particularly cost effective activity was the training of Salvadoran Government technical staff on the operation and maintenance of wastewater treatment plants. The results included minor investments in methods of operations which greatly increased the energy and/or operating efficiency of the plants. The specific municipalities and their actions are listed in Attachment 1.

IR	Municipal Sector	Achievement March 2005	Project Targets
4.1	Number of local government or civil society organizations adopting improved waste management practices, policies or management systems	36	33
4.1.1	Number of local government or civil society organizations which carried out financing mechanisms	25	18
4.1.2	Number of municipalities with improved institutional arrangements for waste management	22	18
4.1.3	Number of households benefiting from improved waste management	23,570	4,250

IR 4.1. Number of local government or civil society organizations adopting improved waste management practices, policies or management systems. Through technical assistance provided by SIGMA subcontractors, 36 municipalities, principally in the areas of Estelí, Nicaragua; Choluteca, Honduras; and La Union, El Salvador, improved their waste management through:

- New ordinances, closing illegal dumps;
- Arranging for the siting of new landfills;
- Constructing or renovating wastewater treatment plants;
- Preparing solid waste action plans, optimizing routes for solid waste collection;
- Charging for services; and
- Improving slaughterhouse waste management, updating user roles.

A detailed list of the 36 municipalities and their respective actions taken are listed in Attachment 1.

IR 4.1.1. Number of local government or civil society organizations carried out financing mechanisms realized. We assisted municipalities to secure funding in part through a series of four financial workshops held at a regional and subregional level to link financial institutions with municipalities and to help municipalities to prepare sound investment plans. In addition, SIGMA subcontracted with municipal technical assistance NGOs such as CARE Nicaragua, with the *mancomunidad* Mambocaura, and with individual technical consultants to prepare investment plans for funding. Organizations that supported municipalities based on the SIGMA assistance included Spanish Cooperative Assistance, the European Union, JICA, and self-financing through municipalities charging for services. Through this effort, 25 municipalities took action. The municipalities and their specific actions are listed in Attachment 1.

IR 4.1.2. Number of municipalities with improved institutional arrangements for waste management. With assistance from SIGMA, municipalities improved their institutional capabilities for waste management. Specific actions have included assigning full time staff to supervise disposal site operations, training staff for the maintenance and operation in new wastewater treatment plants, establishing a commission of local actors to resolve illegal dumpsites, and new deploying monitoring tools for solid waste management. In total, 22 municipalities took action, the details of which are listed in Attachment 1.

IR 4.1.3. Number of households benefiting from improved waste management. Technical assistance by SIGMA provided beneficial impacts on a significant number of households in El Salvador and Nicaragua. For example, approximately 2,000 households were served through the solid waste action planning guided by subcontractor CARE Nicaragua. The improvements to the Santa Rosa de Lima sanitary landfill in El Salvador benefited approximately 5,000 families; and the wastewater treatment plants in La Union and Livingston serve an equivalent of 125 families. The total number of beneficiaries from SIGMA efforts to improve waste

management exceeded our program indicators, reaching approximately 23,000 households. A detailed listing is provided in Attachment 1.

IR	Private Sector	Achievements March 2005	Project Targets
4.2	Number of private sector entities adopting improved environmental management technologies or practices	83	40
4.2.1	Number of private sector entities that secure financial resources for improved environmental management	62	18
4.2.2	Number of private sector entities that proclaim policies for environmental management	36	28
4.2.3-1	Number of businesses that have conducted an assessment of environmental needs with project support	65	53
4.2.3-2	Number of private sector entity representatives participating in training or experience-sharing events	900	250

IR 4.2. Number of private sector entities adopting improved environmental management technologies or practices.

Our strategy to encourage industries to adopt clean production best practices consisted of two phased suites of activities. First, we implemented a series of activities presenting those best practices that demonstrated the economic and environmental benefits to a suite of industry clusters. Second, we developed information packages and sources of financing demonstrating to interested industries how to adopt recommended practices. As shown below, 83 industries have taken action through several activities. A detailed list of participating industries is provided in Attachment 2.

Activities	No. Industries Participating	Type of Improvement
Environmental Management Calendar "Empresa Eficiente"	32	Operational Best Practices
Demonstration Project	35	Best practices, technology change, change in processes
Investment plans	7	Technology change, process change
Total	83	

IR 4.2.1. Number of private sector entities that secure financial resources for improved environmental management.

SIGMA met or exceeded our indicators in several ways. We worked with individual industries to motivate them to invest in clean production initiatives by demonstrating the economic and environmental benefits. In addition, SIGMA facilitated the financing of clean production actions by developing an inventory of available resources by country, which is available on the PROARCA website. We established a regional Development Credit Authority (DCA) exclusively for clean production financing. Investments taken by the individual industries varied. Some industries used their own resources, while others secured small grants, or sought financing from conventional financing institutions such as banks. In total, 62 organizations accessed some type of financing, as summarized below.

Financing Source	No. of industries
Action taken using own resources	60
DCA loans approved by participating banks*	2

* Under the clean production regional DCA, there are currently 13 more loans being evaluated by the banks for loans and 6 industries preparing investment plans for submission.

A list of industries that invested their own funds in clean production, and those industries which prepared investment plans are provided in Attachment 3.

IR 4.2.2. Number of private sector entities that proclaim policies for environmental management.

The SIGMA project defined the application of clean production strategies as a method to promote less contaminating technologies in the region. Using this indicator, any industry which applied one or another of possible best practices in clean production were counted as adopting policies in environmental management. In all, 36 industries took action.

IR 4.2.3-1. Number of businesses that have conducted an environmental needs assessment with project support. Over 100 industries in mainly six industry clusters participated with SIGMA through various activities during the life of project. These activities included 1) environmental needs assessments through the application of clean production initiatives through the use of the SIGMA “La Empresa Eficiente” calendar, 2) pilot projects in selected industrial sectors to improve efficiency and cost savings, and/or 3) the preparation of investment plans using a project technical assistance fund. The number of industries by sector includes:

Industry Sector	No. of Industries
Dairy processing	32
Coffee	7
Slaughterhouses	4
Tourism	20
Tanneries	12
Shrimp packing	4
Others	30
Total	109

IR 4.2.3-2. Number of private sector entity representatives participating in training or experience-sharing events. A variety of interventions were used to achieve these results which included capacity building activities, validation of technical documents, and promotion of selected initiatives. Categories included: institutional capacity building, access to financing, and demonstration projects in selected sectors. The SIGMA project trained over 900 private sector participants in clean production best practices and related topics. A detailed list of technical training activities is provided in Attachment 5.

5.2 CONTRACT DELIVERABLES

Under the ARD task order contract with USAID, very specific deliverables were required, including 9 in the municipal sector and 12 in the private sector. In general the deliverables were organized around the three common subcomponents for the municipal and private sector: 1) assessing financing, 2) capacity and institutional development, and 3) increased access to technologies. Specific deliverables included:

Financing

- Development of a database of financial resources for both the municipal and private sector, which could apply to clean production;
- Preparation of training materials, self-financing instruments; and
- Raising the awareness of financial institutions to develop suitable funding mechanism for clean production technologies.

Capacity Building

- Training materials which demonstrate the environmental and social costs of solid waste management and wastewater management;
- Preparation of a handbook for the private sector entities and consultants to conduct environmental audits;

- Development of a framework for regional recycling and reuse initiatives;
- Demonstrations to plant managers as to the benefits of environmental certification;
- Deliver training activities in each country in environmental management; and
- Supporting work with municipalities to develop bankable proposals.

Access to technologies

- Development and dissemination of results of pilot projects in solid waste management and wastewater management; and
- Identification of improved eco-efficiency for the selected clusters of the private entities and promotion and dissemination of results.

SIGMA has met or exceeded all contract deliverables, as illustrated in Attachment 4.

6.0 ADMINISTRATIVE/FINANCIAL MANAGEMENT

Throughout the life of the project the Administrative Unit of SIGMA has performed efficiently and effectively with both USAID G-CAP staff and the ARD home office in Burlington, Vermont. Since the project covered all of Central America, the administrative requirements to implement the project were complex. Administrative issues that are unique to a regional program are:

- Requirement of US Embassy Country Clearance for all travel outside of Guatemala;
- Logistical support for training events and conferences in other countries;
- Payment of consultant services and subcontracts throughout the region;
- Disseminating technical documents and quarterly bulletins, which on some occasions required customs clearance and the associated transaction costs and delays;
- Travel arrangements and logistic support for SIGMA technical staff;
- Reports to USAID G-CAP regarding projected SIGMA activities, which were included in the PROARCA calendar of activities.

Some key topics require further elaboration and discussion.

6.1 FINANCIAL MANAGEMENT

The Administrative Unit supported the SIGMA Chief of Party in the preparation of annual budgets, financial reports to both ARD Burlington and USAID G-CAP, and monitoring of project expenditures. Included in this work was:

- Explanation of subcontracts and consultancies in each of the monthly vouchers to USAID;
- Preparation and maintenance of weekly status reports of subcontract and consultancy payments and actions taken by the administrative and technical program staff; and
- Periodic review of project expenditures, projected expenditures through the life of the project. Over the last 12 months of the project, this was particularly critical, since the projected expenditures estimated a deficit in early 2004. Through quarterly budget analysis the Administrative Unit revised the budget to allow an orderly completion of the project in which all project objectives were met. This analysis included review of the original budget, summary of expenditures and revision of staffing, subcontracts, and administrative expenditures.

6.2 MEETING CONTRACTUAL REQUIREMENTS

6.1.1 Contract Administration

The SIGMA strategy to subcontract with partner organizations throughout Central America and extend its own technical staff through the use of short-term technical assistance, created a real challenge for the SIGMA Administrative Unit. In the course of the project, 119 contracts were executed, as shown in the accompanying table.

Component	Subcontracts with Organizations	Consultant Contracts
Communications	3	0
Private Sector	33	27
Municipal Sector	29	27
Total	65	54

All subcontracts and consultancies were approved from the USAID G-CAP CTO, initially Joao de Quieroz, and then his successor, Roberto Morales.

6.1.2 Technical Documents Submitted to Development Experience Clearinghouse

ARD has submitted technical documents produced by the project to the Development Experience Clearinghouse through the home office.

6.1.3 Expenditure Tracking by Country

To the extent possible, ARD was required to track its project expenditures by country. Expenditures in the following categories were tracked:

- Subcontracts and short term consultancies,
- Long-term staff time by country,
- Travel and per diem for consultants and long-term staff, and
- Training participants.

Table 6.1. SIGMA Life-of-Project Expenditures Tracked by Country	
Funds expended/country	Totals
Guatemala	
Subcontract & Consult	438,024
Long term staff time	41,002
Travel & per diem	51,501
Total	530,527
El Salvador	
Subcontract & Consult	420,128
Long term staff time	112,238
Travel & per diem	73,414
Total	605,780
Honduras	
Subcontract & Consult	189,759
Long term staff time	102,108
Travel & per diem	57,305
Total	349,172
Nicaragua	
Subcontract & Consult	202,347
Long term staff time	43,258
Travel & per diem	46,608
Total	292,213
Costa Rica	
Subcontract & Consult	145,347
Long term staff time	21,042
Travel & per diem	37,120
Total	203,509
Panama	
Subcontract & Consult	65,177
Long term staff time	23,111

Table 6.1. SIGMA Life-of-Project Expenditures Tracked by Country	
Funds expended/country	Totals
Travel & per diem	25,270
Total	113,558
Belize	
Subcontract & Consult	14,119
Long term staff time	16,659
Travel & per diem	22,621
Total	53,399
Total	1,950,205

ATTACHMENT I. MUNICIPAL SECTOR: ACHIEVING USAID PROGRAM INDICATORS

IR 6.4. Number of municipalities and private sector entities implementing improved environmental management - 20 municipalities

Municipalities	Actions
Nicaragua	
1. Condega	<ul style="list-style-type: none"> Held work days to clean up solid wastes from April – June 2003 (Total waste collected in all municipalities = 97 cubic meters) Completed solid waste action plan (June 2003) Closed two illegal dumpsites Made arrangements for new landfill site
2. Estelí	<ul style="list-style-type: none"> Held work days to clean up solid wastes from April – June 2003, November - January 2003 Expanded service area for solid waste collection Completed solid waste action plan (June 2003)
3. Totogalpa	<ul style="list-style-type: none"> Held work days to clean up solid wastes from April – June 2003, November - January 2003 Closed three illegal dumpsites Completed solid waste action plan (June 2003)
4. Palacaguia	<ul style="list-style-type: none"> Held work days to clean up solid wastes from April – June 2003 Completed solid waste action plan (June 2003)
5. Pueblo Nuevo	<ul style="list-style-type: none"> Held work days to clean up solid wastes from April – June 2003 Began using the official disposal site Two new composting cooperatives were formed Closed illegal dumpsites Completed solid waste action plans (June 2003)
6. La Trinidad	<ul style="list-style-type: none"> Held work days to clean up solid wastes from April – June 2003, November – January 2003 Made arrangements for new landfill site
7. Jalapa	<ul style="list-style-type: none"> Held work days to clean up solid wastes from April – June 2003 Made arrangements for new landfill site Expanded its existing site by one hectare (approximately 2 acres) for composting activities (January '04)
Guatemala	
8. Livingston	<ul style="list-style-type: none"> Construction of wastewater treatment plant and operating as of December 2004. Also developed operation and maintenance and sustainability plans
9. Coban	<ul style="list-style-type: none"> Improved management of slaughterhouse (December 04 – January 05)
10. ERIS, U San Carlos	<ul style="list-style-type: none"> Pilot wetlands treatment project and rehabilitation of wastewater treatment lagoons (July 2004) Implemented a pilot wetland wastewater treatment project (late 2004).
El Salvador	
11. Lal Union, El Salvado	<ul style="list-style-type: none"> La Union began operation of its new wastewater treatment plant (September 2003); also developed operation and maintenance and sustainability plans
12. La Libertad (Rio Chilama)	<ul style="list-style-type: none"> ANDA constructed improvements to wastewater treatment plants based on the evaluation by USEPA consultants, which included aeration and diffusion lines were replaced with galvanized steel, and non-functional secondary clarifier was converted to a Dartmouth unit, and the returned activated sludge recirculation pump was repaired and put into service. Actions taken based on USEPA technical assistance

Municipalities	Actions
13. Saragoza	<ul style="list-style-type: none"> • ANDA constructed improvements to wastewater treatment plants based on the evaluation by USEPA consultants for a lagoon plant not visited by USEPA, ANDA applied similar recommendations to those of Santiago Nonualco, and implemented them in July 2004. Actions taken based on USEPA technical assistance
14. Santiago Nonualco	<ul style="list-style-type: none"> • ANDA constructed improvements to wastewater treatment plants based on the evaluation by USEPA consultants the berms of the lagoon were repaired and raised, and 7000 cubic feet of sludge were removed (sludge had never before been removed)
15. Santa Rosa de Lima	<ul style="list-style-type: none"> • Cleanup of waste, covering solid waste and stopped burning • Applying small scale operations manual principles • Cleaned up waste along the access road to their site, including recycling old vehicles • Begun the process of covering 10 year's worth of waste at the disposal site; stopped burning of waste at the disposal site (July 2003)
16. Conchagua	<ul style="list-style-type: none"> • Worked with Peace Corps and MARN to conduct waste characterization study and begin pilot composting program (October 2004)
17. Pasaquina	<ul style="list-style-type: none"> • Began applying cover material to their waste • Improved their management of yard waste/plant trimmings to increase re-use of the material and prolong the life of the landfill and brought fires in the landfill under control (July 2003) • Improved disposal site management practices (use of cells and daily cover) after receiving training in Dec 2003
18. Somoto	<ul style="list-style-type: none"> • Improved waste collection containers and made improvement in its disposal site
Panama	
19. Renacimiento	<ul style="list-style-type: none"> • Clear new landfill, improved site access, and installed leachate collection system (September 2004)
Belize	
20. Sapodilla Cayes Marine Reserve near Punta Gorda	<ul style="list-style-type: none"> • Constructed septic tanks with advanced treatment (October 2004)

IR 6.4.1 Number of municipalities adopting improved waste management practices, policies or management systems - 36 municipalities

Municipalities	Actions
Nicaragua	
1. Condega	<ul style="list-style-type: none"> • Held work days to clean up solid wastes from April – June 2003 (total waste collected in all municipalities = 97 m³) • Closed two illegal dumpsites • Made arrangements for new landfill site • Completed solid waste action plan (June 2003) • Made arrangements for new landfill site to be opened (January 2004)
2. Estelí	<ul style="list-style-type: none"> • Held work days to clean up solid waste from April – June 2003, November – January 2003 • Expanded service area for solid waste collection • Completed solid waste action plan (June 2003)
3. Totogalpa	<ul style="list-style-type: none"> • Held work days to clean up solid waste from April – June 2003, November - January 2003 • Closed three illegal dumpsites • Completed solid waste action plan (June 2003)
4. Palacaguia	<ul style="list-style-type: none"> • Held work days to clean up solid waste from April – June 2003
5. Pueblo Nuevo	<ul style="list-style-type: none"> • Help work days to clean up solid waste from April – June, 2003 • Drafted a new ordinance which will be approved soon (March 2003) • Municipal tractor stopped dumping waste illegally (March 2003) • Completed solid waste action plan (June 2003)

Municipalities	Actions
6. La Trinidad	<ul style="list-style-type: none"> • Held work days to clean up solid wastes from April – June 2003, November – January 2003 • Made arrangements for new landfill site • Made arrangements for new landfill site to be opened (January 2004)
7. Jalapa	<ul style="list-style-type: none"> • Held work days to clean up solid wastes from April to June 2003 • Made arrangements for new landfill site • Expanded its existing site by one hectare (approximately 2 acres) for composting activities (January 2004)
El Salvador	
8. La Union	<ul style="list-style-type: none"> • Constructed wastewater treatment plant and developed O & M manual and methods for charging for services
9-16. Poloros, Santa Rosa de Lima, El Sauce, Conchagua, Pasaquina, Intipuca Yucuaquin, Chirilagua	<ul style="list-style-type: none"> • Completed one or more: closed illegal dumpsites, solid waste action plans (July 2003), route optimization studies (July 2003), and/or waste characterization study; improved administration of solid waste management as a result of technical assistance (Jan 2004), with help of Peace Corps Volunteers and MARN; conducted waste characterization study and began a pilot composting program (October 2004)
17. Jan Jose de La Fuente	<ul style="list-style-type: none"> • Updated user role
18-20. La Libertad (Rio Chilama), Santiago Nonualco, and Zaragoza	<ul style="list-style-type: none"> • Wastewater treatment improved management with USEPA assistance (May-July 2004)
Guatemala	
21. Livingston	<ul style="list-style-type: none"> • Constructed wastewater treatment plant and developed operation and maintenance manual and methods for charging
22. Coban	<ul style="list-style-type: none"> • Improved management of slaughterhouse waste
23. ERIS	<ul style="list-style-type: none"> • Improved management of wastewater treatment lagoon (July 2004) and wetlands treatment plant (November 2004)
Belize	
24. Punta Gorda	<ul style="list-style-type: none"> • Draft solid waste management action plan and approved by municipality (December 2004)
25. Sapodilla Cayes Marine Reserve	<ul style="list-style-type: none"> • Constructed septic tanks with advanced treatment (October 2004)
Honduras	
26. San Marcos de Colon	<ul style="list-style-type: none"> • Completed detailed environmental diagnostic (March 2004)
27-31. Concepcion de Maria, Yusguare, El Corpus, Duyure, Namasigue	<ul style="list-style-type: none"> • Developed solid waste actions plans and priorities for environmental management
3-33. Danli and Progreso	<ul style="list-style-type: none"> • Improve operation of slaughterhouse with assistance from PRODEMNON
Panama	
34. Changuinola	<ul style="list-style-type: none"> • Began to charge for disposal service (August 2004)
35. Renacimiento	<ul style="list-style-type: none"> • Municipality has committed to continue separate accounting system for solid waste management beyond the duration of their grant to better manage their solid waste finances (September 2004)
Costa Rica	
36. Coto Brus	<ul style="list-style-type: none"> • Adopted new management tool for solid waste management and completed a study to update its solid waste tariffs and new tariffs were approved by the municipal council. Municipality also updated its database of solid waste customers

IR 6.4.1.1. Number of governmental or civil society organizations that developed mechanisms for financing projects - 25 municipalities and mancomunidades take action

Municipalities	Actions
1. Livingston, Guatemala	Secured funds from AECI for building a portion of the wastewater treatment plant in the Marcos Sanchez Diaz subsector. (March 2003)
2. Choluteca, Honduras	Secured funds from FHIS to expand its wastewater collection and treatment system by approximately 80%.
3. Jalapa, Nicaragua	Secured \$3,000 from PRODEL for the formation of two composting cooperatives. (June 2003)
4. Estelí, Nicaragua	Expanded its service area, at no additional cost, to 5 new barrios (March 2003), thereby increasing its income; Estelí secured a compacting truck from their sister city in Europe (June 2003); received funds from PRRAC (European Union project) to finance comprehensive solid waste management program. (November 2003)
5. La Union, El Salvador	Contributed significant municipal resources (estimated at a value of \$21,800) to the completion of the wastewater treatment project.. (February 2003 and April 2004)
6. Pasaquina, El Salvador	Negotiated contribution of private firms to remove 24 tons scrap metal from the disposal site (equivalent of \$800), and committed significant counterpart (\$ 2,420) with its own resources to conduct site improvements, topographic study, reforestation, and public signs at the site. (January 2004)
7-11. Municipalities receive assistance from Denmark	Five municipalities receive funding from Denmark for their landfills: La Trinidad (420,000 Cordobas at approximately 15 Cordobas /US \$), which includes purchase of land for the new site, Pueblo Nuevo (320,000 Cordobas), El Jícaro, Palacaguina, and Ocotal. (January 2004)
12. Santa Rosa de Lima, El Salvador	Increased its income by serving 1500 new families as a result of route optimization and rededication of an existing municipal vehicle to waste collection (October 2003). Also secured a contribution from Bocadelli, their biggest snack provider, for 100 garbage cans now located in the municipal market, and parks. (January 2004)
13-15. Estelí, La Trinidad and Jalapa, Nicaragua	Received financing for 2 collection vehicles each from the Japanese embassy. (February 2004)
16. Somoto, El Salvador	Secured funding for technical assistance in solid waste management from Luxembourg. (February 2004)
17. Nicoya, Costa Rica	Used self-financing to fund study to improve solid waste management (January 2004)
18-22. Pasaquina, Conchagua, Santa Rosa de Lima, Yucuaquin, and Intipucá, El Salvador	Tariff studies completed for municipalities. (February 2004)
23. Coto Brus	Tariff study completed. (September 2004)
24. Mancomunidad de la región norte de departamento La Union (ASINORLU)	Obtained financing from JICA for solid waste management.
25. Mancomunidad del Golfo de Fonseca (ASIGOLFO)	Obtained financing to begin solid waste management through AECI.

IR 6.4.2. Number of municipalities with improved institutional arrangements for waste management - 22 municipalities improve institutional arrangements

Municipalities	Actions
1-7. Seven municipalities in the Estelí Area	Adopted improved institutional arrangements for waste management: environmental action committees were established in Condega, Estelí, Totogalpa, Palacaguina, and Pueblo Nuevo (December 2002), and in Trinidad and Jalapa (May 2003)
8. Santa Rosa de Lima	Assigned one person full time to supervise disposal site operation (July 2003) also negotiated with the private sector, Bocadeli, the construction of 100 garbage cans (Jan 2004)
9. La Union	Assigned new staff responsibilities (two operators and one electrician) for operation and maintenance of the new wastewater treatment plant
10. Pasaquina	A solid waste management committee was formed (Oct 2004); also expanded membership in the Comision Ambiental Municipal and improved its system for applying for external financing (Mar 2004)

Municipalities	Actions
11. Somoto	formed a commission with local actors to find solutions for illegal dumpsites. (Jan 2004)
12. Totogalpa	Enters negotiations with a group of women and a farm to delegate waste collection services (Feb 2004)
13. Estelí, Nic	Negotiated with group of women to expand the number of women involved in vermicompost (October '04)
14. Coto Brus	Adopted the new management tool developed by SIGMA to monitor its solid waste management system, and has committed to following transparent procedures for acquisition of land for its new landfill (Sept 2004)
15-21. Duyure, San Marcos, Yusguare, Namasigue, Corpus, Concepción de Maria, y El Triunfo, Honduras	Environmental action committees established
22. Livingston	The municipality of Livingston assigned responsibilities for operating its new wastewater treatment plant and managing septage from septic tanks in the city.

IR 6.4.1.3. Number of households benefited from improved waste management - 23,570 households benefited

No. Households	Municipality and description
2,000	The expanded service in Estelí benefited an estimated 2000 households
400	The usage of the official waste disposal site rather than the illegal site near the town of Pueblo Nuevo benefited an estimated 400 households.
20	The formation of two new cooperatives to make compost benefited 20 households in Jalapa
795	Condega expanded its service area to the Solidaridad borough, benefiting an estimated 780 families, and the formation of two new composting cooperatives benefited an estimated 15 families (Sept 2003)
80	Pueblo Nuevo expanded its service area to an estimated 80 new families (September 2003)
1,780	The improved operation of the disposal site in Pasaquina benefits an estimated 1780 families. (July 2003)
5,000	The improved operation of the disposal site in Santa Rosa de Lima benefits an estimated 5000 families. (July 2003)
75	The completion of the wastewater treatment plant in La Union benefits an equivalent of 75 families (December '03)
5,000	Improvements made in Somoto waste collection bins and disposal site benefited 5,000 families (which is half of the Somoto population) (January '04)
600	Expanded service areas in Estelí benefited an additional estimated 600 families (February 2004)
200	The expanded service area in La Trinidad benefited an estimated 200 families (February 2004)
1,500	Santa Rosa de Lima expanded service to 1500 new families by re-assigning the task of waste collection to an existing municipal vehicle and optimizing collection routes (October 2003)
1,875	Improvements to plant in La Libertad (Rio Chilama), benefit an estimated 1,875 families (June 2004)
2,025	Improvements to plant in Santiago Nonualco, benefit an estimated 2,025 families (June 2004)
2,000	Improvements to plant in Zaragoza, benefit an estimated 2000 families (July 2004)
70	ERIS has rehabilitated its wastewater treatment lagoons benefit an estimated 70 families (July 2004)
100	Coban has improved operation of its municipal slaughterhouse, benefiting an estimated 100 families (January 2005)
50	Livingston began operation of its wastewater treatment plant, benefiting 50 families (December 2004)

ATTACHMENT 2. PRIVATE SECTOR: ACHIEVING USAID PROGRAM INDICATORS (LIST OF INDUSTRIES WHICH ADOPTED IMPROVED MANAGEMENT TECHNOLOGIES OR PRACTICES [IR 4.2])

No.	Companies	Country	Adopt Best Practices	IR 4.2.1 Invested Own Funds	IR 4.2.3-1 Conducted Environmental Audits
IR 4.2.2 All Demonstration Projects (Numbers 1-36)					
Coffee Mills (Beneficios)					
1	Finca Guaxac	Guatemala	important	X	X
2	Finca Pachilhá	Guatemala	important	X	X
3	La Campeona	Honduras	important	X	X
4	Las Pilas	Honduras	important	X	X
Dairy Plants					
5	Cooperativa Ganadera de Sonsonate	El Salvador	moderate	X	X
6	Xelac	Guatemala	important	X	X
7	Cooperative Santo Tomás	Nicaragua	important	X	X
8	Productos Lácteos Montecristo (PROLACMON)	Honduras	important	X	X
9	Empresa Productos Lácteos San Antonio (PROLACSA)	Panamá	important	X	X
10	Santa Martha (LACTOSAM)	Nicaragua	important	X	X
11	El Pastoreo	Nicaragua	moderate	X	X
12	Las Peñitas	Honduras	moderate	X	X
13	Las Delicias	Honduras	moderate	X	X
14	Lácteos Erika	Honduras	moderate	X	X
15	Telica	Honduras	moderate	X	X
16	El Pataste	Honduras	moderate	X	X
17	Lácteos de Olancho	Honduras	moderate	X	X
Slaughterhouse Demonstrative Project					
18	Procesadora Municipal de Carnes (PROMUCA)	Honduras	important	X	X
Shrimp Package Plants Demonstrative Project					
19	Deli	Honduras	important	X	X
20	Camánica	Nicaragua	important	X	X
21	Mar y Sol S.A.	El Salvador	none	X	X
22	PROSALMAR	El Salvador	none		X
Tourism Sector					
22	Casa Verde	Costa Rica	important		X
24	Pizote Logde	Costa Rica	moderate		X
25	Albergue de Casa Code	Costa Rica	moderate	X	X
26	Doña Mara	Panamá	moderate		X
27	Sagitarios	Panamá	important	X	X
28	Bahía	Panamá	important	X	X
29	Casa de Playa	Honduras	moderate	X	X

No.	Companies	Country	Adopt Best Practices	IR 4.2.1 Invested Own Funds	IR 4.2.3-1 Conducted Environmental Audits
30	Costa Azul	Hondura	important	X	X
31	Ejecutivo	Honduras	important	X	X
32	El Delfin	Guatemala	important	X	X
33	El Tortugal	Guatemala	moderate	X	X
34	Salvador Gaviota	Guatemala	moderate	X	X
Tannery					
35	EXPISA S.A.	Nicaragua	important	X	X
36	ECCA	Honduras			X
Calendar "La Empresa Eficiente"					
37	Hacienda Palmira (Dairy Product)	Costa Rica	moderate		X
38	Planta Las Delicias (Dairy Product)	Costa Rica	important	X	X
39	Embutidos Turrialba (Meat Proc)	Costa Rica	important		X
40	La Costa de Papito (Tourism)	Costa Rica	moderate	X	X
41	Hotel Kashá (Tourism)	Costa Rica	moderate	X	X
42	Hotel Yaré (Tourism)	Costa Rica	moderate	X	X
43	Caribblue Bubgalows (Tourism)	Costa Rica	moderate	X	
44	Cafetalera Intern Canfinter (Coffee)	Costa Rica	moderate		
45	Lácteos Mendoza (Dairy Product)	Nicaragua	moderate	X	
46	Lácteos Valle (Dairy Product)	Nicaragua	moderate	X	
47	Hotel Panorama 1 (Tourism)	Nicaragua	moderate	X	
48	Hotel Panorama 2 (Tourism)	Nicaragua	moderate	X	
49	Lácteos La Perla (Dairy Product)	Nicaragua	moderate	X	
50	Ciudad del Niño (Food Proc)	Panamá	important	X	
51	Taller Ruje (Metal Mechanics)	Panamá	moderate	X	
52	ROCMAR SEAFOOD, S.A.	Panamá	moderate	X	
53	Mariposa	Honduras	moderate		
54	AHDICAS	Honduras	moderate	X	
55	La Libertad	El Salvador	moderate	X	
56	Sirenita S.A. de C.V.	El Salvador	moderate	X	
57	El Progreso (Urania) Tannery)	El Salvador	moderate	X	
58	Noes (Tannery)	El Salvador	moderate	X	
59	El Búfalo, S.A. (Tannery)	El Salvador	moderate	X	
60	DIPOLSA (Tannery)	El Salvador	moderate	X	
61	Jardines del Sur (Tannery)	El Salvador	moderate	X	
62	Rosario (Tannery)	El Salvador	moderate	X	
63	San Francisco (Tannery)	El Salvador	moderate	X	
64	Industrias Americanas (Shoes)	El Salvador	moderate		
65	Industrias Lácteas San José (Dairy Product)	El Salvador	moderate	X	
66	Hotel Country Delights (Tourism)	Guatemala	moderate	X	

No.	Companies	Country	Adopt Best Practices	IR 4.2.1 Invested Own Funds	IR 4.2.3-1 Conducted Environmental Audits
67	Eco Hotel Chi'ixim (Tourism)	Guatemala	moderate	X	
68	Textiles del Sol (Textiles)	Guatemala	moderate		
Monitoring Dairy Good Operational Practices Manual					
69	Coop Multisectorial del Sur R.L., COMSUR (Dairy Product)	Nicaragua	important	X	
	BOLAC (Dairy Product)	Panamá	moderate		
70	Riba – Smith (Dairy Product)	Panamá	important	X	
71	Delis Queso (Dairy Product)	Panamá	important		
72	Alimentos de Cortés (Dairy Product)	Honduras	moderate		
73	Finca Los Andes (Dairy Product)	Honduras	moderate		
74	Chivolac (Dairy Product)	Guatemala	moderate		
75	Cooperativa VERALAC (Dairy Product)	Guatemala	important	X	
76	Coopeleche R.L. (Dairy Product)	Costa Rica	moderate		
77	Coopebrisas R.L. (Dairy Product)	Costa Rica	important		
Financial Business Plan					
78	El Sol (Tannery)	Guatemala	important	X	
79	Masada (Pork Processing)	Panamá	important	X	
80	PROLACSA (Dairy Product)	Panamá	important	X	
81	Foremost (Dairy Product)	El Salvador	moderate		
82	San José (Dairy Product)	El Salvador	moderate		
83	San Julián (Dairy Product)	El Salvador	moderate		

Note: Specific industries determined if adopting best practices was either important or moderately important, or not important at all.

ATTACHMENT 3. STATUS OF LOANS FOR THE REGIONAL CLEAN PRODUCTION DCA¹

Company	Country/Bank	Investments (USD)	Source	
1. Club Campestre La Montaña	Guatemala/Bancafé	20,000	SIGMA	
2. Helados Sarita	Guatemala/Bancafé	64,300	SIGMA	
3. Lácteos San Julián	El Salvador/Cuscatlán	116,432	SIGMA	
4. Lácteos San José	El Salvador/Cuscatlán	64,000	SIGMA	
5. VERALMAR, S.A.	El Salvador/Cuscatlán	20,000	Banks	
6. Compañía Aceites y Parafinas Industriales S.A.	El Salvador/Cuscatlán	140,000	Banks	
7. Agroindustrias del Corral S de RL	Honduras/BAMER	56,377	SIGMA	
8. Plásticos Técnicos S. de RL.	Honduras/BAMER	122,264	SIGMA	
9. Valinsa, Valores Agroindustriales S.A.	Honduras/BAMER	42,415	SIGMA	
10. VIDIKA S.A.	Costa Rica/LAFISE	35,710	SIGMA	
11. Imprenta González	Costa Rica/LAFISE	182,000	SIGMA	
12. Notrilac S.A.	Costa Rica/LAFISE	500,000	Banks	
13. Corporación Rovisa S.A.	Costa Rica/LAFISE	100,000	Banks	
14. PROLACSA (DCA loan)	Panamá/Panabank	100,000	SIGMA	Approved
15. MASADA (non-DCA loan)	Panamá/Panabank	122,575	SIGMA	Approved
Total		1,686,074		

Investment proposals being prepared for submission to DCA Banks

Company	Country	Source		
1. Club Cámara de Industrias	Guatemala	SIGMA		
2. Chivolac	Guatemala	SIGMA		
3. Tenería El Sol	Guatemala	SIGMA		
4. Foremost	El Salvador	SIGMA		
5. IREX	El Salvador	SIGMA		
6. YODECO	Honduras	SIGMA		
7. Tejas Plásticas	Honduras	----		
8. Panadería Don Pan	Nicaragua	----		
9. ETIPRES	Costa Rica	Bank		
10. VIGUI	Costa Rica	Bank		

¹ As of the completion date of project assistance: March 31, 2005.

ATTACHMENT 4. USAID CONTRACT DELIVERABLES

Under the USAID contract with ARD, there were specific deliverables to be completed over the 3.5-year period of performance. The following chart lists these deliverables and indicates if they were completed or not.

Deliverables	Progress
Municipal Sector	
1. Develop a database of funding sources for local level environmental management initiatives	COMPLETED disseminated in four regional or binational workshops and on website
2. Training materials for enhancing local-level capacity to prepare environmental management proposals for financial institutions developed and delivered to all municipalities in Central American seven countries	COMPLETED disseminated in four regional or binational workshops and on website
3. Three proposals for self-financing instruments developed and field-tested in a minimum of 20 municipalities	COMPLETED (21); Three (3) self-financing of improvements with own resources (central government transfers): La Unión, Somoto, Nicoya Two (2) expansion of service area and resulting increase in income: Estelí, Santa Rosa de Lima Six (6) bancable projects prepared as a result of participation in workshops: Santa Rosa de Lima and San Francisco Gotera (slaughterhouses), Condega and Jalapa (wastewater), Ciudad Barrios and Microregion Ahuachapan Sur (solid waste) Seven (7) tariff studies and / or self-financing of improvements with income from tariffs: Pasaquina, Conchagua, Santa Rosa de Lima, Yucuaquin, Poloros, Intipucá, Coto Brus Three (3) municipalities leveraging of resources from the private sector or private sector contracted to provide services: Condega, Totogalpa, Santa Rosa de Lima
4. Training materials for enhancing financial planning and management developed and delivered to all municipalities in the region	COMPLETED: Financial package for municipalities with booklet on costing municipal services completed and used in financial workshop
5. Training materials to demonstrate environmental and social costs of improper management of solid waste and wastewater developed and delivered to all municipalities	COMPLETED: Included within solid waste and wastewater guides
6. Enhanced local level organization through institutional arrangements developed and implemented in a minimum of 10 groups of municipalities in the region	COMPLETED: 16, see IR 6.4.2
7. Develop and disseminate 10 pilot projects for solid waste and 10 pilot projects for waste water to demonstrate viable technical solutions	COMPLETED (10 each) <u>developed</u> (At PACD some not yet implemented by municipalities): 10 solid waste management pilot projects: (3) action plan methodology in Nicaragua, El Salvador and Guatemala, (1) solid waste training series for local government technicians: El Salvador (3) composting projects: Totogalpa, Pueblo Nuevo, Las Sabanas (2) model small landfills: Pasaquina and Pueblo Nuevo (1) municipal arrangement with small enterprise: solid waste collection, Totogalpa 10 wastewater projects: (2) Livingston and La Union pilot wastewater treatment plants

Deliverables	Progress
	<p>(2) ERIS wetland and lagoon / reuse pilot projects (1) treatment of septic tank sludge in Talamanca (1) enhanced septic tank effluent treatment and appropriate sludge handling: TASTE (PRODOMA) (3) improved operation of wastewater treatment plants in La Libertad, Santiago Nonualco, and Zaragoza, El Salvador (1) municipal septic tank sludge handling plan, Livingston</p>
<p>8. Work with the municipalities where the pilot projects are developed to prepare 20 bankable proposals for the implementation of those projects</p>	<p>COMPLETED (23)</p> <p>Part A: Pilot projects developed with SIGMA support that prepare projects for financing (may be donation) that are sustainable in their operation: (3) proposals approved by PRODOMA: PCI, TASTE, CARE Nicaragua (1) proposal submitted to but not approved by PRODOMA: compost, La Unión municipalities (6) Condega, Pueblo Nuevo, Estelí, Jalapa, La Trinidad, and Somoto obtain financing from a variety of sources to implement all or portions of their solid waste management plans (1) Mancomunidad de la región norte de departamento La Union obtains financing from JICA for solid waste management (1) Mancomunidad del Golfo de Fonseca (ASIGOLFO) obtains financing to begin solid waste management through AECI (1) Puerto Barrios presents Phase I solid waste management implementation project to Consejo de Desarrollo (not approved on first attempt) (3) Coto Brus, Costa Rica, Renacimiento and Changuinola, Panama, prepare projects to improve their solid waste management and to generate income so that they might apply for loans in the future.</p> <p>Parte B: loan-worthy project profiles prepared with support of SIGMA: (1) technical assistance: Aguas de Choluteca (wastewater) (6) bankable projects prepared as a result of participation in workshops: Santa Rosa de Lima and San Francisco Gotera (slaughterhouses), Condega and Jalapa (wastewater), Ciudad Barrios and Microregion Ahuachapan Sur (solid waste)</p>
<p>9. Disseminate the achievements on viable technological solutions and bankable proposals through the region</p>	<p>Over 200 municipalities participated in capacity building. There were 20 different training events, with participants from all 7 Central American countries.</p>
<p>Private Sector</p>	
<p>1. Base on priorities identified by PROARCA I and working with Clean production centers, conduct an assessment of private sector entities environmental problems and present the assessment to USAID and CCAD</p>	<p>COMPLETED: study of environmental management needs with CP Centers. This information was presented to CCAD and USAID in the Annual Work Plan (2002-2003)</p>
<p>2. Develop and make it accessible a database of available funding sources for the private sector entities to finance improved management and processes</p>	<p>COMPLETED: Financial database is on the PROARCA website</p>
<p>3. Prepare a handbook for private sector entities and independent consultants to conduct environmental audits and develop environmental management plans</p>	<p>COMPLETED: SIGMA used or prepared:</p> <ul style="list-style-type: none"> – an audit mechanism developed by UNDP and Wuppertal Institut for Climate Environmental and Energy, which establishes a strategy for clean production and disseminate through annual calendar – best practices guides for coffee, dairies, shrimp packing (draft), slaughterhouses (draft), and tourism (draft)
<p>4. Apply the handbook to a minimum of 30 entities covering the 5 selected production clusters</p>	<p>COMPLETED: The Environmental calendar given to 35 companies from various sectors. Through monitoring of individual actions, 31 companies took action based on the calendar. Developed a program to disseminate the best practices for the dairy industry with the participation of 50 industries in the region.</p>
<p>5. Work with a minimum of 2 financial institutions per country, and regional financial organizations to raise their</p>	<p>COMPLETED: Institutions identified and approved DCA mechanisms: Guatemala: Banco Cuscatlan, Bancafe, FIGSA, GENESIS El Salvador: Banco Cuscatlan, Banco Agricola CALPIA</p>

Deliverables	Progress
awareness on providing funding for investment in environmental sound technologies and processes	Nicaragua: Banco Uno, Banco de America Central, Bancentro Honduras: BCIE Fundacion Covelo, Bamer Panamá: Panabank Costa Rica: Banco LAFISE, Banco Cuscatlan, INTERFIN
6. Develop a proposal for a regional policy framework for recycling, reuse, and proper disposal of residual materials in production processes	COMPLETED: Industrial waste use and commercialization study completed in Costa Rica, El Salvador, and Guatemala is the for developing regional policies. Industrial and Municipal waste workshop held in August has identified a series of recommendation policies and specific actions to establish national and regional waste exchange centers to commercialize the waste.
7. Demonstrate to top-level management of entities belonging to the selected clusters, the benefits of certified environmental management systems for their participation in the global market	COMPLETED: Demonstration projects in coordination with APM component of PROARCA: - coffee - tourism - shrimp packing (Certification activities including Rainforest Alliance Certificate, CST y ACCC)
8. Develop and deliver in each country a training package on environmental audits and environmental management systems	COMPELTED: Six courses on environmental management have been conducted including (energy efficiencies, life cycle cost analysis, and methodologies for clean production, and indicators for clean production)
9. Develop and implement a proposal for the reduction of costs of environmental management systems and certification	This subject has not been studied in depth. However, it was emphasized that clean production is a cost effective means to achieve environmental management and certification objectives.
10. Identify a minimum of 10 opportunities for improved eco-efficiency for the selected clusters of private entities	COMPLETED: Demonstration projects have identified eco-efficiency opportunities. 50 options identified. See Best Practices guides for coffee, dairies and shrimp packing
11. Disseminate and promote the adoption of those opportunities willing to participate	COMPLETED: SIGMA focused on dissemination activities through technical workshops, e.g., conducting regional dissemination activities in the dairy production sector.
12. Organize mechanisms to facilitate access by the private sector to eco-efficient technologies	COMPLETED: Best practices guides and case studies provide mechanism. Also, technology transfer consultancy for clean production in process

ATTACHMENT 5. SUMMARY OF SIGMA TRAINING ACTIVITIES

No.	Training Event Name	Country	Date	Total Participants
PRIVATE SECTOR				
Access to Financing				
1	Mechanisms for financing clean production initiatives	Antigua, Guatemala	October 2002	10
2	1 st financial workshop on investing in clean production and environmental management initiatives	Antigua, Guatemala	April 2003	15
3	2 nd financial workshop on investing in clean production and environmental management initiatives	Managua, Nicaragua	November 2003	20
4	Workshops on financing for clean production and environmental management in Panama, Yuri Zenteno	Panamá	June 2003	8
5		Costa Rica	February 2004	16
6		San Pedro Sula, Honduras	March 2004	11
7		El Salvador	March 2004	11
8		Managua, Nicaragua	March 2004	10
9		Guatemala	March 2004	20
10		Costa Rica	July 2004	20
11	Workshops on financing clean production to Bank officials LAFISE, BAMER, Cuscatlan	San Pedro Sula, Honduras	July 2004	21
12		El Salvador	September 2004	18
Institutional strengthening				
13	Methodologies for clean production and environmental management	San Pedro Sula, Honduras	December 2002	30
14	Clean Production and Environmental Management System Training	Belize	January 2004	32
15	Workshop on energy efficiencies	El Salvador	July 2003	39
16	2 nd Workshop on energy efficiencies	Guatemala	May 2004	11
17	Life cycle cost analysis	Costa Rica	September 2003	32
18	Methodologies for developing indicators for clean production by sector	Panamá	July 2004	31
19	Workshop on technology transfer	Guatemala	June 2004	7
20	Workshop on technology transfer	Managua, Nicaragua	June 2004	11
Demonstration Projects by Sector				
21	Agro chemicals , Best practices for use of agro chemical	Choluteca, Honduras	May 2003	51
22	Shrimp Packing : Environmental management best practices in shrimp packing	Choluteca, Honduras	August 2003	22
23	Coffee : Clean production Project in the Rio Polichic watershed	Chicoj-Alta Verapaz, Guatemala	July 2003	37
24	Sub regional Project in the development of best practices, certification, and use of clean production technologies in coffee beneficios in the Golfo of Honduras	Santa Barbará, Honduras	March 2003	23
25	Sub regional Project in the development of best practices certification, and clean production technologies in the coffee beneficios in the Gulf of Honduras	Tucurú-Coban, Guatemala	November 2002	25

No.	Training Event Name	Country	Date	Total Participants
26	Sub regional workshop in the development of best practices certification, and use of clean production in wet processing of coffee.	Pachilja-Tucurú Coban, Guatemala	November 2002	28
27	Course on clean production and certification. An option for new markets.	Pachilja-Tucurú Coban, Guatemala	June 2002	16
28	Workshop on costs for coffee planning and processing coffee farms in Jesus Aguilar Paz, La Fe, Llama	Santa Barbará, Honduras	September 2003	30
	Workshop with members of coffee association to discuss best practices	Coban, Guatemala	October 2004	47
29	Dairy processing: Clean production agro industries: dairy sector	Guayape-Olancho, Honduras	December 2002	23
30	Best Practices in clean production in dairy industry	San José, Costa Rica	September 2004	18
31	Best Practices in clean production in dairy industry	Guatemala	July 2004	17
32	Best Practices in clean production in dairy industry	San Pedro Sula, Honduras	July 2004	32
33	Best Practices in clean production in dairy industry	Panamá	July 2004	22
	Best Practices in clean production in dairy industry	Nicaragua		34
34	Tourism: Workshop on best practices and certification in sustainable tourism	Talamanca, Costa Rica	July & August 2003	38
35		Pto. Barrios, Guatemala	August 2003	26
36	Clean Production in small and médium sized tourist industries in Gulf of Honduras	Belize	April 2004	8
37		Honduras	April 2004	6
38		Guatemala	May 2004	24
MUNICIPAL SECTOR				
	Access to financing			
39	Regional training course for municipalities on financing of projects solid waste, wastewater and slaughterhouse waste management.	Tegucigalpa, Honduras	August 2003	63
40	Sub regional training course for municipalities on financing waste management projects for Nicaragua and Costa Rica.	Managua, Nicaragua	February 2004	143
41	Sub regional training course for municipalities on financing waste management projects in Guatemala and El Salvador	Guatemala	June 2004	45
42	Bi-national workshop between Costa Rica and Panama about developing and financing municipal environmental projects	Costa Rica	September 2003	53
Institutional strengthening				
43	Workshop on draft solid waste and waste water management guides	Guatemala	October 2002	18
44	Validation workshop on materials for training municipalities in solid waste and wastewater management and the financial resources guide.	Guatemala	December 2002	12
45	Regional workshop to train consultants in solid waste management	El Salvador	May 2003	48
46	Training workshop for municipal employees in the management of a sanitary landfill and administrative aspects in solid waste management	Pasaquina, El Salvador	December 2003	33
47	Workshop to validate proposals for solid waste management in the communities in the Lago de Izabal y Rio Dulce watershed	Guatemala	May 2004	82

No.	Training Event Name	Country	Date	Total Participants
48	Biological monitoring workshop provided by EPA experts	Livingston, Guatemala	July 2004	21
49	Workshop on the operation of waste water treatment plants provided by EPA consultants	El Salvador	March 2004	27
50	Regional workshop on operation and maintenance of percolating filters for trainers.	La Unión – Suchitoto, El Salvador	June 2003	22
51	Training workshop to promote the effort of the waste water treatment plant in Puerto Barrios.	Pto. Barrios, Guatemala	February 2003	16
52	Workshop on INFOM standards and best practices in environmental management for the watershed Lago de Izabal y Río Dulce	Izabal, Guatemala	September 2003	39
53	Training of trainer workshop on solid waste management	El Salvador	August 2003	36
54	Training workshop for mayors, municipal advisors, and technical advisors (Carlos Zavala)	El Salvador	June and July 2003	126
55	Workshop for the private sector in wastewater management by PCI	El Salvador	November 2004	50
56	Workshop for the private sector in wastewater management by PCI	Guatemala	December 2004	36
57	Training workshop on management of sanitary landfill	Condega, Nicaragua	May 2004	81
58	Regional workshop on sustainability of wastewater treatment plants	San Pedro Sula, Honduras	May 2004	66
PRIVATE and MUNICIPAL SECTORS				
59	Workshop to review draft guide to manage slaughterhouse waste for municipal and private sectors in Central America.	Managua, Nicaragua	October 2003	36
60	Sustainable management of slaughterhouses (private and public)	Tela, Honduras	April 2004	51
61	Regional workshop on potential use of municipal and industrial waste	El Salvador	August 2004	52
	Total number of people trained			2056
	Total number of activities			61

ATTACHMENT 6. LISTING OF SIGMA CONSULTANTS AND SUBCONTRACTORS

Subcontractors/Contact	Address	Telephone	E-MAILS
Communications			
1. UNIVERSIDAD DEL VALLE /Dr. Edwin Castellanos, Director, GIS Laboratory Publications	18 Ave. 11-95, Zona 15 Vista Hermosa II, Guatemala	(502) 2364-0340 Fax: 2369-3452	
2. PUBLICONSULT/Ing. Luis Roberto Baeza, President Publications	40 Calle 22-30, Zona 12, Guatemala	(502) 5201-0801 Fax: 2477-0989	unionsa@guate.net
Private Sector Subcontractors			
1. CP+L / COSTA RICA # I Mayi Antillón/Sergio Musmanni Clean Production	Cámaras de Industria de Costa Rica, Carretera de Circunvalación 200 metros sur del ICE San Pedro, Edif. Esquinero de 4 pisos Costa Rica	(506) 281-0006 Fax: 234-6163	musmanni@netscape.net smusmanni@cicr.com
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