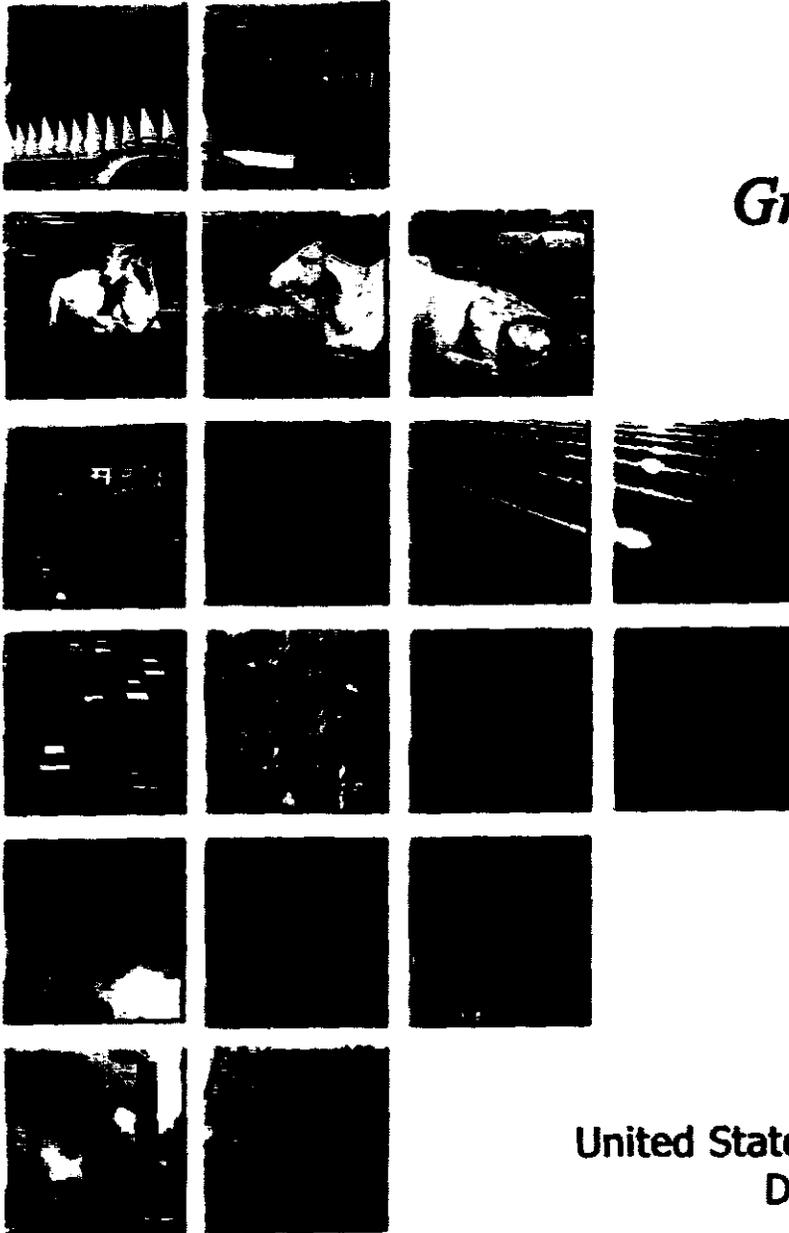


IN-AE4-774

CLIN 6: Policy Level Exchange Visits Between U.S. & Indian Counter-Parts

*Subtask 6.E Completion of Study Tour and Exchanges
for Milestone E - for All CLINS + 2 Policy Exchanges*



Greenhouse Gas Pollution Prevention Project - Climate Change Supplement

A Program of the:

United States Agency for International
Development / India Mission



Implemented by:

The Louis Berger Group, Inc.
Global Environment Team





THE Louis Berger Group, INC.

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Washington, DC 20037 USA

The Louis Berger Group, Inc
Contract No. 386-C-00-00-00058-00
Sandeep Tandon, CTO

TABLE OF CONTENTS

EXECUTIVE SUMMARY

SECTION I. TRANSPORT POLICY EXCHANGE

EXECUTIVE SUMMARY

ANNEXES

- A. POLICY EXCHANGE PARTICIPANT PROFILES**
- B. POLICY EXCHANGE TRIPS**
- C. DELEGATE PRESENTATIONS**

SECTION II. MSW POLICY EXCHANGE

EXECUTIVE SUMMARY

ANNEXES

- A. POLICY EXCHANGE PARTICIPANT PROFILES**
- B. POLICY EXCHANGE TRIPS**
- C. AGENDA – U.S. GOVERNMENT SIDE EVENT (CLIMATE CHANGE TECHNOLOGY)**
- D. AGENDA – ROUNDTABLE DISCUSSION/TRAINING MUNICIPAL CORPORATION OF DELHI**

SECTION III. STUDY TOUR

EXECUTIVE SUMMARY

A. THAILAND PHASE-I

B. US PHASE -II

ANNEXES

- A. EXPOSURE TRIP THAILAND CONTACTS**
- B. EXPOSURE TRIP U.S. FIRM CONTACT INFORMATION**
- C. DELEGATE PROFILES**
- D. THAILAND RECEPTION FOR VISITING DELEGATES**
- E. DELEGATE EVALUATIONS**
- F. PRESENTATIONS**

EXECUTIVE SUMMARY

As large Indian urban centers continue to grow at unprecedented rates, municipal urban infrastructure and services have been severely impacted. This reality places an ever increasing series of demands on municipalities. Struggling to keep pace with their own managerial capacity to meet the growing requirements of burgeoning populations as well as safeguarding the health of communities and the environment, urban leaders and environmentalists both are often hamstrung by preexisting conditions that prevent them from expanding vital services. In particular, greenhouse gas emissions have been an area of concern for many countries as the growth rate of GHG emissions has experienced a drastic rise over recent decades resulting in harmful impacts on society and the environment.

To address this reality and concern, the *Greenhouse Gas Pollution Prevention Project-Climate Change Supplement* - a project of USAID India being implemented by the Louis Berger Group, Inc., has been working with Indian state and municipal level officials to enhance/improve municipal transportation systems and solid waste management practices and services to reduce the growth rate of GHG emissions from urban expansion. Over the course of this contract, LBG/GEP-CCS has met this objective by, among other capacity building interventions, the development of a transportation pilot, creation of sustainable transportation guidelines and providing technical assistance for the design and development of a municipal sanitary landfill project.

One of the methodologies for achieving GEP-CCS project goals has been organizing study tours and policy exchanges to create a core of knowledgeable professionals in India armed with adequate technical information and to provide linkages to an international network of shared expertise. An important objective of these exchanges is to provide the opportunity for quality interaction between international peers and agencies that are confronting the same GHG issues and problems in the urban sector.

For the fourth and final subtask under CLIN 6, the following policy exchanges and study tour were organized.

| | | |
|---------------------------------------------------------------|-----------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><i>A. Policy Exchange</i> (August 1-9, 2003)</p> | <p><i>Developing Sustainable Transportation Policies Strategies for the Future</i></p> | <ul style="list-style-type: none"> • Mr. Andrew Cotugno, the Planning Director, Metro, Portland, Oregon • Mr. Harold Stitt, Senior Transportation Planner, City of Englewood, Colorado |
| <p><i>B. Policy Exchange</i> (November 9-16, 2003)</p> | <p><i>Promoting Sustainable Urban Waste and Landfill Gas Management</i></p> | <ul style="list-style-type: none"> • Mr. Richard Hays, Director, Environmental Services Department, City of San Diego, California • Steve Hamilton, LFG expert, SCS International Engineers |
| <p><i>C. Study Tour</i> (January 27-February 8, 2004)</p> | <p><i>Exploring Landfill Gas Project Development, Design and Financing, Exposure Trip</i></p> | <ul style="list-style-type: none"> • Six senior representatives from Indian municipalities who have a strong interest in municipal solid waste initiatives. |

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A. Policy Exchange - Developing Sustainable Transportation Policies Strategies for the Future

As a result of the assistance that LBG/GEP-CCS provided to the Municipal Corporation of Hyderabad on developing a series of transport planning/management interventions, a policy exchange visit was designed and entitled *Developing Sustainable Transportation Policies and Strategies for the Future*. The objective of this policy exchange was to provide the Government of India (GoI), businesses, and stakeholders with an understanding of the development and implementation of creating effective transportation policies.

Under this policy exchange, LBG/GEP-CCS developed a collaborative partnership with Metro of Portland (the designated metropolitan planning organization for Portland, Oregon) and the City of Englewood in Colorado, who are leading organizations in the field of transportation planning in the US.



METRO

Metro and City of Englewood officials participated in meetings organized in New Delhi and Hyderabad and also served as the honorary keynote speakers at a special roundtable brainstorming session for urban planners in Hyderabad. The roundtable was structured to foster dialogue among influential stakeholders on integrated transportation planning measures and to encourage the development of sustainable transportation policies and practices. The policy exchange meetings were structured to understand the Indian municipalities' transport and land use related goals and offer recommendations and guidance on how municipalities could develop policies and improve and/or restructure programs that would slow the rate of growth of GHG emissions from urban transport while enabling economic growth.

B. Policy Exchange - Promoting Sustainable Urban Waste and Landfill Gas Management

The increased level of interest in solid waste and landfill gas management in India provided LBG/GEP-CCS with the impetus to design and develop a policy exchange visit entitled *Promoting Sustainable Urban Waste and Landfill Gas Management*. This exchange provided Indian stakeholders with a comprehensive understanding of the concepts and processes involved in developing sustainable municipal solid waste and landfill gas projects.



In developing this policy exchange, LBG/GEP-CCS invited representatives from the City of San Diego Environmental Services Department and SCS International Engineers to present on U.S. best case studies in the solid waste management arena..



The meetings during this exchange were organized and led by the LBG GEP-CCS team to include trainings on municipal solid waste (MSW) with USAID partners in development: the Municipal Corporation of New Delhi, the National Institute of Urban Affairs (NIUA), and the Municipal Corporation of Agra. The US experts also presented at the US Government *Climate Change Technology Bazaar and Conference*, and met with a number of senior state and federal executives in Delhi, and Agra.

C. Study Tour - Exploring Landfill Gas Project Development, Design and Financing Exposure Trip

As a follow-up and continuation of the earlier MSW policy exchange, LBG/GEP-CCS designed a study tour entitled *Exploring Landfill Gas Project Development, Design and Financing Exposure Trip* to examine best practices of municipal solid waste management operations and appropriate landfill gas technologies. During this exposure trip, the delegates were provided with an opportunity to explore innovative landfill gas reduction, capture and reuse technologies and practices, and identify appropriate methodologies associated with landfill design and development for the Indian context.

The goal of the visit was to gain a better understanding of the benefits of LfG to energy projects, as well as the many issues, including potential obstacles and barriers, associated with designing and planning sanitary landfills to reduce GHG emissions.

The delegation for the exposure trip included six senior representatives from municipalities who had a strong interest in municipal solid waste initiatives and are working on collaborative efforts with USAID/India. The delegation included representatives who had key decision-making roles in urban development infrastructure projects and policies. In particular, the participating delegates represented the following municipalities and organizations:

- Municipal Corporation of Delhi
- Salngli-Miraj-Kupwad Municipal Corporation - State Government of Maharashtra
- Urban Administration and Development (UADD) - State Government of Madhya Pradesh (M.P.)
- Urban Development Department - State Government of Maharashtra
- Mussoorie-Dehradun Development Authority Dehradun - State Government of Uttrancha
- Infrastructure Development Corporation (Karnataka) Ltd. (iDeCK)

This study tour included a visit to California and an Asian stop in Thailand to observe how some of these best practice concepts are employed in another rapidly developing economy with similar climatic and social conditions as exist in India. Meetings arranged in both Thailand and California included leading experts and government officials in the field of municipal solid waste (MSW) and landfill gas (LfG) technologies.

Resulting from the study tour and interactions with the California Energy Commission, Mr. Rakesh Mehta, Commissioner, Municipal Corporation of Delhi is "planning to install micro-generators at its newly developed toilet complexes [which] will convert methane into electricity."

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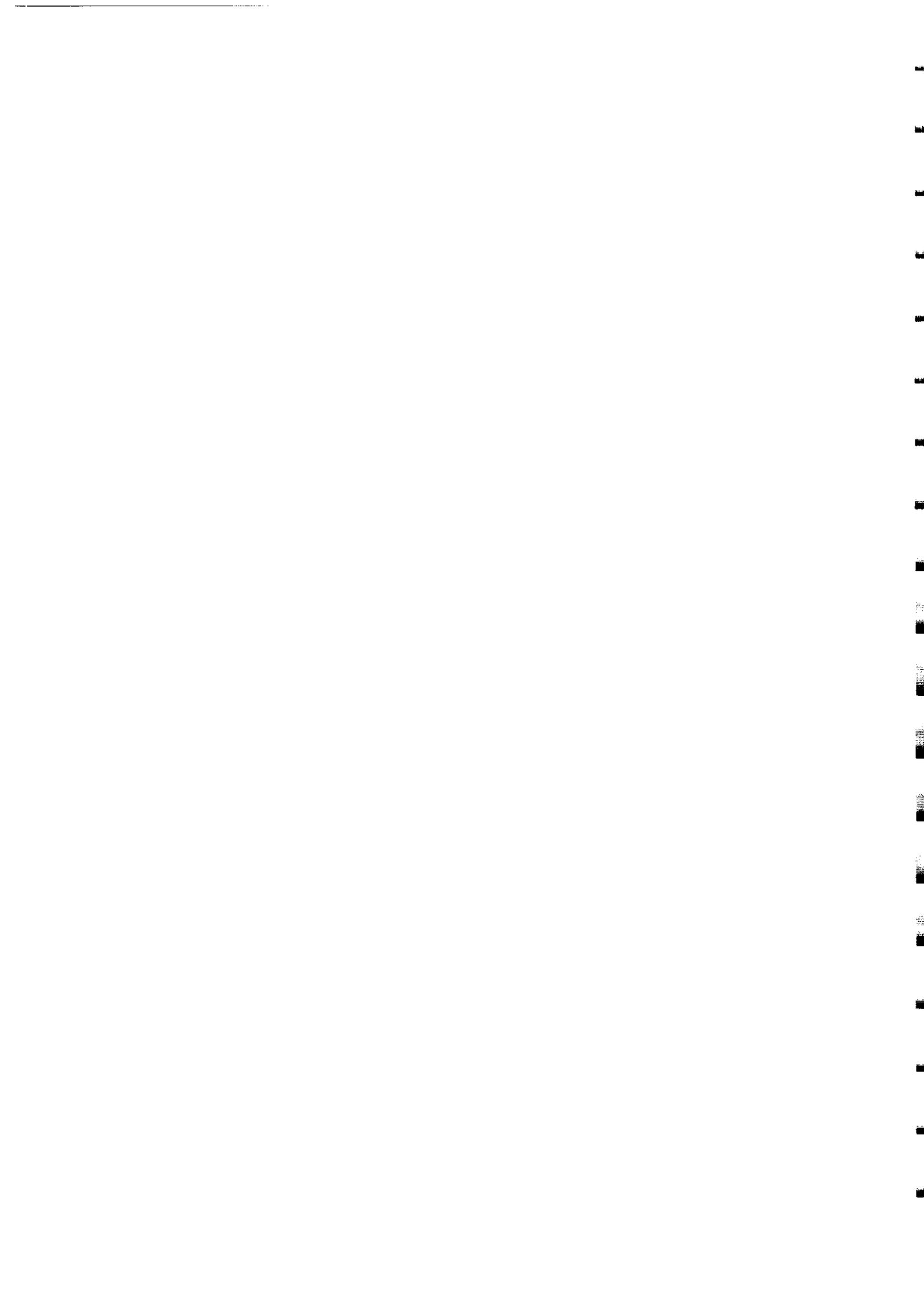
| <i>Meetings</i> | <i>Site Visits</i> |
|----------------------------------|----------------------------------------|
| Bangkok Municipal Administration | Eastern Seaboard Environmental Complex |
| Waste Management Siam | Kamphang Saen Landfill |
| Kasetsart University | Nonthaburi Landfill |

| <i>Meetings</i> | <i>Site Visits</i> |
|-----------------------------------------|--------------------------------------------|
| SCS Engineers, Inc. | S.F. Transfer Station and Recycling Center |
| Power Project Financing LLC. | Ox Mountain Landfill |
| Sonoma County Waste Management Agency | Keifer Landfill |
| California Energy Commission | Norcal Waste Systems Hay Road Landfill |
| California Integrated Solid Waste Board | |
| Global Energy Services | |
| Brown, Vence and Associates | |

Outcomes

The above policy exchanges/study tour contributed to building capacity among key India stakeholders by:

- Increasing the awareness of municipal policy/decision makers associated with landfill design and the development of transportation planning opportunities at the city, regional, and national levels.
- Creating partnerships with political leaders, the business community, and civil society groups to develop a mutual understanding for transportation policy planning and the development of MSW landfills.
- Establishing a foundation for developing credible and systematic landfill gas projects and transportation guidelines in India.
- Providing replicable/adaptable models for structuring MSW management and sustainable transport projects, including fee structures and revenue generation options.
- Enabling delegates and participants from various municipalities in India to exchange information in neutral venues that promote increased collaboration.
- Facilitating the transfer of U.S. technologies.



***DEVELOPING SUSTAINABLE TRANSPORTATION
POLICIES AND STRATEGIES FOR THE FUTURE
POLICY EXCHANGE***

New Delhi • Hyderabad

August 2003

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EXECUTIVE SUMMARY

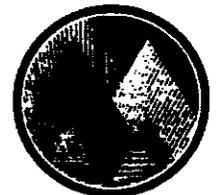
Over the last decade, the transport sector in India has witnessed sharp growth as a result of rapid urbanization. As part of this growth, the total annual kilometers traveled by all vehicles has grown, and correspondingly, vehicular emissions such as CO, CO₂ and NO have increased¹. The inherent complexity of addressing this problem lies in its inter-linkages with various aspects of the development process, and the implications for the environment will require actions at all levels of government. Cooperation among Government, business and civil society would allow for the development of lasting solutions for the country's transportation problems.

The Louis Berger Group Greenhouse Gas Pollution Prevention Project – Climate Change Supplement Project (LBG/GEP-CCS) has worked with several municipalities in India in the areas of transport and solid waste management. More specifically, as part of the transport component of the GEP-CCS project, LBG has worked very closely with the Municipal Corporation of Hyderabad and other key stakeholders in devising a series of transport planning/management interventions that can be incorporated in the urban master planning process. LBG also recommended a series of technology interventions that were aimed at reducing GHG levels.

In response to the increased interest in developing transportation solutions for the future that curb GHG reductions while encouraging economic growth, LBG/GEP-CCS developed and led the policy exchange, *Developing Sustainable Transportation Policies and Strategies for the Future*. This exchange provided the GoI, the private sector and other stakeholders with an understanding of the development and implementation of effective transportation policies.

With USAID approval, LBG/GEP-CCS invited Mr. Andrew C. Cotugno, the Planning Director of Metro, and Mr. Harold Stitt, Senior Transportation Planner for the City of Englewood, to India from August 1st to 9th, 2003 under the policy exchange mechanism. David Jarrett, senior transportation planner with the Louis Berger Group, and author of the guidelines on sustainable transport planning that came out of the demonstration project in Hyderabad, also participated as an additional resource during the policy exchange. LBG/GEP-CCS has a collaborative partnership with Metro of Portland (the designated Metropolitan Planning Organization in Oregon) and the City of Englewood in Colorado, both leaders in sustainable transport planning. These institutions had expressed an interest in developing a long-term relationship with Hyderabad subsequent to their interaction with the Hyderabad Municipal officials during the U.S. policy exchange/study tour in October 2001 which was focused on *Integrated Transportation Planning*.

The City of Portland stands as a national leader in innovative transportation solutions – having encouraged the adoption of transportation alternatives such as public transit, alternative work schedules, car pools, bike and pedestrian travel. The Office of Transportation is responsible for the stewardship of



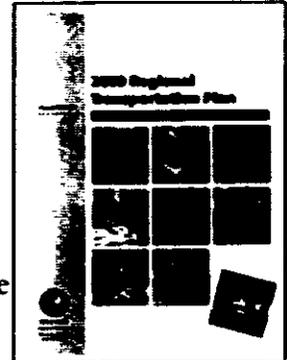
METRO

¹ These estimates are based on values associated with a new engine, assuming perfect maintenance. It does not account for engine deteriorations due to aging or vehicle overloads, or road roughness. It also does not take into account of emission control devices such as catalytic converters.

Portland's mobility and livability. To this end, Metro develops the Transportation System Plan – a long range plan to guide transportation investments in Portland. The City of Portland works closely with Metro in developing this plan. Metro is responsible for setting policy from a regional perspective, focusing on issues that cross local boundaries and require collaborative solutions.

The Transportation System Plan is the blueprint that guides investments in the region's transportation system to reduce congestion, build new sidewalks and bicycle facilities, improve transit service and access to transit and maintain freight access. The plan:

- Sets the direction and guides the planning for improvements to the region's transportation system during the next 20 years;
- Establishes policies and priorities for all forms of travel – motor vehicle, transit, pedestrian, bicycle and freight – and street design;
- Anticipates the region's current and future travel needs based on forecasts of growth in population, households and jobs as well as future travel patterns and analysis of travel conditions;
- Evaluates federal, state and local funding that will be available for transportation improvements; and
- Estimates costs of projects and proposes funding strategies to meet these costs.



Metro also follows a transit-oriented development (TOD) plan which is defined as higher density, mixed-use development that is located in or around transit facilities (train stations, bus stations, etc.). TOD makes more efficient use of land and public infrastructure and focuses on a mix of land-uses, such as residential, office, shopping, civic uses and entertainment within easy walking distance from a transit station.

Both of these programs that Metro is currently implementing have factors that could easily be relevant in the India context as both the Portland region and Indian cities have had large growth in population accompanied by heavy traffic congestion.

The City of Englewood, located in the suburbs of Denver, Colorado, provides both superior access and transportation variety by offering major highways, light rail, and heavy rail to meet the needs of business and residential communities. The City of Englewood has developed a Regional Transportation District (RTD), which offers a unique transportation amenity to cultural, educational, entertainment, recreational, and business activities.



They have also developed a project called CityCenter which is the first project in Colorado--and among a handful of similar projects nationally--to replace a suburban shopping mall with a

living, breathing, mixed-use downtown. It provides a model for intelligent regional design that directs development into established cities served by public transit. This 55-acre public/private project focuses development on a central public place and connects the site with walkable streets, civic and cultural venues, light rail transit station, retail and office space, residential housing, a public library, outdoor performance space, an art museum and outdoor sculpture.

The project's urban design coordinates the complex needs of a city government, regional transportation system, national retailers, homebuilders and nonprofit cultural organizations, while transforming a former single-use development served only by automobiles into a multiple use urban center accessible by train, bus, car, bike, or foot.

CityCenter Englewood is revitalizing the community spirit as well as the tax base of Englewood and provides a model for healthy urban redevelopment. It resolves key issues with practical solutions that can be replicated elsewhere. The ultimate success of CityCenter will point toward a healthier and more urbane future for cities in Colorado and elsewhere.

This TOD mini city has the potential to be replicated in India in areas of urban growth where satellite communities are indicated (e.g. Cyber City in Hyderabad).

This policy exchange was designed to maximize active engagement with representatives from the GoI, non-governmental organizations, and critical stakeholders for the development of more efficient transportation measures and policies that could shape urban transportation planning policies aimed at reducing GHG emissions in India.

The policy exchange meetings took place in Delhi and Hyderabad and included a brainstorming session and a master planner's roundtable as well as structured interactions with organizations and influential stakeholders. The meetings during this policy exchange were structured to work with the individual organizations involved in the urban planning process or mandated to develop policy for sustainable transport. Discussions at the roundtable included the importance of having a "Metro" like organization, or a Bangalore Action Task force to coordinate regional planning.

As an overall finding from this Policy Exchange, it is clear that there is a very strong interest by top government officials in addressing current transportation development issues in Delhi and Hyderabad, but there are a number of issues that need to continue to be examined closely as municipalities further their specific initiatives in developing sustainable transportation policies. Some of these issues:

- Can current land use controls be achieved and enforced?**
- Given working examples of collaboration and cooperation, will the government entities and the private sector work together to develop effective transportation planning policies?**
- Is there a way to overcome the institutional hurdles among organizations, government authorities with similar functions?**

I. BACKGROUND ON THE POLICY EXCHANGE APPROACH

The GEP-CCS LBG project team has worked with several municipalities in India in the areas of transport and solid waste management and has recognized a growing trend towards developing lasting solutions for the country's transportation problems. In order to address a need for solutions to these problems, and as part of the GEP-CCS project transport component, the team has worked very closely with the Municipal Corporation of Hyderabad and other key stakeholders in devising a series of transport planning/management interventions for consideration and future incorporation in Urban Master Plans. Additionally the team recommended a series of technology interventions aimed at reducing GHG levels. In 2003, a public launch kicked off the 'Opening' of the demonstration project corridor in Hyderabad.

GEP-CCS recognized the importance of increased exposure to more advanced forms of integrated transportation planning. The incorporation of integrated strategies into a comprehensive urban plan would be more cost effective now while most Indian cities are still at relatively early stages of devising integrated urban development plans and have relatively low levels of transport infrastructure development². The exposure to international experience would therefore provide the opportunity for India to further refine its policy development process.

II. OBJECTIVES

- To create partnerships with political leaders, the business community, and civil society groups to develop a mutual understanding for transportation policy planning focusing on the development of:
 - Transportation alternatives to control vehicular emissions
 - Regional transportation planning and
 - Long range land-use planning
 - Balancing transportation and land-use plans to protect livability of the region
 - Transportation guidelines for improving traffic flow and congestion.
 - Growth concept strategies and methodologies on a regional level
 - Financial aspects and economic strategies
 - Transit oriented development

- To actively engage a broad group of stakeholders from government, business and civil society and explore models for collaborative activities in the formulation and implementation of transport policies at a city, regional and national level.



² *Percentage of total area covered by roads for most cities is 6-10%, except Delhi which is at 18%; as against this the international norm is 20-30%.*

- To provide an understanding of challenges and barriers – technical, financial and institutional - associated with designing and planning strategies for sustainable transportation.
- To present a model of a Metropolitan Planning Organization and illustrate the roles and responsibilities it undertakes on a regional level in regard to transportation /land-use planning, allocation of federal funding and serving as a regional forum on cross-cutting issues.

III. ANTICIPATED OUTCOMES

- A better informed group of decision-makers associated with the formulation and implementation of transport policies at a city, regional, and national level.
- Establish linkages between Indian decision-makers/ institutions/ professionals, which could lead to collaborative relationships in the future. The possibility of forging a twin city arrangement could be explored between the City of Englewood and Hyderabad or Metro of Portland.
- Create momentum to support the dissemination and adoption of the *Guidelines for Sustainable Transportation* as a follow-up to the Hyderabad demonstration project.



IV. REPRESENTATIVE POLICY EXCHANGE PARTICIPANTS

Government

Through the development of a more comprehensive understanding of the importance of sound transportation policies to curb vehicular emissions, government officials will be better positioned to collectively work together to define future urban transportation policies. The levels of government targeted include the city, state and national levels.

Civil Society

Many organizations in India have an interest in transportation related issues and their relation to the environment and health of the citizens of India. These organizations represent the public voice in addressing concerns and problems related to the transportation sector and provide a mechanism for policy development.

| Name | Title | Organization |
|---------------------------|-------------------------------------|------------------------------------------------|
| Mr. A.K. Giridhar | Transport Commissioner | Regional Transport Commission AP State (RTA) |
| Mr. Rajiv Sharma | Member Secretary | Andhra Pradesh Pollution Control Board (APPCB) |
| Dr. K.V. Ramani | Joint Chief Environmental Scientist | Andhra Pradesh Pollution Control Board (APPCB) |
| Ms. Chitra Ramachandran | Commissioner | Municipal Corporation of Hyderabad (MCH) |
| Mr. Ranadhir Reddy | Additional Commissioner | Municipal Corporation of Hyderabad (MCH) |
| Mr. Rakesh Mehta | Commissioner | Municipal Corporation of Delhi (MCD) |
| Mr. S.P. Shourey | Special Officer (RMP) | Hyderabad Urban Development Authority (HUDA) |
| Ms. Lakshmi Parthasarathy | Vice Chairman | Hyderabad Urban Development Authority (HUDA) |
| Mr. Sandeep Tandon | Cognizant Technical Officer | USAID/India Mission |
| Prof. V. Srinivas Chary | Senior Faculty | Administrative Staff College of India (ASCI) |
| Dr. E.A.S. Sarma | Principal | Administrative Staff College of India (ASCI) |
| Dr. P. K. Mohanty | Executive Director | Centre for Good Governance (CGG) |



V. POLICY EXCHANGE SCHEDULE

New Delhi, India

Sunday, August 3, 2004

- Welcome / Program Debrief

Hyderabad, India

Monday, August 4, 2003

- Centre for Good Governance (CGG)
- Regional Transport Authority (RTA), Department of Transport (DoT)
- Andhra Pradesh Pollution Control Board (APPCB)

Tuesday, August 5, 2003

- Municipal Corporation of Hyderabad (MCH)
- Hyderabad Urban Development Authority (HUDA)

Wednesday, August 6, 2003

- Center for Good Governance
- Administrative Staff College of India

Thursday, August 7, 2003

- Roundtable on Sustainable Transportation & Land Use Planning Strategies for the Future

New Delhi, India

Friday, August 8, 2003

- Delhi Municipal Corporation
- Program Debrief

VI. OVERVIEW OF MEETING NOTES

Sunday, August 3, 2004 - New Delhi

Welcome Lunch and Briefing

Ms. Suzanne Young, GEP-CCS Chief of Party and Leader of this Policy Exchange reviewed the schedule for the overall policy exchange, provided additional background information on institutions and answered any outstanding program and/or logistical questions.

Monday, August 4, 2003 - Hyderabad

Centre for Good Governance (CGG)

The objective of the meeting was to serve as an orientation for the visiting experts as a precursor to the series of meetings and interactions planned in the city of Hyderabad.

At the outset, Mr. Cotugno and Mr. Stitt presented handbooks and material elaborating their respective organizations' experience with transportation and land use planning.

Dr. Mohanty then provided a brief perspective on the current status of Hyderabad's urban planning processes, some of the important projects under implementation as well as the key issues facing the city. He offered suggestions to the visiting experts on aspects/ themes that would be of specific interest and relevance to the city's decision-makers.

Dr. Mohanty and his team also presented their performance tracking system developed by the CGG for the Chief Minister's office. He mentioned that they were interested in extending the system to land use planning and transportation, and to this end would need to identify relevant performance indicators/ benchmarks.

Regional Transport Authority, Department of Transport (DoT)

The meeting was held at the office of Mr. A.K. Giridhar, Transport Commissioner. Apart from Mr. Giridhar, the meeting was attended by senior officials from the transport department.

Mr. Giridhar briefed the team about the responsibilities of RTA and DoT. He mentioned that the department was primarily concerned with enforcement and taxation, while the planning and land use functions were largely handled by HUDA and MCH. His department's principal contribution in this process was through the taxation function which is used to encourage/ discourage select modes of transport so as to facilitate a shift towards the desired mix of transport. Their work required a close level of interaction and coordination with the traffic police department.

Given the growing complexity of the city's urban landscape, he observed that there was a need for a city level coordinating group for land use and transportation planning. In this context, he expressed interest in the model being used in Portland.

Mr. Giridhar mentioned that in order to control the city's burgeoning vehicular population, a move is being considered to limit the total number of vehicles in the city by freezing the registration of automobiles. Moreover, replacement of old cars would need to be done with cleaner fuel autos. To this end, dialogue is in progress with the oil companies to improve the supply infrastructure for cleaner fuels.

He also commented that the introduction of the mass transit system would require substantial policy making with respect to land use and the mix of transportation. The latter would in turn warrant modifications in the taxation structure to implement the proposed transport mix. Once again lessons could be learnt from international experience with respect to the design of efficient and equitable taxes/ charges for this purpose.

He informed the visiting team of the various efforts being made to computerize and modernize the registration and tax collection processes of the city. These in turn would enable adoption of more sophisticated policy/ planning measures vis-à-vis design of transportation systems.

Andhra Pradesh Pollution Control Board (APPCB)

The meeting was held at the office of Mr. Rajiv Sharma, Member Secretary, APPCB. The meeting was attended by Mr. Sharma and Dr. K.V. Ramani, Joint Chief Environmental Scientist.

Dr. Ramani provided a chronology of developments on the twin problems of traffic and air pollution management being faced by the city of Hyderabad. She provided a detailed insight into the decision processes and technical issues involved in tackling the problem of air pollution for the city. She also updated the team on the several initiatives taken by the APPCB in conjunction with the various city/ state departments to address the different facets of the problem.

Some of the critical areas of concern highlighted by her were the large population of old vehicles, inadequate infrastructure for cleaner fuels, poor enforcement of pollution norms.

The APPCB had been very helpful in providing background data and research information in the early stages of the pilot in Hyderabad.

Tuesday, August 5, 2003

Municipal Corporation of Hyderabad (MCH)

A group level interaction was organized at MCH for the visiting experts to share their experiences with senior MCH functionaries. Prior to this, the visiting team met with Ms. Chitra Ramachandran, Commissioner, MCH and Mr. Ranadhir Reddy, Additional Commissioner, MCH. Mr. Cotugno and Mr. Stitt presented material on their organization's experiences along with some of the various handbooks developed for urban planners.

The group level interaction was attended by senior planners and engineers from MCH. The senior representatives from the project consultant (L&T Rampoll) for the light rail transit (LRT) system also attended the session. The total number of participants was approximately 15 persons.

Mr. Cotugno and Mr. Stitt made presentations on the experience and institutional structures/processes of their respective organizations. This was followed by a question and answer session wherein several urban planning and management issues of specific and general interest were discussed.

The interaction was followed by a visit organized by MCH, to the first completed station for the LRT system due for inauguration on August 9, 2003. Mr. Reddy showed the various design features of the station, including several which had been derived from examples and models seen during the U.S. experience with metros and the earlier transportation focused study tour that he participated in under the GEP-CCS project.

Hyderabad Urban Development Authority (HUDA)

Another group level interaction had been organized at HUDA for the visiting experts to share their experiences with senior functionaries at HUDA. The meeting was attended by Mr. S.P. Shourey, Special Officer (RMP) and approximately 10 other senior planners/architects from the organization, including a planner from Warrangal.

At the outset, Mr. Cotugno and Mr. Stitt presented material on their organization's respective experiences as well as sharing copies of handbooks developed for urban planners. Mr. Shourey presented a copy of the draft HUDA Master Plan developed for the city of Hyderabad, to the visiting team.

Mr. Shourey provided a brief introduction to the city's planning processes and HUDA's role in the same. He highlighted some of the primary areas of concern including, the existence of multiple agencies, legal constraints, population pressure and so on.

Mr. Cotugno and Mr. Stitt went on to present their organizations' experiences, institutional approaches and structures. The presentation was interspersed with questions and clarifications on the planning process, norms for urban facilities, community participation and financial processes. Mr. Jarrett presented the pilot project implemented in Hyderabad and the guidelines developed for designing traffic interventions. He illustrated the interventions using experiences of various transportation projects implemented in Asian developing countries, such as Vietnam, Thailand, and Malaysia. Due to the similarities in socio-economic contexts, these were seen to be of special relevance to the Indian planners/ policy-makers.

Wednesday, August 6, 2003

Center for Good Governance

CGG hosted an in-house training session for the CGC staff and other stakeholders in the Hyderabad planning process which included presentations by Mr. Stitt and Mr. Cotugno on their respective organizations including current activities and transport-related programs. Mr. Reddy from the MCH made an extensive presentation on what MCH has been doing in the area of sustainable transportation, including expansion of the work on the corridor, and the light rail system. The CGG staff also demonstrated the software that they had developed to monitor performance of various government offices.

The principal objective of this meeting was to build capacity for the CGG staff and to further prepare the participants with information and discussion points for the brain storming session cum roundtable.

Administrative Staff College of India

A special briefing session for the Director of ASCI, Mr. Sharma and his top transport policy experts was conducted in the ASCII offices. Mr. Sharma is the Chair of a special state level committee set up by executive order to recommend sustainable transport policy. By design, a number of the invitees to the Thursday brain storming session/roundtable were also on this high level committee. The briefing included presentations by Mr. Stitt and Mr. Cotugno on their respective organizations including their current activities and transport-related programs, followed by an open discussion on specific urban transport policies and their efficacy. The discussion ranged from transit oriented development strategies to various pricing incentives for reducing congestion.

Thursday, August 7, 2003

Roundtable on Sustainable Transportation & Land Use Planning Strategies for the Future

The Roundtable was planned both as an outreach activity and an exchange between the critical stakeholders in the municipal planning process. The overall *goal* of the interaction was to

communicate the importance of municipal planning in relationship to controlling the rate of growth of greenhouse gas emissions from urban transport and to assist Indian municipalities to develop strategies for reducing the negative impacts of urban economic growth while responding to the increased prosperity and need for mobility of the city inhabitants. The specific *objectives* of the Roundtable were: to bring together the various stakeholders in the urban master planning process for an informal but structured exchange on urban transport, land use planning and GHG emissions; to explore models and examples of urban transport planning and to encourage the adoption of relevant concepts and/or specific elements of sustainable transport planning into urban development master plans of Hyderabad and other cities in Andhra Pradesh where appropriate. The long term outcome goals for the Roundtable were: developing increased awareness of (a) city transport and land use planning, (b) the links between transport, local air pollution and GHG emissions, and (c) urban master planning processes in the US with transport as a key component. It was also hoped that the brain storming sessions and interactions leading up to the roundtable would contribute to a modification of the Urban Master Plan (of Hyderabad) incorporating discussion on urban transport as one of the city development criteria, and provide input for the preparation of transport guidelines for Hyderabad Master Plan 2020 and transport guidelines/policy for the state of Andhra Pradesh

TARGET AUDIENCE: KEY STAKEHOLDERS FROM THE ANDHRA PRADESH GOVERNMENT

- Director Municipal Administration
- Director Town and Country Planning
- Department of Transport
- Department of Urban Development (HUDA)
- Municipal Corporation of Hyderabad, and surrounding nine municipalities
- Department of Roads and Buildings
- Police Commissioner
- Pollution Control Board
- Urban/environmental experts (e.g. EPTRI, ASCI)

The Roundtable opened with a *welcome* by Dr. E.A.S. Sharma (ASCI), and was followed by a presentation by Mr. Sandeep Tandon (USAID/India Mission) outlining the scope of the GEP-CCS project and activities initiated under it.

In his talk, Dr. Sharma provided a broad policy perspective of the city's transportation systems and identified some of the key areas where policy choices needed to be made. Some of the points made were as follows:

- o At a basic level, an augmentation of the state's transport facilities was required.
- o Institutional change was required in policy and planning activities, with greater coordination between the different agencies. The model used by the Bangalore Action Task Force was one that could be explored. The experience of Metro was also relevant in this context.

- Fiscal issues needed to be addressed, encompassing both direct and indirect taxation, across different modes of transport. The structure of taxes needed to work towards improving the viability and attractiveness of public transport.
- An improved understanding was required of:
 - Decision variables affecting the choice between different modes of public transport (viz. metro, high capacity buses, light rail systems)
 - Interface between the different modes of public transport
 - Types of regulatory structures required
 - Norms to be adopted for emission levels, fuel quality, traffic management etc.

As Chairman of the Transport Policy Committee, he emphasized that there was a need to look at not just Hyderabad, but all the cities of Andhra Pradesh. Moreover, given that each city's needs are unique (in terms of its layout and character) a greater understanding is required of how to address these needs.

Presentations were made by David Jarrett (LBG), Ms. Lakshmi Parthasarathy (Vice Chairperson, HUDA) and Mr. A. K. Giridhar (Transport Commissioner).

In the course of the presentations, Dr. Satyanarayanan made a comment about the higher levels of taxation (per passenger kilometer) being imposed on public transport vis-à-vis private transport. This led to a discussion on the various subsidies (direct and indirect) being provided to different modes of transport and the need to rationalize these.

The above was followed by presentations by Mr. Andrew Cotugno (Metro) and Mr. Harold Stitt (Englewood).

In the discussion that followed, participants raised questions/ sought details on the topics given below.

- Process of *public consultation* being followed by Metro and Englewood
- Rationale for the 50 year *planning horizon* being followed by Metro. Mr. Cotugno explained that the objective of the planning horizon was to define the concepts and vision for the planning process, and not the operational details associated with the Master Plan.
- Possible loss of development opportunities due to defining of an *urban boundary*. Mr. Cotugno clarified that this was not the case, as the aim was to accommodate growth more efficiently (in contrast to the Silicon Valley experience, where professionals had to relocate due to inefficient land use planning and associated rise in cost of living).
- Choice between *bus and rapid transit systems*. Mr. Stitt responded that the choice depended on the volume of traffic being carried. However, he observed that transit-oriented development was usually associated with LRTS or metro. The cost aspects

were typically dependent on the profile of the section being covered (e.g. population density, land use pattern, topography, and existing infrastructure).

- Sources of *financing for projects and the setting of tariffs* at levels that are publicly acceptable. In this context, Mr. Cotugno drew attention to the fact that federal funding support for rail projects is competitive and needs to be backed up by appropriate land use policies.
- Experience with *other urban services* viz. sewage, solid waste and water supply. Apart from the details furnished on these, Mr. Cotugno mentioned that a land use development fee was being levied to finance the growing demands for infrastructure. In other words, growth is paying for the infrastructure required for it.

The participants agreed that in the Indian context, planning was supply driven (as illustrated by the draft HUDA Master Plan), and that growth could not be sustained by such a planning approach. What was required was demand driven planning.

In the observations made by *Dr. P. K. Mohanty (Centre for Good Governance)*, he commented on the overall experience with the GEP-CCS project, and also made some suggestions on areas for further action. These included the following:

- Feedback on the draft HUDA Master Plan, based on international experience.
- Formation of a group consisting of experts and administrators, to develop an agenda/ action plan for consideration by the Transport Policy Committee.
- A study of USA's experience with funding of transit projects, especially vis-à-vis the mix of contributions by federal, state and municipal authorities. Such an analysis could serve as an input for the Central Government in its design of funding policies for transit projects.

In the post-lunch *discussion* session, some of the key points discussed were as follows:

- Dr. Chary mooted the idea of developing a partnership between civil society, corporate representatives and public service providers, for developing an implementation agenda on transportation and land use management for the city of Hyderabad. The Bangalore model – i.e. BATF – was discussed at length in this context.
- Prof. Raghavachary provided another perspective, emphasizing the need for greater professionalism and technical rigor in decision-making, especially at the proposal-making stage. He observed that currently there was no standardization, data analysis and pooling of technical resources by the relevant institutions. He proposed the creation of a unified administrative board (with representation from the various government agencies)

supported by a professional body, which would develop technically sound proposals for consideration by the board.

- Mr. Cotugno commented that whichever model is adopted, the coordination body would need to initially adopt a consensus approach to decision-making, before being assigned any authority. The authority would follow once the consensus approach was fully established – as witnessed in the historical evolution of the Metro.

Friday, August 8, 2003

Municipal Corporation of Delhi

On Friday, August 8, an informal roundtable was held with the Municipal Corporation of Delhi (MCD). The meeting had been organized to facilitate an interaction of the visiting experts with a cross-section of stakeholders associated with Delhi's transportation systems. The meeting had been coordinated by the office of Mr. Rakesh Mehta, Commissioner MCD. It was attended by senior representatives from not just MCD, but also DDA, Delhi Metro Rail Corporation (DMRC), the State Department of Transport, IIT-Delhi and Mokshda.

After an initial round of introductions, Mr. Sandeep Tandon (USAID-E3) gave a brief presentation on the GEP-CCS project, followed by a few words on USAID's other activities in the area of urban planning and management by Mr. Nabaroon Bhattacharjee (USAID RUDO).

Presentations by Mr. Cotugno and Mr. Stitt on the experiences of Metro and CityCenter Englewood were followed up by a lively discussion session. In the course of the discussion some of the issues raised were as follows:

- Factors affecting the choice between light rail transit (LRT) and a subway metro system.
- Reasons for public preference of mass transit over freeways. Processes for assessing public preference vis-à-vis different modes of public transport.
- Parking requirements at metro/ LRT stations. Distinction between 'park and ride stations' versus 'development oriented stations'.
- Means of recovery of operations and maintenance costs for mass transit systems (which are partially subsidized).
- Source of funding for the civic body's contribution to the CityCenter, Englewood project
- Utility and relevance of congestion based pricing (as is being implemented in London)

Mr. Dinesh Mehta (IIT-Delhi) made the observation that a unique feature of the traffic mix in Asia was the widespread use of 2-wheelers - the marginal cost of operating which is very low. Metro/ LRT tariffs would need to benchmark against this very low marginal cost in order to draw middle class users into the mass transit system. This in turn implied a greater challenge for achieving the viability of the transit systems.

In closing, Mr. Rakesh Mehta (MCD) briefly elaborated on the key transport issues facing the city of Delhi, and possible lessons that could be learnt from the international models while designing sustainable transportation systems for the city.

VII. FOLLOW-UP AND NEXT STEPS

Post exchange, GEP-CCS LBG continued to coordinate with the visiting U.S. institutions and follow-up on potential areas of collaboration including gathering additional information for the participants.

Below are the detailed notes from a follow-up meeting with the Hyderabad Urban Development Authority (HUDA) and Administrative Staff College of India (ASCI) which was held on *September 22, 2003*.

Urban Development Authority (HUDA)

Mr. S. P. Shorey, Special Officer (Master Plan)

Mr. Shorey welcomed the creation of the Guidelines document, and the previous LBG interaction with HUDA including the policy exchange visit and sessions with Mr. Stitt and Mr. Cotugno, and was open to incorporating language from the Guidelines document, and concepts from the visit in the final version of the Master Plan, wherever this was perceived to add value to the latter document.

In the context of the Hyderabad Draft Master Plan prepared by HUDA he observed that several of the principles/ concepts have already been incorporated in the Plan. For example, spatial decentralization is being encouraged by creating a large number of multiple use zones, and increasing the flexibility of use (excluding manufacturing activities) even in the residential and commercial zones. Attempts at incorporating elements of TOD have taken the form of proposals for residential and commercial zones along the route of the MMRTS. Moreover, the Master Plan already incorporates an inventory of the transport infrastructure (e.g. roads, vehicular population by ownership & use) as suggested in Section B of the Guidelines, based on separate studies undertaken by HUDA – HATS³ I (1988), HATS II (1999) and RTA 2002 data.

He also discussed the constraints in addressing certain aspects of sustainable transportation particularly in the areas of:

- pedestrian areas/ cycle tracks
- safety issues
- restricted access zones
- provisions for public transportation

³ Hyderabad Area Transportation Study

He observed that typically these aspects do not get adequately addressed by planners/administrators due to public indifference and lack of political will in tackling the constraints associated with these. These lacunae exist in the HUDA Master Plan as well, in that it does not incorporate demand side assessments such as pedestrian surveys, public transport surveys etc.

An additional problem in addressing sustainable transportation issues more comprehensively is the absence of a unified metropolitan transport authority. Planning and implementation of several interventions listed in the Guidelines – in particular those relating to network management, public transport provision and demand management- hinge on the existence of such a coordinating agency.

The Master Plan nevertheless does lay down the principles of sustainable transportation under these heads (e.g. encouragement of public transport, priority to pedestrians/ cyclists, improved traffic management) as reminders for planners/ administrators undertaking the city's transportation management activities. Also, the Master Plan attempts to provide for future land requirements associated with public transport, by providing for an increased ROW for roads – the additional land being kept aside for parallel modes (e.g. rail / bus lanes) that might get developed later.

The more short-term measures listed under Road and Intersection Management lay outside the purview of the Master Plan document (which has a longer time perspective). Mr. Shorey said that these would typically get addressed by concerned departments (in the absence of a unified agency), as part of their periodic action plans.

In the context of the constraints faced due to public indifference and lack of political will, Mr. Shorey suggested that a similar document could be prepared on the principles of Sustainable Transportation for legislators and the ordinary public. This document would need to be written (& illustrated) in layman terms, possibly in the vernacular language, and could be distributed widely. Such an awareness creation effort would help in generating greater consensus for adoption of sustainable transportation ideas/ concepts amongst all stakeholders.

A suggestion for the document was that it could include a brief menu of analytical/ design tools for transportation planning. This would be particularly useful for planners from smaller cities, not having the requisite expertise/ resources for this purpose.

USAID provided copies of a manual prepared for the power industry as a good example of such a document, which GEP-CCS passed on to HUDA for their reference.

Administrative Staff College of India (ASCI)

Prof. V. Srinivas Chary, Senior Faculty

Prof. Chary and ASCI continue to be positive partners in developing a sustainable transport policy for the city and state. In light of their mandate as the host organization for the Transport

Policy Committee, they have been appreciative of the GEP-CCS/LBG team efforts in Hyderabad and welcomed the sharing of the experience of the policy exchange experts, and the Guidelines, saying that these inputs would prove to be a useful in developing planning documents. The discussion also spotlighted some of the other initiatives being implemented in Hyderabad that were addressing the city's planning needs. One such initiative was the City Development Strategy – a cross stakeholder effort at developing a strategy and action plan for nine focus areas, including transportation. A number of the key elements of the Guidelines are already incorporated in the CDS document, courtesy exposure of the authors (which included MCD Additional Commissioner Ranadhir Reddy, and Professor Raguchari, special advisor to MCD, among others) of the transportation section to international best practice (via study tours and the policy exchange), and extensive TA and interactions with LBG transportation and planning experts in preparation for and during the Hyderabad pilot, including the Guidelines document. These elements include both specific traffic management interventions from the pilot, policy exchanges and the guidelines (e.g. suggestions for reducing side friction like the widening of roadways, improvements to intersections, synchronization of signals, etc.), and macro policy guidelines (e.g. transit oriented development, and emphasis on multi-modal transport and public transport)

Prof. Chary also talked about the implementation aspect, stating that translation of these concepts into ground realities would require considerable support and handholding of the city administrators. In that context, he offered his assistance in disseminating the guidelines to various city managers, as well as in any support activities that might emerge.

As regards to suggestions for improving the document further, Prof. Chary suggested provision of information on the following topics in the document would also be useful:

- greenery at traffic junctions
- measures to augment public transport services
- decision-making and planning tools
- financial tools
- demand management tools

ANNEX A.

Policy Exchange Participant Profiles



METRO

Andrew C. Cotugno, Director
Planning Department
Metro
Portland, Oregon

Mr. Andy Cotugno has more than 25 years of professional experience in the transportation and planning fields. Prior to his current position, he worked as a transportation planner for both Metro and the Mid-Ohio Regional Planning Commission.

He received a bachelor's degree in city and regional planning from California Polytechnic State University in 1974, and has done graduate work in public administration at Lewis and Clark College in Portland.

Mr. Cotugno was appointed as Metro's director of Transportation in 1980. In mid-year 2000, the Transportation and Growth Management Services departments were merged into one, the Planning Department, and Mr. Cotugno retains the responsibility of managing the larger department. Metro is a regional government encompassing a tri-county metropolitan area. The agency's charter states that Metro will provide "planning and policy making to preserve and enhance the quality of life and the environment . . ."

As director, Mr. Cotugno is responsible for the more than 80 professional staff in both departments who are charged with travel forecasting, light rail planning, transportation planning and financing, and transit oriented development, Metro's map center and the Regional Land Information System (RLIS), as well as the urban growth boundary, urban growth management and natural resource planning functions.

He is chair of Metro's Transportation Policy Alternatives Committee and Metropolitan Technical Advisory Committee and is active in regional, state and federal financing activities for transportation and growth management projects.

METRO TRANSPORTATION PLANNING

Metro develops the region's transportation plan and prioritizes and allocates federal and state transportation funds. Current programs being implemented by Metro include the following:

The Regional Transportation Plan - Updated and adopted by the Metro Council every three years, this plan sets the direction for regional investments in a mix of transportation options, including roadways, light rail, freight, transit, pedestrian access, and bicycles. The Bi-State Transportation Committee advises Metro on regional transportation goals and issues of significance to both Washington and Oregon in the Portland/Vancouver area.

The Regional Transportation Plan is the blueprint that guides investments in the region's transportation system to reduce congestion, build new sidewalks and bicycle facilities, improve transit service and access to transit and maintain freight access.

The plan:

- sets the direction and guides the planning for improvements to the region's transportation system during the next 20 years
- establishes policies and priorities for all forms of travel – motor vehicle, transit, pedestrian, bicycle and freight – and street design
- anticipates the region's current and future travel needs based on forecasts of growth in population, households and jobs as well as future travel patterns and analysis of travel conditions
- evaluates federal, state and local funding that will be available for transportation improvements
- estimates costs of projects and proposes funding strategies to meet these costs.

Transit-oriented Development (TOD) Implementation Program - Metro's Transit-oriented Development (TOD) Implementation Program effects the construction of "transit villages" and projects that concentrate a mix of retail, housing, and jobs in areas around regional light rail systems and other transit lines.

Metro's Transit-oriented Development Implementation Program brings about the construction of "transit villages" and projects that concentrate a mix of retail, housing and jobs in areas around regional light-rail systems and other transit lines.

The region's growth management plan, the 2040 Growth Concept, calls for protection of farmland and open space. Specifically, the plan limits expansion with an urban growth boundary and focuses growth in regional or town centers and around transit corridors.

Metro's Transit-oriented Development (TOD) Implementation Program brings about the construction of "transit villages" and projects that demonstrate TOD concepts around regional light-rail stations and along other transit lines.

These compact mixed-use, mixed-income developments:

- concentrate retail, housing and jobs in urban environments scaled for pedestrians
- increase use of non-auto transportation choices such as taking transit, riding bikes and walking
- decrease regional congestion and air pollution.

Independent studies indicate that transit-oriented development will reduce congestion and air pollution by up to 30 percent compared to typical suburban development and is a cost-effective means to address traffic congestion.

The TOD Program operates through a series of cooperative agreements between the region's elected regional government (Metro), local jurisdictions and private developers. The primary use of program funds is site acquisition.

Property is acquired, planned and re-parceled. It is then sold with conditions to private developers for constructing transit-oriented development and/or dedicated to local governments for streets, plazas, and other public facilities where appropriate. In many cases the land value is written down to cover the extraordinary development costs required to construct a specific TOD project. In such cases, a "highest and best transit use" appraisal is used to establish the sale price.

The program is the first of its kind in the United States and has been instrumental in helping shape the joint development policies of the Federal Transit Administration.

Transportation Projects - Working together with the public, other jurisdictions and agency partners, Metro develops high-priority projects identified in the Regional Transportation Plan. These include studies and planning for key transportation corridors and other projects such as the Highway 217 Corridor Study, Powell/Foster Study, South Corridor Project, Portland/Vancouver I-5 Transportation and Trade Partnership, the Willamette Trolley, and the Traffic Relief Options Study on peak period pricing.

Funding Transportation Projects - The Transportation Priorities Program sets funding priorities and allocates federal and state funds to projects identified in the Regional Transportation Plan.

Travel Forecasting - Metro's travel forecasters provide assistance to other Metro departments and agencies throughout the region in the form of data analysis and research on travel habits and patterns. Using the latest tools, such as the new TRANSIMS software and analysis procedures, travel forecasting provides us with data to envision future transportation needs and systems.

Transportation Demand Management (TDM) program - The region's Transportation Demand Management Program (TDM) works to provide alternatives to driving alone. Regional TDM policies direct planning and support funding for regional bicycle, pedestrian and public transit systems. The policies respond to the federal Clean Air Act requirements of 1990, the state Transportation Planning Rule and the state Employee Commute Options Rule.



C I T Y O F E N G L E W O O D
C O M M U N I T Y D E V E L O P M E N T

Harold J. Stitt, AICP
Senior Planner

Phone (303) 762-2341
E-mail: hstitt@englewoodgov.org

Mr. Harold Stitt is Senior Planner in the Community Development Department of the City of Englewood, Colorado. He is Manager of the Long-range Planning Section and directs the comprehensive planning activities for the City and serves as principal planner for special redevelopment projects.

Mr. Stitt has over twenty one years progressive local government experience in community development, zoning, urban renewal, environmental planning, economic development, operational and strategic planning. Currently, he serves as project manager of the 2003 Comprehensive Plan project and oversees several transit related sub-area planning efforts. Most recently, he served as principal planner for the CityCenter Englewood project, a redevelopment of an obsolete regional shopping center into a mixed use commercial transit-oriented development. In this capacity, he was responsible for oversight of all planning, zoning, subdivision, and design review aspects of the redevelopment project.

Mr. Stitt received a Master of Regional Planning in 1980 from the University of Michigan and a Bachelor of Urban Planning in 1978 from the University of Cincinnati. He also has taken additional course work in remote sensing and geographic information systems. Stitt is a member of the American Planning Association and American Institute of Certified Planners.

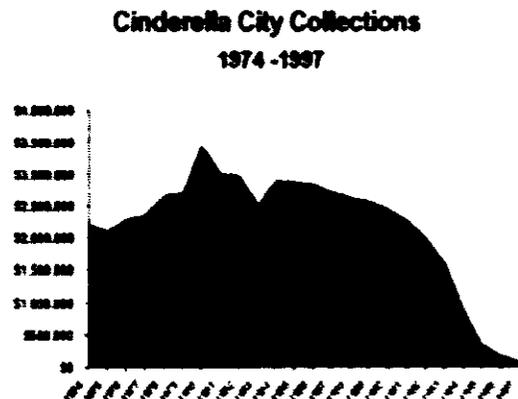
CITYCENTER ENGLEWOOD Englewood, Colorado



Overview

CityCenter Englewood is among the first projects nationally to replace an enclosed, regional shopping mall with an open air, mixed use city core, or CityCenter, into the existing traditional community fabric. This 55-acre public-private project focuses development on a central public place and connects the site with walkable streets, civic and cultural uses, light rail transit station, retail and office space, apartments, a public library, outdoor performance space, and outdoor sculpture.

The former mall opened in 1968 and by 1974, accounted for 52 percent of Englewood's sales tax revenue. As suburban competition increased, retail trends shifted, and decline set in. By 1994, the mall accounted for 2.6 percent of Englewood's tax revenues before closing for good. This decline prompted the City to investigate future needs and use of the site through community planning sessions. These meetings were integral to the creation of a master plan that fulfills most community program requirements. In 1997, the City decided to examine the concepts of New Urbanism and transit-oriented



CITYCENTER ENGLEWOOD Englewood, Colorado

development. The City collaborated with a private, non-profit group of local developers, landscape architects, bankers, real estate executives, planners, and attorneys who came together to help the public consider the benefits of transit-oriented development.

Development program

CityCenter includes more than 800,000 square feet of development, with 440 residential units, 330,000 square feet of retail space, 300,000 square feet of offices, inter-modal transit station, and 50,000 square feet of restaurant space. The development recycles a former department store building into a new Civic Center that includes city offices, library, municipal courts, and a cultural arts center

The development is centered on a two-acre public piazza. At one end of the piazza is a light-rail station that opened in July 2000. A 110-foot steel truss bridge creates a ceremonial gateway into CityCenter from the light rail station and will span an eight-bay bus transfer station and carry 8,000 people daily between the light rail station and the central piazza and main street. At the base of the bridge, a double stairway flanks an outdoor amphitheater, providing performance space for music, films, dance, and community activities. Englewood Parkway, CityCenter's new "main street," terminates at the central piazza, directly on axis with the piazza fountain and Civic Center entrance.

Development Objectives

1) Revitalize the inner suburbs - Inner suburbs now face the critical issues cities began to experience forty years ago: traffic congestion, decline of public schools, and competition for jobs, residents, and tax dollars. This issue is especially acute in Colorado, where municipalities rely on sales tax for their tax base, and there is intense intra-regional competition for retail dollars.

Key concepts: CityCenter builds upon the region's investment in light rail to attract new stores, services, and residents into an inner suburb. The carefully calibrated mixture of uses includes transit, the library, and cultural facilities. These should prove impervious to whims in the retail market that can quickly make redevelopment projects obsolete.



These uses support each other in the manner of traditional downtowns. Patrons of cultural events will help support retail and restaurants. Visitors who come to use city services can take care of convenience shopping. All uses share parking to reduce the overall need for paving and expensive structured parking.

CITYCENTER ENGLEWOOD

Englewood, Colorado

2) Replace mall footprint with a network of urban streets, parks, and pathways.

Key concept: The City overcame the amorphous nature of the 55-acre mall site by using Englewood's existing street grid as the framework for the new plan. This strategy integrates CityCenter into the surrounding urban structure instead of isolating it as a separate development. The use of a traditional street grid also allows for greater pedestrian comfort allowing nearby residents to walk easily to the library, city services, shopping, and cultural/entertainment events.

3) Integrate new development with light rail station and bus transfer lot

Key concept: A new light rail bridge will "fly" over eight bus bays and lead to civic space, performance areas, and a Museum of Outdoor Art. The bridge will create a landmark visible from the train, the Civic Center, and adjacent streets. The bus bays are immediately adjacent to the piazza and the light rail station.

4) Provide adequate parking for transit users, shopping, and civic uses

Key concept: By planning for "shared parking," the City reduced the amount of parking that would normally be required for a project of this scope by nearly 500 spaces. For example, transit riders, city workers, and retail and restaurant patrons will share an 800-space structure adjacent to the light-rail tracks. The plan also provides secure bicycle parking to encourage alternatives to driving.

5) Integrate big-box retail

Key concept: The City worked with staff architects of a national big-box retailer to create a storefront that integrates architecturally with the rest of the site. The team additionally convinced the retailer to modify its standard parking format by allowing a street to bisect one large lot and by adding tree-lined pedestrian walkways. This strategy divides a potentially large expanse of asphalt into several smaller parking fields lined with greenery.



6) Connect CityCenter to the regional system of parks and greenways

Key concept: With 300 days of sunshine a year, the Denver climate is conducive to bicycle commuting. City Center includes an off-road, 10-foot-wide bike path that will connect to the extensive South Platte River Greenway trail system.

CITYCENTER ENGLEWOOD Englewood, Colorado

7) Include housing



Key concept: A residential component was seen as key to creating a CityCenter that would function as a true urban center. The majority of the housing will consist of rental units, with continuing discussions of building some for-sale townhouses or condominiums.

Conclusion

CityCenter is the first project in Colorado and among a handful nationally to replace a suburban shopping mall with a living, breathing, mixed-use downtown. It provides a model for intelligent regional design that directs development into established cities served by transit.

The project's urban design coordinates the complex needs of a city government, regional transportation system, national retailers and homebuilders, and nonprofit cultural organizations, while transforming a single-use development served only by automobiles into a complex setting accessible by train, bus, car, bike, or foot.

CityCenter will revitalize the community spirit as well as the tax base of Englewood and a model for healthy suburban redevelopment. It resolves key issues with practical solutions that can be replicated elsewhere. The ultimate success of CityCenter will point toward a healthier and more urbane future for older suburbs in Colorado and elsewhere.

ANNEX B.

Policy Exchange Trip Reports



CITY OF ENGLEWOOD
COMMUNITY DEVELOPMENT

TO: Suzanne Young, Chief of Party, GEP-CCS
FROM: Harold J. Stitt, AICP
DATE: September 2, 2003
SUBJECT: India Visit - Comments and Observations

First, let me express my gratitude for the opportunity to work with the Louis Berger Group and USAID on the Greenhouse Gas Pollution Prevention Project – Climate Change Supplement. Experiencing a different culture has given me a much broader perspective on urban and transportation planning and the value and need for such collaborative efforts. I am especially indebted to Erik, Howard, and Suzanne for all of their help and guidance before, during and after the visit.

The following are my comments and observations concerning the visit. First, I am impressed that amidst all of the issues facing Hyderabad and India in general, there is significant progress towards sustainable development, improvements in transportation, the environment, and the quality of life. Still much work remains and the tasks are daunting especially given limited resources and the exploding population.

I will direct my observations and comments to the situation in general and not to any one group. For me, two themes stood out. The first was the technical aspect of the project, that is, the transport planning/management interventions and the technology interventions recommended for Hyderabad. The second theme was the sociological aspect of the project, that is, the interactions and coordination among the various local, regional and state governmental agencies responsible for land planning, transportation, and pollution control.

As presented in Sustainable Transportation Guidelines, there is no shortage of tools to assist Hyderabad in dealing with the various impacts of mass transportation in a dense urban area. The suggested interventions have a successful track record in many locations around the world. The difficult part for Hyderabad is applying and integrating these interventions into a political and cultural environment that does not appear to be well coordinated. While a regional governance framework is in place in Hyderabad, my impression is that there is not a high degree of coordination between such entities as the MCH, the Regional Transport Commission, HUDA, and the Air Pollution Control Authority.

I believe it was beneficial for the roundtable participants to see how the Portland example of regional governance works. This advanced level of regional governance is probably not achievable in Hyderabad, at least in the near term. The more traditional regional agency or

metropolitan planning organization (MPO) like the Denver Regional Council of Governments (DRCOG) may be a better fit. However, adding yet another level of government to Hyderabad is also problematic. Perhaps expanding the role of HUDA, with the Chief Minister's blessing, is the appropriate route. I realize that this may be outside the scope of the Berger project, but identifying and addressing these institutional barriers is necessary for the ultimate success of the project.

Both the Administrative Staff College of India and the Centre for Good Governance are important players that could assist in the area of cooperation and collaboration. Specifically, Dr. Mohanty's influence with the Chief Minister could provide the needed political clout to move the coordination issues forward. In addition, Berger's considerable influence and reputation in this area should not be underestimated.

I also believe that Hyderabad can replicate the Englewood transit station area development program. Currently, their focus is on initiating service on the new system, but station area development planning should begin soon. To the extent that the Hyderabad or other public entities control the land adjacent to the stations, development can advanced rapidly. My impression was that HUDA might be in a better position to implement this type of development more so than Hyderabad. Again, a collaborative approach is the key to take full advantage of the development opportunities that transit stations present.

Again, my overall impression is that the Climate Change Supplement project will yield significant benefits to Hyderabad and will gradually improve the quality of life through a cleaner environment and better transportation options. Of course, this does not come without risks as well as a large price tag. I am optimistic that the Hyderabad region and the State of Andhra Pradesh will sort through all of the technical, political and cultural issues, especially with Berger's involvement. I look forward to continuing this relationship with Berger and Hyderabad.

GREEN HOUSE GAS POLLUTION PROJECT
CLIMATE CHANGE SUPPLEMENT
Report of Visit between 1 August and 10 August, 2003

Introduction

This is a report of a visit to India by David H. Jarrett during the month of August, 2003. The visit was made at the invitation of Ms. Suzanne Young, Chief of Party, GEP-CCS.

Purpose of Visit

The primary purposes were:-

- a) To continue providing advice on Transportation Interventions in order to reduce or remove green house gas emissions from vehicle exhausts;
- b) To attend and contribute positively to a series of meetings with actors in both Hyderabad and Delhi, and
- c) To make a presentation to various meetings regarding the Policy Paper and the Hyderabad Demonstration Project.

Meetings Held

Commencing on Sunday 3rd August, the following meetings were attended:-

1. Briefing meeting at Imperial Hotel Delhi (03/08/2003) attended by Suzanne Young, Chief of Party ("COP"), Andrew Cotugno, Portland, Oregon ("AC") and Harold Stitt, Englewood, Colorado ("HS"). Main purpose was to coordinate content of presentations.
2. Centre for Good Governance (04/08/2003) initiated by PK Mohanty, Executive Director ("PKM"). Main purpose was to acquaint the team about the work of the centre in preparation for subsequent meetings.
3. Regional Transport Authority (04/08/2003) to meet AK Giridhar, the Transport Commissioner ("AKG"). Main reason was to introduce the speakers and to obtain information about RTA's responsibilities.
4. Pollution Control Board (04/08/2003) to meet Dr KV Ramani, Chief Environmental Scientist (KVR). Main purpose was to revisit and to obtain her main concerns about the coming seminars.
5. Municipal Corporation of Hyderabad (05/08/2003) to meet Chitra Ramachandran, Commissioner and Rehnadir Reddy, Transportation Additional Commissioner ("RR"). Meeting was a courtesy call on the Commissioner and a discussion with RR for future seminar coordination lead by

- presentations from Portland and Englewood.
6. Hyderabad Urban Development Authority (05/08/2003) to present the approaches in both Portland and Englewood and receive comments for future work at the seminar.
 7. Centre for Good Governance (06/08/2003) in order to make presentations from both Portland and Englewood primarily to the staff of the Centre but also others invited by PKM notably RR.
 8. Administrative Staff College of India (06/08/2003), to meet Dr Sarma, Principal primarily to prepare for the following days seminar at ASCI.
 9. Chief Minister Andra Pradesh, HE Chandrababu Naidu, a courtesy call initiated by PKM.
 10. Round Table Hyderabad (07/08/2003), the primary reason for the visit and a day long discussion.
 11. Delhi Municipal Corporation (08/08/2003) for presentations of Portland and Englewood and further discussions about future role of GHG etc.
 12. Debriefing in LBG Office (08/08/2003).
 13. Debriefing at Imperial Hotel (09/08/2003).

Main Points of Interest

The following points are of interest to record:

- A. The two presentations from Portland and Englewood were well received and various individuals were interested in how planning laws differed between India and USA. It seemed clear that the Indian seminar delegates and those met extraneously were sceptical about the ability to control development the way it had been achieved especially in Portland.

Opinion: It seemed to me rather that the persons were concerned about implementation rather than whether the laws were in place to allow land use control to be achieved. The laws do exist; they just seem unable or unwilling to implement them and enforce them. The situation was further complicated by the fact that Delhi was about to change its Land Use Planning approach to encourage mixed development. However it was pointed out that if this was a result of accepting the inevitable, then the planning process had broken down and needed reviewing.

- B. Further on planning control and basic approaches, PKM was keen to ensure that

there were a number of preliminary decisions made prior to the main Master Plan being drawn. What he was talking about really was **Sieve Mapping** and one of the presenters (AC) was able to include a more specific reference to sieve mapping into his subsequent presentation at the Seminar.

Opinion: This is an important aspect of the Master Planning process. However, I am sure that RR is aware of this technique and also HUDA. If not it would be of value to introduce it into a short memo or bring it up next time there is a meeting at MCH.

- C. PKM also asked questions about how it was possible to move towards an acceptable **Master Plan**. It seems that he is not happy with the current HUDA plan and would like advice on how they could improve it. The Portland and Englewood delegates tried to explain their procedures but it seemed not to satisfy PKM.

Opinion: This is part of a much wider challenge and is covered in X below.

- D. We learned that moves had been made recently to **cap the level** of 3WV registrations by using age as a yardstick to remove them from the roads. In addition, new registrations are restricted to those vehicles which have clean burning engines. This is clearly a move towards reducing the congestion and the pollution caused from them. In parallel, the RTA is encouraging the use of LPG but is concerned that the expansion will not really be significant until the actual numbers of retail outlets of the fuel are increased.

Opinion: I spoke causally with, USAID/India Mission and with RR and suggested that a better way to reduce pollution and congestion would be to sift out the poor quality vehicles not those of a certain age. Whilst I am in full agreement about the need to reduce the numbers, the condition of the vehicles is more important than their age.

- E. Although all candidates agreed that an **awareness program** was essential, very little action was being undertaken in this field. The possible exceptions were the Police (a safety awareness was noted) and PCB (a survey had been undertaken to increase awareness with young people).

Opinion: The idea of public consultation is well known and accepted in principal. However, most senior persons were afraid to 'waken sleeping dogs' and tried to have schemes implemented without public acceptance or consultation. This, of course is contrary to the normally practised planning process and needs to be reviewed.

- F. The HUDA people were very gracious and it seems that they have some difficulty in having authorities accept their Master Plan. They described the process and there was a missing link with public discussion and acceptance.

Opinion: It seemed to me that they were rather despairing at the meeting and seemed frustrated not to be in control of their plan. They were receiving criticisms from all quarters. I suggested that this was normal since they had produce a "DRAFT" plan for consultation. Comments were a normal procedure and they would then need to revise it to take account of positive feed back. This did not seem to cheer them up. They seemed afraid to grasp the nettle firmly, although I believe that they are quite capable personnel.

- G. The message about the use of Public Transport rather than Private Transport has got across. Many agencies and individuals were happy to preach this gospel. The demonstration project had been successful in this respect in that it had raised the awareness of the potential for this mode shift intervention. The first phase of a 'metro' system is soon to be opened and there are plans for an extension of the network. Meanwhile buses are carrying the burden along with 3WV.

Opinion: It seems that this is one area where further work is urgently needed. There is need to complete a study of how the various sub-modes can be integrated so as to create a uniform system which uses the best sub-mode for the best role. This aspect went over well at the Seminar.

- H. Possibly the most important aspect which derived from the Seminar was due to the lead in the discussion in the afternoon. LBG took the lead and introduced the idea of an "Umbrella Organisation" to control development in greater Hyderabad. This was chosen due to the frequent references in discussions to the fact that nobody was coordinating the planning process. The point proved to be one, which was on many people's mind. Discussion was animated and wide-reaching. It was also most useful and ASCI agreed to pursue the ideas further.

Opinion: This is a major reason why the planning the area is not developing as quickly and as efficiently as it should. There are too many organisations who have some powers to plan and to implement. There needs to be either a) a new organisation with overall powers to plan and direct implementation or b) an identification of an existing organisation with increased powers. Obviously this is a difficult thing to achieve politically but without it I do not see efficient development being achieved.

- I. The presentation to Delhi opened up a most useful option namely the parking issue. The commissioner (Mehta) is concerned about an apparent dichotomy in which he is worried about the lack of parking provision and at the same time the apparent profusion of uncontrolled parking, which exists.

Opinion: Parking is the most significant way to control traffic demand and the flow of traffic into the city centres. This can be done either by pricing means or by physical control on the numbers and locations of the spaces provided. Delhi has an extremely challenging position with regard to parking and a study of this aspect alone would have dramatic results in terms of traffic flows on the radials and on localised circulation. Mehta was interested in providing large multi-storey car parks to be provided by the private sector and self-financed. I can't see this working and suggested multi-use buildings in which rental or sales revenue could cross-finance the parking. However, the needs go deeper than this one-off concept. The city needs a comprehensive investigation into the parking approach and we could possibly suggest a way to move this forward¹.

David H. Jarrett

Report Dated: 3rd September, 2003

¹ I have provided a separate memo on the overall content of this approach

ANNEX C.

DELEGATE PRESENTATIONS

ANDREW COTUGNO
METRO PLANNING DIRECTOR,
PORTLAND, OREGON

**“MAKING THE LAND USE, TRANSPORTATION
AIR QUALITY CONNECTION”**



Making the Land Use, Transportation Air Quality Connection

***Andy Cotugno
Metro Planning Director
Portland, Oregon U.S.A.***

Summer 2003



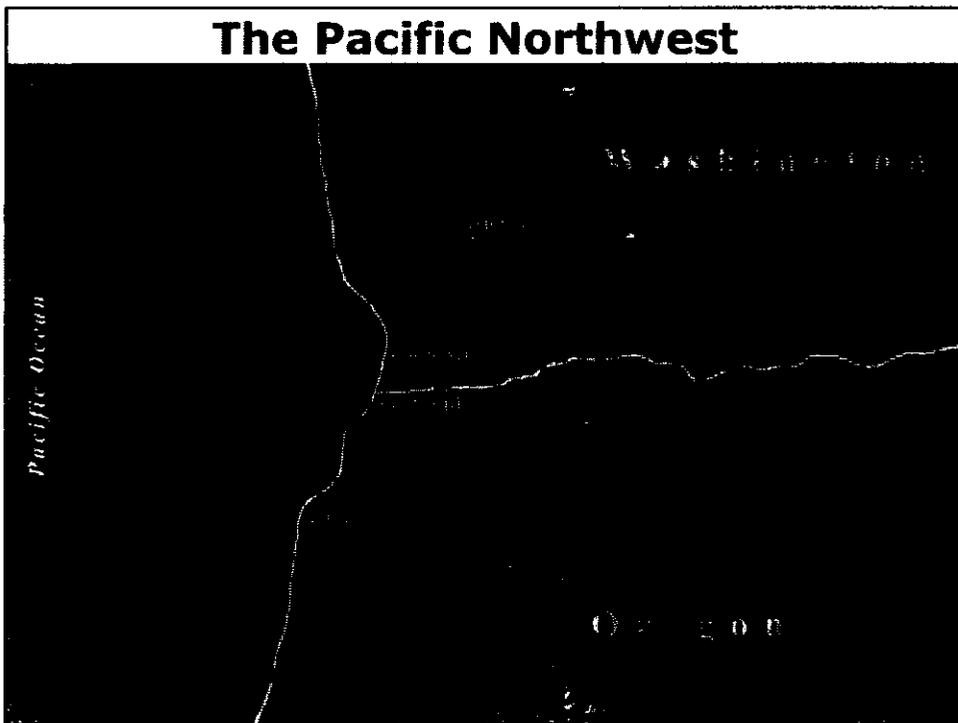
Making the Land Use, Transportation, Air Quality Connection

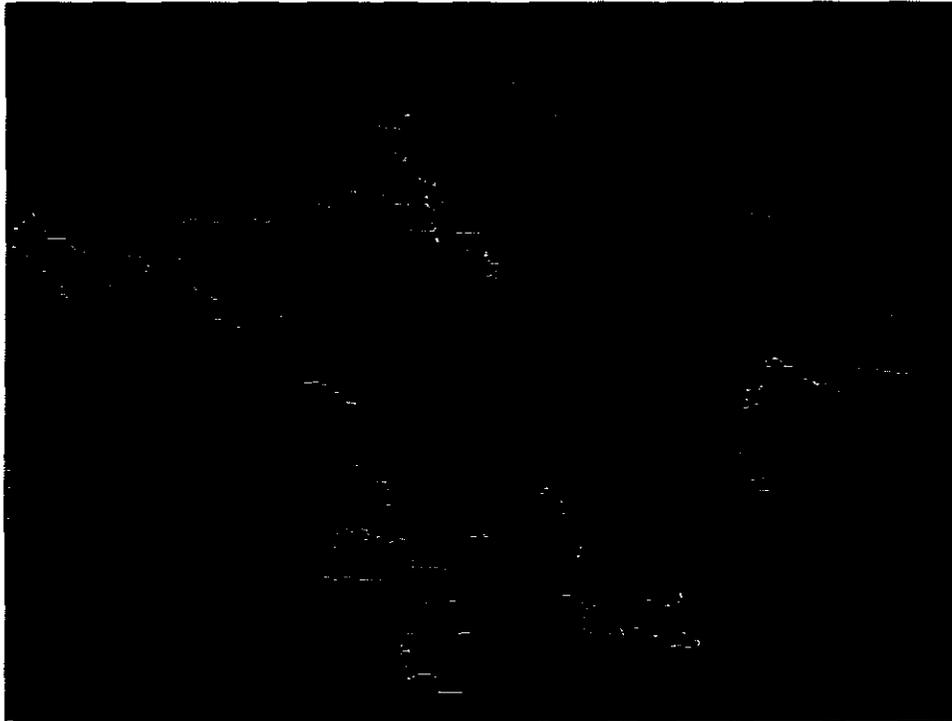
Outline

- ❖ **Where is Portland, Oregon?**
- ❖ **Growth in the region**
- ❖ **Metro history**
- ❖ **Planning history**
- ❖ **2040 Growth Concept framework**
- ❖ **Land use/transportation implementation**
- ❖ **Project implementation**
 - Westside LRT/The Round
 - Eastside LRT/Gresham Civic Station
 - I-5 trade corridor/Bi-State Compact



Portland, Oregon





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Air Quality Connection***

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Growth in the Region

Population Base

- ❖ **1.7 million people**
(includes Clark County, Washington)
 - 1.2 million people in Metro boundary (37% of the state)
 - 512,400 people in the City of Portland
 - 23 smaller cities (615 to 85,000 people each)

Major Economic Trends

- ❖ **Growing industries**
 - Hi-tech
 - Metals
 - Transport equipment
 - Printing
 - Retail & Service sector
- ❖ **Declining industries**
 - Lumber/wood
 - Paper
 - Food processing

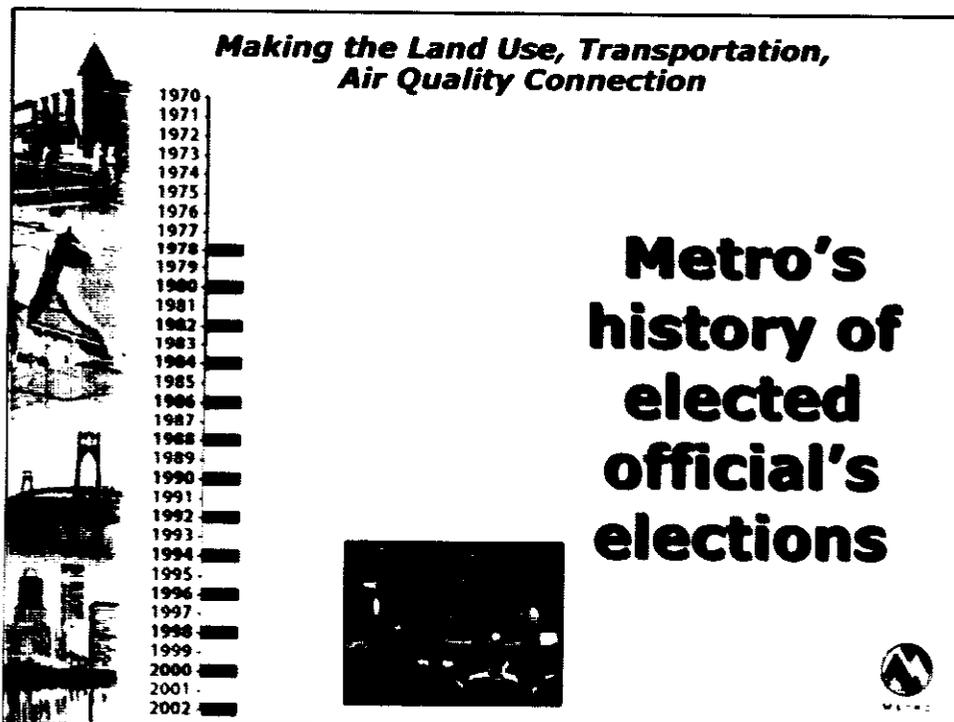
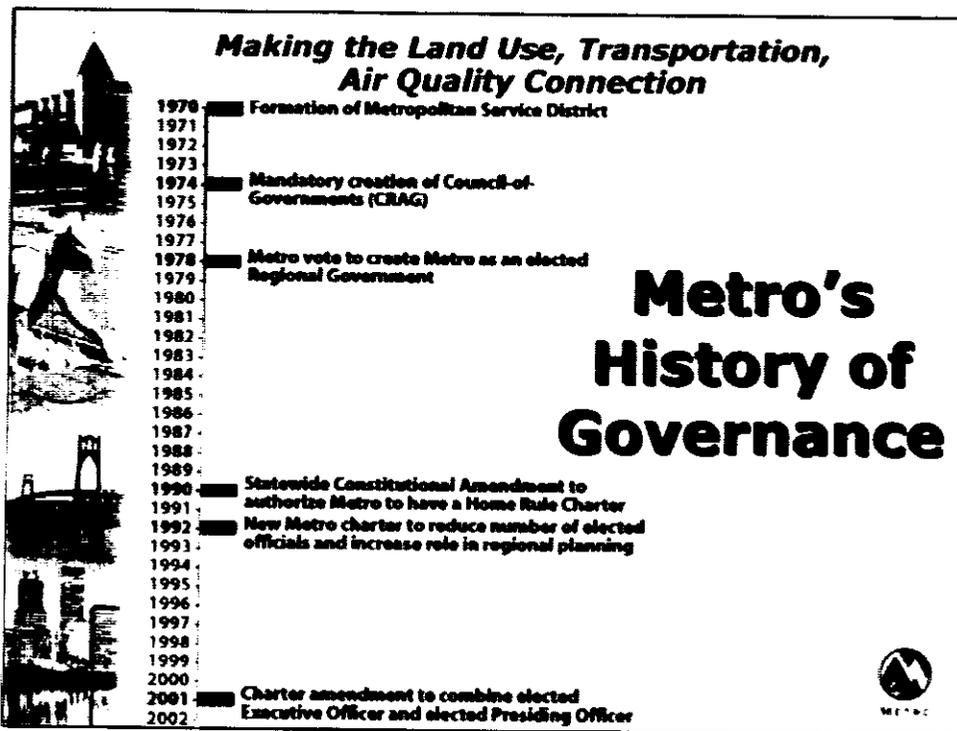




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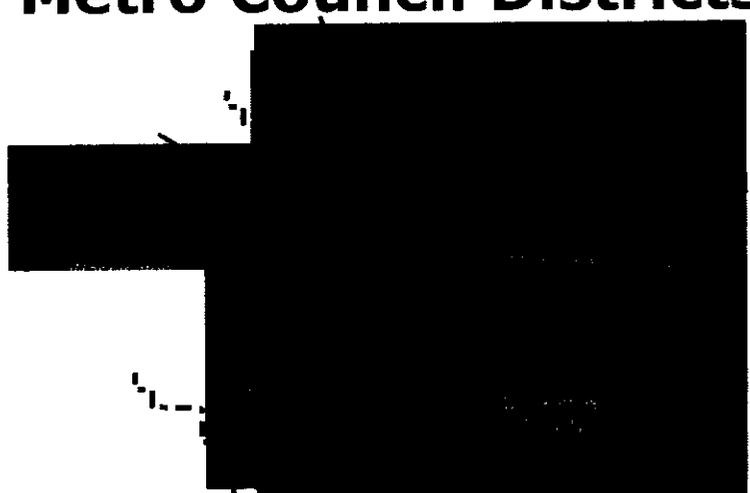
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Metro Council Districts





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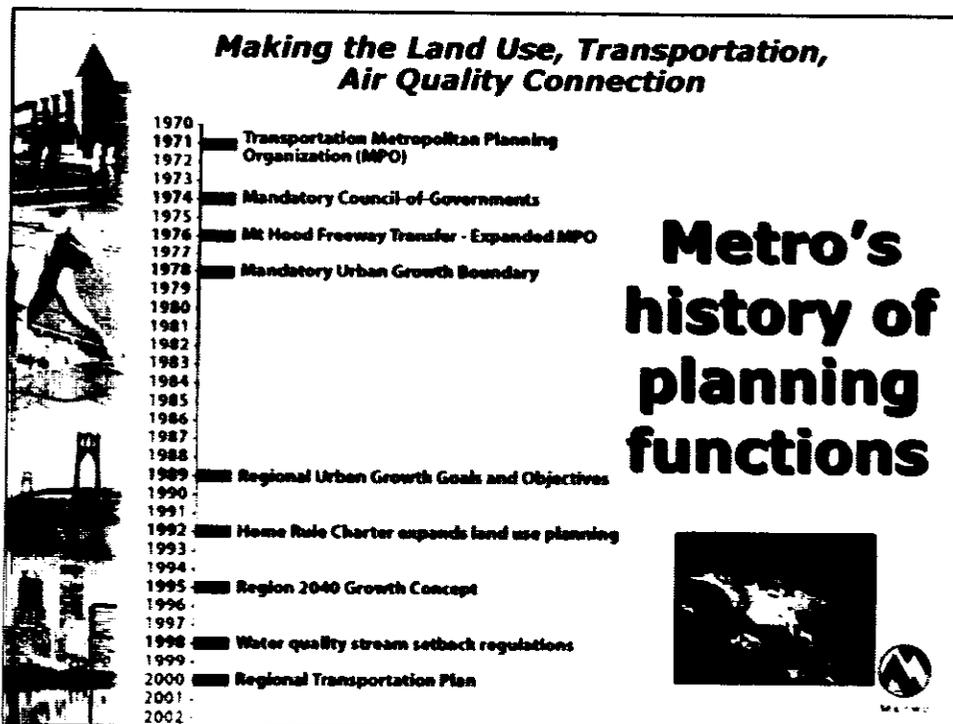
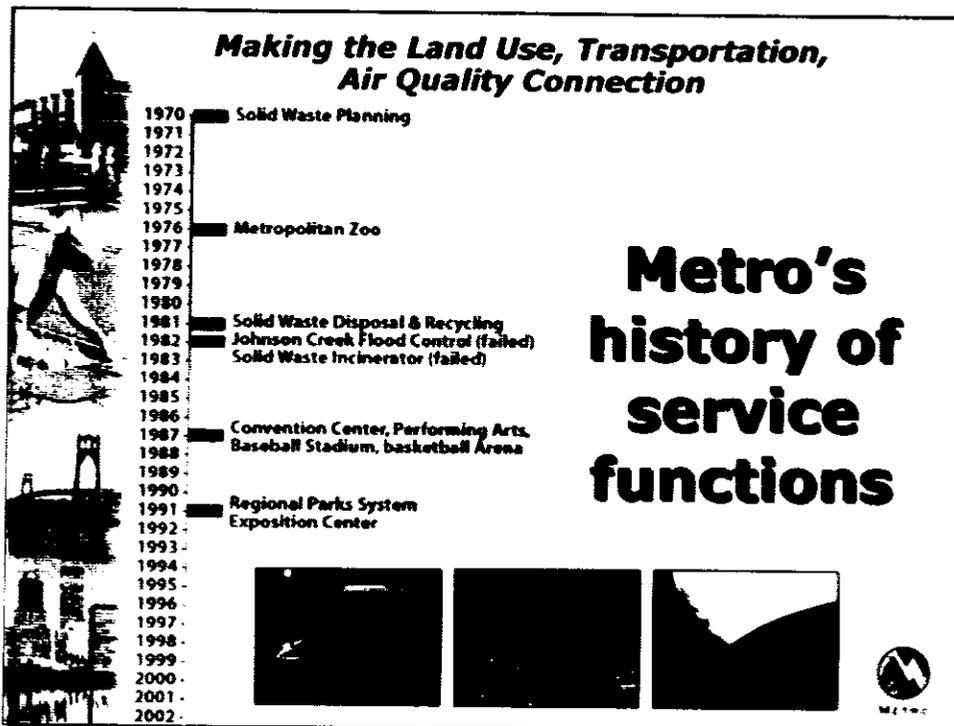
Metro's history of tax measures







| Year | Measure | Status |
|------|---------------------------------------------------|----------|
| 1970 | Tax Base | (failed) |
| 1971 | | |
| 1972 | | |
| 1973 | | |
| 1974 | | |
| 1975 | | |
| 1976 | Zoo Operating Levy | (passed) |
| 1977 | | |
| 1978 | | |
| 1979 | | |
| 1980 | Zoo Operating Special Levy | (passed) |
| 1981 | | |
| 1982 | Zoo Tax Base | (failed) |
| 1983 | | |
| 1984 | | |
| 1985 | Zoo Operating Levy; Zoo Capital Levy | (passed) |
| 1986 | Convention Center General Obligation Bond Measure | (passed) |
| 1987 | | |
| 1988 | | |
| 1989 | | |
| 1990 | Zoo Tax Base | (passed) |
| 1991 | Greenspaces General Obligation Bond Measure | (failed) |
| 1992 | | |
| 1993 | | |
| 1994 | | |
| 1995 | Zoo Capital Levy | (passed) |
| 1996 | Greenspaces General Obligation Bond Measure | (passed) |
| 1997 | | |
| 1998 | Convention Center General Obligation Bond Measure | (failed) |
| 1999 | | |
| 2000 | | |
| 2001 | | |
| 2002 | | |





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Federal Context

- ❖ MPO approval of federal transportation funds
- ❖ 20-year plan, policies, needs
- ❖ National Environmental Policy Act
- ❖ Local coordination and public outreach
- ❖ Multi-modal/inter-modal plans and congestion management
- ❖ Air quality conformity of financially constrained system



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State Context

- ❖ State land use planning goals
- ❖ Public outreach
- ❖ Hierarchy of plans: state, regional, local
- ❖ Strategies to reduce reliance on the automobile
- ❖ Land use alternatives
- ❖ Linking land use and transportation

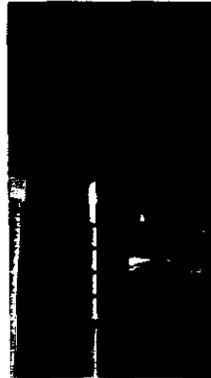




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Metro Context

- ❖ Elected regional government
- ❖ Manages growth, transportation, regional parks and solid waste
- ❖ Operates zoo, convention center, performing arts centers and Expo center
- ❖ Serves as MPO for Portland region
- ❖ Allocates federal transportation funds to 24 cities and 3 counties

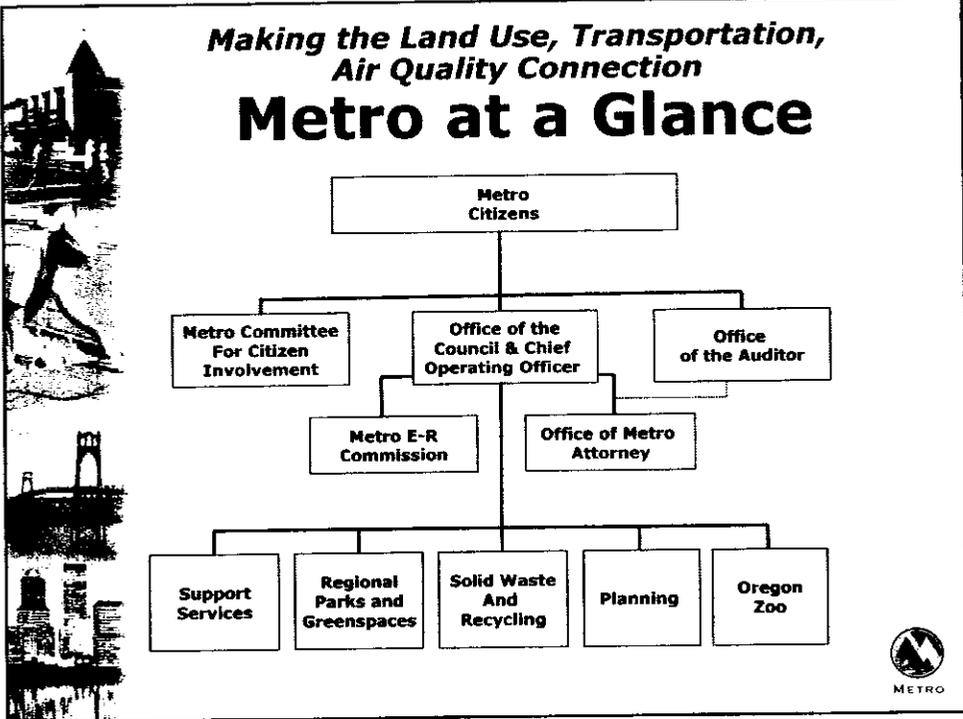


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Roles in the Region

- ❖ State land use goals establish framework for planning in Oregon
 - Oregon Department of Transportation (state highways)
 - Oregon Department of Land Conservation and Development (state land use goals and transportation planning rule)
- ❖ Regional plans guide land use and transportation planning
 - Metro Charter, 2040 Growth Concept and functional plans
 - TriMet (Transit)
 - Port of Portland (Marine and air terminals)
- ❖ Local plans control development permits and project implementation
 - 24 cities
 - 3 counties



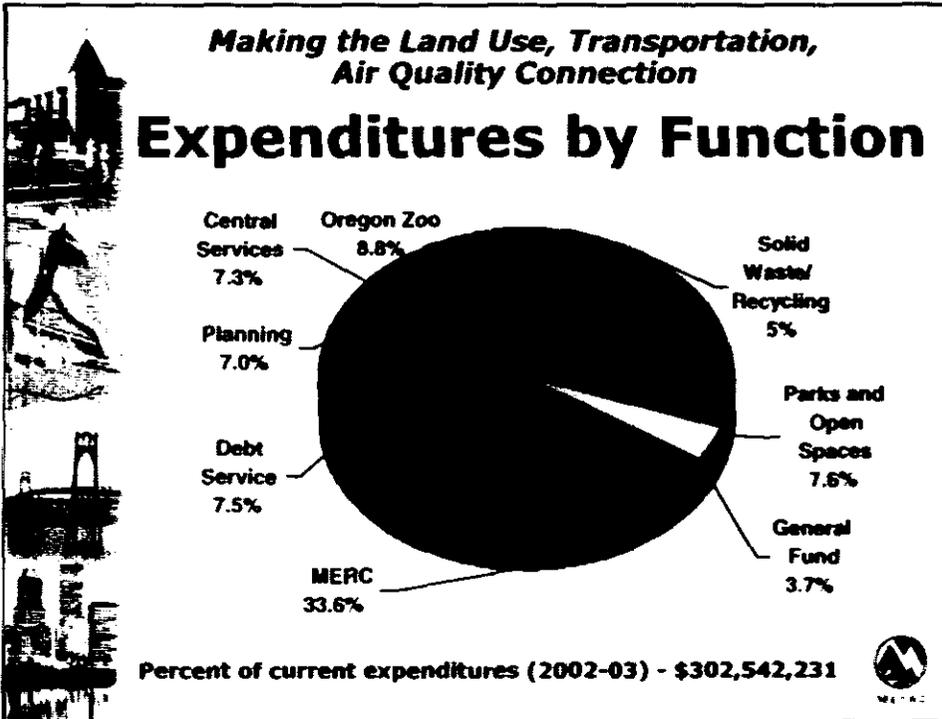


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Metro Budget Facts 2002-03

- ❖ **Total budget - \$364 million**
- 28.1 percent (\$85 million) of authorized spending is allocated to capital projects/needs
- ❖ **731 Full-time equivalent (FTE) staff**
- ❖ **7 departments, 1 commission, 5 offices**



- Making the Land Use, Transportation, Air Quality Connection**
- ❖ **Where is Portland, Oregon?**
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- 



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Industry Rises

- ❖ The Industrial Revolution in the mid-1800s gives rise to shoddy tenement housing in crowded cities
- ❖ Urban environment becomes increasingly polluted and dangerous






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Euclid Decision

- ❖ U.S. Supreme Court makes landmark decision in *Village of Euclid v. Ambler Realty*, setting the stage for modern zoning of private land
- ❖ Cities across the country rush to adopt zoning -- largely in absence of any guiding plan, and primarily to protect property values






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Post-War Highways

- ❖ The National Defense Highway System is launched after World War II, and transforms the landscape
- ❖ Farm towns across the country suddenly become bedroom communities when new highways link them to nearby cities

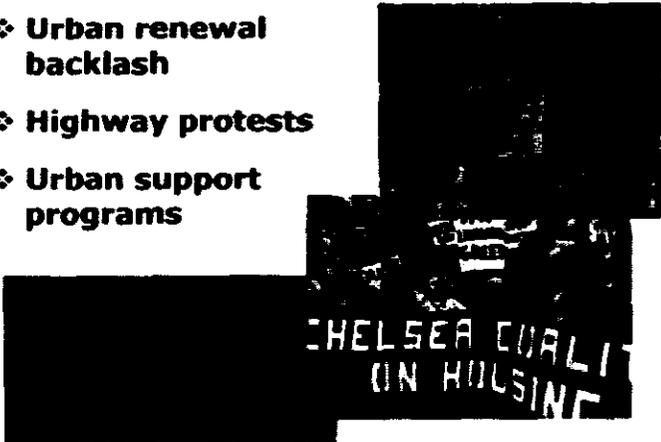




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70s Quiet Revolution

- ❖ National environmental policy
- ❖ Urban renewal backlash
- ❖ Highway protests
- ❖ Urban support programs






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The Oregon Story

"There is a shameless threat to our environment and to the whole quality of life: unfettered despoiling of the land. Sagebrush subdivisions, coastal 'condomania'..."



Governor Tom McCall




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The Oregon Story

"...and the ravenous rampage of suburbia in the Willamette Valley all threaten to mock Oregon's status as the environmental model for the nation."



Tom McCall's address to the Legislature, January 8, 1973

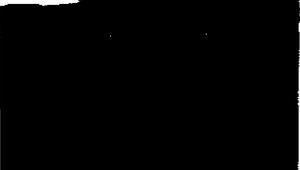




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Senate Bill 100

- ❖ Legislature adopts pioneering 1973 statewide planning program to limit sprawl and protect forest and farms
- ❖ Legislation requires local plans to meet statewide goals; creates LCDC
- ❖ Urbanization now focused inside urban growth boundaries

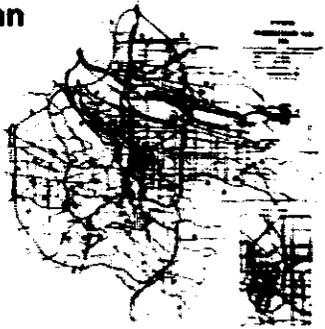





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Portland's Backlash

- ❖ In Portland, a backlash forms against a plan for massive freeway building that is already destroying urban neighborhoods




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Downtown in Decline

- ❖ Freeways focusing growth in suburbs
- ❖ Downtown buildings razed to construct more parking lots
- ❖ Urban renewal replaces vibrant neighborhoods with sterile high-rise apartments





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1972 Downtown Plan

Mayor Neil Goldschmidt leads reform movement, and development of Portland's innovative downtown plan:

- ❖ emphasis on transit-oriented development
- ❖ 24-hour downtown with more housing and ground-floor retail




Mayor Neil Goldschmidt





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Lid on Parking

- ❖ Parking lid in Downtown Plan slowed the loss of historic buildings to surface parking lots
- ❖ In 1977, the new transit mall became the new focus of downtown redevelopment, making transit a viable option to driving



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Highway Revolt

- ❖ Harbor Freeway removed in 1976 to make way for Tom McCall Waterfront Park
- ❖ Mount Hood Freeway withdrawn in favor of light rail transit along the Banfield
- ❖ Shift freeway money to multi-modal projects

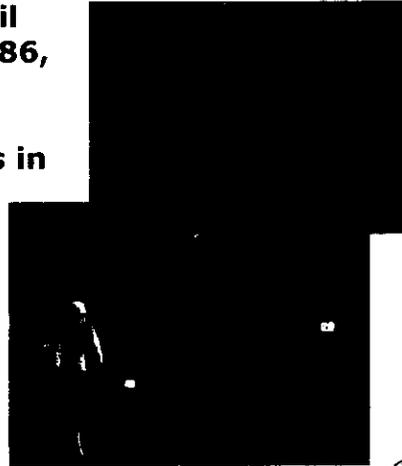




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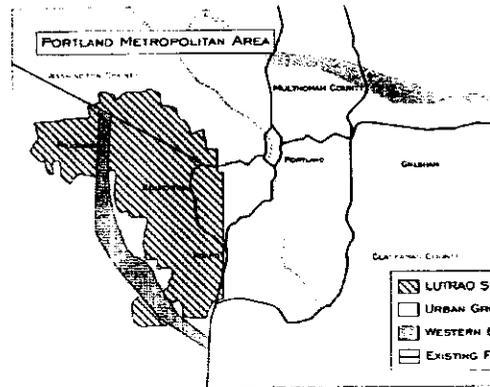
Light Rail Opens

- ❖ Banfield light rail opens in late 1986, becoming the centerpiece of downtown plans in Portland and Gresham
- ❖ Westside light rail to Hillsboro begins in 1998
- ❖ Airport service begins in 2001



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Opposition Forms



❖ Western bypass freeway plan in rapidly growing Washington County

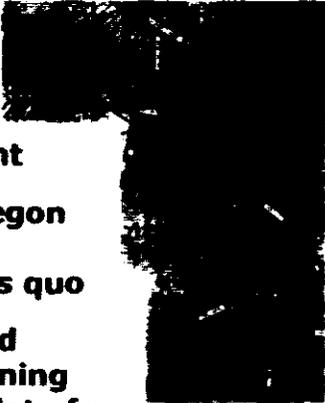




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LUTRAQ

- ❖ **1989 Western Bypass proposal frames a new debate on regional growth management**
- ❖ **1000 Friends of Oregon proposes LUTRAQ alternative to status quo**
- ❖ **Linking land use and transportation planning becomes new mandate for regional plans**





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2040 Plan Begins

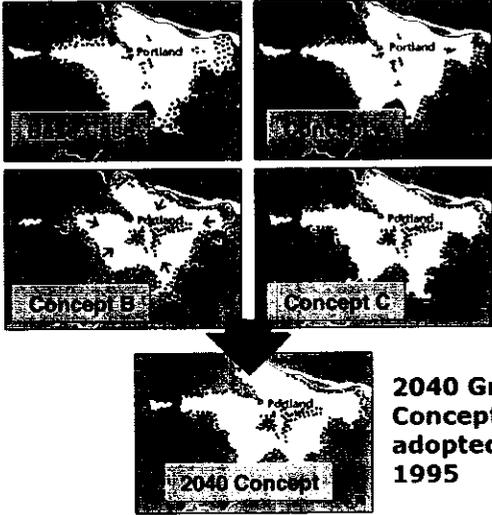
- ❖ First regional growth goals established in 1990
- ❖ Metro Charter expanded by voters in 1992 to focus on managing growth






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2040 Concepts



2040 Growth Concept adopted in 1995





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2040 Growth Concept

- ❖ 50-year vision for managing region's growth
- ❖ Incorporates best parts of "Concepts for Growth options"
- ❖ Kicks off an major effort to enact the new regional vision through local plans





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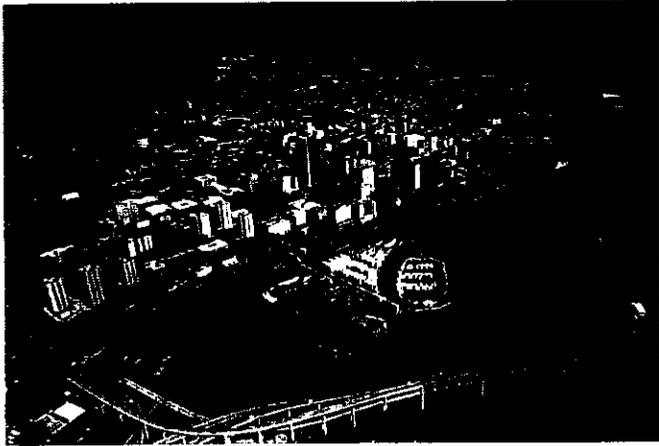
2040 Theme: Growth in Centers

- ❖ Compact urban centers built to human scale
- ❖ Mixed housing and commerce served with good transit
- ❖ Focus of civic activities and public services
- ❖ Parking ratios established




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**2040 Theme:
Central City**



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**2040 Theme:
Protect Industry**

- ❖ **Maintain freight mobility on highways**
- ❖ **Ensure quality freight access to ports and industrial areas from region's highway and rail network**





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2040 Theme: Protect Rural Areas

- ❖ Create Green Corridors along rural state highways
- ❖ Mitigate urban overflow on rural routes
- ❖ Maintain rural separation between Metro region and neighbor cities



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2040 Theme: Nature in the City

- ❖ Network of parks, trails and open spaces
- ❖ Protections for streams and upland natural areas
- ❖ Green Streets - designs that minimize runoff
- ❖ Manage hazardous waste to protect streams and groundwater





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2040 Theme: Travel Options

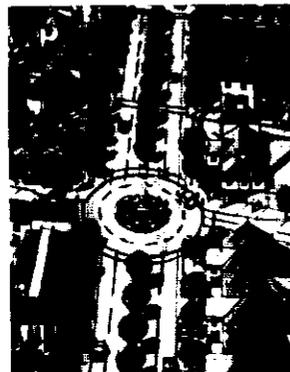
- ❖ All streets retrofitted to include sidewalks and bikeways
- ❖ Better-connected street systems that allow easier walking and access to transit
- ❖ Frequent transit service on all major streets



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2040 Themes: Streets for People

- ❖ Boulevard designs in centers that promote walking, bicycling and transit, while creating civic space and a sense of community
- ❖ Street designs with self-enforcing features that calm traffic to posted speeds





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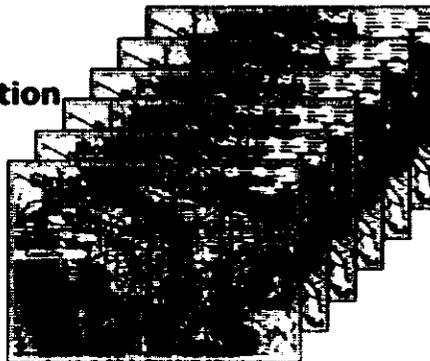
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**2040 Implementation:
Focus on Multi-Modal**

- ❖ **Motor vehicle**
- ❖ **Public transportation**
- ❖ **Freight**
- ❖ **Pedestrian
& bicycle**
- ❖ **Street design**





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2040 Implementation: Street Design Concepts

-  **Throughways** connect centers and provide mobility across the region, and include freeway and highway design types.
-  **Boulevards** are transit, pedestrian, and bicycle-oriented designs that serve centers and main streets.
-  **Streets** balance all modes of travel with general traffic mobility in corridors and neighborhoods.
-  **Roads** are vehicle-oriented with urban roads that serve industrial areas and rural roads that serve urban and rural reserves.




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2040 Implementation: Sizing Major Streets

| | | |
|------------|---------------|-------------|
| Throughway | Up to 6 lanes | 6-10 miles |
| Arterial | Up to 4 lanes | 1 mile |
| Collector | 2-3 lanes | 1/2 mile |
| Local | 1-2 lanes | 330 to 530' |

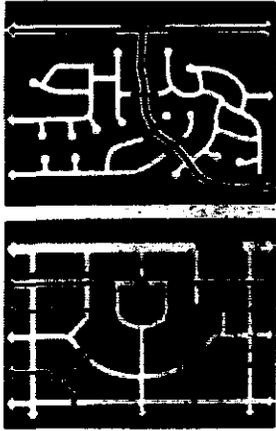





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2040 Implementation: Connectivity

- ❖ Map key connections
- ❖ New streets at 10-16 per mile in residential and mixed-use areas
- ❖ Bike/ped accessways where street connections not provided
- ❖ Maintains function and helps state highways



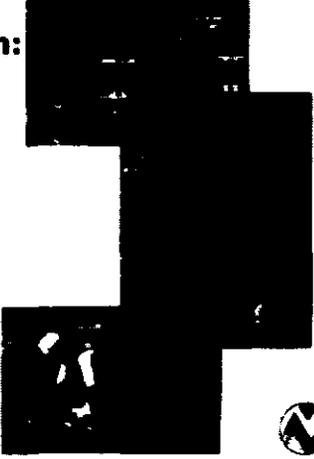


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2040 Implementation: Air Quality

CO/Ozone Maintenance Plan:

- ❖ Increase transit service 1.5% each year
- ❖ Complete LRT in South/North corridor
- ❖ 28 miles of new bike facilities by 2006
- ❖ 9 miles of pedestrian improvements per year



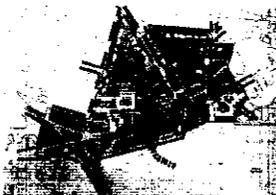



*Making the Land Use, Transportation,
Air Quality Connection*

2040 Implementation: Air Quality

CO/Ozone Maintenance Plan:

- ❖ Local plan adoption of 2040
- ❖ Urban growth boundary
- ❖ Downtown Portland parking plan
- ❖ Regional parking requirements

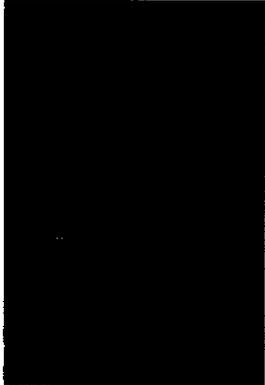





*Making the Land Use, Transportation,
Air Quality Connection*

2040 Implementation: Air Quality Results

- ❖ No violations since 1989
- ❖ Designated attainment in 1997
- ❖ Credit for 5 percent reduction in overall mobile source emissions use controls
 - 2 tons/day less VOCs
 - 3 tons/day less nitrogen oxides
 - 19 tons/day less carbon monoxide






**Making the Land Use, Transportation,
Air Quality Connection**

2040 Implementation: Air Quality Trends

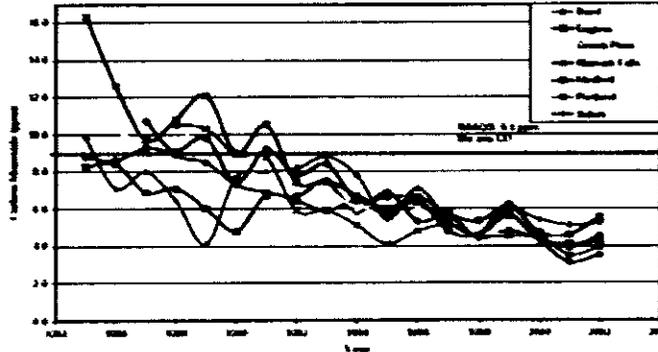
**Oregon Ozone Trend
1991-2002**



**Making the Land Use, Transportation,
Air Quality Connection**

2040 Implementation: Air Quality Trends

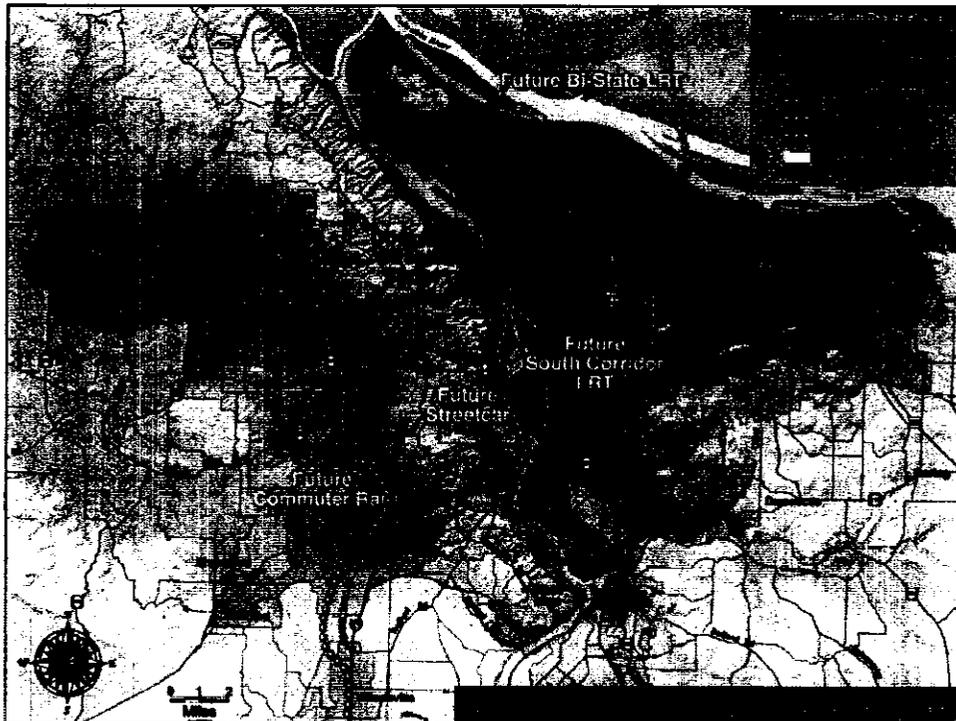
**Oregon Carbon Monoxide Trend
1985-2002**





Making the Land Use, Transportation, Air Quality Connection

- ❖ **Where is Portland, Oregon?**
- ❖ **Growth in the region**
- ❖ **Metro history**
- ❖ **Planning history**
- ❖ **2040 Growth Concept framework**
- ❖ **Land use/transportation implementation**
- ❖ **Project implementation**
 - Westside LRT/The Round
 - Eastside LRT/Gresham Civic Station
 - I-5 trade corridor/Bi-State Compact





**Making the Land Use, Transportation,
Air Quality Connection**

Eastside LRT



- ❖ **Banfield LRT opened in 1986**
 - Ridership more than doubled since opening
 - 48,000 riders on average weekday
- ❖ **Airport LRT extension opened in 2001**




**Making the Land Use, Transportation,
Air Quality Connection**

Gresham Civic Station...



Summer 1998

- ❖ **Metro TOD program purchases 13.6 acres of land**
- ❖ **Public/private partnership to develop land**



Summer 2003



*Making the Land Use, Transportation,
Air Quality Connection*

...Gresham Civic Station...





- ❖ Hill adjacent to MAX station used for dramatic effect and building design draws pedestrians up hill through mixed of transit supportive uses
- ❖ A station building helps create transit presence



*Making the Land Use, Transportation,
Air Quality Connection*

...Gresham Civic Station







*Making the Land Use, Transportation,
Air Quality Connection*

Westside LRT





- ❖ **Completed in 1998**
 - Daily ridership averages more than 29,000 trips, surpassing 2008 projections
 - Transportation capacity equal to 1.2 highway lanes
- ❖ **Portland street car opened in 2001**

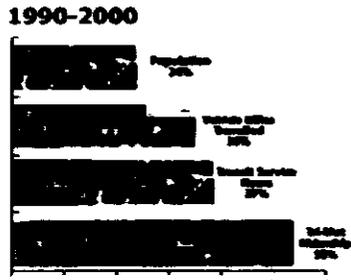


*Making the Land Use, Transportation,
Air Quality Connection*

2040 Implementation: Transit Trends

In 2002:

- ❖ **MAX provides 27% of weekday transit trips**
- ❖ **MAX ridership has increased four-fold in 16-year history**
- ❖ **88.6 million boardings**
 - 63.2 million bus trips
 - 25.4 million MAX trips
 - 287,3000 average daily boardings
- ❖ **25th largest metro with 13th largest annual transit ridership**



Source: TriMet, 2002



*Making the Land Use, Transportation,
Air Quality Connection*

The Round



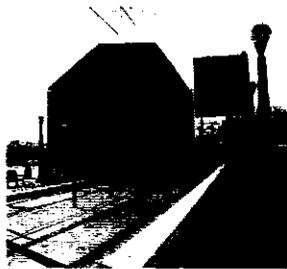
An old sewage treatment plant...

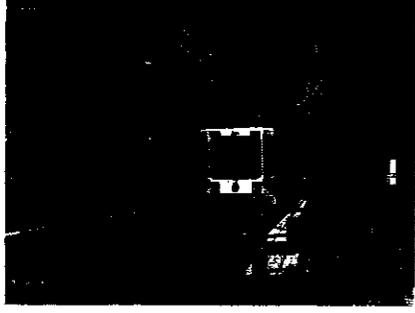



*Making the Land Use, Transportation,
Air Quality Connection*

The Round

...becomes a new downtown







*Making the Land Use, Transportation,
Air Quality Connection*

The Round - Phase 2, 3...



*Making the Land Use, Transportation,
Air Quality Connection*

I-5 Corridor

❖ I-5 splits
North Portland
neighborhoods



*Making the Land Use, Transportation,
Air Quality Connection*

I-5 Interstate Bridge



*Making the Land Use, Transportation,
Air Quality Connection*

Railroad Swing-Span Bridge





**Making the Land Use, Transportation,
Air Quality Connection**



Recommendations

1. **Widen I-5 to a maximum 3-lanes each way**
2. **Increase I-5/Columbia River crossing from 6 to 10-lanes**
3. **Add an LRT loop in the I-5 and I-205 corridors**
4. **Improve railroads for freight and inter-city passenger**
5. **Replace the railroad "swing-span" across the Columbia River**
6. **Implement a Bi-State Land Use Accord**
7. **Fund and implement additional TDM/TSM strategies**
8. **Establish an Environmental Justice "Fund"**



**Learn more about Metro at
www.metro-region.org**

Download this slide show at
<ftp://ftp.metro-region.org/pub/greenhousegasproject.ppt>



Andrew C. Cotugno

Planning Director

Metro

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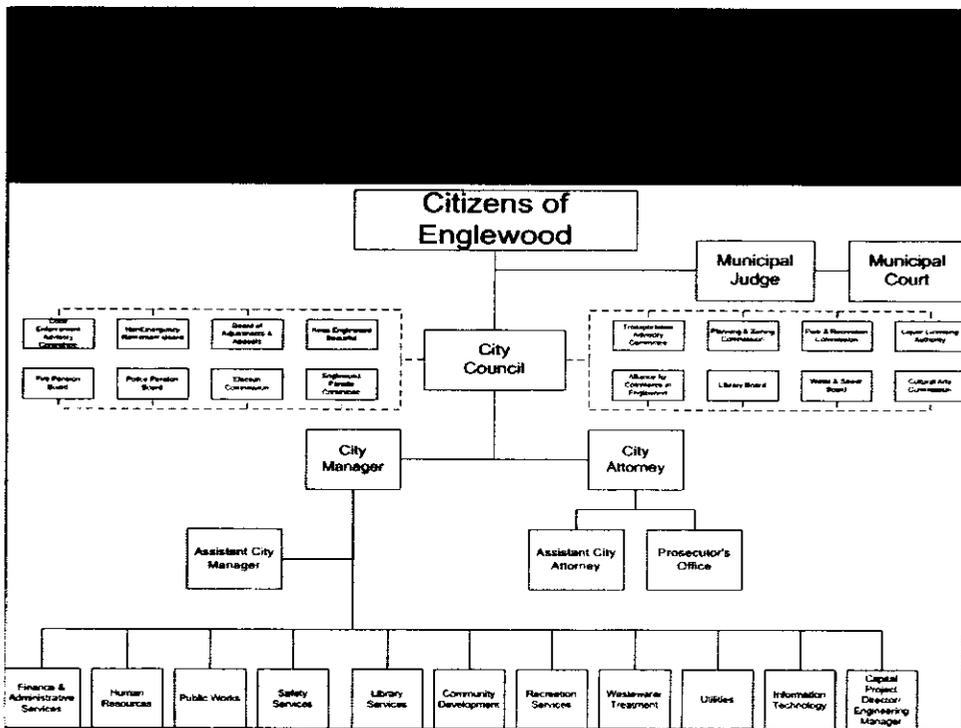
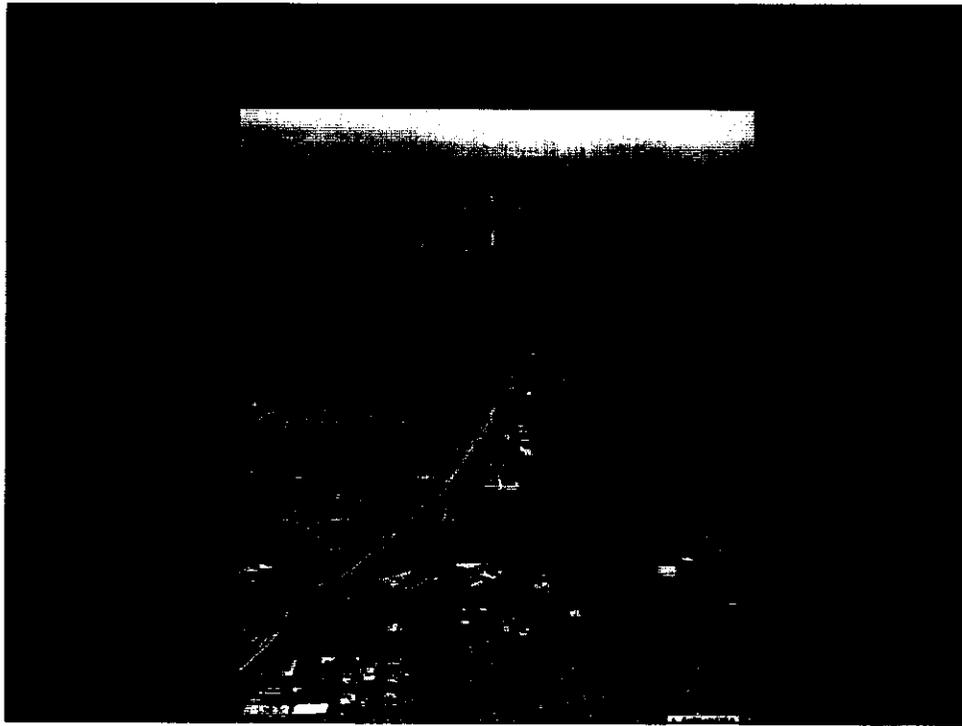


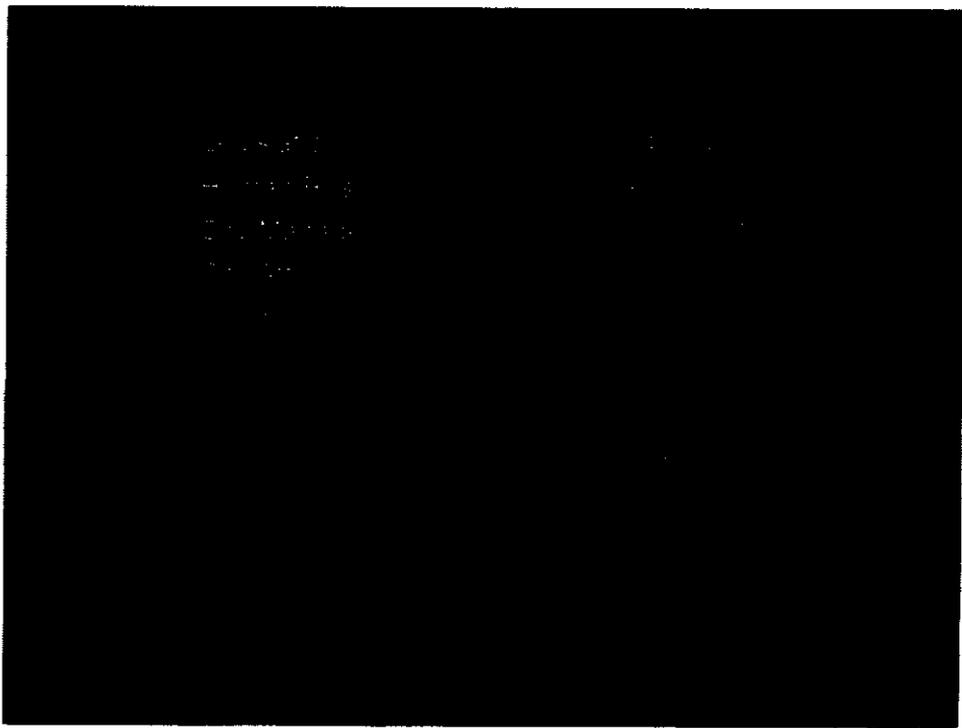
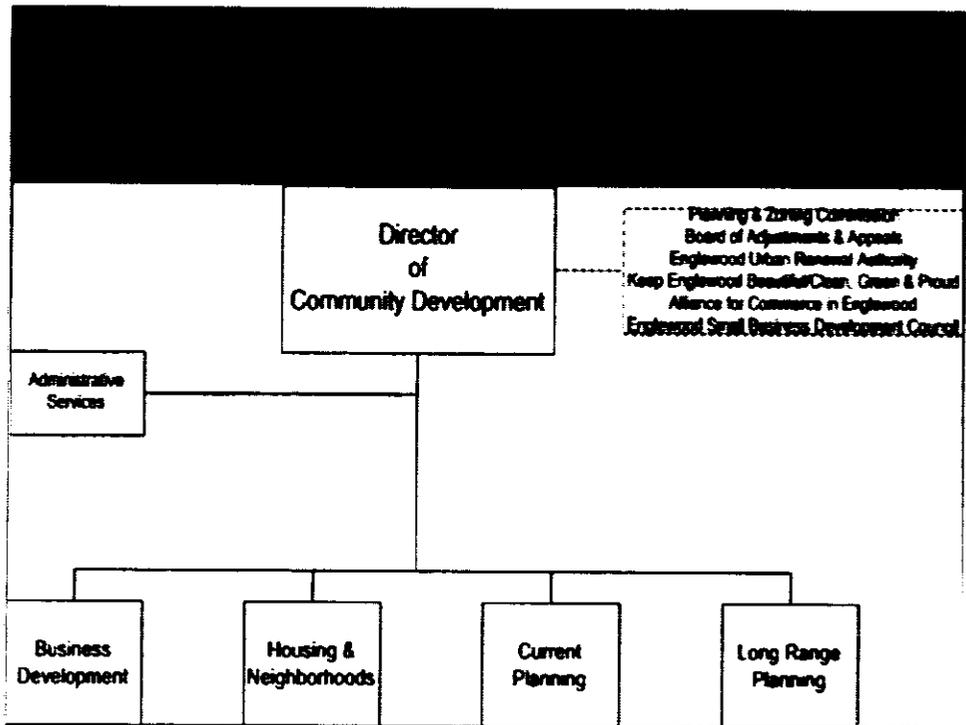
HAROLD STITT
SENIOR TRANSPORTATION PLANNER
CITY OF ENGLEWOOD, COLORADO

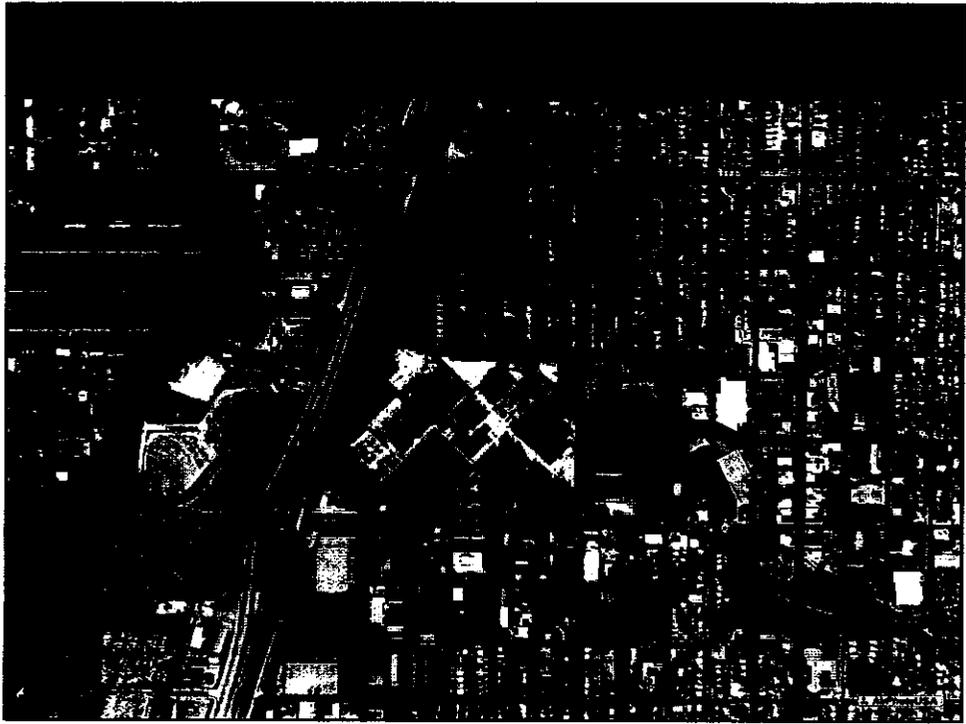
**“CONNECTING THE PIECES:
TRANSIT ORIENTED DEVELOPMENT”**

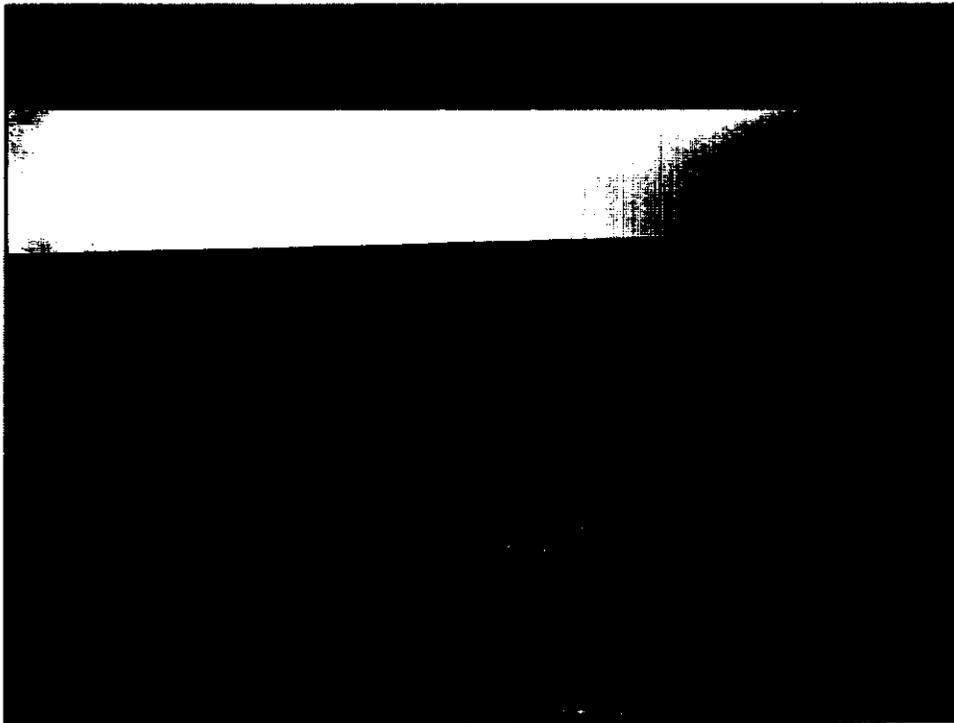


First Tier Suburb of Denver
Full service city
17.6 km² (6.8 mi²), land locked community
Located along SW LRT Corridor
33,000 residents; 25,000 jobs
Politically and fiscally conservative
Declining City revenues
Strong, stable neighborhoods
Large commercial/industrial base









Environmental Health Services
Public Health Division
1015 North 34th Street
Seattle, WA 98107
206-467-2300
www.seattle.gov/ehs

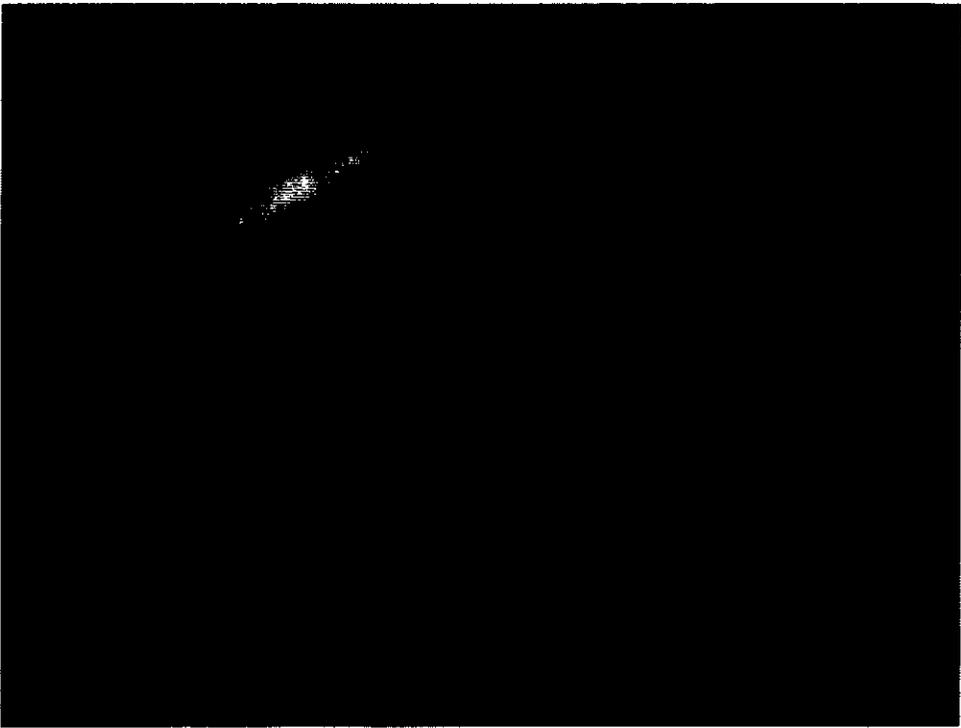
Summer Ozone Pollution Action Alert

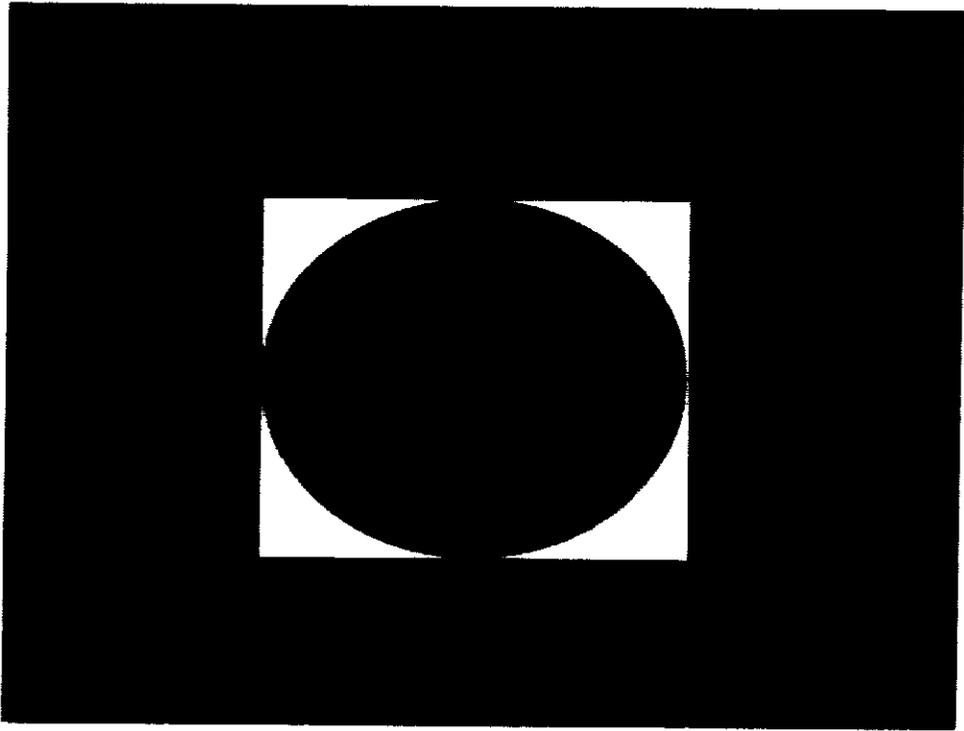
On Wednesday, July 24, 2008, the National Weather Service issued an Action Alert for Smog (O₃) for the Puget Sound area on Wednesday, July 23.

Hot and clear summer weather, light to moderate winds, and a clear blue sky may lead to increased ground-level ozone concentrations in the Puget Sound. This action alert is in effect from 12:00 PM on WEDNESDAY, JULY 23 until 12:00 AM on WEDNESDAY, JULY 23.

Voluntary Actions to help reduce ground-level ozone pollution include:

- Use public transit or carpooling.
- Reduce car idling in transportation.
- Reduce power usage at work; avoid idling.
- Avoid using gas-powered lawn equipment (do not mow).
- Avoid solvent use in home projects and using solvent-based products.





Transitioned development (TOD) is defined as a period of time that is required to complete the development of a project. The period of time is defined as the time from the start of the project to the end of the project. The period of time is defined as the time from the start of the project to the end of the project.

TOD is a measure of the time required to complete the development of a project. The period of time is defined as the time from the start of the project to the end of the project. The period of time is defined as the time from the start of the project to the end of the project.

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Building and public infrastructure are designed to favor landscaped public spaces and people walking, bicycling, or using transit.

Building entrances face streets and transit stops. Parking is behind buildings, in structures or underground, or shared facilities.

Reduced and managed parking inside 10-minute walk circle around town center train station.

Funding for transportation projects comes from a variety of sources, both public and private

The majority of the funds flow from the federal government to state, regional and local governments.

Private funding sources are driven on a project specific basis

Federal sources

- The Federal Department of Transport provides to all states the state share of the Mexican tax Planning Office (MFO) Fund as a percentage of the Federal Government's total tax revenue.

State sources

- Current State tax revenue

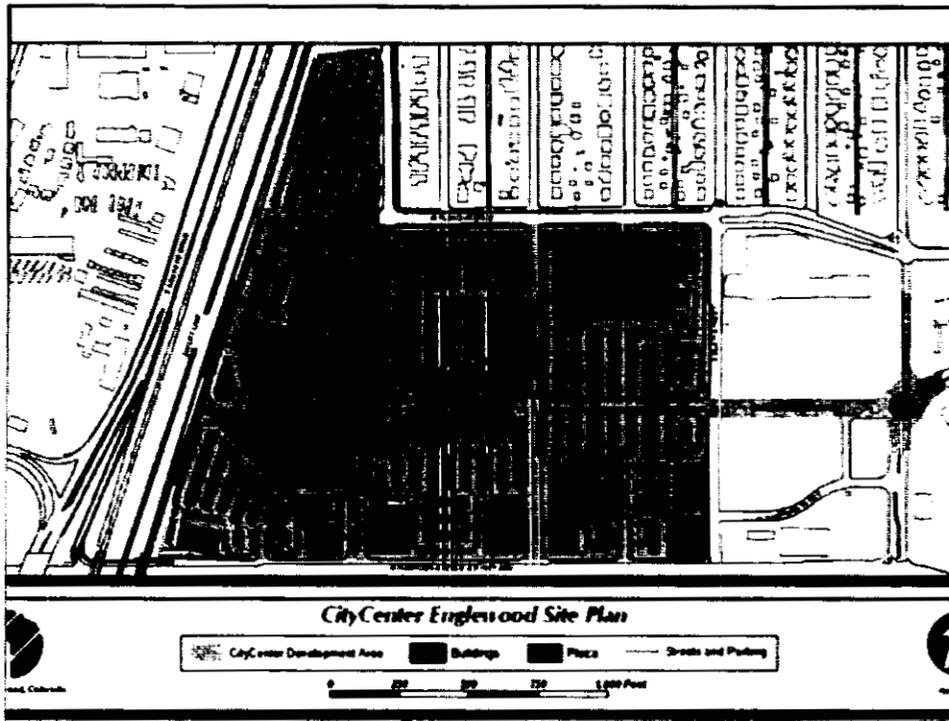
Regional sources

- Brazil Transport Authority
- State Revenue Commission
- FROG



Reinvigorate the community
Long term financial viability
Make it "special"
Prudent investment
Build on transit connection
Open on time

Business growth and job creation
Increased tax base
Economic stability and diversification
Cleans environment
Eliminates blight
Reduces sprawl, creates public space



22.3 hectare site (55 acres)
 83,612 m² (900,000 ft²) of development
 Retail 35,300 m² (380,000 ft²)
 Office 4,600 m² (50,000 ft²)
 Housing 438 rental dwellings
 Civic 13,500 m² (145,000 ft²)
 Parking 1,968 surface, 787 structured
 \$3.7 billion development budget
 \$150 million total public infrastructure investment

| | |
|-----------------------------------------|------------------|
| City funded public improvements | \$ 18.5 M |
| Retail developer | \$ 4.2 M |
| Major general retailer | \$ 3.4 M |
| Residential developer | \$ 5.0 M |
| <u>Regional Transportation District</u> | <u>\$ 5.7 M</u> |
| Total Budget | \$ 36.8 M |

Environmental issues – underground storage tanks, asbestos, PCBs, BTEX, PCE

7.3 hectares (18 acres) impacted by PCE, BTEX

120,800 m² (1.3 million ft²) impacted by asbestos, PCBs, mercury vapor waste product

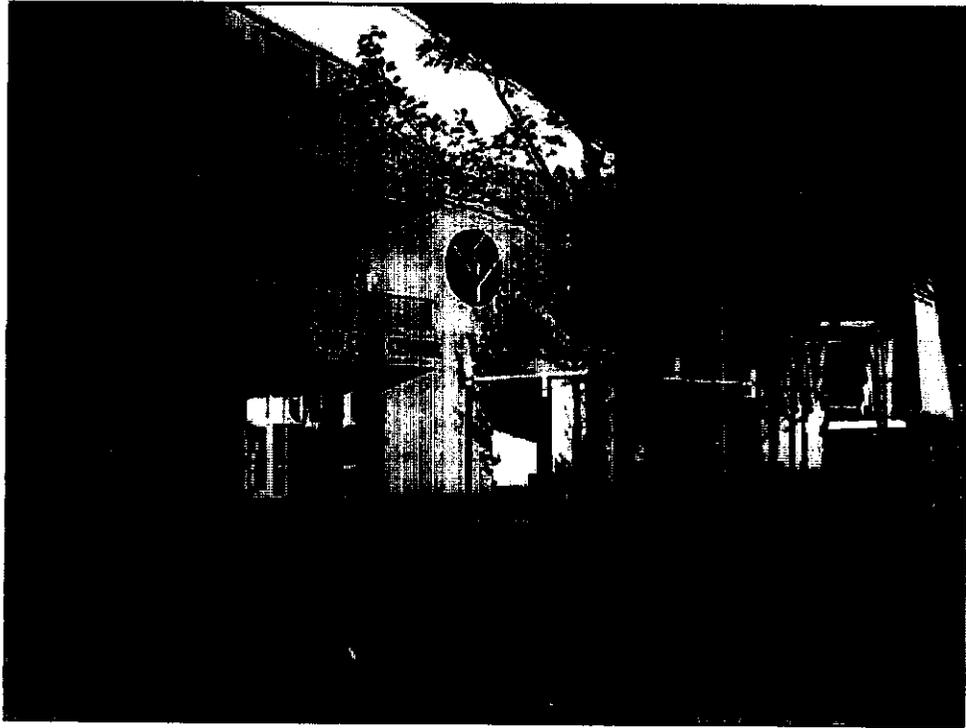
City creates Englewood Environmental Foundation (EEF) – established for acquisition, redevelopment, and reuse

EEF takes title, environmental assessments, remediation, takes property through State VCUP process

Cooperative Multi-Party Effort – EEF, City, Private Developers, State Health, Tri-County Health, and USEPA-Region 8 join together.

Liability/Cost-Sharing Apportionment
– cooperation among multiple partners critical to property development

Environmental Assessment and Remediation costs \$4.5 million



Rapid, effective six month public input process

Adaptive Reuse –

Converted former retail department store into Civic Center, created 12,550m² (135,000 ft²) of new community space

Civic Center costs -

\$880/m² (\$80/ft²) renovation cost

\$1,760/m² (\$160/ft²) new construction cost

Recycling demolition materials for construction

Multiple funding sources, project phasing

750 new jobs created and new sales tax revenues

New housing choices

New community confidence





It isn't easy!

Be clear about goals

Public sector must provide Vision

Public sector must participate as full partner

Think long term and be persistent

Provide effective incentives

Markets change

Create supportive plans and development regulations

Land use diversity reduces community risk

Coordinate, cooperate and collaborate

Maintaining flexibility is critical in the development stages of the project.

Strong city leadership is crucial when developing a successful bus TOD.

City ownership of the land allows development to occur when the right design proposal is presented.

Partnering between the city and the developer to finance and construct improvements when planned project densities are not able to cover the required infrastructure.

Educating retailers about shared parking, smaller retail formats, and multiple retailers per block is an important part of gaining retail support for compact mixed-use development.

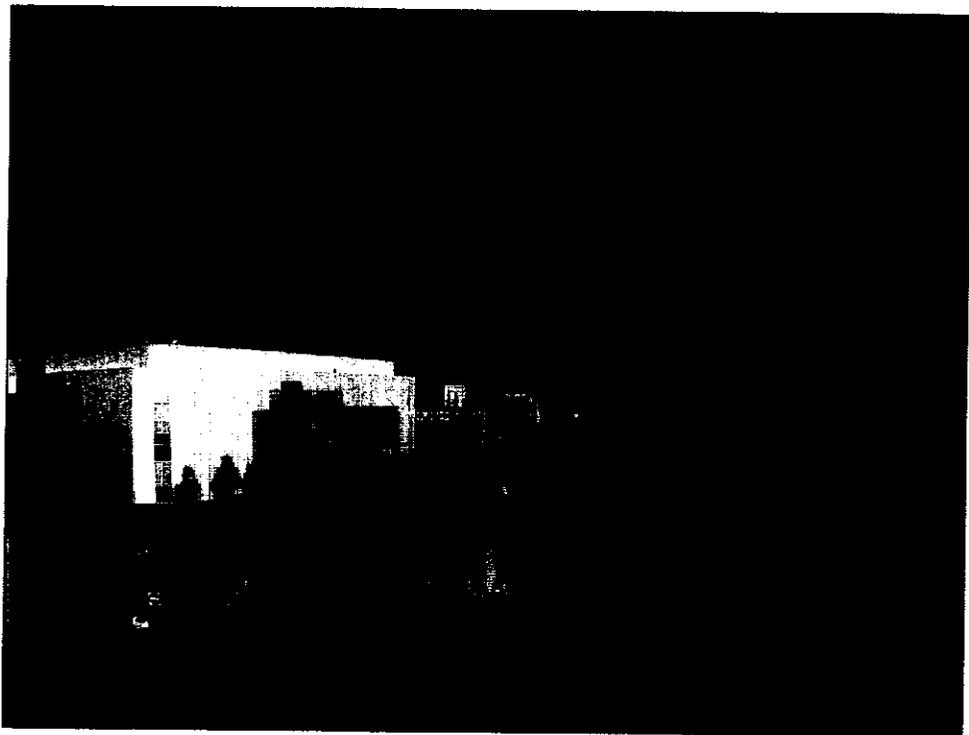
Projects should strive to create a strong sense of civic and cultural identity to become a focal point for the community.

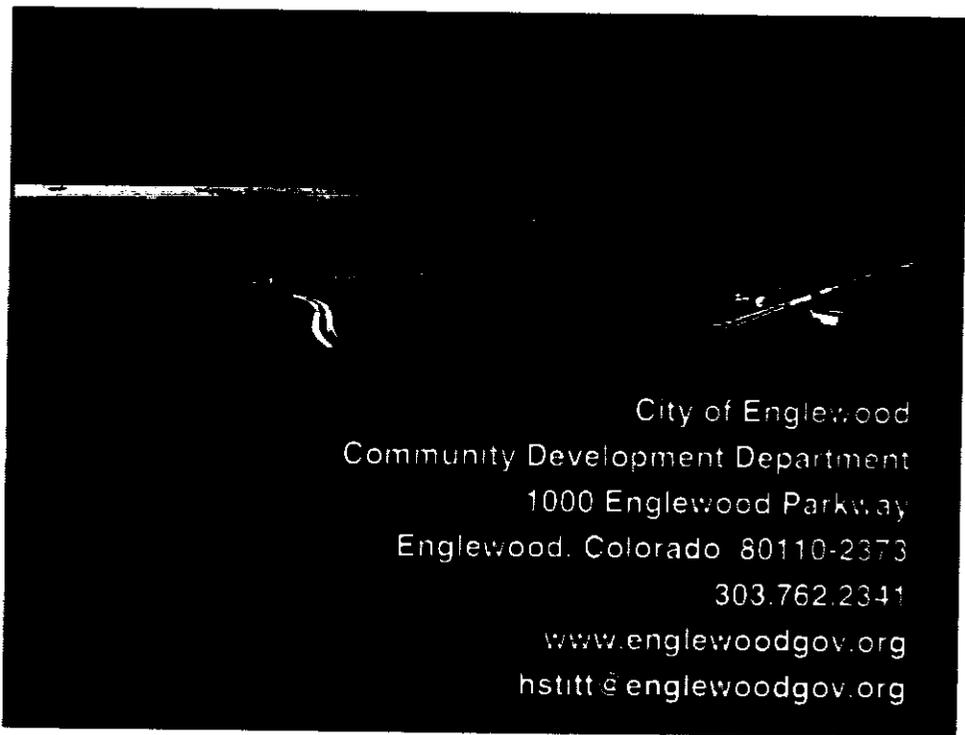
Mixed-use development is better able than traditional development to be sustainable and adjust over time.

Targets for mixed-use ratios should be established early on to develop a mix of uses appropriate for the surrounding community.

Well designed central spaces that combine circulation elements with open space amenities are very desirable.

When possible, renovating existing structures instead of constructing new buildings provides a sense of authenticity.





City of Englewood
Community Development Department
1000 Englewood Parkway
Englewood, Colorado 80110-2373
303.762.2341
www.engagewoodgov.org
hstitt@engagewoodgov.org

***PROMOTING SUSTAINABLE
URBAN WASTE AND LANDFILL GAS MANAGEMENT
POLICY EXCHANGE***

New Delhi • Agra, India

November 9 – 16, 2003

EXECUTIVE SUMMARY

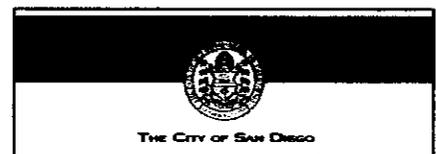
Statistics indicate that India's municipal solid waste is increasing at a rate that is already problematic and will continue to be so in the near future. This growth in waste volume will in turn produce a corresponding growth in GHG emissions unless significant measures are undertaken to reduce the growth rate of these emissions. Currently, however, in India, there is no systematic process to address the reduction of GHG emissions through solid waste management.

The Greenhouse Gas Pollution Prevention -Climate Change Supplement (GEP-CCS), a USAID/India project, has been working to identify and propose viable technology and planning interventions to Indian municipalities with the objective of improving municipal solid waste management practices and services to reduce the growth rate of GHG (methane) emissions from urban waste. Outreach and awareness activities connected with these efforts, and the fast approaching deadline to implement the Government mandated MSW regulations have prompted a number of Indian municipalities to request technical assistance for addressing the development of sanitary landfills and designs for landfill gas control.

In response to this need for information on solid waste and landfill gas management and with discussion with USAID, the LBG/GEP-CCS team designed and developed a policy exchange visit to India entitled, *Promoting Sustainable Urban Waste and Landfill Gas Management Policies*. The policy exchange was designed to provide Indian stakeholders with a comprehensive understanding of the concepts and processes involved in developing sustainable municipal solid waste solutions.

LBG/GEP-CCS has developed a collaborative partnership with the city of San Diego Environmental Services Department and SCS International Engineers. These institutions have expressed a long-term interest in supporting GoI initiatives and programs regarding MSW management and development. With the approval of USAID, the LBG/GEP-CCS team invited Mr. Richard Hays, Director of the City of San Diego's Environmental Services Department and Mr. Steve Hamilton, a seasoned LFG expert and a member of SCS International Engineers, to India from November 9 – 16, 2003 under the policy exchange mechanism, to promote best practices in municipal solid waste management operations and appropriate landfill gas technologies.

LBG/GEP-CCS selected the City of San Diego Environmental Services Department to be a resource for this Policy Exchange for their prominence as a leading municipal body promoting sustainable solid waste management practices in the U.S. Created by the San Diego City Council in 1988, the Environmental Services Department was designed to ensure that all residents of San Diego are provided with a clean, safe, and ecologically-sound environment and to pursue waste management strategies that emphasize waste reduction and recycling, composting, and environmentally-sound landfill management to meet the City's long-term disposal needs. The Department is organized into six divisions: Collection Services, Energy Conservation & Management, Environmental Programs,



Environmental Protection, Refuse Disposal, and Resource Management.

The City of San Diego is currently conducting a cross-border environmental program, the San Diego-Tijuana Border WasteWise initiative, aimed at promoting waste reduction among businesses on both sides of the San Diego-Tijuana border.

The State of California has mandated (AB 939, 1989) that all cities reduce waste disposed of in landfills by 25% by 1995 and 50% by the year 2000. To meet this mandate, City of San Diego devised a working plan called Plan 2000. The 25% diversion goal has already been met and surpassed, and they are currently working towards reaching the 50% reduction level.

In addition to the City of San Diego, SCS International Engineers complemented the policy exchange team as an award-winning, **SCS ENGINEERS** employee-owned, engineering and construction firm specializing in solid waste management and environmental services. Since 1970, SCS Engineers has been a national leader in the planning, permitting, investigation, design, construction, and operation of LfG control and energy recovery systems. SCS offers comprehensive solid waste planning services to assist in achieving their clients' goals in solid waste management, including:

- Waste disposal and diversion characterizations.
- Waste reduction, recycling, and green waste diversion program planning and implementation.
- Solid waste facility siting, feasibility studies, facility design, and permitting.
- Collection services and facility development procurements (Requests for Proposals and Requests for Qualifications).
- Regional Solid Waste Management Plans, Household Hazardous Waste Plans, Collection Productivity and Routing Studies, and Waste Audits.
- Evaluation of alternative financing methods.

SCS Engineers has completed more than 2,000 landfill-engineering assignments for municipal and industrial clients in over 40 countries. Landfill projects in the Asian region have included work on the following:

- Landfill Gas-to-Energy project (Kamphangsaen Landfill, Nakohn Pathom, Thailand)
- Landfill Gas-to-Energy project (Sang-Am Landfill, Seoul, South Korea)
- Landfill Gas Control System Design (Taichung, Taiwan (ROC))

The visit was structured to provide a comprehensive perspective of MSW and LfG capture operations, management, project development and conventional/hybrid financing mechanisms in the U.S. and best practices in municipal waste management. This policy exchange focused on providing training and exposure to MSW best practices for two cities, Delhi and Agra, and included an appearance at the Climate Change Technology Bazaar and Conference in Delhi, a presentation during the USG sponsored half-day side event at the Conference and a number of various meetings with senior state and federal executives in Delhi and Agra.

As an overall finding from this Policy Exchange, it is clear that there is an urgency to the interest/need of municipal officials in employing better waste management practices, developing sanitary landfills and eventually incorporating landfill gas technologies throughout India. There are however, a number of issues and questions that need to be further addressed to ensure a smooth transition to improved municipal waste management practices and sanitary engineered landfills including:

- ❑ **The development of a better understanding of options and strategies for the design of disposal projects which are environmentally as well as financially viable.**
- ❑ **The incorporation of lessons learned from other (USAID) MSW projects that have been successful in other emerging economies/countries such as Egypt.**
- ❑ **How can municipalities structure and fund their full waste management costs, including collection procedures and billing structures?**
- ❑ **What are the necessary steps to ensure sound monitoring and evaluation of MSW services and sites including those sites being operated by private companies under contract?**
- ❑ **What is the potential of collaborating with a partnering city or state in the U.S to develop similar programs such as WasteWise?**
- ❑ **How can heritage site cities such as Agra, who facing a high floating population of tourists and day-trippers deal with the increasing volumes of waste?**



I. BACKGROUND ON THE POLICY EXCHANGE APPROACH

Under the GEP-CCS project, considerable work has been done to identify and propose viable technology and planning interventions for MSW management to Indian municipalities. Various capacity building initiatives been implemented under this program by LBG.

In Delhi, currently around 7000 tons of MSW is being generated per day, of which approximately 6000 TPD are collected and dumped on three operational sites. Not only is there a shortfall in capacity to dispose of the MSW generated, but the current methods of disposal are environmentally unsustainable. Interactions with senior officials at Municipal Corporation of Delhi (MCD) indicated both a commitment to and a growing sense of urgency in addressing the capacity shortfall problem.

The need to initiate necessary measures on a priority basis was evidenced by MCD's MOU with IDFC and proposed plans for new landfill facilities. There was special interest expressed by MCD in acquiring a better understanding of options and strategies for design of disposal projects that are environmentally as well as financially viable. In response to this interest and in continuation of its efforts under GEP-CCS, LBG arranged a visit from Mr. Richard Hays, Director of the City of San Diego's Environmental Services Department and Mr. Steve Hamilton, Sr. Team member, SCS Engineers to facilitate an exchange of information on municipal solid waste management and landfill gas strategies pertinent to the needs of Indian municipalities.

II. OBJECTIVES

To implement a policy exchange that provided an opportunity:

- To actively engage a broad group of key stakeholders in the development of municipal solid waste facilities.
- To identify conventional and hybrid financial approaches and methodologies associated with landfill design and development.
- To provide an understanding of the obstacles and barriers associated in designing and planning sanitary landfills to reduce/ capture GHG emissions in India.

III. ANTICIPATED OUTCOMES

- A better-informed group of municipal policy/decision makers associated with landfill design and development at the city, regional, and national levels.

- Establish linkages between Indian decision-makers/ institutions/ professionals and San Diego's Department of Environment Services and SCS International Engineers, which could lead to collaborative relationships in the future. The possibility of forging a twin city arrangement could be explored between San Diego and Agra or New Delhi.
- Create momentum to support the use of best practices/guidelines for sustainable landfill gas to energy project design and development.

IV. Policy Exchange Schedule

New Delhi, India

Sunday, November 9, 2003

- Welcome / Program Brief - GEP- CCS Chief of Party Ms. Suzanne Young

Monday, November 10, 2004

- Climate Change Technology Bazaar Opening
- National Institute of Urban Affairs (NIUA)

Tuesday, November 11, 2003

- Municipal Corporation of Delhi - MSW Site Visits
- U.S. Government Side Event - Climate Change Technology

Wednesday, November 12, 2003 (New Delhi)

- Roundtable Discussion/Training - Municipal Corporation of Delhi

Thursday, November 13, 2003 (New Delhi)

- Debrief - Municipal Corporation of Delhi
- USAID/ India Mission

Agra, India

Friday, November 14, 2003 (Agra)

- Agra Mayor - Mr. Kishori Lal
- Agra Divisional Commissioner
- Agra Municipal Corporation
- MSW dumpsites visits
- Roundtable discussion with Agra Municipal Corporation officials

VI. Overview of Meeting Notes

Sunday, November 9, 2003

Welcome / Program Debrief

Ms. Suzanne Young, GEP-CCS Chief of Party and leader of this policy exchange reviewed the schedule for the overall exchange, reviewed prepared presentations and suggested changes, provided additional background information on institutions and answered any outstanding program and/or logistical questions.

Monday, November 10, 2003

Climate Change Technology Bazaar and Conference

The Climate Technology Bazaar was an international exhibition organized by the Confederation of Indian Industry (CII), in partnership with the Ministry Environment & Forests (MoEF). This unique event was an opportunity for businesses from developed economies (Canada, UK, Germany, Sweden, Denmark, USA, Japan etc.) to achieve Greenhouse Gas (GHG) emission reduction by showcasing appropriate technologies and services for companies in India.

- a. The international and national exhibitors included a USG booth on US-India Cooperation on Climate Change. Over 5000 visitors participated in this four-day exhibition showcasing state-of-the-art technologies in various fields including: renewable energy, energy from waste, resource conservation, and energy efficiency technologies.

- b. Ministry of Environment and Forests (MoEF) organized various conferences and workshops on subjects related to Climate Change and technology transfer and adaptation.
- c. Major Themes of the Bazaar included the following: Climate-Friendly Technologies: Technologies that encouraged manufacturing and industrial operations with the use of such technologies that minimize GHG emissions and thereby reduce their environmental “footprint”. There was also a Carbon Bazaar for companies and countries interested in emission reduction trading.

NIUA Seminar

A half-day seminar was organized in partnership with the National Institute of Urban Administration (NIUA) on the theme of *Urban Waste Disposal and Landfill Gas Management – International strategies for the Indian context*. The seminar was held at the NIUA office. NIUA had partnered with GEP-CCS on the municipal waste capacity building efforts under CLIN 8, hosting an earlier training as well as having been a responsive partner with USAID on numerous other past and ongoing urban initiatives including the RUDO FIRE project. The objective of the seminar was to provide both a structured interface with decision-makers representing a cross-section of stakeholder interests on municipal waste management and to reinforce NIUA’s leadership role. Designed to synergize with the MCD training program scheduled later in the policy exchange program; the scope and audience for the seminar was broader than that of the MCD training program, including infrastructure financial institutions, as well as GoI, NGOs, and academia.

The seminar had approximately 25 participants from diverse organizations such as Ministry of Urban Development, MCD, NDMC, Delhi Cantt. Board, IIPA, HUDCO, IL&FS, IDFC, HSMIS (Lucknow), IIT-Delhi, Lee Associates. Mr. N. Bhattacharjee from USAID RUDO and senior officials from NIUA were also present at the event

The seminar opened with a round of introductions, followed by a welcome address and a brief introduction on GEP-CCS by Ms. Young. Mr. Hays gave a presentation on his experience addressing San Diego’s MSW challenges, and provided details on the policies/institutional systems currently in place in San Diego. He also showed a video film on V-TRAC – the satellite based garbage collection monitoring system being used in San Diego. This video generated a great deal of interest among the participants.

This was followed by a presentation by Mr. Hamilton, in which he explored the technical and financial aspects associated with landfill gas management. He also elaborated on the various options available and emerging technologies for reuse of LfG.

Some of the points that were raised in the discussion that followed are given below:

- o Technical details of landfill design viz. details of liners used, systems for leachate treatment, depth of landfill sites. In this context, Mr. Hamilton emphasized that state-of-

the-art technologies should not be merely superimposed on the local context; instead more cost-effective technological options might be found to be more appropriate to the local context.

- Cost details were discussed e.g. per ton cost for building, operating and closing landfills. Also discussed were the funding structures (including tipping fees) used for covering the cost of MSW operations and recovery of costs by recycling, composting etc.
- Experiences (if any) with collaborations between municipalities. Mr. Hays mentioned that there had been no experience in San Diego. However, he did mention the collaborative projects undertaken with Mexico under the WasteWise program.
- Experience with composting. Mr. Hays informed that there had been little or no success in San Diego with composting of MSW due to existence of hazardous materials (mainly heavy metals from electronic waste) being present in the compost. Accordingly, composting is being done on a limited basis in San Diego from simple green materials (similar to horticulture waste), and is not being used as a fertilizer substitute, but as a soil amendment.
- Process for selection of waste collection company and contractual arrangements for the same.
- Norms for charges levied by waste collection companies, on waste generating entities (individuals, institutions or industry). Mr. Hays informed that these could be set by the city or negotiated – the exact arrangement varies from city to city. Mr. Hamilton mentioned Egypt's experience with introduction of charges for MSW services. In that country's case, an additional charge was added on the electricity bill to pay for these services, to overcome the logistical and perception barriers associated with collection of such service charges separately. Mr. Hays added that in the U.S. as well several cities levied a flat amount for SW services, along with the water bill.
- Technical and financial details of LFG recovery systems were discussed e.g. use of liners, compacting layers, vertical versus horizontal wells, lifespan of gas generation, piping systems, capital cost.
- Experience with privatization processes – Mr. Hamilton provided details of the Egyptian experience and how it was an evolutionary process, wherein refinements kept taking place on an on-going basis.
- Details of the annual customer satisfaction rating conducted in the city of San Diego by independent organizations.

Tuesday, November 11, 2003

Site Visits to MCD Landfill Facilities

In order to provide the visiting experts a better perspective on the landfill operations and practices in Delhi, visits were organized in coordination with MCD to two landfill sites, namely Okhla and Ghazipur. A brief visit was also included to the Rajiv Gandhi Park which had been developed on a closed landfill site. Mr. Khandelwal and Mr. T. Ahmed from MCD accompanied the international experts on the site visits.

The Okhla site covers an area of approximately 56 acres with a filled up depth of around 9 meters of which 4 meters is above road level. The site receives about 1200-1300 Mt/day garbage of Central, South Zones and part of Najafgarh Zone. As sanitary landfill facility, its leachate is collected in the drain at the backside of the landfill and provision has also been made for collection of landfill gas. Mr. Hamilton complimented the quality of operations at the facility, and provided his observations in the visitors' book.

The Ghazipur site covers an area of about 70 acres, and receives garbage of 2500 Mt/ day. The solid waste brought to this site consists largely of abattoir waste from the chicken and poultry market from within the vicinity. Consequently, there is greater prevalence of birds at this site. Slight evidence of fires due to landfill gas was also observed.

USG Sponsored Side Event for the Climate Change Technology Bazaar and Conference

The USG side event for the Climate Change Technology Bazaar focused on US-India cooperation on climate change. Richard Hays made a presentation on Solid Waste Management and Climate Change during an afternoon event which included presentations by Glenn Whaley, Director Environment, Energy and Enterprise, USAID/India, Harlan Watson, Sr. Climate Change Negotiator, US Department of State, David Garman, Assistant Secretary, US Department of Energy and Prodipto Ghosh, Secretary, Ministry of Environments and Forest, GoI. Steve Hamilton, along with the key members of the LBG Global Environment Team in Delhi, also attended in support of this side event sponsored by the USG.

Wednesday, November 12, 2003

MCD Training Program

An intensive one-day training program was organized for MCD officials on the theme of *Strategies for Sustainable Urban Waste Disposal and Landfill Gas Management*. Interactions with senior officials at MCD revealed considerable interest in acquiring a better understanding of options and strategies for design of disposal projects that are environmentally as well as financially viable. The training program was organized specifically in response to this need.

The program was conducted at MCD's office at India Habitat Centre. Approximately 20 people participated in the program, and encompassed senior and mid-level officials from MCD associated with planning and implementing landfill facilities for the city. In addition, there were representatives from JICA and IDFC.

The program began with a round of introductions, followed by a presentation by Mr. Ravi Dass, Deputy Municipal Commissioner, on the status of SWM in Delhi. Ms. Young then briefly introduced the GEP-CCS project.

Mr. Hays and Mr. Hamilton provided a brief perspective on international trends in the field of MSW management. Mr. Hamilton emphasized the need for customized solutions for each location. He highlighted two important elements for a successful solid waste management system, namely – (a) efficient collection since this encompasses 95% of the environmental and health impacts associated with SWM; (b) statistically appropriate sampling of the waste stream across different seasons/ areas. He also emphasized the need for proven technology appropriate for the local context.

Mr. Hays showed the film on V-TRAC, followed by a presentation on the San Diego experience with SWM. In the question and answer session that followed some of the points that were raised are given below.

- In response to a query on factors contributing to the high customer satisfaction rating in San Diego, Mr. Hays identified high collection efficiency and pride in work performance (especially among drivers). With respect to the latter, he mentioned that workers had been involved in developing solutions including the V-TRAC software.
- Details of the collection and transportation system were discussed viz. frequency of collection, size of collection bins, and kind of trucks used, cost details, charges levied to the customer. Providing details on these, Mr. Hays stated that collection frequency could be as low as once a week (for all climatic conditions). The bins were approximately 90 gallons. The trucks used included both fully and semi-automated varieties, the latter being more useful for narrow streets. Charges to customer included, \$9.80 for SW collection per month, \$4 for greenery collection and \$4 for recycling undertaken. With respect to cost of disposal, Mr. Hays mentioned that this could vary substantially between cities. In the case of San Diego it was \$40 per ton, while in the case of New York this cost was as high as \$100 per ton. The variations were attributable to land costs and disposal solutions used (on the eastern side of USA, WTE projects were common which are typically more expensive than other disposal options).
- Process of rationalization of manpower (especially in the drivers category). Mr. Hays mentioned that they did not undertake much retrenchment; instead several of the personnel were diverted to the growing recycling program.

- Reasons for varied levels of privatization undertaken across different cities. Mr. Hays expressed the view that a well-run city managed system was likely to be more economically efficient than a privately owned one, given the absence of profit making in the former.
- Agency responsible for collection of hazardous waste from households. It was clarified that the responsibility for this lay with the municipality.
- Recycling requirements mandated for city agencies, as per law (AB939). Mr. Hays informed the group that as per the State of California law, the requirement to recycle was 50%, which was difficult to achieve in reality. Most cities were achieving up to 40-42% recycling.
- Factors contributing to high levels of segregation achieved in the US, at the household level. In the context of San Diego, Mr. Hays identified the high percentage of a well-educated population as being an important facilitating factor since it made the citizenry more amenable to public education/ awareness initiatives. Further highlighting the importance of this factor, Mr. Hays added that in Mexico not even a 3% segregation rate had been achieved. Mr. Hamilton once again emphasized the importance of undertaking a proper waste stream analysis in order to design appropriate strategies for segregation and reuse. Awareness creation through children was another effective strategy. In the context of Delhi, it was felt that multiple approaches might be required to address the different segments of population.

Mr. Hamilton discussed the public/private approaches to addressing MSW needs by pointing out that the municipality will always have the ultimate responsibility for managing solid waste issues. As a result, the service will never be truly "privatized" rather, the private sector may become an active and significant "participant" in solid waste management. Therefore, it is important for the municipality to understand the range of issues associated with effective contract management, including the identification of:

- minimum technical requirements,
- minimum results and performance standards,
- performance monitoring, and
- penalties for failure to perform by the contractor.

This led to a discussion of the importance of public awareness about the goals and processes of a new MSW project, including the importance explaining the public health impacts associated with MSW issues.

Several waste management options were outlined, such as composting and incineration, as well as their respective environmental impacts.

The advantages of a full-cost accounting approach to costing an MSW project were also discussed, including the need to anticipate and estimate post-landfill-closure costs. Mr.

Hamilton explained the fee collection technique that has been adopted by several cities in Egypt: including a graduated cost for total MSW management that is included in the electricity bill, with the rate for MSW indexed to a consumers power usage.

Mr. Hamilton provided a review of the technical issues surrounding landfill management, including the environmental impacts of landfills (air pollution, leachate production, odor, siting, etc), which led to a discussion of elements needed for the effective operation of a landfill: moisture management, landfill depth/height, leachate collection (linings, wells), gas collection (pressure/concentration gradients, wells, piping), and operational changes over different seasons. He presented examples of proven landfill gas management technologies, such as flaring, landfill-gas-to-energy, and use as a fuel for on-site or nearby consumers of natural gas. Mr. Hamilton also described some emerging uses for landfill gas, such as fuel for micro turbines, vehicles, and fuel cells.

The question and answer session was followed by a video on San Diego's vision for the future. Then Mr. Hamilton gave a presentation on technical options for disposal. In the context of composting, Mr. Hays shared his concerns with respect to the environmental and health risks associated with the same. Mr. Hamilton added that in Egypt use of compost was restricted to horticulture purposes and desert reclamation. He also cautioned against sales pitches by technology suppliers, especially for in-vessel composting.

After the presentation, Mr. Negi mentioned that in the next 3-4 months MCD would need to appoint a consultant to study the waste streams and identify appropriate technologies. He expressed interest in exploring collaboration possibilities with SCS Engineers.

Mr. Hays went on to distribute public awareness material prepared by his department, as well as service badges used by his staff.

Mr. Hamilton then gave a talk on the privatization process, with specific reference to the Egyptian experience. He emphasized the importance of a planning process for developing a clear understanding of the current situation and the desired end-result. He mentioned that billing for SWM services could be merged with the electricity and water bills, with the money being subsequently transferred from the concerned utility to the SWM agency. Moreover, as in the Egyptian case, an equity element could be incorporated wherein higher charges could be levied for households having higher levels of electricity consumption.

Thursday, November 13, 2003

Meeting at MCD

Following the training program of the previous day, a meeting was organized with Mr. Rakesh Mehta, Commissioner MCD to debrief him on the previous day proceedings. Mr. Negi and Mr. Khandelwal from MCD were also present at the meeting. In the course of the discussions, some of the points that were raised were as follows:

12

- Mr. Mehta enquired about details of San Diego's SW systems, fee structures, and infrastructure etc. Mr. Hays invited Mr. Mehta for a visit to San Diego, to see their systems first hand.
- Approach to staff management and motivation techniques used were also discussed. Mr. Hays informed the Commissioner that in San Diego, there are performance evaluation systems, as well as a reward scheme for good performers. He added that further reductions in staff were being considered for cost reduction; moreover, they have a system for sharing the savings resulting from such measures.
- On the possibility of privatization of the service, Mr. Hays said if public operations were cheaper and more efficient, there was no argument in favor of privatization. He added that in most big cities of the US, SWM was a public service. Mr. Hamilton clarified that while collection was usually a public service, disposal was more often in private hands. He said that "privatization" was a misnomer since either ways, SWM remained a public responsibility – the more appropriate description would be "private sector participation".
- Mr. Hamilton gave details of the Egyptian experience with privatization as well as the Mexico experience with engaging the rag-picker community – both of which elicited considerable interest among the MCD officials. Mr. Mehta was particularly interested in the Egyptian model for levying of charges from households¹ for SWM services provided. This entailed loading of the entire cost of SW systems (including contract monitoring, closure, non-collection, street sweeping etc.), onto the electricity bill (Approximately 3-4% of electricity bill in Egypt.). Mr. Mehta began immediately exploring the possibilities of introducing a similar charge on the electricity bill. He added however, that it could be made acceptable only if there was complete transparency on the utilization of these funds for the purpose of SWM services.
- In the context of privatization process, Mr. Hamilton emphasized the importance of good contract definition, contract-monitoring systems and last but not the least, public awareness.
- Issues related to segregation were also discussed. Mr. Mehta said that this was a critical block in the privatization process. Mr. Hamilton observed that segregation was unlikely to succeed until collection systems were made efficient. Once people see cleaner surroundings, they are likely to become more aware and proactive in supporting segregation efforts. Mr. Mehta concurred with the need for public awareness and engagement, adding that possibly schools could be involved for this purpose. In this connection, visits could be organized to landfills, to increase awareness of the problem.

¹ Charges to large industrial and commercial users, would be negotiated individually depending the solid waste profile and quantities generated.

- Mr. Mehta enquired about the solid waste experience in China. Mr. Hays said that from his observations during a recent trip, he did not find the systems very evolved. Collection is fairly good, but disposal is poor with 90% of the solid waste dumped in open fields.
- Mr. Mehta mentioned that there are plans to introduce biodegradable plastic bags in Delhi. They have already floated a tender for companies to supply these bags.

Meeting at USAID

A debriefing meeting was held at USAID for the visiting experts to share their observations with USAID officials. Mr. John Smith-Sreen, Mr. K. Balakrishnan (USAEP) and Ms. Kristen Easter (USAEP) were present at the meeting. Some of the salient points made were as follows:

- In general Mr. Hamilton found the stakeholders to be technically sound. He however added that while there was a change process underway, it appeared to be piecemeal. There was a need to adopt an integrated approach, and for this purpose some handholding could be provided. He also emphasized the utility of a statistically relevant waste characterization study.
- Mr. Mehta's keen interest in the Egyptian approach for levying charges as well as other aspects of the Egyptian experience was discussed.
- Mr. Hays emphasized,
 - the need for a systemic approach – one which could not be provided by engineers alone;
 - the importance of education as a crucial link in the process;
 - the role of change agents/ leaders to drive the change process;
 - the need for customized solutions/ models appropriate to different socio-economic contexts (e.g. picking line approach for rag pickers rather than segregation at the household level – this way reduce job losses, and also improve condition of rag-pickers. Mr. Hamilton mentioned the Mexico experience with rag pickers in this context, which elicited interest on the part of Ms. Easter.)
- Issues related to composting were also discussed. Ms. Young drew attention to the fact that in India composting is done for mixed MSW, as against just green waste in San Diego and elsewhere. Mr. Balakrishnan added that the compost market in India suffered from the low fertilizer prices.
- Mr. Hays offered to host visitors for study tours to San Diego and Mexico.

Friday, November 14, 2003

Series of Meetings in Agra

Meeting with Mr. Kishorilal Mahore, Mayor Agra Nagar Nigam (ANN)

- Mr. Mahore welcomed the U. S. Experts and thanked LBG and USAID for making their visit possible.
- He mentioned that Agra is growing rapidly and there is a significant development work taking place that results in debris contaminating the municipal solid waste (MSW)
- Agra has initiated several efforts to streamline collection but is faced with typical problems of a small and growing town. The infrastructure for collection and disposal of waste is proving inadequate. The existing dumpsites have become full and for the new site there is an acute shortage of funds.
- He welcomed suggestions and possible tie up with San Diego, which is similar in population size to Agra and has a number of large tourists, or another city.
- Mr. Hays conveyed the message from Mayor of San Diego to Mr. Mahore and provided details of the MSW practices followed by them.
- Mr. Hamilton narrated his experience with the USAID MSW project in Egypt, comparing similar MSW issues in the city of Cairo to Agra, both being ancient cities with high seasonal tourist influxes.

Meeting with Mr. B. M. Meena, Divisional Commissioner, Agra division

- The team apprised Mr. Meena of the purpose and objectives of the MSW policy exchange visit and suggested the potential for cooperation with municipalities in the TTZ area.
- Mr. Meena welcomed the idea and suggested that the work in Agra would prove highly useful for replication in other cities nearby. In this regard he also suggested a creation of sister city concept between Agra and San Diego.

Agra Site Visits

The Mayor personally escorted the group on a visit to a proposed landfill site, and the existing Municipal dump site. This site was more typical of conditions in other Indian municipalities, with many birds, animals and humans on the dump itself. Steve Hamilton called attention to a number of small landfill fires.

Meeting with Mr. S. K. Singh, Municipal Commissioner ANN

- Mr. Singh related his experiences and observations during his recent visit to the city of Los Angeles' solid waste management facilities. He welcomed the initiative of USAID and the LBG team for the exchange of information on this very important subject.
- He made a presentation on the details of the Agra city, solid waste collection, transport and disposal. He mentioned that ANN was in the process of evaluation of a proposal for MSW disposal based on the Plasma Arc technology.

Presentation at the ANN

The Mayor and Municipal Commissioner and number of officers of ANN participated in the discussions. A comprehensive presentation was made by ANN that highlighted the problems faced by the corporation on disposal of MSW. Mr. Hays provided details of the state-of-the-art technology that is employed in San Diego. The use of LNG vehicles for transportation of MSW, and the potential for the conversion of landfill gas to LNG was discussed. Similarities in population and area but differences in economic conditions and composition and practices were considered. Both the cities expressed interest in working together to improve the conditions of MSW collection and disposal in an economically viable manner.

The discussions between LBG/GEP-CCS and Municipal officials assisted in identifying urban best practices related to solid waste management, creating interest in the formation of cross municipality committees, and the development of a prioritized MSW action plan for the Taj Trapezium Zone in Agra. Topics discussed also included technical monitoring and reporting, financial monitoring and reporting, and benchmarking.

VII. FOLLOW-UP OBSERVATIONS AND NEXT STEPS

LBG/GEP-CCS will continue to coordinate with the visited U.S. institutions and follow-up on potential areas of collaboration and gather additional information for the participants. Over the course of the meetings there was strong interest of continuing to work together with the City of San Diego and SCS Engineers as model organizations who have excelled in the field of MSW.

Programs or activities that were developed by the City of San Diego and SCS that were of interest included the following:

- San Diego's MSW challenges, policies and institutional systems currently in place in San Diego
- San Diego's V-TRAC – the satellite based garbage collection monitoring system being used in San Diego.
- Technical details of landfill design viz. details of liners used, systems for leachate treatment, depth of landfill sites
- Cost details e.g. per ton cost for building, operating and closing landfills.
- San Diego's WasteWise Sister City Partnership program
- Norms for charges levied by waste collection companies, on waste generating entities
- Technical and financial details of LFG recovery systems were discussed
- Technical options for disposal
- The privatization process and the importance of a planning process for developing a clear understanding of the current situation and the desired end-result.

In particular, Mr. Negi and Mr. Mehta from the Municipal Corporation of Delhi showed a very keen interest in continuing to work with the City of San Diego and SCS Engineers in the future as they identified a number of programs that could be easily replicated in Delhi. In particular:

- Mr. Negi from MCD expressed a strong interest in hiring a consultant to study the waste streams and identify appropriate technologies that would be economically and technologically viable. In particular Mr. Negi expressed an interest in exploring collaboration possibilities with SCS Engineers.
- Mr. Mehta was very curious to learn more about San Diego's SW systems, fee structures, and infrastructure etc. This conversation led to Mr. Hays inviting Mr. Mehta for a visit to

San Diego, to see first hand and further explore the possibilities of incorporating such as system in Delhi.

- Mr. Mehta was particularly interested in SCS's Egyptian model for levying of charges from households² for SWM services as well as to exploring the possibilities of introducing a similar charge on the electricity bill as was done in Egypt.

Agra was also identified as a city that could easily adapt much of the work that Mr. Hamilton conducted for the Cairo, Egypt Project under SCS Engineers as Agra as both Cairo and Agra are ancient cities facing high floating population of tourists.

NEXT STEPS

Following the quality feedback from this Policy Exchange and identifying the need to further collaborate with many of these municipalities with whom Mr. Hays and Hamilton met, LBG/GEP-CCS, in collaboration with USAID/India, developed an Exposure Trip to Thailand and the United States. The visit was structured to provide the delegates a "hands-on" experience of MSW operations, management, project development, and conventional and hybrid financing mechanisms in the U.S., and will include an Asian stop in Thailand, to observe how some of these best practice concepts are employed in another rapidly developing economy with some of the same or similar climatic and social conditions as exist in India.

² Charges to large industrial and commercial users, would be negotiated individually depending the solid waste profile and quantities generated.

115

ANNEX A.

Policy Exchange Participant Profiles

Richard L. Hays

Director, City of San Diego Environmental Services Department
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Mr. Hays has over thirty-seven years of progressively responsible and complex management experience in municipal government. Fifteen years focusing on municipal solid waste, waste reduction and diversion, sustainability, recycling, environmental protection and energy conservation and management. First Director of the City of San Diego's Environmental Services Department, specializing in the development of creative solutions to environmental challenges, a department-wide commitment to outstanding customer service, and the use of financial monitoring and bench marking to ensure cost effectiveness. Demonstrated leadership skills resulting in the attraction and retention of exceptional employees dedicated to environmental protection and "doing what's right." Able to envision future environmental issues and work to find entrepreneurial and financially responsible solutions.

EXPERIENCE

Environmental Management

Driven by a commitment to "continuous improvement," successfully transformed the City's traditional solid waste management functions into a state-of-the-art system, and expanded the Department's responsibilities to include a city-wide energy management program and a broad-based community sustainability program. Directed the implementation of several award winning projects which resulted in:

- Receipt of the nation's first Energy Star Award for buildings for the department's "green" headquarters facility which has saved over \$750,000 in energy costs;
- The nation's first municipally-operated landfill to receive ISO 14001 certification (which has saved \$2,162,000 annually since July 2001);
- The siting of the region's first Liquefied Natural Gas (LNG) fueling station at the Department's operations yard;
- Fleet conversion of refuse collection packers from diesel to LNG to reduce nitrogen oxides of nitrogen (NoX) emissions and promote employee health;
- The first "energy independent" municipal building in the city of San Diego using photovoltaics, and off the shelf energy conservation equipment.

Fiscal Management

Responsible for developing and administering the Environmental Services Department's \$90 million operating budget and \$6 million Capital Improvement Budget. Established two independent Enterprise Funds and supervised the development of an Energy Conservation and Management Fund. Initiated and oversees the management of two significant City franchise systems which bring in over \$12 million annually and implemented the use of complex financial modeling to determine future economic conditions for planning purposes. In addition, taught budgeting and finance at the U.S. Army Academy of Health Services Master Degree Program with Baylor University.

Human Resource Management

Responsible for all personnel actions involving the Department's 500 plus employees including recognition, professional enrichment and discipline. Continually engaged with various employee groups and labor organizations to avoid or reach consensus on potential labor issues.

As the Director of the City of San Diego's first Organization Development Program, initiated and managed organization development and productivity improvement programs for City departments. Designed and implemented training programs related to human relations, equal opportunity and sexual and gender issues. Both as a first line supervisor and as a manager, successfully conducted numerous complex and contentious personnel actions resulting in various degrees of discipline up to and including termination. Functioned as a member of the City Manager's Labor Relations Advisory Committee for fifteen years.

International Activities

Based on reputation as an innovator, served as a consultant in environmental issues to South Africa, Saudi Arabia and the Marshall Islands at the request of such agencies as the United States Agency for International Development (USAID) and the International City/County Management Association. At USAID's request, participated in a forum on transparency in government and various aspects of public participation, which was held in Brazil. Participated in the United Nations' Chinese Mayors' Seminar on Municipal Solid Waste Management and Landfill Gas Utilization held in Nanjing, China at the request of the U. S. Environmental Protection Agency and made presentations at the last three Mayors' Asia - Pacific Environmental Summits sponsored by the City of Honolulu, Hawaii. Established a close long-term working relationship with San Diego's Sister City, Tijuana, Mexico and initiated the first Border WasteWiSe project, a public-private partnership funded by the U.S. Environmental Protection Agency. Also provided in-depth training on solid waste management through AMMAC (The Association of Mexican Municipalities) in Mexico City and for Capacita's (The Institute of Education and Training International Symposium of Successful Programs) in Mazatlan. Additional joint projects with the City of Tijuana include various environmental conferences, staff exchanges and feasibility studies. Provided Technical assistance regarding landfill siting issues and funding options for municipal solid waste management.

Other Professional Accomplishments

Active and have served as the past president of the United States Conference of Mayors' Municipal Waste Management Association. Was appointed as the first chair of the California Integrated Waste Board's Local Government Technical Advisory Committee. Currently serve as Chair of the Solid Waste and Litter Committee for Keep America Beautiful, and Treasurer of Keep California Beautiful. Also, currently serve as a Board Member of the National Center for Housing and the Environment (NCHE) and the San Diego Regional Energy Office. Appointed by the U.S. Department of Energy's Secretary to the Federal Energy Management Advisory Committee (FEMAC). Taught in Environmental Science Program at UCSD. BS and MS in Public Administration – San Diego State University

The City of San Diego Department of Environmental Services

The City of San Diego is dedicated to helping to foster the region's economic base to improve the quality of life for its citizens and business community. Through many continuing programs and projects, the City creates opportunities for businesses to succeed. San Diego occupies a strategic location in the United States, being both on the U.S.-Mexico border and on the Pacific Rim.

San Diego-Tijuana Border Waste Wise Project

The San Diego-Tijuana Border Waste Wise Project was a bi-national public-private partnership that helped businesses in the large metropolitan region take advantage of the economic and environmental opportunities of waste reduction and recycling. The San Diego-Tijuana Border Waste Wise project promotes waste reduction among businesses on both sides of the San Diego-Tijuana border. The Cities of San Diego and Tijuana are leading this unique cross-border environmental initiative along with their other project partners. Border Waste Wise provided technical assistance to manufacturers on innovative ways to increase materials efficiency, and reduce and recycle wastes. The primary goal was to enhance economic competitiveness and ease the environmental pressures resulting from the region's large and rapidly growing maquiladora and industrial sectors.

Border Waste Wise helped more than 27 large and medium-sized manufacturers in the electronics, transportation, plastic injection and furniture industries identify methods and technologies to reduce waste in product design, manufacturing and packaging

Miramar Landfill

The City of San Diego also manages the Miramar Landfill, an LMOP certified landfill, which receives more than .3 million tons of waste a year. This landfill is currently capturing landfill gas as a source of energy.

STEVEN M. HAMILTON

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Mr. Hamilton has over 24 years of environmental project experience, with particular emphasis in solid waste management. This work has involved over 350 projects on more than 240 sites throughout the United States and in Egypt, Brazil, Colombia, Jamaica, México, Poland, and Puerto Rico. Mr. Hamilton also has extensive experience in providing solid waste training and education at numerous venues internationally and previously served as a Director of the Solid Waste Association of North America's (SWANA) Training Program.

EXPERIENCE

- Managed the development of a "How-To Privatize" procedural manual to be used by Egyptian Governorates in privatizing their solid waste management systems. Subjects covered include: Introduction to Privatization, Solid Waste Planning, Solid Waste Financial Management, Contractor Pre-Qualification, Tendering and Contracting, Contract Monitoring, Public Awareness and Communications, and Residential and Commercial Solid Waste Collection. Disseminated the privatization manual to the Egyptian Environmental Affairs Agency (EEAA) and all 26 Egyptian Governorates in a series of workshops held throughout Egypt. The project was funded by the United States Agency for International Development (USAID) under the Sustainable Urban Management (SUM) program.
- Provided solid waste privatization assistance to the Governorates of Alexandria, Cairo, and Qalyubiya, Egypt. Activities performed included training, review and ranking of responses to previously prepared Requests for Qualifications (RFQs), Request for Tender (RFT) preparation, and assistance during the bidding process, Contract Monitoring Plan preparation, and landfill siting recommendations. The project was funded by USAID.
- Prepared training specifications for and conducted a USAID-funded study tour with eight Egyptian solid waste managers to the International Solid Waste Association 2002 World Environment Congress and Exhibition in Istanbul, Turkey.
- Conducted USEPA-funded workshops on greenhouse gas emission control technologies for landfills in Warsaw, Poland and in Houston, Texas.
- Conducted solid waste management training workshops in Kingston, Jamaica and Ciudad Juárez, México for the United States Environmental Training Institute (USETI).

- Site visits, generation and collection modeling, and energy recovery feasibility studies at 13 landfills in Brazil (funded by USAID). The data was used to extrapolate the total possible energy production capacity of all Brazilian landfills.
- Evaluation of leachate collection and treatment options for the Prados de la Montaña Landfill in Mexico City, México. The site, closed in 1996, had an estimated 528,000,000 gallons of stored leachate. The project was funded by USAID.
- Managed the remediation design for a major landfill slope failure for the Doña Juana Landfill in Santafe de Bogotá, Colombia. Over 1,000,000 metric tons of waste slid out of the canyon landfill in September 1997, traveling over 2 kilometers, and dropping over 600 meters. The landfill dammed a river at the base of the canyon and partially filled a quarry on the opposite side of the river. The remedial design consisted of dewatering the existing landfill and slides, closing a portion of the slide in place, and removal of the lower portions of the slide to a new disposal area. The design also included landfill gas management facilities for the landfill and a wetlands treatment system for leachate management. The project was funded by the World Bank.
- Took charge of an alternative energy company in severe financial difficulty with a majority shareholder who wanted out of the business. Restructured over \$3,000,000 in debt. Renegotiated several contracts to turn losing projects into profitable ones. Identified potential buyers for the business. Entered into negotiations with the highest bidder and completed a transaction in which the majority of the company's assets were purchased and the proceeds used to satisfy the company's creditors.
- Materials recovery facility (MRF) engineering, permitting, and consulting services for Frontier Recycling, Inc. The client purchased an existing construction and demolition (C&D) debris transfer station and recycling facility in Largo, Florida. Upon closure of the sale, the client expanded the existing recycling and transfer operations and added a C&D landfill.

Training and Education Experience

- Participated in the development and presentation of a 5-day Municipal Solid Waste Management Course in Kingston, Jamaica for the U.S. Environmental Training Institute and the Jamaica Natural Resources Conservation Authority.
- Participated in the development and presentation of a 5-day Municipal Solid Waste Management Course in Ciudad Juárez, Chihuahua, México for the U.S. Environmental Training Institute.
- Conducted U.S. Environmental Protection Agency (U.S. EPA) Landfill Methane Outreach Program (LMOP) Workshops in Warsaw, Poland, and in Houston, Texas.
- Served as an instructor for the State-of-Florida required Landfill Operators' Training and Certification Program.

- Served for 5 years as the Director of SWANA's Landfill Gas Management Training Program. As Director, co-authored the "Solid Waste Association of North America Course Manual for Managing Landfill Gas at Municipal Solid Waste Landfills, Edition 2", and serve as Course Director and instructor at numerous presentations of the Training Program nationwide.
- Served as Training Committee Chairperson for the Florida Sunshine Chapter of SWANA. As Training Committee Chair developed and presented numerous solid waste continuing education programs.
- As a member of the faculty of the University of Florida's Center for Training, Research and Education for Environmental Occupations (TREEO), served in curriculum development and as an instructor for TREEO's Landfill Design Series Course.

Publications and Presentations

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Hamilton, S.M., Perkins, R.A., Kane, H., Windolph, G., and Iskandar, L. "Solid Waste Management Privatization Procedural Manual", Chapters 1 through 8, Published by the Egyptian Environmental Policy Program, March 2003. Presented to the Egyptian Environmental Affairs Agency and the Governorates of Egypt, March 11 through 13, 2003.

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Hamilton, S.M., Walsh, J.J., and Vogt, W.G., "The Potential Human Health Risks And Mitigation Options Associated with Landfill Gas at Old, Closed Landfills", Presented at the Ninth Annual Municipal Solid Waste Management "Options for Texas" Conference, Austin, Texas, December 14, 1995.

SCS International Engineers

Established in 1970, SCS Engineers is a leading engineering and construction firm specializing in solid waste management and environmental services. Some of the world's leading experts in these subjects make up its staff; with sixty percent of the staff regularly working on landfill projects. SCS Engineers has completed more than 2,000 landfill-engineering assignments for municipal and industrial clients. Based on its strong professional foundation, the company has successfully balanced the often-conflicting technical, financial, institutional, and legal issues inherent in solid waste programs.

In the area of solid waste management, it works with clients in the private and public sectors to plan for, permit, design, and implement facilities and programs, to safely and economically manage all types of solid wastes. Apart from conventional services like regional waste planning and landfill transfer station siting and design, SCS also undertakes innovative assignments like underground fire suppression at landfills, and design of recycling facilities for theme parks.

Following is a listing of some of the specific areas of activity that the company is engaged in:-

- *Landfill engineering:* Siting, design, permitting, hydrogeological/ geotechnical investigations, groundwater monitoring, construction engineering, bioreactors, public participations, political/regulatory interaction, closure/ post-closure care and site reuse.
- *Landfill gas control and recovery:* Gas monitoring, migration and odor control, energy recovery
- *Solid waste planning:* Comprehensive planning, waste composition and generation studies, community involvement
- *Materials recovery facilities and Transfer stations:* Recycling and processing facilities, composting, secondary materials market research and procurement

Apart from extensive operations in the United States, SCS provides environmental consulting and engineering services to clients around the world. It has completed solid waste, landfill gas, site remediation, privatization, and other environmental projects in over 40 countries spread across Latin America, the Middle East, Asia-Pacific, Europe, and Canada. The company's international clients include federal agencies (of the United States and elsewhere) local government agencies (often funded by multi-lateral bank loans), U.S. based companies with operations or investments overseas, and other private firms.

SCS Engineers has completed more than 2,000 landfill-engineering assignments for municipal and industrial clients – spread across over 40 countries. Landfill projects in the Asian region including the following:

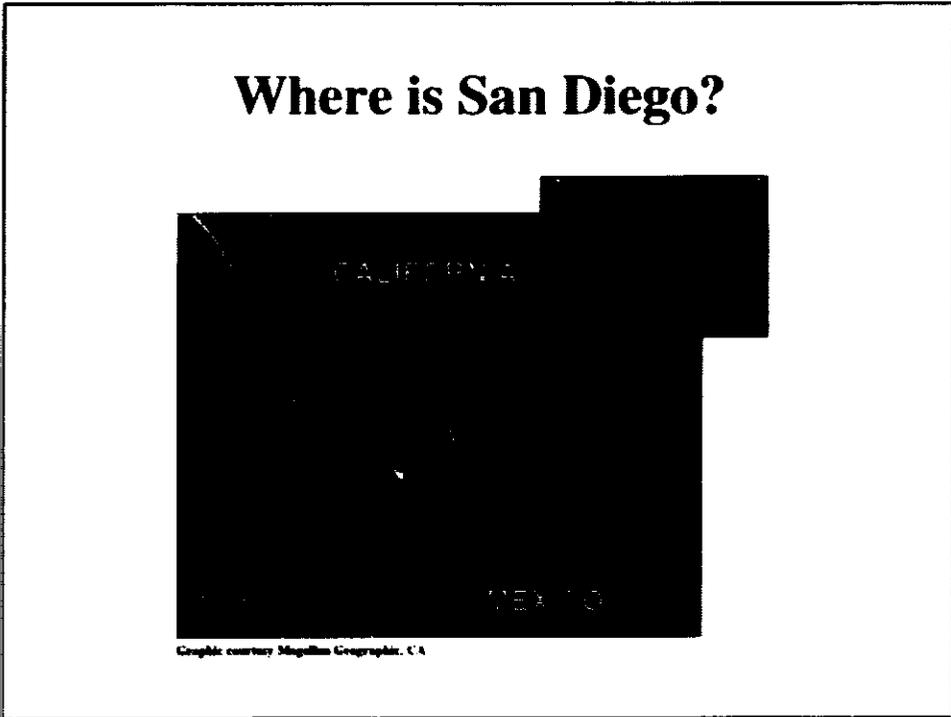
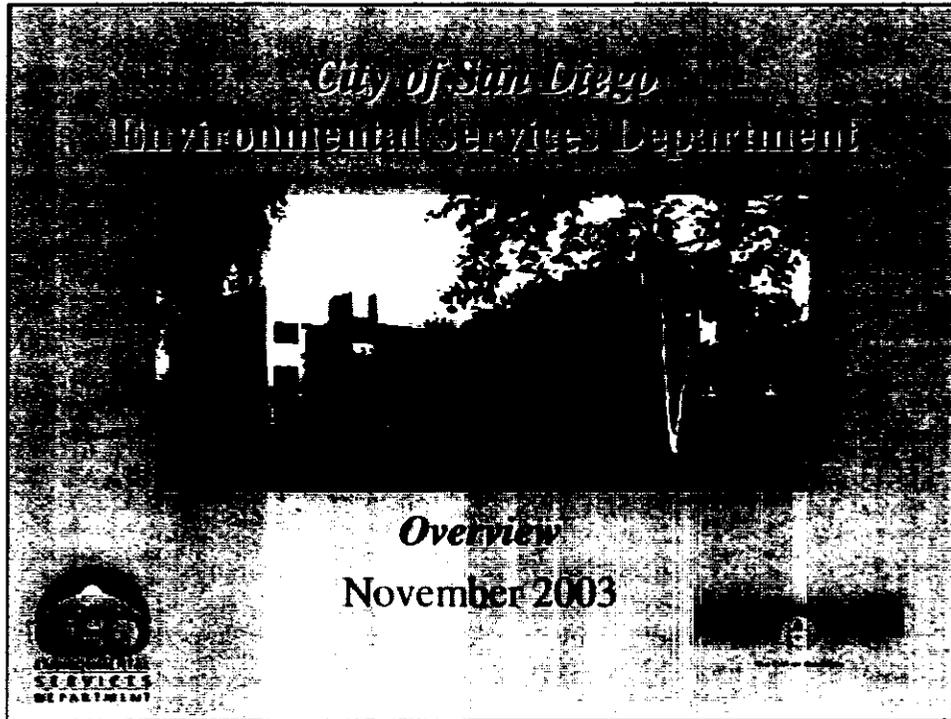
- Landfill Gas-to-Energy project (Kamphangsaen Landfill, Nakohn Pathom, Thailand)
- Landfill Gas-to-Energy project (Sang-Am Landfill, Seoul, South Korea)
- Landfill Gas Control System Design (Taichung, Taiwan (ROC))

ANNEX B.

DELEGATE PRESENTATIONS

RICHARD HAYS
DIRECTOR OF THE CITY OF SAN DIEGO'S
ENVIRONMENTAL SERVICES DEPARTMENT

"CITY OF SAN DIEGO
ENVIRONMENTAL SERVICES DEPARTMENT
OVERVIEW"



Environmental Services Department



Our Mission

We provide environmental services to sustain and improve the quality of life in San Diego.

We achieve this through the integrity, creativity, teamwork, and the use of technological innovation by dedicated and competent employees who are committed to fully meeting community needs.

We take pride in being the best!!

Environmental Services Department

Director
Richard L. Hoyt

Assistant Director
Robert A. Egan

Air Quality
[Name]

Construction
[Name]

Hazardous Waste
[Name]

Noise
[Name]

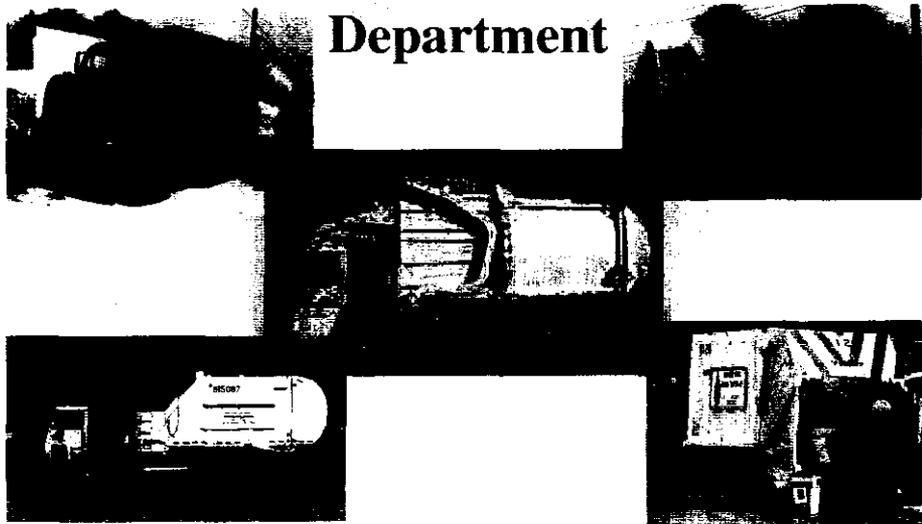
Solid Waste
[Name]

Environmental Services Department

Fiscal Year 2004
Operating and Capital Budget Summary

| | |
|-------------------------------------------------------------------------------------------------|------------------|
| General Fund (GF) Property Tax and other sources | \$ 33.8 M |
| Refuse Disposal Enterprise Fund (RDF) Miramar Landfill Tip Fee Revenue | \$ 38.3 M |
| Recycling Enterprise Fund (RF) \$7/ton fee on City of S.D. Collected & Disposed Waste | \$ 21.5 M |
| Energy Conservation and Management City Departments | \$ 1.1 M |
| DEPARTMENT TOTAL | \$ 94.7 M |

**Environmental Services
Department**



Collection Services Division

Collection Services Division

- Refuse Collection
- Curbside Greenery Collection
- Curbside Recycling Collection
- Special Collection



| Positions | Trucks | FY 2004 Budget |
|-----------|--------|----------------|
| 252.88 | 183 | \$ 49.7 M |

Refuse Collection

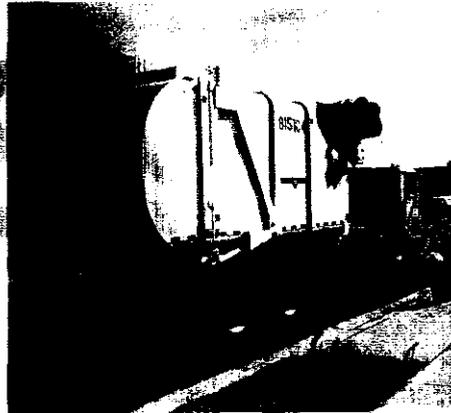


- Over 315,000 weekly residential collections.
- Over 29,000,000 total refuse, recycling and greenery stops per year.
- More than 375,000 tons of refuse collected yearly.

Automated Curbside Recycling

Citywide Curbside Recycling

- 276,000 homes served biweekly (Citywide)
- 75,000+ tons diverted annually
- Savings of \$6.9 million to the General Fund in FY 2003



Curbside Greenery Collection

- About 146,000 weekly residential collections
- More than 36,000 tons expected to be collected this year
- Citywide expansion long-term goal
- Savings of \$3.3 million to the General Fund expected in FY 2003



| Positions | Trucks | FY 2004 Budget |
|------------|--------|----------------|
| (RF) 52.08 | 25 | \$6.5 M |

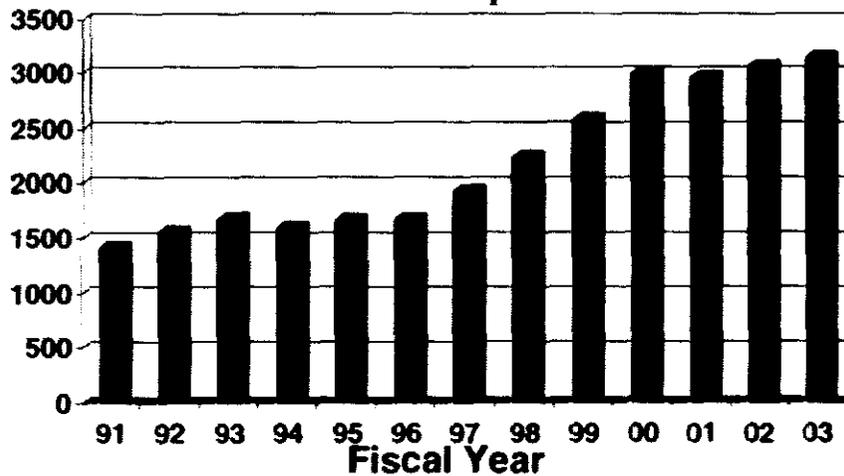
Special Collection

- 8.10 budgeted positions
- Five dedicated trucks
- \$1,729,927 budget
- More than 905 street litter containers serviced at least three times/week
- Responsible for maintenance & graffiti removal

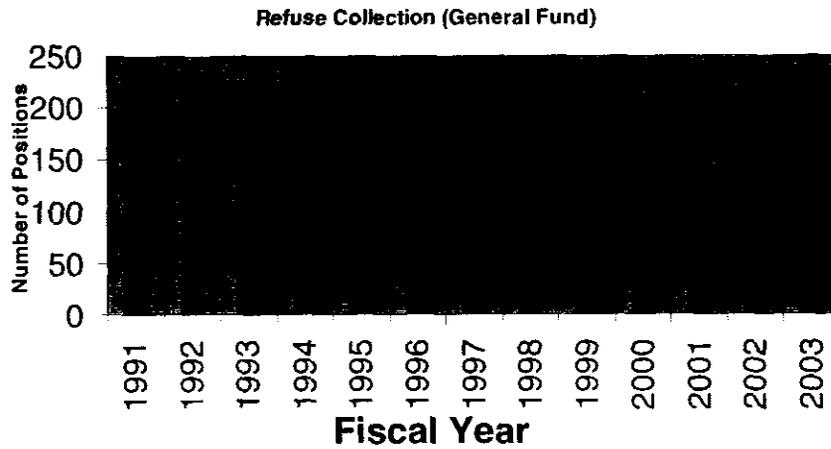


Refuse Collection Productivity Achievements

Tons/Positions per Year



Budgeted Sanitation Driver Positions

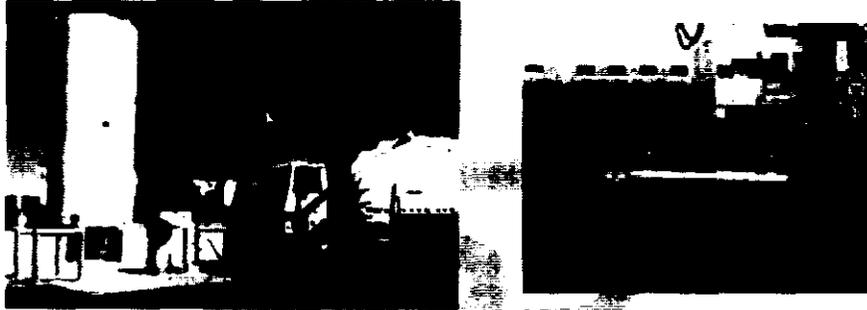


New Facility Benefits



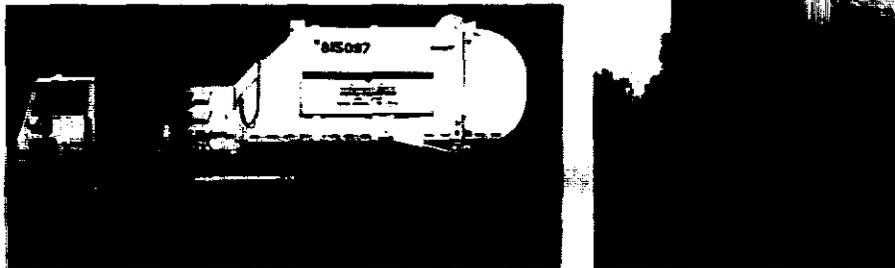
- Consolidation of four operation stations to one single location
- Previous locations of four operation stations may now be used for other City purposes
- Reduces miles traveled each day by collection packers
- Allows for on-site refueling during day and evening of 77 LNG packers, which use 3,000 gallons each day

Liquefied Natural Gas Benefits

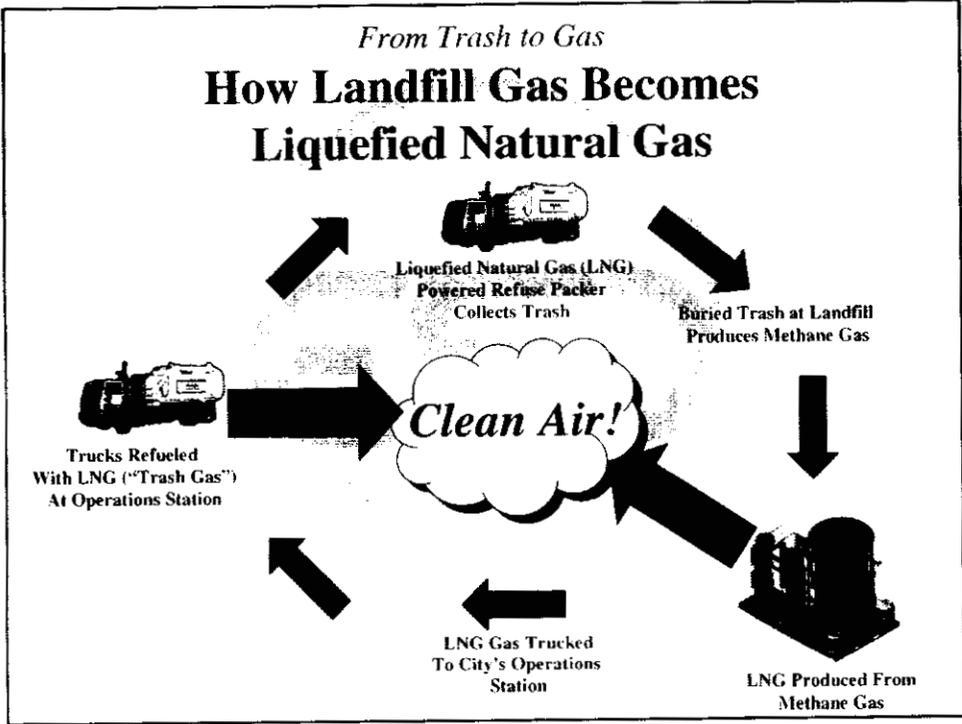


- In terms of emissions, each diesel truck converted to dual fuel LNG will remove the equivalent of 100 sedans or 20 SUVs off the road
- Significantly reduces cancer-causing diesel particulate and reduces nitrous oxide (Nox) by approximately 37 percent
- LNG engines are quieter and have longer life spans than diesel fueled engines

Next Steps...



- Capture methane gas emitted from decomposing garbage at City's closed landfills and convert to LNG (anticipated completion date: two to three years)
- Fuel 77 dual-fuel packers with LNG from City's Landfill Gas Project
- Operation of vehicles on City produced LNG will reduce greenhouse gas emissions per vehicle by almost half



Environmental Services Department

Refuse Disposal Division

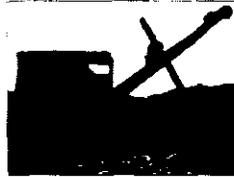


Refuse Disposal Division

"MIRAMAR: A full-scale waste management and environmental effort."

--Waste Age Magazine, 1992

- Miramar Landfill Operations
- Fee Collection
- Ecological Services
- Maintain Closed Landfills
- Regulatory Compliance



| Positions | FY 2004 Budget |
|-----------|------------------------------|
| 92.50 | \$ 19.2 M C.I.P. \$ 5.7 M |

Fee Collection

- Collect and administer almost \$50 M in fees
- Transaction error rate < 1%
- Process about 500,000 vehicles/year, open 361 days/yr

| Positions | FY 2004 Budget |
|-------------|----------------|
| (RDF) 19.34 | \$1.9 M |

Closed Landfills



- Maintain five inactive landfills
- Perform approximately 200 groundwater samplings
- Manage five landfill gas systems
- Approximately 900 tests and adjustments to gas wells performed

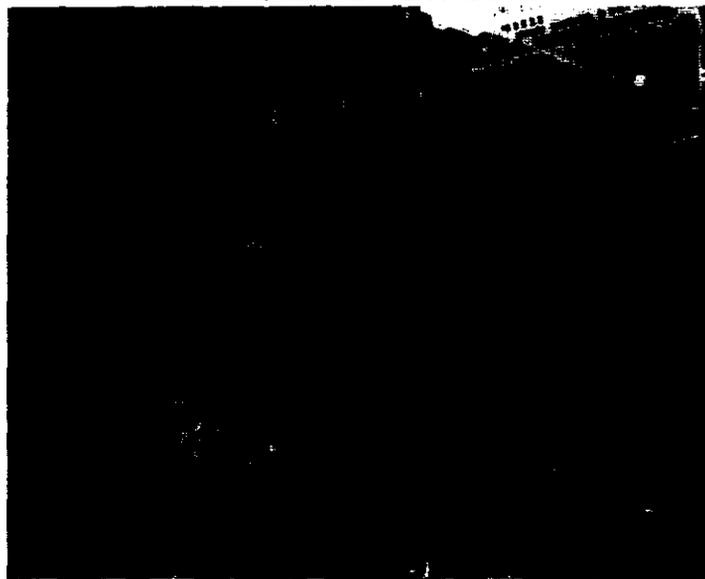
| Positions | FY 2004 Budget |
|-------------|----------------|
| (RDF) 15.12 | \$2.7 M |

Miramar Landfill Facts



- Operated by City of San Diego
- City's only operating landfill
- Land owned by U.S. Department of Navy
- "Rent" = free disposal of military waste
- Site of nationally known bird control program
- Innovative native plant revegetation program
- 1,423-acre site in operation since 1959
- Projected closure: 2012
- Rock aggregate mining provided additional capacity
- Landfill gas extraction partnerships

Miramar Landfill



November 25, 2000

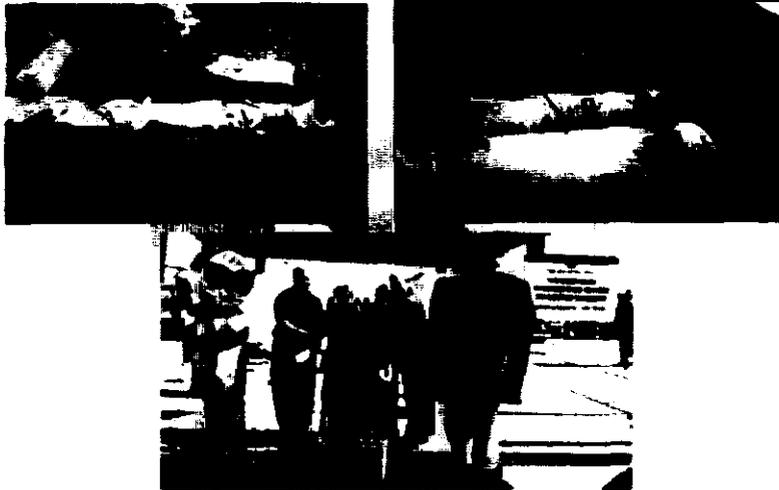
Refuse Disposal Environmental Management System

ISO 14001 Certified in July 2002



- First municipally owned and operated landfill in the U.S. certified to ISO 14001
- Identifies every point at which day-to-day operations impact the environment
- Determines if OR how you will optimize or manage/minimize those impacts
- More environmental awareness, involvement and competency
- Better communication about environmental issues inside and outside of organization
- More efficiency, - costs, + competency
- Better ability to compete (privatization)
- Better relationship with regulators

Environmental Services Department



Environmental Protection Division

Environmental Protection Division

- Burn Ash Site Cleanup
- Hazardous Materials Management
- Asbestos/Lead Management
- Underground Storage Tank Management



| Positions | FY 2004 Budget |
|-----------|----------------|
| 32.00 | \$4.5 M |

Burn Ash Site Cleanup



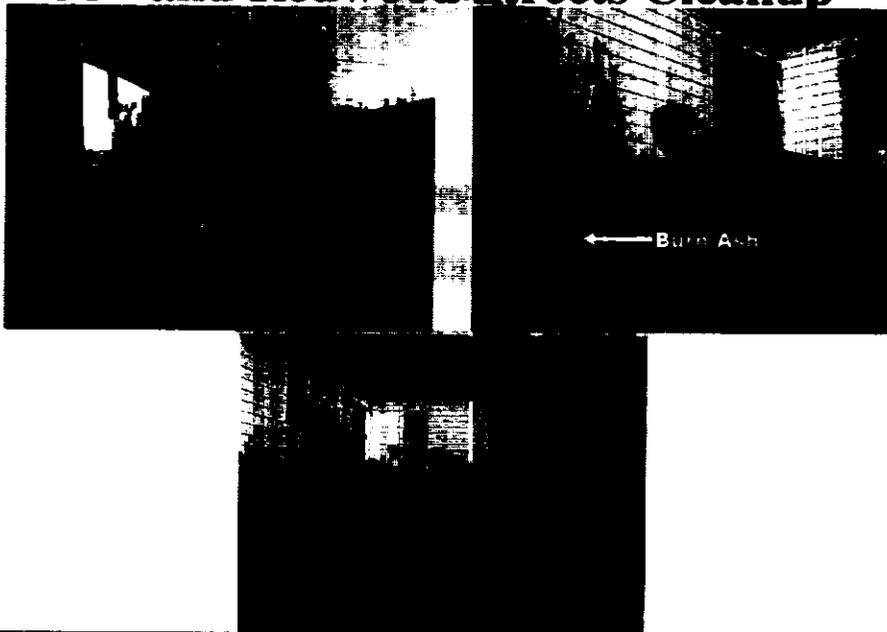
Circa 1930



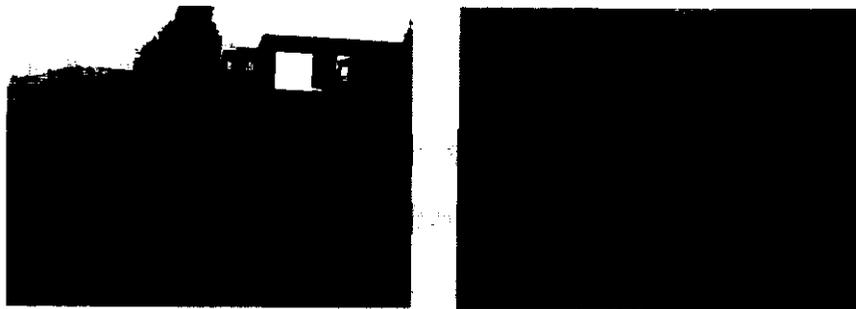
1999

- 1938 report identified 51 rubbish/burn dumps in City
- City had no centralized "dump" until 1950s
- Pre-1970 trash burning common
- Soil typically high in lead
- Health concerns raised in 70s
- State involvement began in mid-1990s

38th and Redwood Streets Cleanup



38th and Redwood Streets Cleanup



- Removed top three feet of contaminated soil
- Installed geotextile membrane as barrier
- Replaced with clean soil

Household Hazardous Waste/Auto Product Program



- HHW collection facility
- Eight auto product collection events/year
- Public education outreach
 - Direct mail and other media outreach
 - Hotline

Internal Hazardous Materials and Asbestos/Lead Management

Through City administrative regulations:

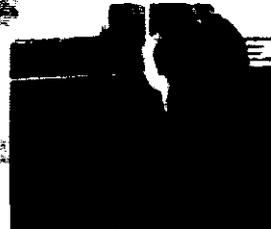
- Acts as liaison to regulatory agencies
- Performs inspection, sampling and project management for City facilities, properties, and construction projects
- Provides technical support to Departments
- Performs specialized training/instruction to City staff



Lead Safe Neighborhoods Program

The Lead Safe Neighborhoods Program created by City Council April 2002 to develop and implement a Citywide lead poison prevention program.

- Develop an enforcement policy for substandard housing when lead hazards are present
- Provide City staff, contractors, and landlords with lead hazard training
- Develop education and outreach infrastructure
- Implement a lead hazard pilot program in two "high risk" communities of San Diego to identify effective communication and best methods of lead hazard abatement



Underground Storage Tank Program



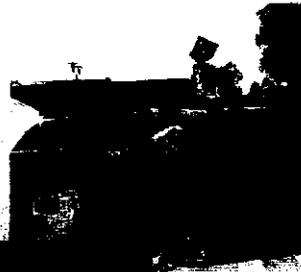
- Removed approximately 250 buried and above-ground tanks since 1987
- Provides technical support to client Departments and liaison activities with regulatory agencies
- Performs environmental site assessment and project management
- Manages cleanup of contaminated sites

Hazardous Substances Enforcement Team



- Performs approximately 7,000 annual random inspections of waste tipped at Miramar Landfill
- Diverted 19 tons of hazardous waste from the landfill
- Issued 1,400 special waste manifests
- Initiated enforcement actions for illegal disposal

Environmental Services Department



Environmental Programs Division

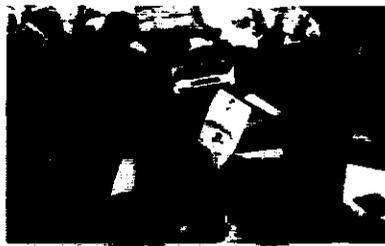
Environmental Programs Division

- AB 939 Compliance
- Solid Waste Code Enforcement
- Community Sustainability
- Curbside Recycling Planning
- Support Services/Field Operations



| Positions | FY 2004 Budget |
|-----------|----------------|
| 72.00 | \$8.8 M |

Solid Waste Code Enforcement



- Enforce solid waste-related Municipal Codes
- Issue notices of violation, citations and file court cases
- More than 20,000 annual investigations
- Organized/conducted 73 Community Cleanups in FY 2002

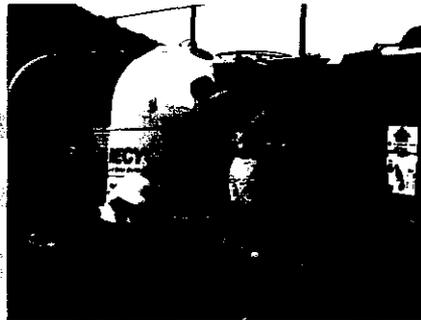
Support Services

- Abated over 16,000 illegal dumps and litter complaints in FY 2002
- Conduct Community Cleanups
 - 1,133 tons of trash and 365 tons of recyclables collected last year
- Dead Animal Removal
- Provide other field op functions



Citywide Diversion Programs (AB 939 Compliance)

- Residential Curbside Recycling Program planning and outreach
- Realized over \$1.1 million in revenue from recyclables FY 2002
- Park and Recreation Drop-off Program
 - 55 Facilities
 - More than \$600,000 in revenue since FY 1995
- 15,000 annual outreach contacts in commercial and industrial sectors



Environmental Services Department



Energy Conservation & Management Division

Energy Conservation & Management Division

- Energy Financing
- Energy Legislative Analysis
- Energy Grant Analysis
- Energy Data Analysis
- Energy Accounting and Acquisition
- Public Outreach and Education



| Positions | FY 2004 Budget |
|-----------|----------------|
| 7.85 | \$ 1.1 M |

City of San Diego Goal #9: *Pursue Energy Independence*

1. Manage City Energy Use
2. Conserve Energy
3. Enhance Energy Efficiency in Existing City Facilities
4. Energy Efficiency in New Facilities and Major Remodels
5. Self-Generation of Electricity Using Renewable Resources
6. Create a Regional Energy Authority



Energy Project Highlights *Police HQ Retrofit*

- Includes cogeneration, photovoltaics, lighting control, and load management
- \$4.7 million total project cost
- \$719,000 energy incentives
- Guaranteed annual energy cost savings more than \$600,000
- 12-year financed payback
- Late 2003 estimated completion date

Energy Project Highlights

Ridgehaven "Green Building"



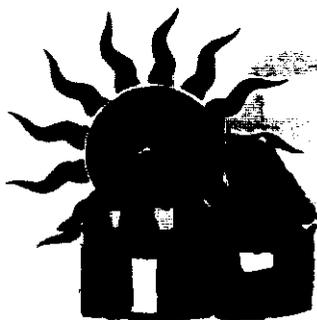
- 54-kilowatt solar power arrays
- Activated May 2003
- Will produce 80,702 kWh of electricity annually
- Rooftop and carport arrays

Miramar Operations Center



- 62-kilowatt solar power array
- Activated October 18, 2002
- Will produce 91,000 kWh of electricity annually
- "Net Zero" electric bill for administration building

Whole House Energy Retrofit Program



- Energy efficiency rebate program for pre-1978 homes
- \$1.48 million funding by California Public Utilities Commission (CPUC)
- City effort to provide demand reductions in private homes

Ridgehaven "Green Building"



*Winner of nation's first
Federal Energy Star*

- "Green building" by design
- Renovated with recycled and reused products and/or energy-efficient components
- Pilot for Leadership in Energy Efficiency Design for Existing Buildings (LEED-EB) program

Environmental Services Department



Resource Management Division

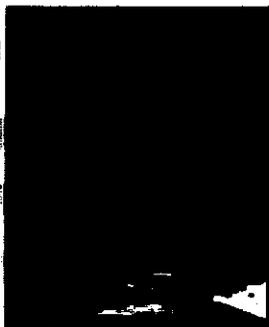
Resource Management Division

- Bilingual Program
- Community Outreach and Education
- Facilities Maintenance
- Fiscal Planning and Management
- Franchise Management
- Customer Service
- Management Information Services
- Organization Development and Training
- Safety



| Positions | FY2004 Budget |
|-----------|---------------|
| 51.14 | \$ 5.7 M |

Resource Management Division



- Develop and implement an extensive Community Outreach program
- Manage over \$90 million departmental budget
- FOCUS on Safety Program resulted in 75% decrease in worker injuries
- Manage a complex Solid Waste Franchise system
- Conduct department-wide training

Community Education and Outreach



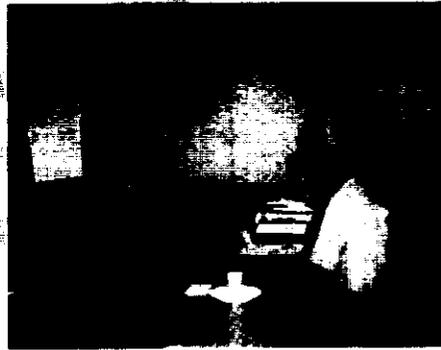
- Coordinates communication within the Department
- In charge of public education and outreach
- Liaison between the Department and the local, national and international media
- Reports to the public
- Responsible for marketing the waste, recycling and green collection programs as well as the energy and sustainability programs
- Updates the Department's Web sites
- In charge of Award Programs

Franchise Administration

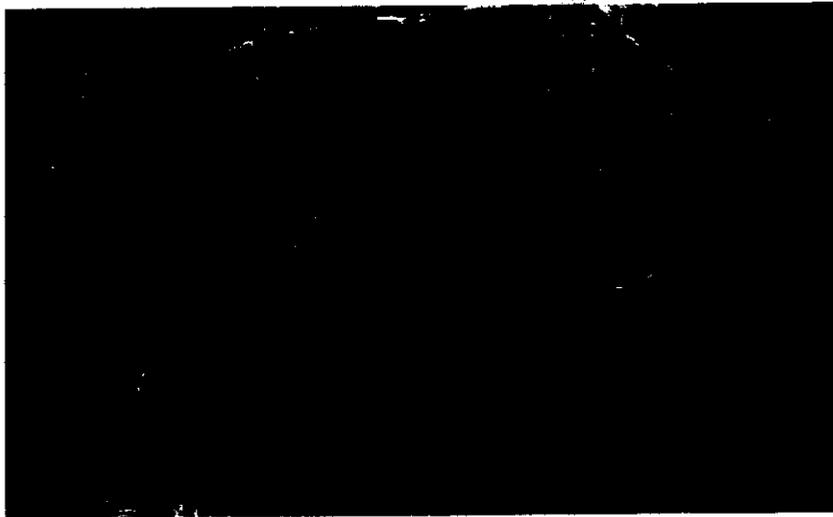
- Manages 21 waste transportation franchise agreements
- Processes and oversees all the franchise rates and tonnage accounts
- Responsible for carrying out the franchise regulation code
- Serves as liaison between the Department and the waste transportation franchises and non-franchises

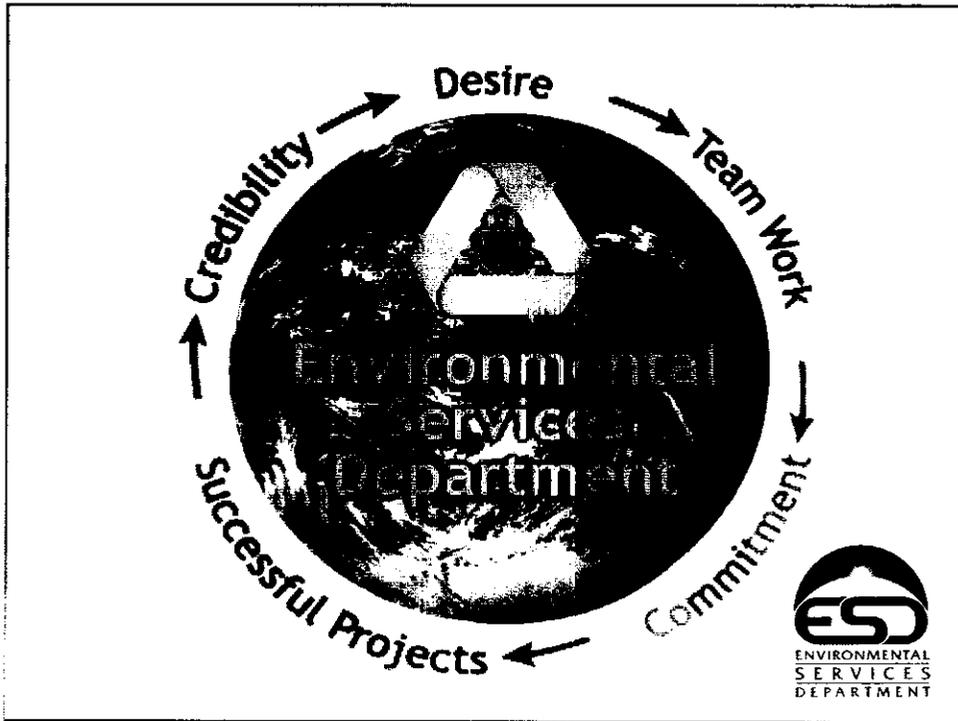
Safety

- 48 formal/informal education and training events
- Comprehensive Safety Handbook that includes all the current programs
- Observes field safety measures
- Investigates accidents and injuries
- Analyses and reports data and tendencies
- 75% reduction in work related injuries
- Total savings of \$721,269 in workers compensation from 1997 to 2002



Geographic Information Systems (GIS)





STEVE HAMILTON
LFG EXPERT –
SCS INTERNATIONAL ENGINEERS

**“MANAGEMENT OF LANDFILL GAS AS A
GREENHOUSE GAS”**

MANAGEMENT OF LANDFILL GAS AS A GREENHOUSE GAS

Steven M. Hamilton, R.E.P.

SCS Engineers

Santa Rosa, California, USA

shamilton@scsengineers.com

SCS ENGINEERS

OVERVIEW

- What is Landfill Gas (LFG)?
- Why is it a Concern?
- How Can it be Managed?

SCS ENGINEERS

WHAT IS LANDFILL GAS?

- Byproduct of Anaerobic Decomposition of Solid Waste:
 - ~50% Methane
 - ~50% Carbon Dioxide
 - Up to 200 Other Compounds in Trace Concentrations

SCS ENGINEERS

WHAT IS LANDFILL GAS?

- Heating Value of 500 Btu/cf or 18.6 kJ/m³
- Saturated

SCS ENGINEERS

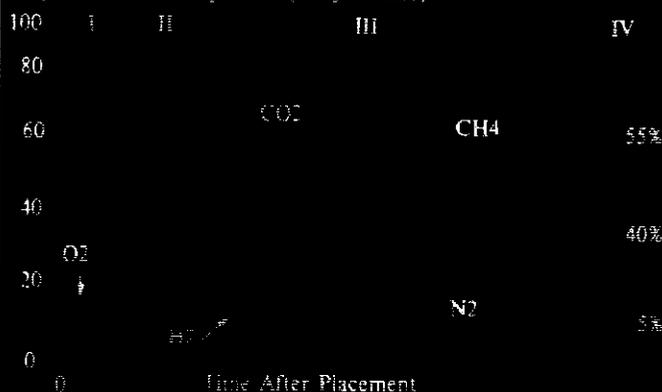
LANDFILL GAS GENERATION FACTORS

- Waste Content
- Moisture
- Particle Size and Shape
- Oxygen
- Compaction
- Temperature, pH, Nutrients, Toxins

SCS ENGINEERS

LANDFILL GAS PRODUCTION PHASES

Fig VI-1. Gas Composition (% by volume)



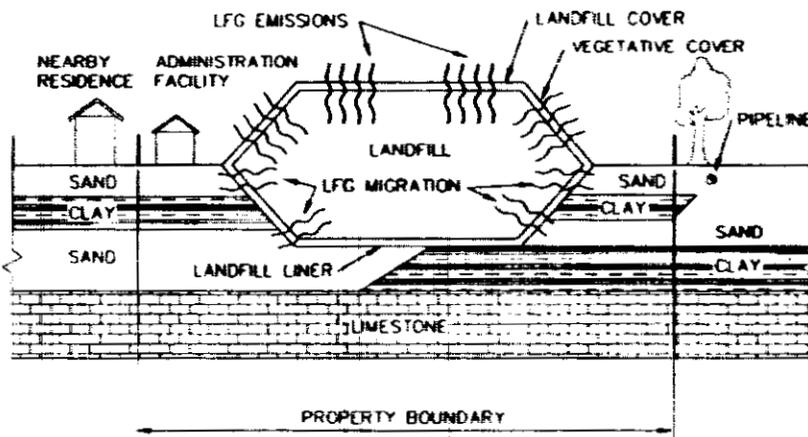
SCS ENGINEERS

WHY LANDFILL GAS NOW?

- Open Dumps:
 - Landfill gas is not as much of an issue
- Modern (Sanitary) Landfills:
 - Landfill gas will occur and must be managed

SCS ENGINEERS

LANDFILL GAS MOVEMENT



SCS ENGINEERS

WHY DO WE CARE?

Migration:

- Explosion/Fire
- Groundwater Contamination
- Toxic Hazards
- Vegetation Damage
- Asphyxiation

SCS ENGINEERS

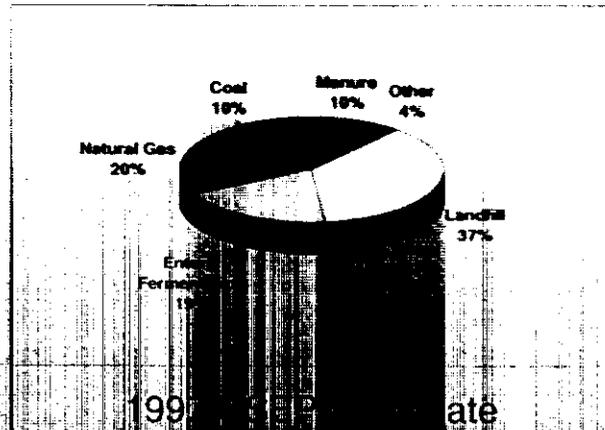
WHY DO WE CARE?

Emissions:

- Odors
- Smog Formation
- Global Climate Change

SCS ENGINEERS

U.S. METHANE EMISSIONS



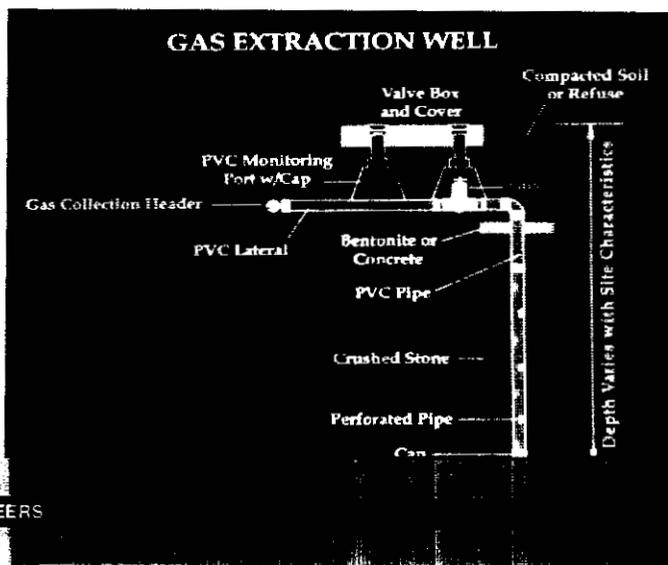
SCS ENGINEERS

CONTROL TECHNOLOGIES

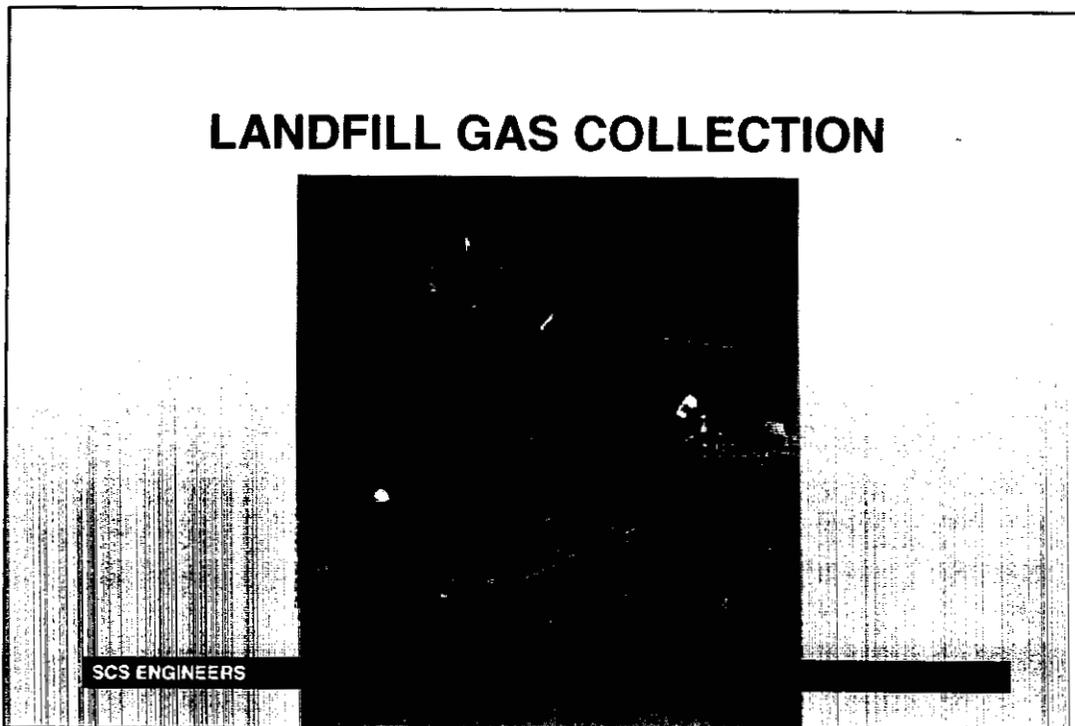
- Flaring or Incineration
- Energy Recovery
- Both are Dependent on Collecting the Landfill Gas

SCS ENGINEERS

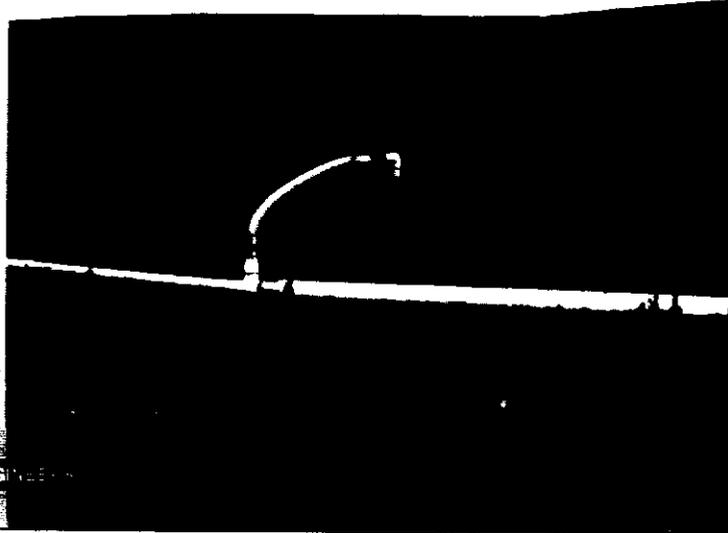
LANDFILL GAS COLLECTION



LANDFILL GAS COLLECTION



LANDFILL GAS COLLECTION



LANDFILL GAS COLLECTION



COLLECTION ISSUES

- Differential Settlement
- Condensate Management
- Operations
- Vandalism
- Above-ground versus Below-ground
- Piping Material

SCS ENGINEERS

LANDFILL GAS FLARING

- Open or "Candle" Flare
- Less Expensive
- Easier Operation
- Lower Destruction Efficiency



SCS ENGINEERS

LANDFILL GAS INCINERATION

- Enclosed or "Ground" Flare
- Temperature Control
- Retention Time
- Higher Destruction Efficiency

SCS ENGINEERS



LANDFILL GAS TO ENERGY RECOVERY

(Los Angeles, California, USA)

SCS ENGI



LANDFILL GAS TO ENERGY RECOVERY

- Provides a Beneficial Use for Collected LFG
- Reduces Greenhouse Gas (GHG) Emissions
- Displaces Fossil Fuel Use

SCS ENGINEERS

LANDFILL GAS TO ENERGY RECOVERY

- US, Canada, and EU – 600+ operational projects
- Potential to double this number in next decade
- World Bank survey of 50 landfills in developing nations found only two operational projects
- Developing countries are making progress towards LFG utilization
- Large potential in India, Brazil, China, Russia

SCS ENGINEERS

LANDFILL GAS TO ENERGY RECOVERY

- **Proven Recovery Technologies:**
 - Direct Use
 - Leachate Evaporation
 - Electric Power
 - Pipeline Quality Gas

SCS ENGINEERS

DIRECT USE

- **Medium Btu Gas**
 - 18.6 kJ/m³
- **Remove Water**
- **Remove Trace Hydrocarbons**
- **Odorize**

SCS ENGINEERS

DIRECT USE

- Simplest Approach
- Energy Customer Located on or Close to Landfill
- Customer Energy Demands Should Match LFG Supply

SCS ENGINEERS

DIRECT USE

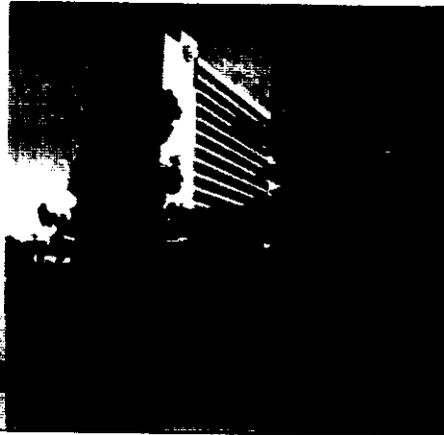
(Industry Hills, California, USA)



SCS ENGINEERS

DIRECT USE

(Industry Hills, CA)



LEACHATE EVAPORATION

(Florida, USA)

- Direct Injection
- In-Direct Heat
- Can Include
Condensate
Treatment



SCS ENGINEERS

ELECTRIC POWER

- Generate Electricity On-Site
- Sell Power into Grid, Directly to Nearby User, or Use On-Site
- Most Common Recovery Technology

SCS ENGINEERS

ELECTRIC POWER

- Internal Combustion (IC) Engines
 - 0.5 Megawatt (MW) and greater
- Turbines
 - 3 MW and greater
- Steam Cycle Boilers

SCS ENGINEERS

TURBINE VS. IC

Advantages:

Compared to IC engines, turbines have lower emissions and lower O&M costs

Disadvantages:

High compression requirements (approx. 100 to 300 psi) and lower efficiency

SCS ENGINEERS

ELECTRIC POWER

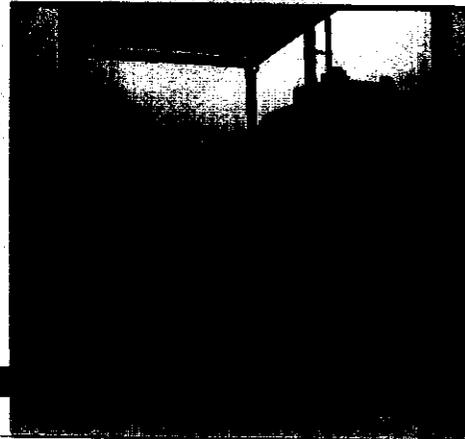
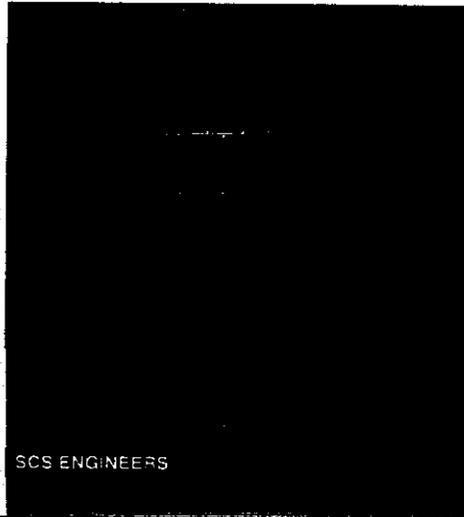
(Istanbul, Turkey)



SCS ENGINEERS

ELECTRIC POWER

(Sydney, Australia & Hong Kong, China)



PIPELINE QUALITY GAS

- CO2 Removal
- Very Stringent Gas Quality Requirements
- Limited Number of Sites
- Very Capital & Operations Intensive

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PIPELINE QUALITY GAS

(Cincinnati, Ohio, USA)

SCS ENGINEERS

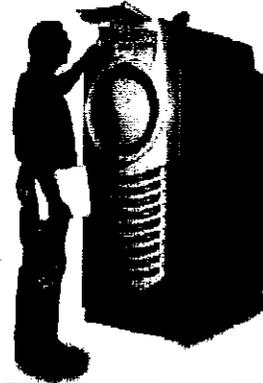
LANDFILL GAS TO ENERGY RECOVERY

- **Emerging Recovery Technologies:**
 - Microturbines
 - Vehicle Fuel
 - CO₂ Recovery
 - Fuel Cells
 - Ethanol/Methanol

SCS ENGINEERS

MICROTURBINES

- High-Speed Turbo-Charged Generator
- 25 kW to 75 kW
- Usually for On-site Power Demands



SCS ENGINEERS

MICROTURBINES

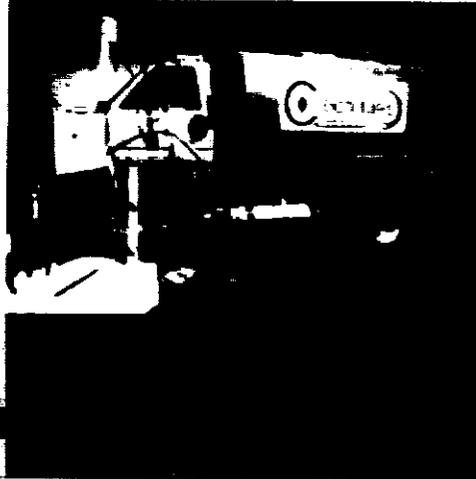
- Advantages
 - Low emissions
 - Multiple fuel capability
 - Light weight/small size
 - Lower operation & maintenance cost
- Disadvantages
 - Low efficiencies
 - Limited LFG applications
 - Capital cost per kW

SCS ENGINEERS

VEHICLE FUEL

(Los Angeles, California, USA)

- Capital & Operations Intensive
- Not yet Done on a Commercial Scale



SCS ENGINEERS

FUEL CELLS

(Los Angeles, California, USA)

- Capital & Operations Intensive
- Not yet Done on a Commercial Scale



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PROJECT DEVELOPMENT OPTIONS

- GASCO vs. GENCO
- Own & Operate Entire System
- Contracting Options

SCS ENGINEERS

MAJOR REASONS RECOVERY PROJECTS FAIL

- Can't Make Project Economically Feasible
- Over-Estimate LFG Recovery Volumes
- Poor Design/Construction
- Poor Operations
- Permitting Issues

SCS ENGINEERS

RECOVERY ESTIMATES

- Why do Over-Estimates Happen?
 - Over Estimate In-Place Waste
 - Over Estimate Total Site Capacity
 - Over Estimate Projected Waste Volumes
 - Over Estimate Recoverable LFG
 - Waste Composition is Atypical
 - Some Models Just Plain Over Estimate

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DESIGN ISSUES

- Capital vs. Operations Costs
 - Estimate both
- Interaction with Landfill Operator
 - Landfill operations vs. LFG operations
 - Additional LFG management requirements?
- What are the Gas Specs?

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DESIGN ISSUES

- Site Geometry
- Equipment/Materials Specs
 - Corrosion
 - Flexibility
 - Climate
- Condensate Management
- System Access

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CONSTRUCTION ISSUES

- Use an Experienced Contractor!
 - Understands construction on landfills
 - Field-fitting typically required
 - Health & Safety practices
- Use Effective COA Program

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OPERATIONS ISSUES

- Gas Quality is Key!
- Higher Level of Operations.
- Trends Analysis.
- Landfill Fires.

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GHG EMISSIONS CREDIT OPPORTUNITIES

- Landfill gas utilization projects are attractive GHG mitigation projects
- Private GHG market has emerged
- Participation may include sale of historic, current or future emissions credits
- LFG utilization an attractive CDM project

SCS ENGINEERS

SUMMARY

- Landfill methane emissions will increase in India
- LFG utilization can significantly reduce these emissions
- These investments are win/win:
 - LFG utilization provides a revenue stream
 - Improves safety at the landfill
 - Very cost-effective greenhouse gas mitigation projects

SCS ENGINEERS

ANNEX C.

Agenda

***U.S. GOVERNMENT SIDE EVENT –
CLIMATE CHANGE TECHNOLOGY***

US-India Cooperation on Climate Change

November 11, 2003

Hotel Samrat, Kautiliya Room
Chanakyapuri, New Delhi

Agenda 12:30-17:30

-
- | | |
|------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1230-1400 | Registration |
| 1300-1400 | Lunch |
| 1400- 1405 | Welcome and Introduction: USAID Energy and Environment Program in India - Glenn Whaley, Director Environment, Energy & Enterprise, USAID/India |
| 1405- 1415 | An Overview of US-India Climate Change Partnership – Harlan Watson, Senior Climate Negotiator, U.S. Department of State |
| 1415-1425 | Climate Change Cooperation in India – Prodipto Ghosh, Secretary, Ministry of Environment & Forests, Government of India |
| 1425-1440 | U.S.-Indo Initiatives in Clean Energy Technology – David Garman, Assistant Secretary, U.S. Department of Energy |
| 1440-1455 | India's Interest in a Hydrogen Economy – Surya P. Sethi, Advisor – Energy Sector, Planning Commission, Government of India |
| 1455-1510 | EPA's Voluntary Partnerships with Industry: Achieving Reductions in the Near Term, Dennis Leaf, Senior Advisor for Energy and International Cooperation, U.S. Environmental Protection Agency |
| 1510-1520 | Discussion |
| 1520-1540 | Tea Break |
| 1540-1545 | Welcome and Introduction: US-India Technology Cooperation on Climate Change - John Smith-Sreen, Deputy Director Environment, Energy & Enterprise, USAID/India |
| 1545-1600 | Best Practices for Pollution Reduction in the Indian Power Sector - CENPEEP, NTPC – S.C. Deo Sharma, General Manager (CENPEEP), National Thermal Power Corporation, India |

- 1600-1615 Clean Transport Alternatives: Electric Three-wheeler, Tapan Basu, Bajaj Auto Ltd, India
- 1615-1630 Energy efficiency innovations and climate change: Potential for US-India cooperation, Jayant A. Sathaye, Senior Staff Scientist, Lawrence Berkeley National Laboratory, U.S. Department of Energy
- 1630-1645 Role of NGOs in Climate Change Cooperation – Ashok Khosla, Director, Development Alternatives, India
- 1645-1700 Urban and Industrial Development and Climate Change – KP Nyati, Confederation of Indian Industry
- 1700-1730 Solid Waste Management and Climate Change - The Louis Berger Group, Inc. Greenhouse Gas Pollution Prevention Project – Climate Change Supplement
- 1730-1715 Discussions
- 1745 Close

ANNEX D.

Agenda

***ROUNDTABLE DISCUSSION/TRAINING -
MUNICIPAL CORPORATION OF DELHI***

STRATEGIES FOR SUSTAINABLE URBAN WASTE & LANDFILL GAS MANAGEMENT

(Greenhouse Gas Pollution Prevention Project – Climate Change Supplement)

MCD, New Delhi
November 12, 2003

| | |
|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 10:00 – 10:15 | Welcome and introductions USAID, MCD, LBG |
| 10:15 – 10:25 | GEP-CCS – Enabling sustainable solid waste management in India |
| 10:25 – 10:35 | Delhi's Solid Waste Scenario – Key Challenges |
| 10:35 – 10:45 | International Trends in MSW Management |
| 10:45 – 12:30 | Perspectives on Design and Development of MSW Services for the Future <ul style="list-style-type: none">• <i>Emerging strategies for MSW collection and transportation</i> [Video film on innovative collection & monitoring systems used in San Diego]• <i>Technological options for MSW disposal and key issues in technology choice</i>• <i>Public-private approaches to MSW management services</i> (including structuring of legal and liability issues in privatization agreements)• <i>Financial strategies for MSW management – costing and budgeting techniques</i>• <i>GHG emissions from landfills – financial opportunities & strategies for mitigation</i> |
| 12:30 – 1:15 | Discussion |
| 1:15 – 2:00 | Lunch |
| 2:00 – 3:00 | Case Studies on Landfill Design and GHG Mitigation Strategies <ul style="list-style-type: none">- Thailand- Korea- Taiwan- San Diego |

3:00 – 3:45

Discussion on Lessons Learned from MSW and LFG Projects in Thailand, Korea, Taiwan and the US and How these Relate to the Indian Context and Can Translate into Possible Options for MCD

3:45 – 4:00

Closing Remarks

***EXPLORING LANDFILL-TO-GAS PROJECT DEVELOPMENT
DESIGN AND FINANCING
EXPOSURE TRIP***

Bangkok, Thailand • San Francisco, CA, U.S.A

January 27 – February 8, 2004

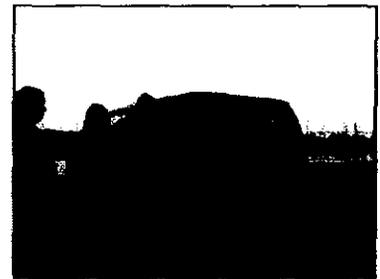
EXECUTIVE SUMMARY

Worldwide, municipal solid waste management is often a costly and difficult problem for local authorities. There is generally low service coverage and on the management side there are substantial inefficiencies as well as a lack of resources. In many places around the world, including India, open dumping is still the 'business as usual' norm. The result is a high cost to society in terms of public health impact and environmental degradation. These inefficiencies in municipal solid waste (MSW) management also prevent many countries from being able to take advantage of the benefits of developing landfill gas projects. The adoption of better waste management practices including the development of sanitary landfills with landfill gas reduction measures has become a necessity for many municipalities in India.

Under the USAID Greenhouse Gas Pollution Prevention Project – Climate Change Supplement (GEP-CCS) program being implemented by the Louis Berger Group, Inc., the LBG GEP-CCS team has been providing ongoing technical assistance to municipalities on the development and management of sanitary municipal solid waste landfills and the development of landfill gas projects. Responding to the need for improved urban solid waste and LfG management as a critical step in GHG reductions, LBG/GEP-CCS designed and implemented an exposure trip to the U.S. and Thailand on January 27 – February 8, 2004.

This exposure trip, *Exploring Landfill-to-Gas Project Development, Design and Financing*, was designed to examine best practices in municipal solid waste management operations and appropriate landfill gas technologies. The goal was to provide the delegates with an opportunity to explore innovative landfill gas abatement, reduction, capture and re-use technologies and practices, to identify conventional and hybrid financial approaches to MSW management, and examine various methodologies associated with sanitary landfill design and development. A further objective was to work with Indian municipalities to help them gain a better understanding of the obstacles and barriers associated in designing and planning sanitary landfills to reduce and capture GHG emissions.

It has been found that a number of emerging and proven landfill gas technologies could be suitable to Indian conditions and have the potential for reducing GHG emissions from municipal landfills and throughout the solid waste management process from collection to disposal. The visit, which was structured to provide the delegates a "hands-on" learning experience of MSW operations, management, project development, included an Asian stop in Thailand to observe how some of these best practice concepts are employed in another rapidly developing economy with some of the same or similar climatic and social conditions as exist in India. The overall visit was organized into two phases; Phase I taking place in Thailand and Phase II taking place the U.S.



Phase I, the Thailand portion of the exposure trip was held from January 27 - 31, 2004 with meetings organized in and around Bangkok, Thailand. These meetings were organized through collaboration with the USAID-funded U.S.-Asia Environmental Partnership Program (US-AEP).

One role of the regional US-AEP program is to help facilitate bi-lateral programs in meeting their objectives. This effort provided the delegates with the opportunity to meet with USAID partners in Thailand, like the Bangkok Metropolitan Administration, who have been working on improving urban policy and management. The principal organizations which the delegates met with included the Bangkok Metropolitan Administration, Waste Management Siam (which operates the Eastern Seaboard Environmental Complex), and Kasetsart University's Energy and Engineering Department (who have taken the lead in a number of LfG to energy projects in Thailand and escorted the site visits to the Kampaengsaen Landfill and Nonthaburi Landfills).

Phase II, the U.S. portion of the exposure trip was held from February 1 – 8, 2004 with meetings organized in San Francisco, Sonoma and Sacramento, California. The network of collaborative partnerships that the LBG GEP-CCS team has developed enabled the delegates to meet with organizations that are leading the movement and development of LfG projects in the U.S. These organizations include SCS Engineers, Inc., Power Project Financing LLC., Sonoma County Waste Management Agency, California Energy Commission, California Integrated Solid Waste Board, Global Energy Services, and Brown, Vence and Associates. Site visits included the S.F. Transfer Station and Recycling Center, Ox Mountain Landfill, Keifer Landfill, and the Norcal Waste Systems Hay Road Landfill.

The strategic delegation from India included representatives who had key decision-making roles in urban development infrastructure projects and policies. The six person delegation for the exposure trip included five senior representatives from municipalities who have a strong interest in municipal solid waste initiatives and are working on collaborative efforts with USAID/India. In particular, the participating delegates represented the following municipalities and organizations: Municipal Corporation of Delhi, Salngli-Miraj-Kupwad Municipal Corporation - State Government of Maharashtra, Urban Administration and Development (UADD) - State Government of Madhya Pradesh (M.P.), Urban Development Department - State Government of Maharashtra, and the Mussoorie-Dehradun Development Authority Dehradun - State Government of Uttrancha. The sixth delegate was from the Infrastructure Development Corporation (Karnataka) Ltd. (iDeCK). iDeCK is a USAID and a GEP-CCS partner in the development of the first sanitary landfill in India (in Bangalore) under CLIN 8 of the GEP-CCS project.

The exposure trip meetings began in Bangkok, Thailand with an examination of practices for Bangkok's MSW management, and a look at landfills where LfG projects had been initiated. These meetings and site visits provided the delegates with an opportunity to see first hand the 'best practices' in waste collection and transfer being practiced successfully by the BMA, as well as the obstacles and difficulties inherent in contracting with private companies for disposal, developing sanitary landfills and the realities of developing LfG projects.

In San Francisco and Sacramento, the group was provided with structured opportunities for constructive exchange with prominent U.S. institutions whose collective experiences and perspectives provided much information on progressive municipal solid waste management initiatives. These interactions also served as networking venues for the delegation to develop collaborative partnerships with leading U.S. organizations in MSW and LfG project development.

As an overall finding from this Exposure Trip, it is evident that there is a clear need and the will among the delegates to develop sanitary MSW landfills and better urban waste management practices. There are, however, a number of issues that the delegation will need to consider closely as they further develop specific initiatives in municipal waste management, including sanitary landfills and landfill gas technologies. These issues include:

- How can current and future landfills in India be adapted or developed to adhere to the GOI MSW Guidelines from a financial and appropriate technology aspect?
- Having seen the Bangkok example where the collection rate is 95%, what do they need to do within their own government structure and local community to create the political will, funding and the public interest to emulate this example?
- What are the opportunities for and the implications of creating IFC to energy projects in their municipality?
- The proper procedures in siting a Landfill.

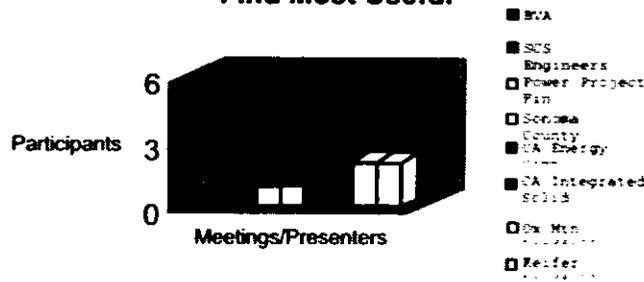
DELEGATE SURVEY

At the end of the exposure trip all the delegates were asked to respond to a questionnaire on their experience with the trip. With the exception of Mr. Sandhu's input, whose survey was not received in time for inclusion, the results were consolidated and are graphed below:

Overall, How Would You Rate the Exposure Trip?



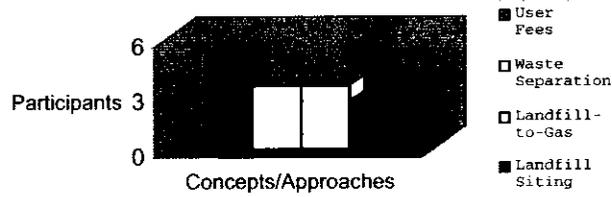
What Meetings/Presenters of the Exposure Trip Did You Find Most Useful?



Overall Rating of the LBG Exposure Trip Facilitation



What Concepts/Approaches Observed on the Tour will You Consider Incorporating into Your Own Institutional Practices



I. BACKGROUND ON THE EXPOSURE APPROACH

Today, as global climate change becomes more of an international issue, governments around the world are recognizing the importance of curbing GHG emissions through a variety of environmental measures. In 2000 the Ministry of Environment and Forests (MOEF) developed and released the "*Municipal Solid Wastes (Management and Handling) Rules, 2000*" which set parameters for setting up waste processing and disposal facility including landfills, and in particular, addressed the need for reducing GHG emissions from landfills. Consultations with a variety of officials at the GOI, state and local levels, as well as program experts from USAID/India, that stemmed from the issuance and response to these guidelines, confirmed that there existed knowledge gaps among municipal authorities on MSW management that would need to be addressed in order for urban authorities to comply with these requirements. As these new requirements mandated a need for municipalities to develop sustainable urban waste management practices, they also created interest in waste-to-energy projects throughout India.

II. OBJECTIVES

To implement an exposure trip that will provide the delegates with an opportunity:

- To explore innovative landfill gas reduction technologies and practices.
- To identify conventional and hybrid financial approaches and methodologies associated with landfill design and development.
- To gain a better understanding of the obstacles and barriers associated in designing and planning sanitary landfills to reduce and capture GHG.

III. ANTICIPATED OUTCOMES

- A better informed group of local policy makers.
- Partnerships created with U.S. institutions with which Indian stakeholders can form an informal network on related municipal solid waste issues.
- A foundation established for developing credible and systematic landfill gas projects in India.

IV. EXPOSURE TRIP PARTICIPANTS



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V. Exposure Trip Schedule

Bangkok, Thailand

Wednesday, January 28, 2004

- Welcome / Introductory Session on Thailand Visit (Phase I)

Thursday, January 29, 2004

- Bangkok Metropolitan Administration (BMA) - *Public Cleansing Department*
- Kampaengsaen Landfill Site Visit
- Nonthaburi Municipal Landfill Site Visit – *Methane Flare Testing*

Friday, January 30, 2004

- Waste Management Siam
- Eastern Sea Board Environmental Complex (ESBEC) Site Visit

San Francisco, CA

Sunday February 1, 2004

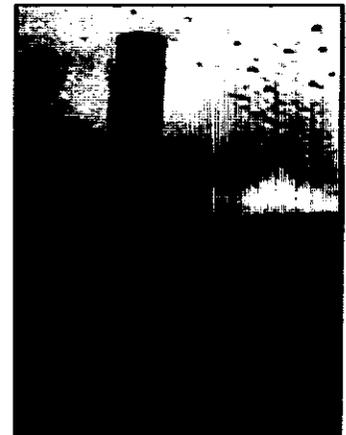
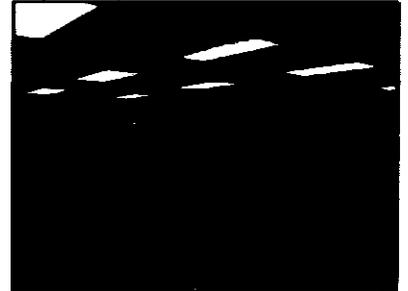
- Welcome / Introductory Session on California Visit (Phase II)
- Sightseeing Tour of San Francisco

Monday, February 2, 2004

- Ox Mountain Landfill Site Visit
- SCS Engineers - *MSW Training Session #1*

Tuesday, February 3, 2004

- San Francisco Recycling & Disposal Company - *Transfer Station and Recycling Center Site Visit*
- SCS Engineers - *MSW Training Session #2*
- Power Project Financing, LLC.



Wednesday, February 4, 2004

- Group Discussion and Review of MSW Training
- Sonoma County Waste Management Agency

Sacramento, CA

Thursday, February 5, 2004

- California Energy Commission
- California Integrated Waste Management Board, A Division of Cal-EPA
- Keifer Landfill - *Gas Collection System Site Visit*

San Francisco, CA

Thursday, February 5, 2004

- Brown, Vence and Associates – *MSW LfG Division*
- Norcal Waste Systems - *Hay Road Landfill, Inc.*
- Program Debrief

VI. OVERVIEW OF MEETING SCHEDULE

Phase I - Bangkok, Thailand

Wednesday, January 28, 2004

Welcome / Program Briefing – Phase I (Louis Berger Group/US-AEP Thailand Office)

A briefing for the Phase-I activities of the MSW Exposure Trip was held at the Louis Berger Group US-AEP Project office in Thailand, 10th Floor, Q House, Convent Building Bangkok. In addition to Suzanne Young and the five delegates from India, the other participants were the LBG staff implementing the US-AEP TSSC program.

After introductions, Ms. Suzanne Young and the LBG Thailand team, Saengroaj Srisawaskraisorn and Mark Mason, went over the program logistics and details for the next few days. Ms. Young also provided a brief overview of the GEP-CCS project, the exposure trip objectives and anticipated results. The participants were also provided with extensive program books and background information on the upcoming site visits and meetings. After the briefing, the delegates also had an opportunity to express what subjects they would like to have more in-depth information on or areas of particular interest e.g. specific information on BMA's MSW collection system and the transfer stations.

Ms Elaine Blatt, Chief of Party for the US-AEP TSSC, addressed the group with a welcome to the LBG offices and Bangkok and a brief comments on the program areas of the US-AEP. She explained how its regional mandate corresponds with and reinforces country environmental projects such as GEP-CCS, and the facilitation role that the US-AEP program plays in assisting bilateral programs meet their objectives.

Thursday, January 29, 2004

Bangkok Metropolitan Administration (BMA) (Public Cleansing Department)

- **Thongchai Bitrakui, Chief of Public Cleansing, BMA Department of Public Cleansing** (The Department of Public Cleansing is responsible for Bangkok's Municipal Solid Waste Collection and Management)

Background

The BMA is a special local government unit that administers the entire city of Bangkok. Its jurisdiction is divided into 50 districts in 1,500 sq km area.

In terms of solid waste management, the BMA operates the biggest single such system in Thailand. More than 95% of its 9,000 tpd solid waste is properly collected, and around 15% of it is sorted for recycling. BMA personnel collect the waste and carry it to three transfer stations – On-nut, Nong-Khaem, and Tha-Raeng. Two private companies have contracts with the BMA to operate the waste transfer sites and transport waste to sanitary landfills at Khamphaengsaen, Lad Krabang, and Rachatheva.

According to Article 89 of the Bangkok Metropolitan Administration Act 1985 as well as other related laws, the BMA has been authorized to perform 44 various functions within its jurisdiction area. Select environmental and related urban functions of the BMA include, maintaining cleanliness and orderliness of the city, city planning, disposal of trash, night soil, and wastewater, promotion and support of local governing authorities in local development, cooperate and coordinate work efforts with other local authorities, allocation of funds in accorded to the specified laws to the local governing authorities, promotion of appropriate *technology development, and environment and pollution management.*

Meeting Notes

The lengthy presentation on the solid waste management of BMA gave the delegates a picture of the solid waste management situation in Bangkok. Delegates were able to compare the waste generation rate per person in Bangkok (0.8 to 1kg/day), with their own municipalities in India (about half the Bangkok rate). The collection practices and average % (95%!) were of great interest to the participants who asked a number of very specific questions about the collection procedures, timings, schedule, equipment used by BMA, equipment provided for trash collection in the public parks and other public places, and the transfer stations and their operation. Questions were also asked about public awareness campaigns and recycling. The BMA has a goal to reduce the volume of waste, and at the same time improve the efficiency of the waste collection and disposal services. While the BMA contracts with privately owned and managed landfills, they are committed to improving the quality of the sanitary landfills and reducing the environmental problems.

All the delegates were interested in the quantity of waste moved and the contracting arrangements.

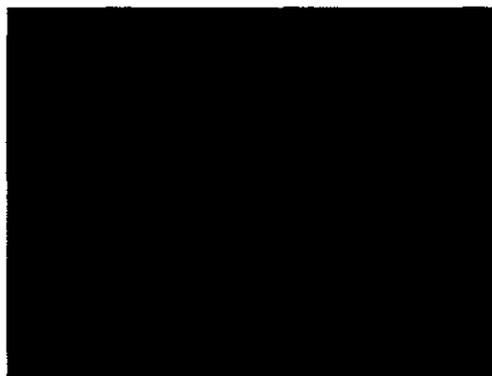
Following the presentation and discussion, a video clip was shown on how the BMA handles the household collection of waste from the inhabitants who live along the klongs (waterways). This clip was of particular interest to Mr. Lalla and Mr. Mhaskar, both from the Government of Maharashtra. The state of Maharashtra has similar urban growth colonies along waterways. Following the video, the group was led on a BMA guided walking tour of the sub-transfer station located near the Department's office. Delegates were very interested in the mini-compactor technology in use at the station, and had the opportunity to see it in operation. BMA plans to increase the numbers of the sub-transfer stations.

Meeting and Site Visit to the Kampaengsaen Landfill

- **Dr. Kanoksak Eam-Opas, Dean Faculty of Engineering, Kasetsart University, Energy & Environment Engineering Center**

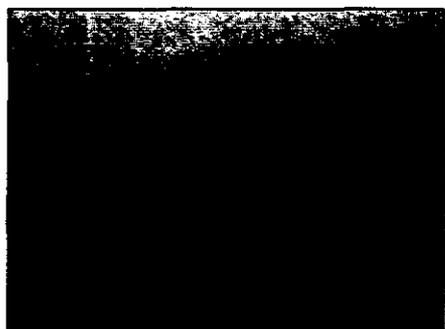
Background

Professor Kanoksak was the driving force behind the LfG project at Kampaengsaen and Rachatheva. One of the first LfG to energy projects of its kind in Thailand, the approach used initially at Kampaengsaen proved to have fatal design flaws, particularly in the pipe placement of the collection system and in the estimate of LfG that would be produced. The approach was re-thought and a new design, with horizontal rather than vertical collectors, has been installed in another area of the landfill and has been more successful. Based on the results, the project intends to expand with funding from the EPPO's energy conservation fund.



Meeting Notes

The group met with Prof. Kanoksak Eam-Opas and his project team at the Nakkonprathom province campus of the prestigious Kasetsart University. The team made a presentation of both phase I and II of the LfG to energy project that they have been developing at the Kampaengsaen landfill. This is one of the two large landfill sites under contract by BMA to receive the Bangkok's municipal waste. The privately owned Kampaengsaen landfill is approximately 80 Kilometers NW of Bangkok and receives the majority of Bangkok's waste (approx 60%). The landfill has almost reached capacity and is slated to be closed soon.



The delegates asked a number of questions about the financing opportunities for such a project, future plans for the LfG project in phase II and what is anticipated: in regards to the quantity of and quality of the LfG, the amount of power that will be generated, and to what use it will be put.

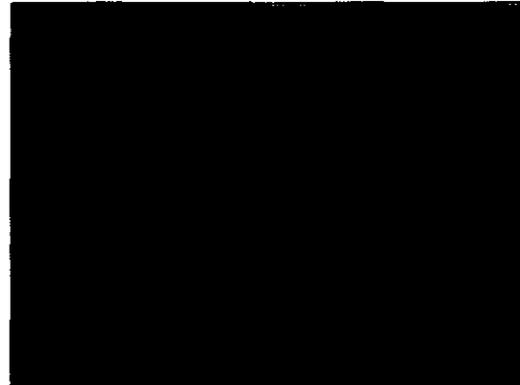
After the presentation and discussion, a site visit was made to the area of the landfill site where the LfG project was underway. The Kasetsart technical project staff escorted the delegation to the site and briefed the group on technical aspects of the project. He also gave the delegation insight into problem areas and another perspective on what happens to the Bangkok waste after it leaves the BMA control at the transfer station and is loaded into the trucks of the private contractor. The delegates made a number of observations on areas where the private company could improve, including worker and community safety.

Nonthaburi Municipal Landfill- (Flare Testing of Methane)

- **Dr Kanosksak's Staff**

Background

At Nonthaburi, a large Japanese corporation is funding a LfG flaring pilot to determine the quantity/quality of the LfG from the landfill. If warranted, the company will implement a large scale project to make use of the carbon emission reductions.



Meeting Notes

As opposed to the Kampaengsaen site, the Nonthaburi site is a municipally owned landfill. The delegates commented on the absence of best MSW management practices there, and thought perhaps the management was a reflection of the difficulties small municipalities have in operating landfills. One notable example was the presence of a new engineered cell that was nicely graded in tiers and covered with waterproof liner of an acceptable quality. There was large quantity of water/liquid of some variety at the bottom of the pit however, and our guide explained that the local community had blocked the use of the new cell site because they feared that the water at the bottom of the pit was really leachate runoff from the currently used site, and not rainwater as the municipality was asserting.

Friday, January 30, 2004

Waste Management Siam

Eastern Seaboard Environmental Complex Site Visit (Chonburi)

This meeting and site visit were led by Edward Corcoran, President and COO (who joined the meeting via teleconference facility.), John L Hamilton, General Manager Eastern Seaboard Environmental Complex, Sutthida Fakkun, Public Relations Manager, and Suchintana Virarat, Sales and Customer Service Manager.

Background

Waste Management Siam (WMS) is a locally owned and operated company providing high quality environmental services for customers that value the minimization of environmental risk. WMS is a division of Modern Asia Environmental Ltd. (MAE), a regional environmental service provider that owns both the operations in Thailand and owns the only hazardous waste facility in

Indonesia, called PPLi. The founders and regional team are experienced waste management professionals with world-wide expertise.

WMS designs, develops and operates waste management facilities in Thailand that serve industrial, commercial and municipal customers. Services include waste collection and transport, waste disposal through sanitary landfills, wastewater treatment, recycling, composting and bio-remediation. WMS also provides site clean-ups and value by offering its management and expertise, competitive rates, and full compliance with local and international regulations and standards.

WMS also operates the Eastern Seaboard Environmental complex, located approximately 150 km Southeast of Bangkok, which is the only company fully licensed for non hazardous waste complying with both local and international standards in Thailand.

Meeting Notes

Suzanne Young, Mark Mason and the delegates met with John L Hamilton, General Manager Eastern Seaboard Environmental Complex., Sutthida Fakkun, Public Relations Manager, and Suchintana Virarat, the Sales and Customer Service Manager. Edward Corcoran, President and COO of WMS joined the meeting via teleconference facility.

The WMS site at the Eastern Seaboard Environmental Complex in Chonburi was an excellent example of a planned well managed landfill and provided an interesting counterpoint contrast to the sites at Kampaengsaen and Nonthaburi. Having previously seen two sites that were very similar to the open dump sites in India with the difference that at Kampaengsaen and Nonthaburi attempts were being made to capture the LfG from the municipal waste with waste to energy projects, the delegates had a chance to see how it **could** be done.

John Hamilton, who had been the site manager of the largest waste management landfill in Hong Kong before joining WMS's parent company MAE, emphasized the importance of quality worker training, constant monitoring and especially technology transfer so that a group of competent waste management professionals can be developed in-country to carry forward.

Currently the ESBEC site is getting mostly industrial waste from the number of industrial estates in the area. They change these clients from \$20-\$50 US/ton for disposal, fees depending on the composition, quantity etc. of the waste. While they would like to handle more municipal waste at lower fees, they face stiff competition from the "informal" sector.

Both Mr. Hamilton and Mr. Corcoran were very candid about the obstacles they had to surmount and barriers that they and other operators of professionally managed landfill sites still face in Asia. Some of the barriers include municipal waste collection practices and deals with the agents in the "informal" sector, many of whom then engage in open dumping waste disposal even for hazardous materials. At the WMS site they contract with a private lab which operates on site and physically tests every single load of waste that comes in the gate. While they do not currently

accept hazardous waste at their site, it is not uncommon for companies to try and leave undeclared hazardous waste loads.

The lively discussion at the meeting continued during the hard-hat walk-through of the site, which included a visit to the leachate and wastewater treatment plant, the gas collection and flare point, and a tour of the various cells: in preparation, in use, closed, and the areas due to be developed. Clearly this visit was one of the highlights of the Thai Phase I for the participants.



Phase I – Thailand Debrief

Following the meeting with Waste Management Siam and the site visit to the Eastern Seaboard Environmental Complex, the group debriefed with an open discussion on what they had seen so far, looking at the comparisons between the Kampaengsaen privately run site which BMA contracts with to dispose of waste at about \$ 10/ton, the municipally owned site at Nonthaburi and the ESBEC. Much of the discussion centered around the economics of waste disposal. As the economics of waste disposal differ widely from country to country and municipality to municipality, dependent on hundreds of factors including at a minimum: the cost of labor, land, gas, power waste characteristics local customs, regulatory control and enforcement, there is no one single answer to the question of how much should it cost per ton for waste disposal and what is the right /reasonable amount for a municipality to pay. The group debated whether or not the \$10/ton price was a realistic figure given the current pressure on BMA and the other municipalities in Thailand to adopt better practices in waste disposal. The BMA had said during the discussion with the delegates that they spend approximately 1000 Bhatt (about \$29/ton) on MSW disposal. The delegates were not sure if that figure represented a true full cost accounting for the cities MSW management.

There was a concurrence among the group that municipalities in Thailand face some similar constraints as in India, particularly with the adoption of better practices in the public sector, and the difficulties with the 'informal' sector influences. While they were impressed with the BMA's great efficiency in collection (they brag 95%) and extremely clean streets, they realized that India's strong democratic tradition and the Green Bench can be an advantage. Thailand is just developing a similar "Green Bench" capacity in their judicial system.

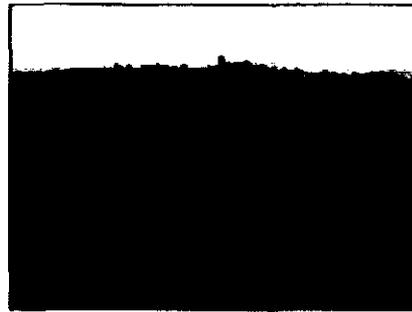
Looking forward to the next phase, the delegates expressed that they would like to look closely at the various financial aspects of MSW management, from funding and revenue generation to contracting models.

Phase II – California, United States

San Francisco, California

Sunday, February 1, 2004

Welcome Lunch and Briefing



- Mr. Erik Brejla, GEP-CCS US Program Manager, The Louis Berger Group, Inc.

Mr. Erik Brejla, GEP-CCS U.S. Program Manager and leader of the Phase II visit reviewed the schedule for the overall exposure trip visit, provided additional background information on institutions and answered any outstanding program and/or logistical questions. The meeting also provided the delegates an opportunity to discuss as a group key points and issues that they would like to focus on during the trip. The following highlights those key areas of interest:

Mr. K. Jayakishan

- Sanitary landfill project development
- Economics of landfill operations
- Framework of host fees

Dr. Sukhbash Sandhu

- LfG opportunities for rural regions
- Gas recovery options and methods
- Landfill zoning and ordinance structures

Mr. Subhash Lalla

- Municipal solid waste management “franchise” contracting
- Waste planning from a state and county perspective

Mr. M.A. Khan

- Development of hierarchical levels of laws pertaining to solid waste management and urban land use
- Final disposal methods, including composting options

Mr. Milind Mhaiskar

- Sanitary landfill – siting, zoning
- Finance structures (host fee, user fee, tax base)

Mr. Rakesh Mehta

- Models of public – private partnerships
- Landfill gas recovery operations
- Municipal tax structures and revenue generation models

Monday, February 2, 2004

SCS ENGINEERS SCS Engineers, LLC

- Mr. David Ross, Senior Vice President, International Programs
- Mr. Steven Hamilton, Municipal Solid Waste Specialist

Background

Established in 1970, SCS Engineers is a leading engineering and construction firm specializing in solid waste management, the operation of LfG control and energy recovery systems and environmental services. Some of the world's leading experts in these subjects make up its staff; with sixty percent of the staff regularly working on landfill projects. SCS Engineers has completed more than 2,000 landfill engineering assignments for municipal and industrial clients. Based on its strong professional foundation, the company has successfully balanced the often conflicting technical, financial, institutional, and legal issues inherent in solid waste programs.

SCS Engineers has been a national leader in the planning, permitting, investigation, design, construction, and operation of LfG control and energy recovery systems. Their LfG experts are working at hundreds of locations around the world specializing in: (a) engineering design services and investigations; (b) system construction; and (c) long-term system operations, maintenance and monitoring. SCS provides design/build services for the construction of landfill gas systems. A design/build project typically combines the design and construction steps into a single contract, resulting in an expedited construction schedule and reduced overall costs.

In the area of solid waste management, it works with clients in the private and public sectors to plan for, permit, design, and implement facilities and programs, to safely and economically manage all types of solid wastes. Apart from conventional services like regional waste planning and landfill transfer station siting and design, SCS also undertakes innovative assignments like underground fire suppression at landfills and design of recycling facilities for theme parks.

Apart from extensive operations in the United States, SCS provides environmental consulting and engineering services to clients around the world. It has completed solid waste, landfill gas, site remediation, privatization, and other environmental projects in over 40 countries spread across Latin America, the Middle East, Asia-Pacific, Europe and Canada. The company's international clients include federal agencies (of the United States and elsewhere) local government agencies (often funded by multi-lateral bank loans), U.S. based companies with operations or investments overseas, and other private firms.

Meeting Notes

LBG/GEP-CCS designed a two day interactive training for the delegates that introduced topical areas from waste planning to financial structuring to landfill gas recovery project development. During this two day training, the group visited the Ox Mountain landfill facility to understand contracting and analyzing waste characteristics. LBG/GEP-CCS contracted SCS Engineers, an award-winning, employee-owned, engineering and construction firm specializing in solid waste management and environmental services, to design and conduct the training. Leading this training were Mr. Steve Hamilton and Mr. David Ross who are two of the world's leading experts in these subject areas and have worked in emerging economies.



The training was organized in the following manner:

- Training Session #1: *Overview of Solid Waste Management Needs and Practices*
- Training Session #2: *Overview of Solid Waste Management Needs and Practices Continued*
- Training Session #3: *Final Disposal of MSW via Sanitary Landfill*
- Training Session #4: *MSW Financing and Public-Private Partnership Opportunities*

Training Session #1: Overview of Solid Waste Management Needs and Practices

Background - Training Session #1

The first training session *Overview of Solid Waste Management Needs and Practices* was designed to focus on the following areas:

- Overview of solid waste management needs and practices
 - In India (informally presented by each delegate)
 - In the USA
- Laws and Regulations (from the perspective of those responsible for waste management)
 - Federal laws & regulations
 - State laws & regulations
 - Local ordinances and policies

Meeting Notes - Training Session #1

As part of the overview of solid waste management needs and practices, Mr. Steve Hamilton discussed how US Municipalities have been challenged on addressing rapid growth and development and in turn, the level of construction and demolition (C&D) waste. Mr. Mehta was interested in how municipalities price the various waste streams. It was pointed out that indeed different standards apply to each waste stream and that only specific sites will accept C&D refuse. C&D refuse typically is priced 10% above the average tonnage cost given the special considerations for final disposal and treatment.

Mr. Hamilton also discussed how certain construction items, such as chemically treated lumber, can not go into the sanitary landfill, however in most cases will be shredded and resold as household and commercial woodchips.

Mr. David Ross explained how, although rural and urban municipalities face complex and varied solid waste issues, the basic national and state level laws regulating waste disposal remain the same across the board.

The group felt that the City of San Francisco's mandate to reduce waste generated and sent to the landfill by 50% is aggressive. Mr. Mehta posed the question of how the city would reduce waste as the city is clearly increasing in population. Mr. Hamilton explained in detail how the California Integrated Waste Management Board and Cal-EPA use a precise formula to determine waste reduction potentials, while factoring population and growth increases. Mr. Lalla applauded this mandate and Mr. Mehta felt that "phased-in" waste reduction goals could be established in the Indian context.

Mr. Ross explained that the City, although they established aggressive targets, would address the reduction in two separate initiatives:

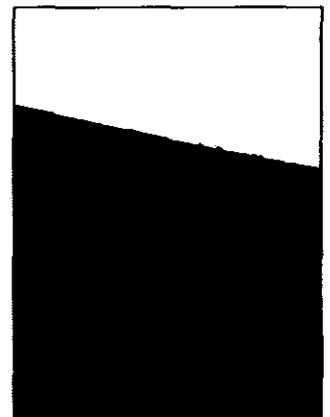
1. Recycling – Municipal "Single Stream" recycling containers would be given to each home for disposing of paper products, plastics and glass. It has been determined in San Francisco that these items account for over 60% of the waste.
2. User Fees – Pricing schedule that accurately has users pay based on the level of waste produced. In the long run it is a deterring factor and will reduce waste produced per family household.



ALLIED WASTE
INDUSTRIES, INC.

Ox Mountain Landfill, Half Moon Bay Location

- Lochlin Caffey, Allied Waste Industries, Inc, Ox Mountain Landfill



Training Session #2: Overview of Solid Waste Management Needs and Practices Continued

Background - Training Session #2

The second training session, an *Overview of Solid Waste Management Needs and Practices*, was designed to focus on the following areas:

- Waste characterization (MSW composition and quantities)
- Forecasting waste generation
- Inventory of alternative and appropriate technologies and associated costs
- Public education and participation
- Identification of options for ownership, operations, and financing
- Selection and implementation of an action plan
- Waste storage and collection
- Waste processing (for materials and/or energy recovery and/or volume reduction)

Meeting Notes - Training Session #2

As part of the discussion on the identification and ownership of waste operations, Mr. Lalla described how, in parts of Mumbai, the collection is focused on a door to door scale effort. The Municipal Government has effectively organized street committees to handle waste collection for a series of buildings in a specific region. These committees serve as the middleman for collecting, cleaning and segregating possible recyclable waste. The payment for the street committees is from the post market product sale and revenue generation.

Mr. Hamilton conceded that the high cost of waste operations in the U.S. has driven municipalities to consider alternate arrangements in addressing collection methods.

Mr. Mehta agreed in principle with the plan Mr. Lalla described but felt that in New Delhi, due to high density, they could not provide these services through street committees. Mr. Mehta and Mr. Ross discussed how it is common that municipalities across the world oppose the segregation of waste by a third party given the loss of potential income.

If a waste collection system were to be proposed under a privatization plan, it was reiterated how the employees training and hiring are critical. Mr. Hamilton explained how in Egypt, privatization legislation has bred a new culture, with the larger privatization plans having catalyzed a new transparent workforce and work ethic.

Mr. Hamilton cautioned the delegation on the desire to have state of the art equipment be the only option considered when evaluating long-term MSW planning. He indicated that the critical path is to concentrate on collection, which is the most important thing you can do that collects waste out of streets and moves it to one location. "If you can't collect, you can not dispose!" Mr. Ross indicated in a BOOT model that the municipalities should make sure that vendors can demonstrate at least three other successful projects and look at the corporate books for a solidified and transparent management structure.

Tuesday, February 3, 2004

San Francisco Recycling & Disposal Company Transfer Station and Recycling Center

- Maurice Quillen, General Manager, San Francisco Recycling & Disposal Company @ Pier 96

Background

RECYCLE CENTRAL®, the premier recycling facility in the United States, officially opened on March 5, 2003 on San Francisco's Pier 96. San Francisco Mayor Willie Brown and Norcal Waste Systems, Inc. President Mike Sangiacomo threw the switch to power up the 200,000-square-foot plant capable of sorting and baling up to 2,100 tons of recyclables a day.

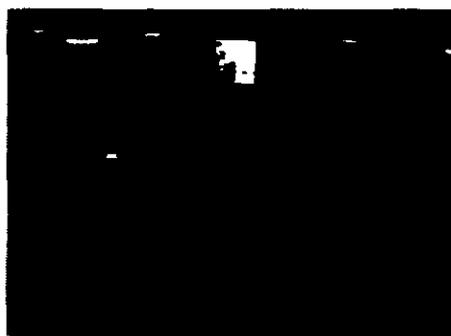
RECYCLE CENTRAL® brings the most effective mechanical systems for sorting recyclables under one roof. Recyclables in this \$38 million facility are separated using a combination of specialized equipment and hand sorting. Clean, baled recyclables are loaded into cargo containers for shipment to paper mills, glass plants and manufacturing facilities that produce new consumer goods from yesterday's discards.

Inside RECYCLE CENTRAL® spinning disk screens send bottles and cans in one direction, float paper in another and further sort it into independent streams of newsprint and mixed paper (magazines, cardboard and junk mail). A giant vacuum system sucks computer paper, envelopes and letterhead off conveyer belts and automatically sends clean material to baling machines. A powerful magnet pulls steel and tin cans off the sorting belt and flips them into a large storage cage. Aluminum cans fly off the belt as if by magic, thanks to another machine called an eddy current separator.

Meeting Notes

In California, state law requires municipalities to reduce waste that is sent to landfills by 50%. In reaching this goal, the city of San Francisco has undertaken a massive recycling program. The group visited the new Norcal SF Recycling Center that recently opened in the fall of 2003. All the delegates, and particularly Mr. Mehta, were impressed with the public private partnership arrangement between the city and Norcal on reaching the recycling goal. Norcal officials provided the delegation with a framework for developing franchise agreements between a city/county and the private sector.

Mr. Quillen explained that they receive on average 2 tons of waste per day and explained the process and flow of waste being separated. The facility currently is able to recycle up to 78% of the waste received. The recyclable materials are sold to brokering organizations that primarily purchase these items at the current market rate. The streams sold on the post-market include:



- i) Multi-Colored Glass Products
- ii) Dry Paper Products (no water/leachate contact)
- iii) Aluminum and Light Metal Products

The delegation was very impressed with the small level of remaining waste returned to the landfill, 22%, and although returned, it was explained the landfill that performs the final disposal is a landfill gas recovery site. Mr. Mhaiskar described how an organized union of rag pickers in his municipality could establish the foundation for systematic recycling and as well as serve as a model for job growth if successful.

Training Session #3: Final Disposal of MSW via Sanitary Landfill

Background - Training Session #3

The third training session, *Final Disposal of MSW via Sanitary Landfill*, was designed to focus on the following areas:

- Selection of new sites for new landfills
- Design of new landfills and/or upgrades to existing landfills (for expansion)
- Need for and design of emission control measures
- Opportunities for energy recovery (and revenue) from landfill gas (LfG) collection systems:
 - Sale of gas for direct use (via pipeline)
 - Production and sale electricity from LfG-fired engine-generation units
 - Potential for sale of GHG emission reduction credits
- Long-term monitoring and maintenance of landfills

Meeting Notes - Training Session #3

Mr. Jayakishan described how the new MOEF guidelines seem to be based upon international standards and not necessarily on measures conducive for effective implementation in the Indian scenario. The entire delegation discussed how the MSW rules will be difficult to change and that those bureaucrats who created these mandates were not necessarily aware of the technical implementation barriers.

Mr. Hamilton and Mr. Ross explained that in Egypt a similar path was followed and through a collaborative process, concessions were given as municipalities were unable to meet or achieve the provided targets.

Mr. Mehta and Mr. Lalla added that the first issue they are facing is identifying an ideal site, given vague guidelines on the selection process, topographical restraints and climatic measures. "No one wants a landfill near their home", Mr. Ross added, but felt the following general criteria are applicable across the world.

- Encourage canyon style development: provides gravity controlled and nicely filled solid waste cells
- Avoid high water tables: will create the need for extensive lining and sloping into one corridor
- The transportation dilemma: divert traffic from main roads and ancillary road connectors through non-high density corridors
- Power of topographical Barriers: natural barriers will provide less visible operations and ensure seclusion

Training Session #4: MSW Financing and Public-Private Partnership Opportunities

Background - Training Session #4

The fourth training session, *MSW Financing and Public-Private Partnership Opportunities*, was designed to focus on the following areas:

- Financing for landfill improvement and/or LfG-to-energy projects
- Public-private partnership opportunities: Egypt case study
- Management and staffing of agencies charged with the proper management of MSW

Meeting Notes - Training Session #4

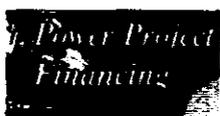
Mr. Ross explained that revenues have been historically been organized around taxes, user fees and grants/loans. The delegation was concerned that the financing of new systems would employ large capital costs for landfill construction, buildings and equipment, but was unsure of the typical cost in the US for collection and equipment.

Mr. Hamilton explained the collection costs are devised around compactor truck and operations and maintenance costs. He described how the O&M cost could run close to \$200 to \$300 per ton, on average in the US, and compactor equipment can run from \$100,000 on up.

Mr. Sandhu noted that transfer stations seemed to indicate an additional cost element to a municipal budget and that he would want to explore ways to ensure direct drop-off in the central landfill. Referring to the Ox Mountain facility, Mr. Ross explained that if a county or region is large enough, the economics might not support having fewer trucks, or driving longer distances to dispose of waste.

The delegation expressed interest in the "Enterprise Fund" structure, as when a state agency is responsible for the delivery of MSW services and receives fees to cover all costs. Mr. Ross discussed how most funds operate and described how fees could be raised for services rendered ONLY to support the solid waste enterprise. Mr. Mehta felt a separate wing of the urban development offices could play this role and would ensure a systematic delivery and management of MSW services in a defined area.

Mr. Sandhu asked how the tax collection and fees could be considered sources of revenue for a municipality and if it would hinder modernization or accountability. Mr. Hamilton explained how a new culture would need to be bred for citizens to be accustomed to paying taxes; however a collection infrastructure would ensure a sustainable solution and governing framework.



Power Project Financing, LLC.

- Daniel Potash, Senior Financial Consultant

Background

Power Project Financing is a consulting practice specializing in renewable energy, independent power, project financing, and power sector privatization. They provide financial advice, financial structuring, and equity and debt capital for governments and developers of power projects around the world.

Meeting Notes

Mr. Potash presented to the group the finer intricacies of financing urban infrastructure projects in the US and in emerging economies. Mr. Potash discussed at length the "Opportunity vs. Risk Scenario" and how many prominent US banking institutions have turned away from financing projects perceived to have a high level of risk, even if the potential return on investment can be quantified and endorsed. Mr. Mehta agreed with this scenario and felt that for municipalities the community perception and buy-in for certain projects would be a determining factor in a projects approval.

Mr. Potash and the delegation discussed billing structures and the cash flow for municipal collection services and disposal. Mr. Sandhu expressed an interest in linking billing factors for multiple utilities in a consolidated bill structure. The delegation felt that municipal and state government could have a streamlined monitoring and oversight for utility and even tax collection. Mr. Khan and Mr. Lalla spoke at length on creating state-level incentives to encourage municipal stream line billing and collection. Currently, it was felt that collection is done ad-hoc with limited oversight and there is a need for a formal monitoring plan to be established. At the same time, however, there seems to be a desire to encourage deregulation.

Mr. Potash explained that deregulation has had some successes, but that deregulation also has made it difficult to get cooperation in multi-dimensional infrastructure development.

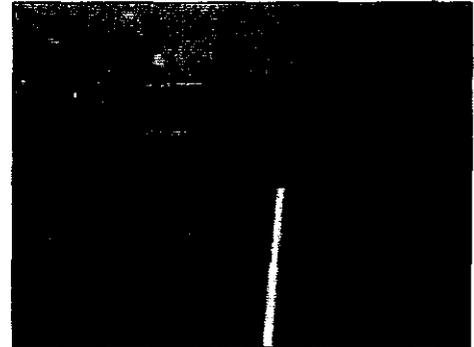
Sonoma, California

Wednesday, February 4, 2004



Sonoma County Central Landfill

- Donna Caldwell, Integrated Waste Specialist, Sonoma Co. Waste Management Agency



Background

The Sonoma County Waste Management Agency, formed in 1992, is the joint powers authority of the nine cities and the County of Sonoma. The specific focus of the Agency's efforts is the implementation of regional waste diversion programs required in the following categories: Wood Waste, Yard Debris, Household Hazardous Waste, Education and Planning.

The central landfill is unique in design in that it has an extensive segregation facility that focuses on appliances/hard metals, and industrial waste. These segregation facilities provide additional revenue stream for the facility aside from the basic waste service/collection fees collected from industry and households. The central landfill is classified as a Class A site, which collects both industrial and limited amounts of low-hazardous industrial waste materials.



The central landfill site is 3,000 acres in total size, with a planned extension of 1,000 acres into nearby localities. The county began initial testing and monitoring for methane in 1990, and commenced the design and capturing of gas collection piping in 1994. The site contains over 140 pumps, with 72 vertical and 68 horizontal designs. The landfill utilizes a cogeneration facility, which produces 6 MHW that is sold to the local grid, and provides power to 4,000-5,000 homes and business in the Sonoma and Napa County areas.

Meeting Notes

The Sonoma facility is operated and managed by the City and County of Sonoma. With 1,900 tons/per day, this site currently operates an 8 MW facility that has established a power purchase agreement with Pacific Gas and Electric. This agreement has been viewed as a "hallmark project" as this particular site has the ability to power approximately 6,000 homes and provides a balance to the grid of US\$3 million. Sonoma also operates an extensive composting and wood chip facility over a 20 acre landfill footprint. The wood-chipping and composting facility processes over 200



212

tons per day. The Sonoma officials explained in detail the process undertaken for the technical and financial evaluation for the landfill recovery and composting facilities. Delegates were interested in understanding the timeframe for evaluating landfill gas and drivers for determining economic viability over a 30 year timeframe.

Mr. Mehta explained that a critical factor for sanitary landfills in India was to address leachate management and was interested in the various strategies employed for treatment. The Sonoma officials talked about the 4.2 million gallon/2 pond facilities at the central landfill site. Given the landfill is a canyon model; they use natural gravity and no pumps for leachate collection. The local wine vineyard businesses in the region prevent them from treating the leachate or constructing a wastewater treatment facility on site, however they discussed how leachate is hauled by truck to wastewater facilities in nearby counties. The delegation was surprised at the 86,000 gallons removed per day, and it was explained how the high precipitation levels are a large contributing factor.

Mr. Khan talked about the construction and demo diversion practices in India, but felt a surcharge fee could supplement the services provided and ensure a nice cost recovery system for the labor and capital intensive process. Sonoma explained that they have only recently begun applying a surcharge that has been approved at a rate of 25% for the diversion of: wood, scrap metal, roofing, miscellaneous construction debris, and concrete.

Sacramento, California

Thursday, February 5, 2004

California Energy Commission



- Tim Olson, Program Manager, Energy Technology Export Program, California Energy Commission

Background

The California Energy Commission is the state's primary energy policy and planning agency. Created by the Legislature in 1974 and located in Sacramento, the Commission has five major responsibilities:

- Forecasting future energy needs and keeping historical energy data.
- Licensing thermal power plants 50 megawatts or larger.
- Promoting energy efficiency through appliance and building standards.
- Developing energy technologies and supporting renewable energy.
- Planning for and directing state response to energy emergency.

With the signing of the Electric Industry Deregulation Law (Assembly Bill 1890), the Commission's role includes overseeing funding programs that support public interest energy

research; advance energy science and technology through research, development and demonstration; and providing market support to existing, new and emerging renewable technologies.

More specifically, the Energy Commission is a member of the LMOP program responsible for determining Landfill Gas-To-Energy (LFGTE) directions in California, identifying regulatory requirements and opportunities for decision makers that are tied to LFGTE, and assisting in developing LFGTE Case Studies.

Meeting Notes

Commissioner Boyd opened the roundtable discussion and described how he presides over the Energy Commission's Transportation Committee and oversees climate change and international export programs. He serves on the Electricity and Natural Gas and Renewables Committees. He chairs the state's Joint Action Climate Change Team and the state's Natural Gas Working Group. Climate change is a subject that matters to California. Commissioner Boyd praised the group for their progressive nature and underlined how the state of California understands that the full repercussions of a change in climate are serious. The Commissioner discussed how climate change challenges the state's infrastructure investments and touches all sectors of the economy: waste management, water supply, agriculture, forestry, energy production, health, transportation, tourism and others. The delegation and Commissioner Boyd agreed that it is critical that the state and India begin to actively reduce the rate of growth in emissions from not only the waste management sector but also from the other urban factors.

Mr. Lalla and Mr. Mehta were particularly interested in this subject, and the discussion explored how the 20% renewables utilization mandate could be relevant in the South Asian scenario. Jayakishan and the delegation took interest in the seed money and grants the energy commission provides to firms seeking international partnerships for exporting technologies and services. Tim Olson talked about the landfill gas credits obtained from a MSW project in Mexico and the process undertaken.

Mr. Mehta and Mr. Mhaiskar were interested in the role the Energy Technology Export Program played with small and medium sized enterprises. Mr. Lalla felt that providing pre-investment "seed" funding (for qualified companies) will facilitate energy project development.

Mr. Olson further explained how the Export Program has been able to spur project development by assisting in:

- Conducting market and trade analyses.
- Organizing overseas trade missions to introduce foreign decision-makers to companies.
- Arranging orientation visits for foreign energy officials to California energy generation sites and briefings with experts.

Mr. Olson offered the delegation assistance in identifying California technology providers and also encouraged the delegation to advise the Export Program of potential project development opportunities.



California Integrated Waste Management Board

- Howard Levenson, Deputy Director, Permitting and Enforcement Division
- Scott Walker, Branch Manager Remediation, Closure, and Technical Services

Background

California Integrated Waste Management Board, a Division of the California Environmental Protection Agency, is a six-member Integrated Waste Management Board responsible for protecting the public's health and safety and the environment through management of the estimated 60 million tons of solid waste generated in California. The Board works in partnership with local government, industry, and the public to reduce waste disposal and ensure environmentally safe landfills. California reuses and recycles approximately 42 percent of its solid waste.

The Board is one of six agencies under the umbrella of the California Environmental Protection Agency. The California Integrated Waste Management Board is responsible for managing California's solid waste stream.

The Board is helping California divert 50 percent of its waste from landfills by 2000 by:

- Developing waste reduction programs.
- Providing public education and outreach.
- Assisting local governments and businesses.
- Fostering market development for recyclable materials.

The Board also protects public health and the environment by:

- Encouraging used oil recycling.
- Regulating waste management facilities.
- Cleaning up abandoned and illegal dumpsites.

The Board, in partnership with local government, industry, and the public, works to reduce solid waste disposal, manage the estimated 66 million tons of waste generated in California each year, and ensure environmentally safe solid waste facilities.

A roundtable meeting was organized for the delegation to understand the policy perspectives on landfill gas recovery, particularly for the state of California. The roundtable was attended by senior state representatives, including Commissioner Jim Boyd of the California Energy

Commission, California Integrated Waste Management Board, Cal-EPA and the Energy Export Development Agency.

Meeting Notes

The entire delegation was interested in the role the Waste Management Board plays and the reporting structure and mandates it has introduced within the state. The streamlined reporting system allows the state to respond and provide TA in a focused manner. The discussion focused around the structure of the board and their mandate. Mr. Walker explained how the board was a partnership between local governments, industry and the public works department. The board provides: i) permitting and enforcement of USEPA, State laws; ii) waste prevention; iii) diversion, planning; iv) special assistance for special wastes.

The delegation, particularly Mr. Mehta and Mr. Lalla, wanted to explore developing a model Board in India that would address the functions of the CIWB, but further, to be able to track the universe of landfill sites, contacts and characteristics. The model board could serve as a "clearinghouse" as Mr. Sandhu suggested. The delegation felt an informal relationship would be needed with CIWMB to ensure the model structure was designed and developed properly and would benefit from the lessons learned by the state of California in this arena.

Mr. Levenson said that an applicable SWM technology/technique that might be suitable to the Indian context would focus on developing a bioreactor landfill technology and spoke at length about this technology. The bioreactor is designed to inject specific levels of water into an engineered cell. This process will catalyze the methane generation and produce very pure methane gas. It was explained how this has been done successfully at the Yolo County landfill in Davis, California.

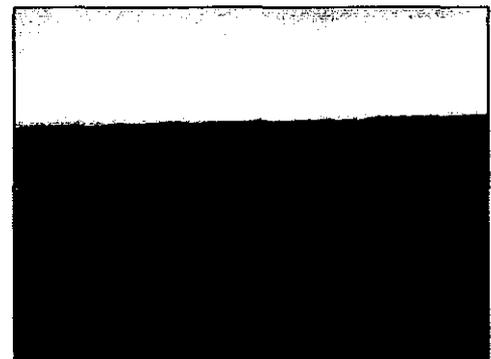


Keifer Landfill Gas Collection System Site Visit

- Mr. Chris Richgels, Principle Engineer

Background

The Kiefer Landfill, owned and operated by the County of Sacramento, was opened in 1967 and currently has over 16 million tons of municipal solid waste in place. It presently covers 232 acres with plans to expand by up to 675 additional acres and currently receives 900,000 tons of waste annually. The EPA's Landfill Methane Outreach Program awarded this project the distinction of the "Landfill Gas to Energy Project of the Year" in 1999. The County is planning on expanding the facility to include two CAT 3616 engine generator sets, which would add an additional 6 megawatts. "Landfill Energy Systems (LES)



was instrumental in the County winning the 1999 US EPA Landfill Methane Outreach Program Project of the Year for the Kiefer Landfill Gas-to-Energy facility by utilizing their extensive specialized experience in LfG power systems in the design and build of the facility allowing construction to occur in a timely manner and by operating the facility with top efficiency.” – quoting from Kathy Garcia, Associate Engineer, County of Sacramento.

Meeting Notes

The Kiefer facility is the “best case study” of landfill gas recovery in the US, as they currently operate a 9MW facility that has the ability to electrify over 7,000 homes in the region. The delegates had an opportunity to closely examine the four Caterpillar engines and an opportunity to interact with the contracting firm, Landfill Energy Systems, to understand the technological aspects in greater detail.

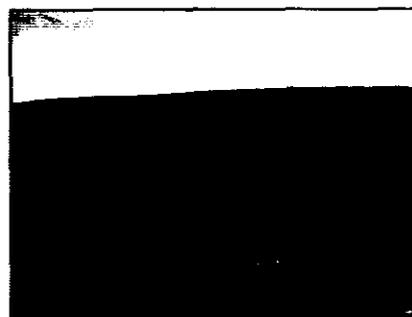


Mr. Richgels and representatives explained the macro level elements of their partnering agreement. The City/County has issued a 99 year leasing rights agreement on the gas produced from the methane. The revenue generation from the power sold to the grid is split 70/30 and the Kiefer facility is further electrified completely by the power produced onsite. The delegation was impressed with the US\$300,000 cost savings a year in the operating cost structure of the facility.

Mr. Khan and Jayakishan spoke at length with the Kiefer Landfill project manager on leachate evaporation process and design. The larger group discussion focused on contracting and tipping fee schedules to ensure site financial stability.



Mr. Mhaiskar and Mr. Khan expressed praise for the level of customer service that the City/County of Sacramento provides, including: free residential tipping and special pick-up requests. Mr. Richgels explained that the City/County was able to recover these costs through a one-time user charge issued for all new residents in the community. There has been a 23% growth rate over the past 20 years and City/County officials have calculated a continued growth of 20% over the next ten years.



Friday, February 6, 2004



Brown, Vence and Associates MSW Presentation

- Michael Brown, President
- Devon Rager, Associate Planner II

Background

Brown, Vence & Associates, Inc. (BVA) is a full service engineering and management consulting firm with approximately 25 years of experience in recycling, waste and energy management, serving clients throughout the United States and internationally. Their consulting practice combines management and financial consulting services with engineering expertise to assist local government agencies and private companies in planning and implementing waste management, energy efficiency, and small power production services. Established in 1979, BVA was created to provide assistance to municipalities and organizations at a time of rapidly changing environmental regulations.

International Experience - Since its establishment, BVA has drawn on its technical, financial, and engineering expertise to assist clients internationally in meeting their technical and management consulting needs in solid waste and energy management. BVA has provided services in Latin America, Europe, Asia, and the Middle East with the assistance of multi-lateral banks, including:

Inter-American Development Bank
U.S. Trade and Development Agency
Other U.S. and international agencies

U.S. Agency for International Development
World Bank

Landfill Gas to Energy Experience – BVA provides complete landfill gas technical services including environmental controls and energy recovery. With the increasing deregulation of the electric industry, BVA is using its distinctive combination of expertise in both solid waste and energy to assist clients with landfill gas-to-energy projects. BVA has expertise in the management of landfill gas collection, destruction systems, and gas-to-energy projects, including construction, start-up, and operations management of landfill gas facilities. Their services combine the required technical and business management aspects to for success in any phase of a landfill gas-to-energy project.

Landfill Gas Generation and Recovery Estimates - Drawing from BVA's extensive project experience, they have developed modeling software to estimate gas generation and recovery, which allows BVA to provide realistic assessments that take into account the in-place tonnage, landfill characteristics, operation and management procedures, and climate.

Design and Construction of Landfill Gas Collection Systems - BVA has also prepared plans and specifications for new and expanded landfill gas collection and treatment systems and supervised the installation of systems.

Meeting Notes

A leading MSW/Energy California based firm, BVA presented a MSW siting and locating process, approved by CAL-EPA, for siting a new landfill location. BVA presented several case studies from California and introduced the 9 step process undertaken. The entire delegation felt that a similar type of process could be introduced within their own respective areas and would provide the further necessary guidance in addressing the MOEF guidelines.

The entire delegation felt that the siting and evaluation process is the most pressing issue facing Indian municipalities today and agreed upon establishing state level exclusionary criteria and having municipalities develop preferential criteria.

Mr. Brown described how the Task Force criteria in the state of California focus exclusively on making sure that:

- Primary transportation routes (for waste) do not pass through centers of high density
- There is a minimum capacity of 35 years for a site
- Sites shall not be located in canyons that serve as a storm water drain
- Sites shall not be located near steep canyons or large earthquake faults



Norcal Waste Systems Hay Road Landfill, Inc.

- Chris Choate

Background

Norcal Waste Systems Hay Road Landfill, Inc. is a state-of-the-art landfill facility providing disposal services for both municipal and commercial customers. The landfill has a permitted capacity of 2400 tons per day. The total acreage of the site is 640 with the disposal area of 256 acres. Hay Road Landfill is also the home of the Clean City Compost Program, a sophisticated process that takes San Francisco yard trimmings and food scraps and transforms the waste into productive soils. Brown, Vence and Associates was retained and recently completed the feasibility study and conceptual design for a landfill gas to electricity system and continues to work closely with Norcal Waste Systems to complete the next steps in this project.



Meeting Notes

The Norcal representatives defined the process undertaken in examining the advantages of incorporating a landfill gas recovery vertical system at the Hay Rd facility. The delegation was quite interested in understanding the financial structuring of the project and the impacts of the franchise agreement with the City/County of Sacramento.

The Hay Rd. facility also has a thriving composting facility that provides organic product to over 35% of the agriculture market in the region. Mr. Mhaskar and Mr. Khan discussed with facility representatives the viability of a composting market and price structure.

BVA and Norcal jointly presented on how they are currently evaluating the waste characteristics of the site and future growth in the area to consider developing a 12 MW cogeneration facility. The group discussed at length the process undertaken in finalizing a power purchase agreement with the local utility and the ability to sell "all power produced", which has been a recurring problem for landfills in California.



VII. FOLLOW-UP AND NEXT STEPS

Follow-up

The Thailand/US Exposure Trip provided a series of models and examples that we anticipate will be institutionalized into state and municipal government urban development programs. LBG/GEP-CCS will continue to coordinate with the visited Thai and U.S. institutions and follow-up on potential areas of collaboration and gathering additional information for the participants. Below are specific areas for follow-up:

PHASE I - BANGKOK, THAILAND

□ Thailand LBG Welcome Briefing Session

- CD with Photos from all Exposure Trip Field Visits
- Exchange trip meeting notes, observations to US-AEP office for further networking on MSW and LfG

□ BMA

- Further information on the financial aspects of Bangkok's MSW management
- Additional information on mobilizing communities for better collection

□ Kasasart University -

- Follow-up on progress with the Phase II of the Kampaengsaen LfG to energy project.
- Additional information on the results of the methane flaring pilot at the Nonhaburi municipal landfill site.

□ WMS- ESBE

- Continue the dialog begun with WMS for possible future exchanges

PHASE II - SAN FRANCISCO / SONOMA / SACRAMENTO

□ U.S. LBG Welcome Breakfast / Introductory Session

- Include Exposure Trip Participants in the GEP-CCS and USAID/India Mailing List
- Background Information on LBG World-wide Operations

- GEP-CCS Project Development Tool-Kit
- CD with Photos from all Exposure Trip Field Visits

- ***SCS Engineers, LLC***
 - U.S. Subtitle D: Ground Water and Corrective Action Requirements
 - U.S. EPA: 40CFR258 pertaining to "Criteria for Municipal Solid Waste Landfills"

- ***Sonoma County Waste Management Agency / Central Landfill***
 - 2003 Sonoma Recycling Guide
 - GHG Emission Inventories for Eight Cities in Sonoma County

- ***California Energy Commission***
 - California Energy Technology Guide (CD-ROM)
 - Proceedings from the International Finance Forum, September 2003
 - Framework for Project Development Opportunities

- ***California Integrated Waste Management Board***
 - -Conversion and Biomass Technology Information
 - -Draft Primer, CA-Specific Guidance

- ***Brown, Vence and Associates***
 - Electronic Copy of the "How to Site a Sanitary Landfill" BVA Presentation
 - Electronic Copy of the "Integrated Waste Management" BVA Presentation
 - Landfill Region Siting Study and Recommendation – *Salinas Valley Solid Waste Authority*

ANNEX A.

Exposure Trip Thailand Firm Contact Information



**THE
WORLD
BANK**

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ANNEX B.

Exposure Trip U.S. Firm Contact Information

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Senior Vice-President
International Programs

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Landfill Gas
To Energy Power Systems

**Landfill
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Devon Rager
Associate II

ANNEX C.

Delegate Profiles

MSW Exposure Trip Delegate Profiles

1. Rakesh Mehta, Commissioner, Municipal Corporation of Delhi
2. Milind Mhaikar, Municipal Commissioner, Salngli-Miraj-Kupwad Municipal Corporation, State Government of Maharashtra
3. M.A. Khan, Commissioner, Urban Administration and Development (UADD), State Government of Madhya Pradesh (M.P.)
4. Subhash Lalla, Secretary, Urban Development Department, State Government of Maharashtra
5. Dr. Sukhbir Sandhu, Vice-Chairman, Mussoorie-Dehradun Development Authority Dehradun, State Government of Uttranchal
6. K. Jayakishan, Senior Head, Infrastructure Development Corporation (Karnataka) Ltd. (iDeCK)

Rakesh Mehta (IAS)

Mr. Rakesh Mehta, a senior IAS (AGMUT) officer of 1975 batch assumed the charge of Commissioner, Municipal Corporation of Delhi. He brings with him a rich and variegated administrative experience spanning an eventful career of 27 years in important positions in various government departments.

Mr. Mehta has brilliant academic record. He did his M.A in History from Jawaharlal Nehru University. He subsequently did M.Sc in Social Policy from London School of Economics.

Having held various important positions in Delhi Government and other State Governments, he is well aware of the challenges before the local bodies like the MCD. Prior to joining as Commissioner, MCD, he had a short stint of nearly three months as Secretary, Urban-Development and PWD in Delhi Government. Earlier, he spent two eventful years (2000-2002) in Delhi Transport Corporation as its Chairman-cum-Managing Director. He is credited with initiating the process of modernization and restructuring of DTC. It was during his tenure that despite serious challenges, 2000 CNG buses joined the DTC fleet making it the largest bus fleet operator in the world.

Mr. Mehta held the office of the Development Commissioner, Delhi including Secretary, Environment (1992-94). During this tenure, he was Member Secretary of Lokraj Committee which prepared its report on preservation of the Delhi Ridge.

Mr. Mehta was closely associated with development of Goa from 1995- 2000 as its Development Commissioner and Finance Secretary. He also occupied the office of Secretary Government of Pondichery (1983-88) and Deputy Commissioner, Arunachal Pradesh (1979-83). He began his career as Sub-Divisional Magistrate in Darya Ganj in 1977.

Truly academic, he has a number of publications and articles to his credit. These include "Mediation and Participation in a Delhi Slum" published in the book "City for All - Valuing Difference and Working With Diversity" edited by Jo Beall, Zed Books London, 1997; "Industrial growth in Goa Since Liberation" published by Goa Chamber of Commerce and Industry, edited by Mario Cabral E Sa, 1997; "Financing Public Health Care - A Case for Health Cooperatives" to be published by Voluntary Health Association of India for the Seminar on State of Health for Goa on 19-20 February, 2000; "The Alternative Rural Development Paradigm" published by O Herald newspaper to initiate a debate on rural-development alternatives; "Industrial Policy of Goa" drafted for a debate on improving the industrial climate in Goa and presented in a seminar organized by the Goa International Center, 1999; "Options for Power Sector Reforms in Goa" drafted to build consensus on power sector reforms and presented in the seminar on Power Sector Reforms at the Goa International Centre 1999; and History, Politics and Technology of the Diesel to CNG Bus Switch in Delhi", paper written for a seminar conducted by Harvard University in Pune in December, 2001.

Mr. Mehta is well versed in Hindi, English and French. His interests include jogging, yoga and reading on development issues. He is Member and Founder of the Goa Watershed Development Society to promote water conservation and empowering rural communities through a process of Bottom-up Planning.

Milind Mhaiskar (IAS)

Educational Qualifications:

B. Tech. (Chemical Eng.), I.I.T. Bombay, 1990

IAS, 1992 batch (Maharashtra cadre)

Present assignment:

Municipal Commissioner,
Sangli-Miraj-Kupwad Municipal Corporation

Municipal Commissioner is the administrative head of the Municipal Corporation. The Municipal Commissioner is responsible to provide civic amenities like potable drinking water, sanitation facilities, health, education facilities, street lights etc. in the Municipal area. The Corporation is an independent body earning its own revenue through octroi, property tax and water tax. Various other responsibilities in the corporation include the maintenance of roads, drainage systems, and gardens in the municipal area. Municipal Corporation is also the planning authority of the city and hence is accountable for town planning and enforcement of the development control rules.

Previous Assignments:

- Addl. Collector, Mumbai Suburban District
- CEO, Zilla Parishad, Amraavati
- Collector, Wardha

Special areas of Interest:

- SHG's
- Computerization of land records (as Collector, Wardha)
- Solid Waste Management
- Projects on BOT basis

[About Sangli-Miraj-Kupwad Municipal Corporation:

Population: 450,000

Area: 118 sq.km.

No. of households: 87351

M. A. Khan (IAS)

Educational Qualifications:

B.Eng (Mechanical)

Diploma in Business Management

Profile:

Over 30 years of work experience in various State Government departments, including experience at the district/ division level.

Present Assignment:

Commissioner cum Secretary, Urban Administration & Development Dept. (UADD), State Govt. of Madhya Pradesh (M.P.)

In current capacity, responsible for

- all 337 urban local bodies of the State, including their financial and other mandatory functions;
- all matters relating to administration of urban local bodies of the State; and
- urban development in the State.

Previous Assignments:

- Commissioner of Urban Administration & Development (State Govt. of M.P.)
- Director of Urban Welfare (State Govt. of M.P.)
- District Magistrate cum Collector, Bhopal
- Addl. Collector cum Administrator, Municipal Corporation of Bhopal (capital of M.P.)
- Managing Director, M.P. Industrial Development Corporation

[Madhya Pradesh statistics:

Area: 308000 sq km

Population: 60.4 million

Urban population: 26.7%]

Subhash S. Lalla (IAS)

Educational Qualifications:

B.Eng (Civil), M.I.E., L.L.B., P.G.D.M.
IAS

Profile:

Over 30 years of work experience in various State and Central Government departments, including experience at the district/ division level. Vast field experience in engineering on construction sites in urban and rural areas.

Present Assignment:

Secretary, Urban Development Dept.,
State Govt. of Maharashtra

As the senior most administrative functionary of the department of urban development for the state of Maharashtra, current responsibilities include policy and planning activities associated with urban and civic infrastructure for the state. These include land use policies, property tax, octroi tax, water and sanitation services, health, street lighting etc. Maharashtra is one of the largest states (in land area, population and economic activity) as well as among the fastest growing states in India. Its capital Mumbai is the commercial hub of the country. The urban development department faces the challenges of meeting the growing pressures of economic expansion and population growth.

Previous Assignments:

- Secretary, Social Justice Deptt (State Govt. of Maharashtra)
- Commissioner, Municipal Corporation of Pune
- Managing Director, Maharashtra State Warehousing Corporation
- Director Administration (Ministry of Information & Broadcasting, Govt. of India)
- Deputy Secretary, Rural Development Deptt. (Govt. of India)
- Collector/ Chief Executive Officer of Zilla Parishad in various districts of Maharashtra

[Maharashtra statistics:

Area: 308,000 sq km

Population: 78.9 million

Urban population: 38.7%]

Dr. Sukhbir Singh Sandhu (IAS)

Educational Qualifications:

M.B.B.S, Govt. Medical College, Amritsar; 1985

M.A (History); G.N.D University, Amritsar

LLB; 1987

Profile:

Over 15 years of work experience in various State Government departments, including experience at the district/ division level.

Present Assignment:

Vice-Chairman

Mussoorie-Dehradun Development Authority

Dehradun (State Govt. of Uttranchal)

As a Vice-Chairman of Mussoorie-Dehradun Development Authority, responsibilities include urban planning and development for the twin cities of Mussoorie and Dehradun. Located in the recently created hill state of Uttranchal, MMDA is entrusted with task of undertaking all necessary activities for enabling well-planned and sustainable urban development in this environmentally fragile region. These include the following:

- Implementation of the Master Plan
- Acquisition of land to implement the various schemes
- Enforcement of plans and development schemes
- Adaptation of measures for protection of the natural environment in the development area
- Coordination with Municipal Corporation, Public Works Deptt and other agencies involved with urban development.

It is committed to keep pace with the needs of the fast growing population and relevant infrastructure required for such growth. To this end, various models for private sector participation are also being explored.

Previous Assignments:

1. Managing Director, Electronics Corporation of Punjab, Chandigarh (2.10.01 to 3.4.02)
2. Commissioner, Municipal Corporation, Ludhiana (23.7.98 to 01.10.01)
3. District Magistrate – NOIDA (Gautam Budha Nagar) (9.5.97 to 2.12.97)
4. District Magistrate – HARDWAR (27.7.96 to 8.4.98)
5. Deputy Managing Director PICUP (Pradesia Industrial Investment Corporation of U.P.), Lucknow (16.1.96 to 26.7.96)
6. District Magistrate – Udham Singh Nagar (1.10.95 to 31.12.95)
7. Jt.Managing Director, Sugar Fed (UP Co-operative Sugar Factories Federation,) Lucknow (17.6.94 to 31.7.95)
8. Chief Development Officer, Distt: Lucknow (12.7.93 to 17.6.94)
9. Chief Development Officer, Distt. HARDOI (U.P.) (2.7.92 to 12.7.93)
10. SDM - Sardana, Distt. Meerut (29.9.91 to 1.7.92)
11. SDM (Sub-Divisional Magistrate) Salampur, Distt. Deoria, U.P. (7.9.90 to 21.9.91)

K. Jayakishan

Educational Qualifications:

Master of Business Administration *Specialization: Finance*, Faculty of Management Studies, University of Delhi, 1995

Bachelor of Technology (Electrical & Electronics), Birla Institute of Technology, MESRA, 1992

Employment Record

1. Infrastructure Development Corporation (Karnataka) Ltd.

- Position held** : Sector Head; from April 2003-till date
: Senior Associate; from June 2001 April 2003
- Location** : Bangalore
- Types of activities performed**
- Project identification for development (based on preliminary viability analysis)
 - Financial modeling
 - Project structuring for financial viability
 - Project appraisal for investment
 - Co-ordination of relevant studies for project implementation
 - Developing project implementation plans
 - Bid process management
- Key Assignments handled**
- Project development, structuring and bid process management for setting up of the following projects through private participation:
 - Sanitary Landfill for MSW in Bangalore
 - Private bus terminals in Bangalore and Shimoga
 - 4-laning of Bangalore-Mysore highway (Bangalore-Maddur package)
 - Development of city roads in Thiruvnanthapuram
 - Project preparation and structuring for Kotekere lake rejuvenation

2. Feedback Infrastructure Limited

- Position held** : General Manager
- Duration** : From March 1999– June 2001
- Location** : Chandigarh and New Delhi

- Types of activities performed**
- Project identification based on preliminary viability analysis
 - Financial modeling
 - Project structuring for financial viability
 - Co-ordination of relevant studies for project implementation
 - Developing project implementation plans
 - Project appraisal for investment
 - Bid process management
- Client References**
- Punjab Infrastructure Development Board

2. Feedback Strategic Consultancy Pvt. Ltd.

| | | |
|--------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|
| Position held | Manager | Deputy Manager |
| Duration | From March 1997– March 1999 | May 1995 – March 1997 |
| Location | Chennai | New Delhi/Chennai |
| Types of activities performed | <ul style="list-style-type: none"> ▪ Analysis of product-markets/businesses ▪ Carrying out demand/market estimation studies and Market feasibility analysis ▪ Developing business plan and business entry strategies | |

Languages

| | Speaking | Reading | Writing |
|-----------|-----------------|----------------|----------------|
| Hindi | Excellent | Excellent | Excellent |
| English | Excellent | Excellent | Excellent |
| Malayalam | Excellent | Fair | Poor |
| Tamil | Fair | Poor | Poor |

ANNEX D.

THAILAND RECEPTION FOR VISITING INDIAN DELEGATES

Thailand Reception For Visiting Indian Delegates

Scheduled for attendance the evening of January 29th from 18:30 to 21:00 in the Monthathip Room were partner officials from the Thai government, the World Bank, the United Nations, the National Research Center, Kasetsart University, Waste Management Siam USAID and USAEP.

Invited Guests, in addition to the Indian Delegation, included the following:

Bangkok Metropolitan Administration

Nathanon Thavisin Permanent Secretary City Clerk

Taweesak Dejdech, Director of Public Cleansing
Department

Energy Policy & Planning Office

Chananan Buakhiew, Director of Energy Conservation
& Renewable Energy Division

**National Research Center of Environmental
Development & Hazardous Waste Management**

Dr. Somporn Kamolsiripichaiporn

Waste Management Siam

John Hamilton, General Manager
Eastern Seaboard Environmental Complex

Suttidha Fakkum, Public Relations Manager
(Modern Asia Environmental)

US-AEP Technical Services Support Contract

Elaine Blatt, Chief of Party

World Bank Thailand

Patchamuthu Illangovan
Senior Environmental Specialist

Kasetsart Univeristy

Professor Kanoksak Eam-Opas
Associate Dean, Faculty of
Engineering

**U.S. Asia Environmental
Partnership**

Winston Bowman, Regional
Coordinator

United Nations

Peter Repinski
Environmental Affairs Officer

ANNEX E.

DELEGATE EVALUATIONS



**THE LOUIS BERGER GROUP, INC.
GREENHOUSE GAS POLLUTION PREVENTION PROJECT -
CLIMATE CHANGE SUPPLEMENT**

*Exploring Sustainable Landfill-to-Gas Project Development, Design and
Financing Exposure Trip*

**PHASE II - U.S. SEGMENT
EXPOSURE TRIP EVALUATION FORM**

Name : Subhash Lalla
 Title : Secretary
 Organization : Coal. of Maharashtra
 Address : Nandolga, Mumbai.

1. Overall, how would you rate the U.S. Exposure Trip?

Excellent Good _____ Fair _____ Poor _____

2. What meetings / presenters of the Exposure Trip did you find most useful?

All met - all were precise.

3. What concepts / approaches, observed on the trip, will you consider incorporating into your own institutional practices?

Every part of the visit.

4. What meetings / presenters of the Exposure Trip do you think could have been improved?

It was perfect. No 14 met, remaining.

5. How did you find the overall logistical arrangements?

Excellent Good _____ Fair _____ Poor _____

6. How did you find the following:

Hotel: _____
Excellent Good _____ Fair _____ Poor _____

Ground Transportation: _____
Excellent Good _____ Fair _____ Poor _____

7. Overall Rating of the LBG Exposure Trip Facilitator:

Excellent Good _____ Fair _____ Poor _____

8. Additional Comments ?

It was excellent in all respects -
My compliments to the
organizer.

Thank you for spending time to complete this evaluation.

Please handover the completed form to Mr. Erik Brejla at the Study Tour closing session.


Sibnah Laha



**THE LOUIS BERGER GROUP, INC.
GREENHOUSE GAS POLLUTION PREVENTION PROJECT -
CLIMATE CHANGE SUPPLEMENT**

*Exploring Sustainable Landfill-to-Gas Project Development, Design and
Financing Exposure Trip*

**PHASE II – U.S. SEGMENT
EXPOSURE TRIP EVALUATION FORM**

Name : K. JAYAKRISHAN
 Title : Sector Head
 Organization : Infrastructure Development Corporation (Karnataka) Ltd.
 Address : 118, Cunningham Road, Bangalore

1. Overall, how would you rate the U.S. Exposure Trip?

Excellent _____ Good Fair _____ Poor _____

2. What meetings / presenters of the Exposure Trip did you find most useful?

- BVA presentation on siting of Landfills
- SCI Engineers presentation on economics of Landfills
- Ox Mountain site visit

3. What concepts / approaches, observed on the trip, will you consider incorporating into your own institutional practices?

- Contracting for shorter time periods
- Incorporation of host fees

4. What meetings / presenters of the Exposure Trip do you think could have been improved? / incorporated.

- Financing and contracting aspects of ~~the~~ developing SLFs through private participation

5. How did you find the overall logistical arrangements?

Excellent 2/5 Good ✓ Fair _____ Poor _____

6. How did you find the following:

Hotel: Excellent _____ Good ✓ Fair _____ Poor _____

Ground Transportation: Excellent _____ Good ✓ Fair _____ Poor _____
(excellent in SFO and Sacramento)

7. Overall Rating of the LBG Exposure Trip Facilitator:

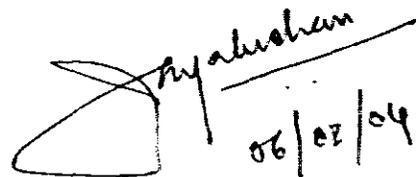
Excellent _____ Good ✓ Fair _____ Poor _____

8. Additional Comments ?

1. The number of landfill trips could have been reduced. May 1 one or two intensive site visits covering all aspects
 - L operated by a private developer
 - L leachate
 - L gas collection & power generation
2. Elements of contracting should be incorporated
3. The trip should be funded from home base eg. in my case from/to Bangalore.

Thank you for spending time to complete this evaluation.

Please handover the completed form to Mr. Erik Brejla at the Study Tour closing session.


06/02/04



**THE LOUIS BERGER GROUP, INC.
GREENHOUSE GAS POLLUTION PREVENTION PROJECT -
CLIMATE CHANGE SUPPLEMENT**

*Exploring Sustainable Landfill-to-Gas Project Development, Design and
Financing Exposure Trip*

**PHASE II - U.S. SEGMENT
EXPOSURE TRIP EVALUATION FORM**

Name : M. A. KHAN
 Title : COMMISSIONER, URBAN ADMINISTRATION DEPTT
 Organization : GOVT OF MADHYA PRADESH ~~INDIA~~
 Address : MANTRALYA R.No 324 , BHOPAL

1. Overall, how would you rate the U.S. Exposure Trip?

Excellent Good _____ Fair _____ Poor _____

2. What meetings / presenters of the Exposure Trip did you find most useful?

PRESENTATION OF Mr BROWN

3. What concepts / approaches, observed on the trip, will you consider incorporating into your own institutional practices?

Almost all the practices which are prevalent in Bangkok & Sacramento, Sacramento

4. What meetings / presenters of the Exposure Trip do you think could have been improved?

Meeting with BMA would have been betterly organised if some senior officer of BMA would have been invited

5. How did you find the overall logistical arrangements?

Excellent Good _____ Fair _____ Poor _____

6. How did you find the following:

Hotel: Excellent Good _____ Fair _____ Poor _____

Ground Transportation: Excellent Good _____ Fair _____ Poor _____

7. Overall Rating of the LBG Exposure Trip Facilitator:

Excellent Good _____ Fair _____ Poor _____

8. Additional Comments ?

Mr Erik arranged programme professionally. He deserves appreciation

manu 6/2
(J A KHAN)

Thank you for spending time to complete this evaluation.

Please handover the completed form to Mr. Erik Brejla at the Study Tour closing session.



**THE LOUIS BERGER GROUP, INC.
GREENHOUSE GAS POLLUTION PREVENTION PROJECT -
CLIMATE CHANGE SUPPLEMENT**

*Exploring Sustainable Landfill-to-Gas Project Development, Design and
Financing Exposure Trip*

**PHASE II - U.S. SEGMENT
EXPOSURE TRIP EVALUATION FORM**

Name : RAKESH MEHTA
 Title : Commissioner
 Organization : Municipal Corporation of Delhi
 Address : Town Hall
CHANDNI CHAWK.
DELHI INDIA 110006

1. Overall, how would you rate the U.S. Exposure Trip?

Excellent Good Fair Poor

2. What meetings / presenters of the Exposure Trip did you find most useful?

Brown Venca + Associates

3. What concepts / approaches, observed on the trip, will you consider incorporating into your own institutional practices?

- 1 Incorporating MSW practices on segregation.
- 2 Gas extraction from landfills

4. What meetings / presenters of the Exposure Trip do you think could have been improved?

Financing options - needs better
focus and case studies of
successes / failures.

5. How did you find the overall logistical arrangements?

Excellent Good _____ Fair _____ Poor _____

6. How did you find the following:

Hotel: Excellent Good _____ Fair _____ Poor _____

Ground Transportation: Excellent Good _____ Fair _____ Poor _____

7. Overall Rating of the LBG Exposure Trip Facilitator:

Excellent Good _____ Fair _____ Poor _____

8. Additional Comments ?

A fine mix of presentations /
discussions and field visits.
It was a great learning
experience. Eric was ~~not~~
a training manager. He
was a team leader,
sensitive and creative.

Thank you for spending time to complete this evaluation.

Please handover the completed form to Mr. Erik Brejla at the Study Tour closing session.

Subt
Dattesh Mehta



THE LOUIS BERGER GROUP, INC.
GREENHOUSE GAS POLLUTION PREVENTION PROJECT -
CLIMATE CHANGE SUPPLEMENT

*Exploring Sustainable Landfill-to-Gas Project Development, Design and
Financing Exposure Trip*

PHASE II - U.S. SEGMENT
EXPOSURE TRIP EVALUATION FORM

Name: MILIND MHAISKAR
Title: COMMISSIONER
Organization: Sangli Miraj Kupwad Municipal Corporation
Address: Rajwada Sangli (Maharashtra)
INDIA 416 416

1. Overall, how would you rate the U.S. Exposure Trip?

Excellent Good Fair Poor

2. What meetings / presenters of the Exposure Trip did you find most useful?

- BVA at Sacramento.
- SCS engr at San Francisco.
- Visit to the Keiter landfill site.

3. What concepts / approaches, observed on the trip, will you consider incorporating into your own institutional practices?

- Long term thinking on SWM, Lfg concepts.
- The idea of 'User must pay'.

4. What meetings / presenters of the Exposure Trip do you think could have been improved?

None.
All were upto the mark & more.

5. How did you find the overall logistical arrangements?

Excellent Good _____ Fair _____ Poor _____

6. How did you find the following:

Hotel: Excellent Good _____ Fair _____ Poor _____

Ground Transportation: Excellent Good _____ Fair _____ Poor _____

7. Overall Rating of the LBG Exposure Trip Facilitator:

Excellent Good _____ Fair _____ Poor _____

8. Additional Comments ?

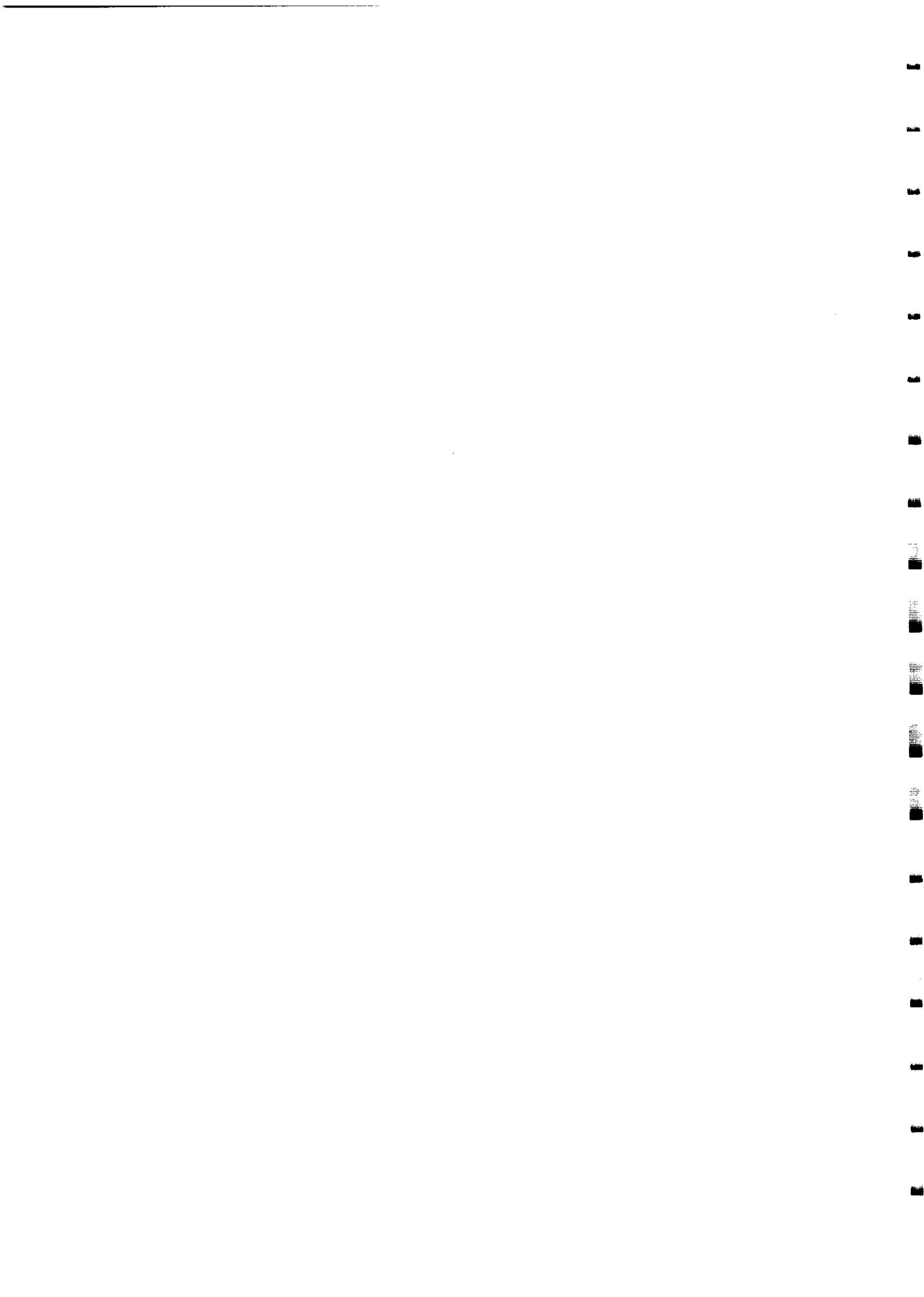
The trip gave us a good exposure of the ^{whole} SWM exercise & where we need to exert back home. There are areas which we can replicate & areas which are, as of today, a bit lobby for our country. The clear focus would be important in order to work out the priorities.

There was a perfect mix of theory & practice, formal presentations & informal chat which permitted us to pick up most out of this visit. The visit was organised to the last inch of perfection.

Thank you for spending time to complete this evaluation.

12/2/88

Please handover the completed form to Mr. Erik Brejls at the Study Tour closing session.

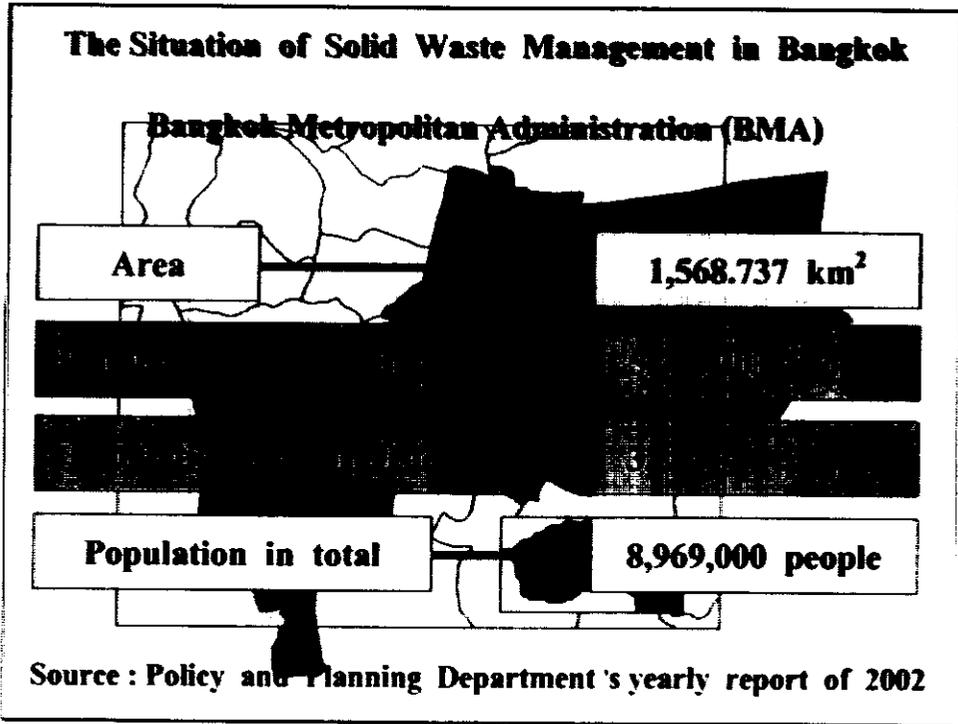


ANNEX F.

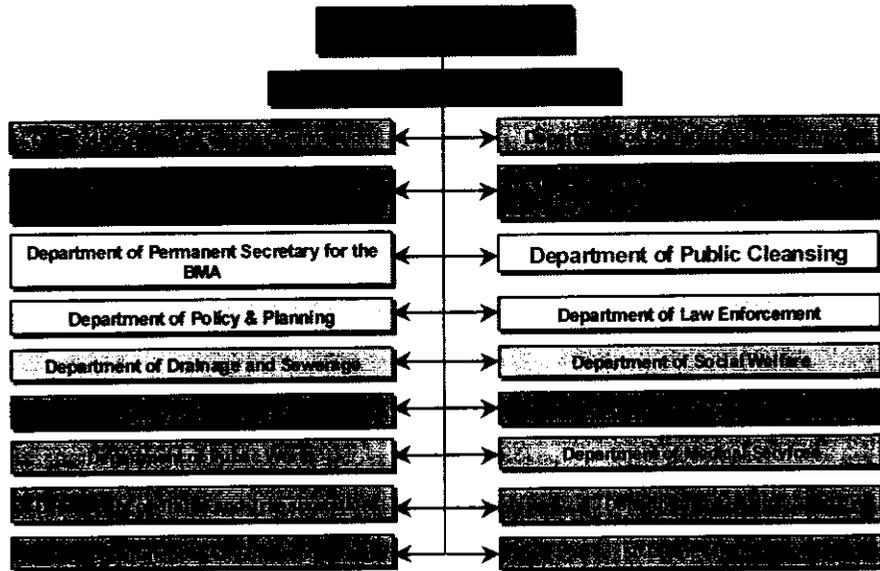
PRESENTATIONS

BANGKOK METROPOLITAN ADMINISTRATION

“SOLID WASTE MANAGEMENT OF BMA”



BMA Organization



Solid Waste Management of BMA

The responsible organization

- K Department of Public Cleansing
 - K Chief of Public Cleansing and Public park subdistrict
- 50 districts



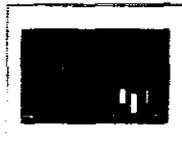
Sources of Solid Waste



Residential
area



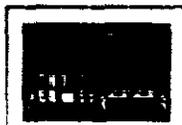
Community
area



Temple



School



Department
store, shop,
Hotel



Market,
Mini-mart



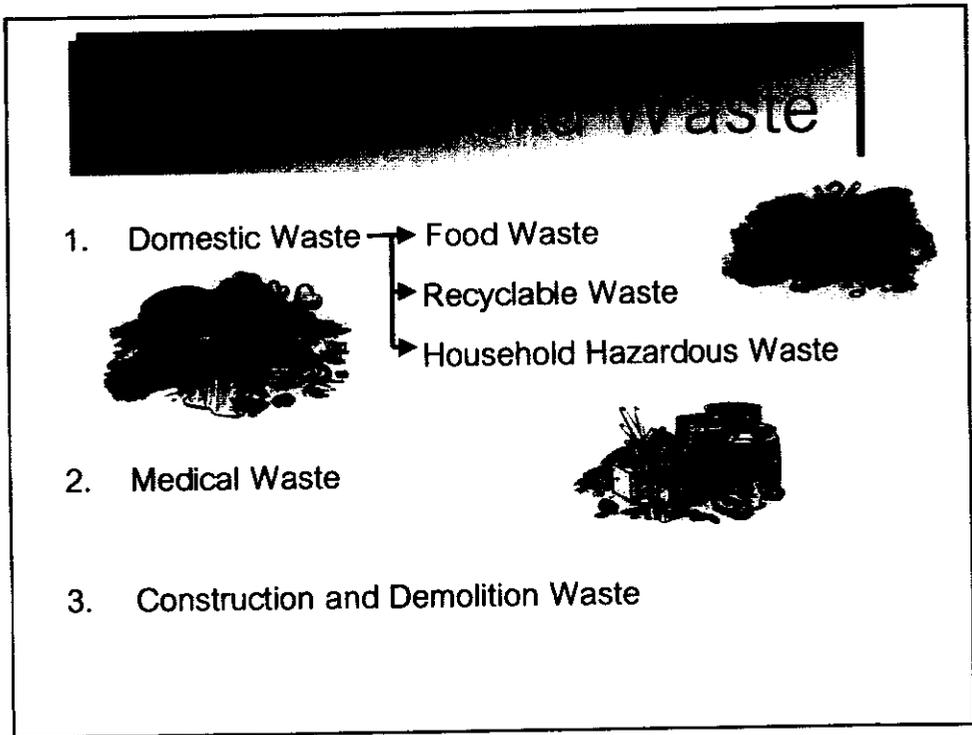
Government
institution,
Hospital

Waste Generation Rate



0.8 - 1 kg /capita/day

In 2003, Solid Waste of BMA is 9,400 tons/day
or 3.43×10^6 tons/year.



Location for 3 Solid Waste Disposal Sites in BMA



Solid Waste Collection System

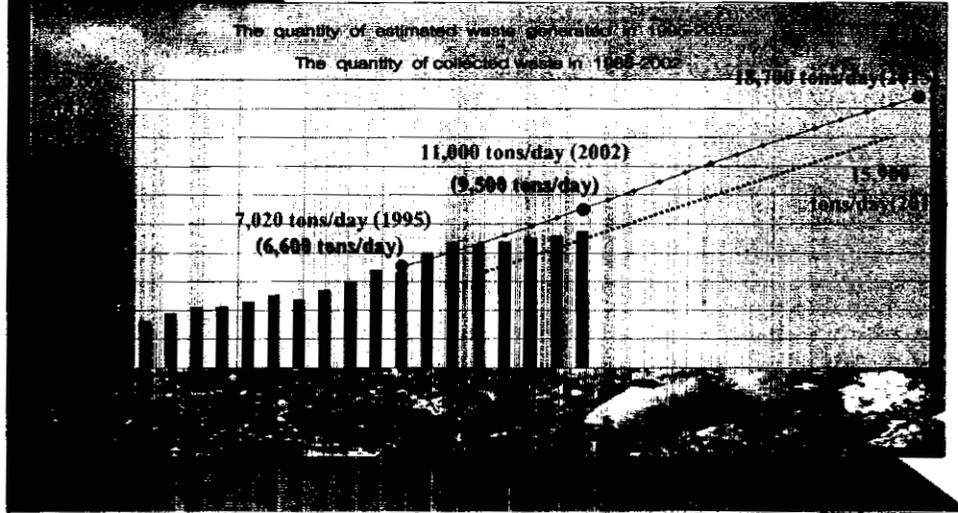
- District Offices → By Cleansing and Public Park Sub - Division
- Public Cleansing Department

3 transfer stations

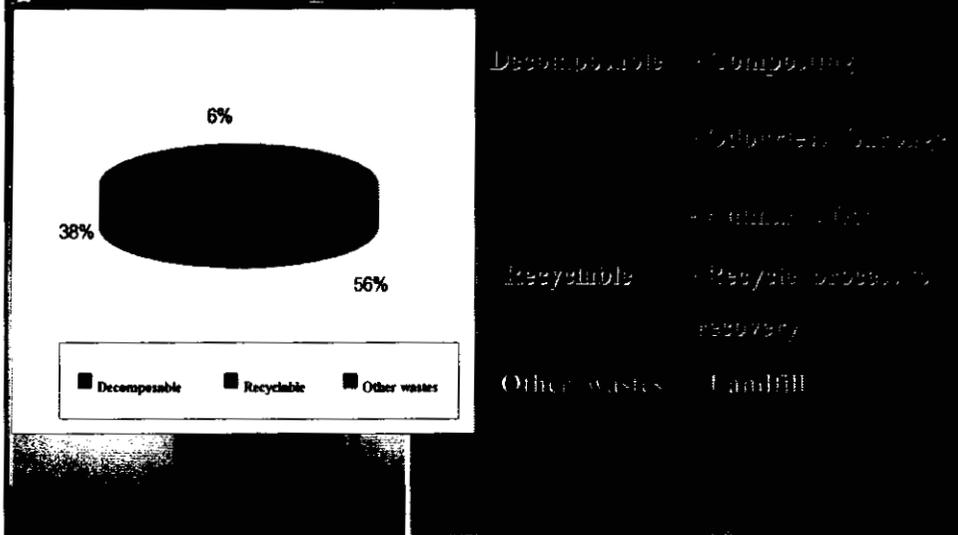
| | | |
|-----------|------------------------|--------------------------------------------------------------------|
| On - Nuch | 3,585 tons/day (37%) | All Deceit, all collected wastes are disposed by sanitary landfill |
| | 3,556 tons/day (37.6%) | |
| | 2,410 tons/day (25.4%) | |

Solid Waste Problems

1. Rapidly increasing quantities of solid waste



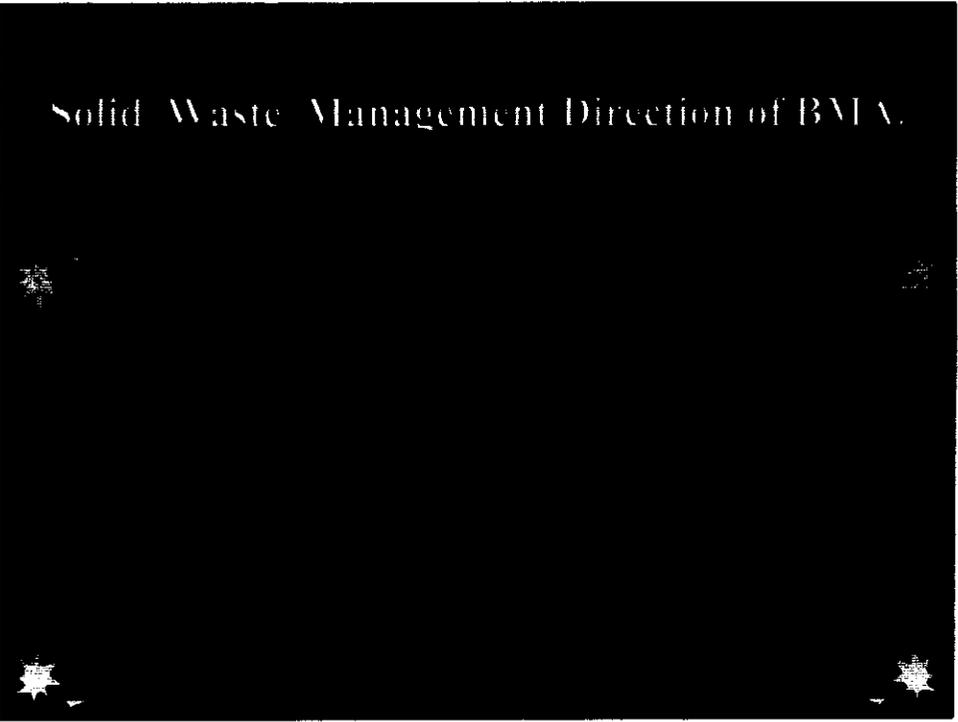
2. Contaminating of Hazardous Waste and Clinical Waste in Domestic Waste is due to lacking of waste separating cooperation



**3. Lacking of Environmental Protection
due to public protest.**



Solid Waste Management Direction of BMA.



[REDACTED]

1. [REDACTED] people's participation in all target [REDACTED] of cleaning responsibility and [REDACTED] waste, nightsoil and hazardous waste.

2. [REDACTED] efficiency of solid waste management on [REDACTED] transportation and disposal system, including sanitary services.

3. To develop [REDACTED] transportation and treatment, including [REDACTED] public toilet services.

4. To develop [REDACTED] system on collecting, processing and [REDACTED] public relations and information [REDACTED]

5 To enhance officials' knowledge with rapid development.

6 To improve related regulations including solid waste, nightsoil and management.

7 To increase private sectors' role in nightsoil operation on behalf of BMA.

Management Dir

participation in waste minimization and
l e n a t s o u r c e .

within BMA. to promote waste
separation, including improve waste
ciency.

outside BMA. to cooperate in waste

Public Participation

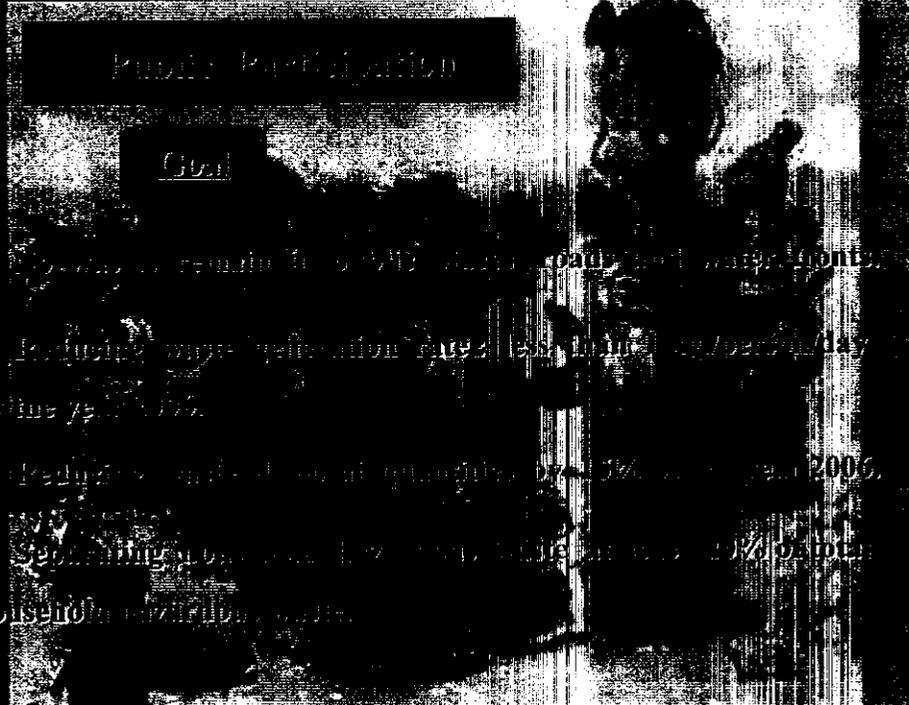
GOAL

Reduce the amount of solid waste sent to landfills and incinerators

Reduce single-use plastic and paper products by the year 2006.

Reduce the amount of solid waste by 17.3% by the year 2006.

Separating solid waste by material type by 20% by the household recycling rate.



Project Implementation

6. Loving canal project.
7. Clean city project.



2

Waste Collection Improvement

Goal

- to waste remain in public collection system
- improving the efficiency of waste collection
- improving the efficiency of fee collection to cover all costs to customers.
- improving clinical waste collection to cover all medical centers

2

Waste Collection Improvement

- improving waste collection efficiency
- reducing trips/day of collection trucks
- Improvement Director
- capacity of waste collection to meet collection standard.
- use of collection trucks at least 80%



Waste Collection Improvement

Presently, waste collection managed by district offices are 122 trips/day on average.

Improvement Direction

No waste remain in public places.

Waste Collection Service must follow the notification in BWA Regulation on principle of Solid Waste and Nighttime Management in Buildings and Public Health Centers of 2002.



Economic Measures

In 2002

Waste Collection Cost 783 Bani/ton

Waste Collection Cost 783 Bani/ton

BWA, was hardened with 783 Bani/ton





Economic Measures

Improvement of ratio

→ more value added, less waste, less energy, less CO₂

→ less material, less energy, less CO₂, less waste, less cost

→ less material, less energy, less CO₂, less waste, less cost



Economic Measures

Improvement of ratio

→ more value added, less waste, less energy, less CO₂

→ less material, less energy, less CO₂, less waste, less cost

→ less material, less energy, less CO₂, less waste, less cost





Improve the quality of sanitary landfill and reduce environmental problems.

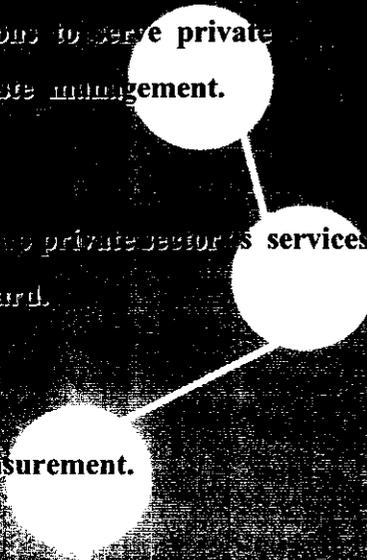
- ❖ Improve organic waste disposal system.
- ❖ Use modern and suitable waste disposal technologies.

❖ Control the quality of waste disposal to meet the standard which no impact on the environment and people's health.

• Improve related regulations to serve private sectors to take part in waste management.

Set up private sector's services standard.

• Set up investigation measurement.



Potential role of Private Sector in the Project

1. Garbage collection efficiency.

... private company to carry
... order to keep up with
... collection trucks. The
... reading will help
on controlling the use of all types of garbage
collection trucks with more efficient.



Potential role of Private Sector in the Project

2. Public cleansing services.

... officer
... private
... such as
... season, street
cleaning within BMA with monitoring and
controlling to be within the required



Activities to be implemented in the future:

- 1.) Use private companies to handle garbage collection and disposal as one business.
- 2.) Set controlling measures to monitor for efficient private operation.
- 3.) Provide more trends on privatization of garbage collection and disposal system in several models.



Potential role of Private Sector in the Project

3. Garbage disposal system.

... 1000-9,500
... within BMA at
... system. The BMA
... operated by
private companies with payment from BMA
according to the tonnage of garbage



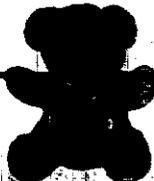
Measures to be implemented in the future:

- 1.) Decide on appropriate technology in garbage disposal system to cope with present and future garbage quantity.
- 2.) Improve and renovate the existing Composting Plant to be more efficient.
- 3.) Construct municipal waste incinerator to be one of BMA municipal waste disposal system.



Measures to be implemented in the future:

- 4.) Construct the sorting system at the disposal site to separate different types of garbage to be further disposed by appropriate system.
- 5.) Request for depreciating preserved forest or similar type of land to be reserved as long term landfill from the concerning organizations.
- 6.) Push on privatization of garbage disposal business.



Potential role of Private Sector in the Project

4. Management for household hazardous and toxic waste.

DPC hire GENCO, special companies to dispose of hazardous waste from industries, to take care of further management. DPC will improve the efficiency in hazardous waste management by studying for public relation on knowledge of household hazardous waste to get more participation from people.

Potential role of Private Sector in the Project

The infectious waste management from hospitals and other medical care centers is also taken care by DPC.

The collection amount from hospitals and medical care centers is on

2 Infectious or medical waste management units with capacity of 10

tons/day. The operation is currently handed over to Krungthep Thanakorn Company to increase efficiency and reduce BMA operation.

Measures to be implemented by BMA:

1.) BMA will conduct a feasibility study on household hazardous waste storage and preliminary disposal system within BMA area.

2.) BMA with other government organizations and commercial buildings will set some activities to create public awareness and public participation in hazardous waste separation.



Measures to be implemented by BMA:

3.) BMA will establish public relations to public on the knowledge and necessary in household hazardous waste separation and disposal to the proper places.

4.) Set more household hazardous waste receiving points convenient to people.

5.) Set up appropriate hazardous waste collection points.



...ities to be implemented by BMA:

... hazardous waste collection bins to be distributed through out communities.

7.) Promote private sector role in household hazardous waste collection in the same way as infectious waste collection.

8.) Set distinctive measures to support the ... hazardous waste activity by ...



Using IT measures

- Use IT to control waste collection and disposal.**
- Set up the standard of collection trucks using.**
- Set up investigation measurement.**

Enhance officials' knowledge and experiences through training and studying, strengthen their capacities to tackle BMA. waste problems.



BMA.'s present law

...ing private sectors who manage
... solid waste ... on, transportation or disposal
... or gaini... of service fees of 2001.

... Ordinance on ... fees of 2000.

... for solid waste collection,
... 2001.

... of solid waste and nightsoil
... public health centers of 2002.

The Origin of the Regulation

Public Health Act of 1992

↓ article 20

Ministry of Health (MOH) Regulation on
Solid Waste and Nightsoil Management of 2001

↓ point 7 and 14

BMA Regulation on Principle of Solid Waste and Nightsoil
Management in Buildings and Public Health Centers
of 2002

Important Contents of the Regulation

The regulation consists of 4 chapters

1. General Provisions

☐ Definition

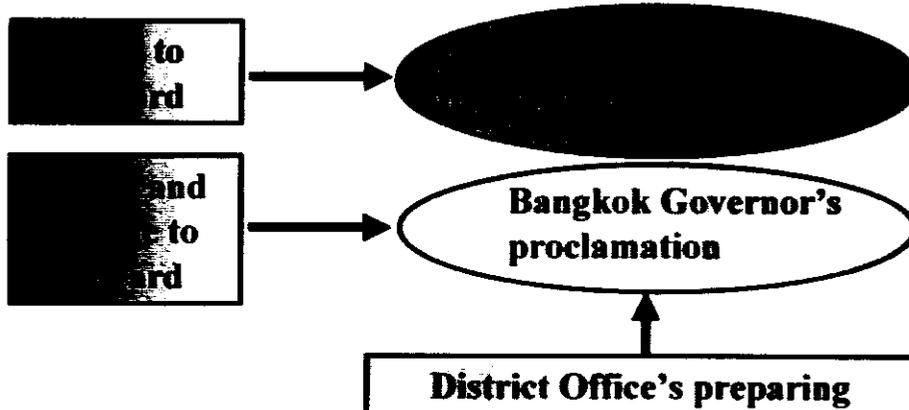
☐ Bangkok Governor's authority

Important Contents of the Regulation

2. Solid waste management in buildings or places which are non-public health centers
3. Solid waste management in public health centers
4. Nightsoil disposal

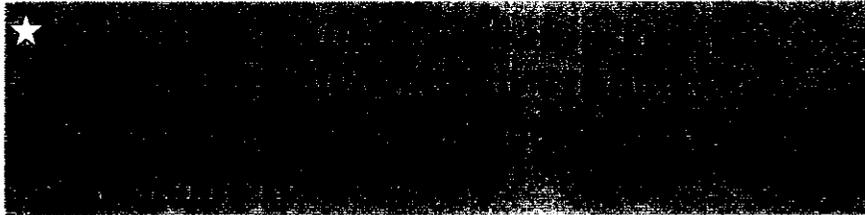
Operation Concept

In General Buildings and Places



In Households

☆ Put solid waste into bags and fasten them



☆ Discarding time

On main streets : 6.00 p.m - 3.00 a.m.

In lanes : Set up by District Office

- Draft BMA Rule on principles to be followed by BMA to approve private sectors to collect, transport, dispose of nightsoil or solid waste as business by private sectors on service fees.
- Draft BMA. Formulation on service fees of nightsoil or solid waste collection and transportation according to the Public Health Act.
- Draft BMA. ordinance on additional payment for workers who work for nightsoil or solid waste collection and transportation, including payment for private sectors who receive service fees from BMA's customers on behalf of BMA.



SCS ENGINEERS

**“AN OVERVIEW OF SOLID WASTE
MANAGEMENT IN THE USA”**



**AN OVERVIEW OF
SOLID WASTE
MANAGEMENT
IN THE USA**

February 2 and 3, 2004
San Francisco, California USA

Session 1

SCS ENGINEERS
Environmental Consultants and Contractors

Sponsors & Participants

Funded by: The United States Agency for
International Development (USAID)

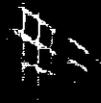


Prime Contractor: LOUIS BERGER GROUP
Solid Waste Consultants: SCS ENGINEERS
Students: DELEGATES FROM INDIA

SCS ENGINEERS
Environmental Consultants and Contractors

The Program

Four Sessions for Presentations & Discussion
1 on Monday, 2 February
2 on Tuesday, 3 February



Two Site Visits

Ox Mountain Landfill (after tea morning)
Recycle Central (material recovery facility - MRF)
to be tea morning

SCS ENGINEERS
Environmental Services

Objectives of these Sessions

Describe & discuss

- The LFG program in the USA
- The LFG program in the USA and
- How LFG treatment is used in the USA
- How LFG treatment is used in the USA
- MANAGEMENT OF LFG IN THE USA

SCS ENGINEERS
Environmental Services

Outcomes

Delegates will take away

- An understanding of the LFG and MSWLF regulatory context in the USA
- An awareness of the types of grants and programs available in the USA (the context for LFG)
- Understanding of the regulatory context for LFG and MSWLF in the USA

SCS ENGINEERS
Environmental Consultants and Engineers

INTRODUCTIONS-- SCS ENGINEERS

Founded in 1970

100% employee-owned

Headquartered in Long Beach, California

450 environmental professionals

LFG & solid waste engineering are SCS specialties

SCS ENGINEERS
Environmental Consultants and Engineers



INTRODUCTIONS- SCS ENGINEERS (cont.)

10% of staff work outside the USA

SCS has worked in 40 countries since 1960
mostly on LFG & solid waste projects.

Privatization of collection & disposal services in
Egypt: a major on-going USAID program

SCS ENGINEERS
INTERNATIONAL

INTRODUCTIONS- SCS ENGINEERS (cont.)

Representing SCS today are:

Steve Hamilton

USC Engineer, 1960-1965
SCS Engineer

1965-1970: Environmental Engineering Consultant

David Ross, PE

USC Engineer, 1960-1965
SCS Engineer

1965-1970: Environmental Engineering Consultant

SCS ENGINEERS
INTERNATIONAL

INTRODUCTIONS-- INDIAN DELEGATES

EACH DELEGATE is asked to give:

- Name
- Affiliation

A few minute summary of SW practices & current issues in your state or city

SCS ENGINEERS
Environmental Consultants and Chemists

INDIA



SCS ENGINEERS
Environmental Consultants and Chemists

Solid Waste Management Objectives in the USA

Protect Public Health

Protect the Environment

Enhance community aesthetics

Promote sustainable development



THE END USERS
OF THE WASTE MANAGEMENT SYSTEM

Solid Waste Management Hierarchy in the USA

Traditional hierarchy:

WASTE PREVENTION, SOURCE SEPARATION

VOLUME REDUCTION

REUSE

RECYCLE

PROCESS TO RECOVER ENERGY

DISPOSAL

THE WASTE MANAGEMENT SYSTEM

DEFINITION OF SOLID WASTE

Distinction between hazardous & non-hazardous wastes

Hazardous wastes defined by law, based on:

- Ignitability
- Corrosiveness
- Reactivity
- Toxicity (leaching test)

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Environmental Consultants and Engineers

Definition of solid waste, cont.

Non-hazardous waste is the focus here



Such waste is typically called...
Municipal Solid Waste (MSW)

SCS ENGINEERS
Environmental Consultants and Engineers

Definition of solid waste, cont.

MSW fractions refer to the source of waste:

- Residential
- Commercial
- Industrial
- Institutional
- Medical
- Construction & demolition (C&D)
- Street sweepings

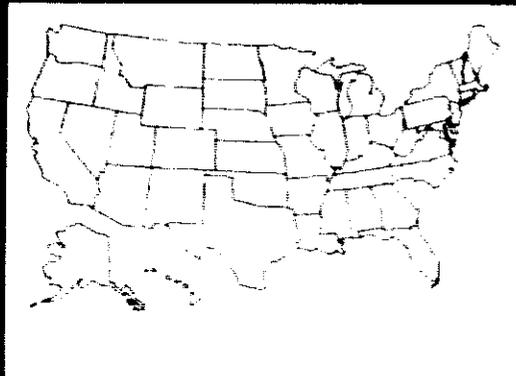
SEE END NEEDS
Environmental Engineering and Technology

LAWS & REGULATIONS

FEDERAL

STATE

LOCAL



SEE END NEEDS
Environmental Engineering and Technology

Scope of Federal Laws & Agencies

- Set National requirements & guidelines
- Technical & financial support to states
- Research
- Technology transfer
- Enhance markets for secondary materials

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Environmental Consultants and Engineers

Major US Federal Laws

(administered by USEPA)

- Solid Waste Disposal Act (SWDA): 1965
- Resource Recovery Act: 1970
- Resource Conservation & Recovery Act: 1976 (RCRA)
- Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA): 1980 (a.k.a. "Superfund")

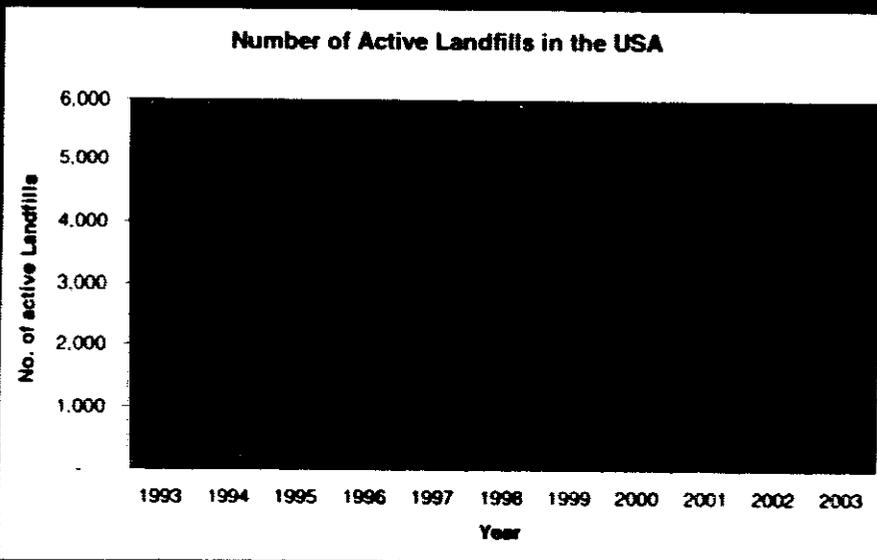
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Environmental Consultants and Engineers

RCRA 1976; Highlights

- Mission 5000– Close open dumps
- Siting criteria for new landfills
- Emphasis on waste reduction & recycling
- Distinction between solid waste & hazardous waste
- Delegated authorities to States

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Environmental Consultants and Contractors

ONE RESULT OF RCRA... FEWER BUT LARGER LANDFILLS



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Environmental Consultants and Contractors

Scope of State Laws & Agencies

- Establish & enforce SW mgt regulations in response to & consistent with Federal laws
- Set additional (more stringent) rules (California is typically more stringent)
- Empower and/or mandate local agencies
- Provide technical support to local agencies

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Scope of Local Ordinances & Agencies

- Protect the public health & sanitation
- Implement and conform to State laws
- Set basic policy: Public or private ownership & operation of solid waste systems

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Environmental Consultants and Contractors

Scope of Local Ordinances & Agencies, cont.

Land use planning and permitting

Plan for proper waste management and secure adequate disposal capacity

Fund the proper management of MSW

- User fees
- Taxes
- Bonds

SCS ENGINEERS
Environmental Services

Scope of Local Ordinances & Agencies, cont.

• Construct, own, and/or operate solid waste services & facilities:

- Collection
- Recycling
- Transfer
- Processing
- Disposal

OR...

SCS ENGINEERS
Environmental Services

Scope of Local Ordinances & Agencies, cont.

License, franchise, or contract with private contractors and their collection, recycling and processing services.

Monitor all contract owner/operators

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Role of Private Enterprise

Partnership with public agencies for efficient collection & disposal of MSW

Own & operate MSW collection fleets

Own & develop landfills

Compete openly for long-term contracts, offering highest level of service at lowest practical price

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Waste Management Practices in the USA

Waste storage at the source

- Rigid containers
- Plastic bags



Collection by truck is typical

- Trend towards one-man automated trucks
- Front-end loaders for commercial wastes

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US Practices, cont.

Recycling is increasing

- At the source
- At MRFs (material recovery facilities)

Transfer when not done at the source

- Front-end loaders
- Front-end loaders

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US Practices, cont.

Processing

- Composting
- Waste-to-energy (incineration)
- Gasification (and others)

Disposal of residuals

- Sanitary Landfill (dry tomb)
- Bio-reactor landfill

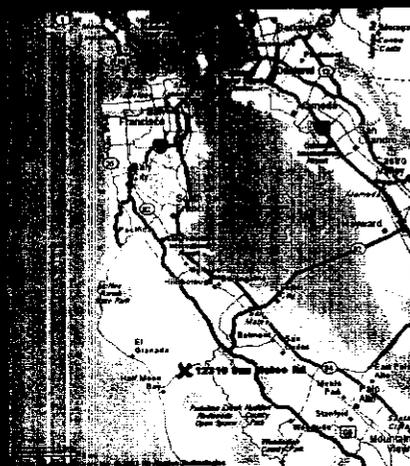
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Site Visit #1:

Ox Mountain Landfill

Location

- 30 miles south
- 3,598 tons/day
- Site:
 - 2,756 ac
 - 6% used for MSW



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Ox Mountain LF, cont.

Owner: Allied Waste Industries
(Formerly BFI)

Closure date: Jan 2018

Volume of waste:

Permitted capacity= 29 million m³

Physical capacity = 34 million m³

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Ox Mountain LF, cont.

Features of note:

- Near San Antonio, TX
- LFG collection with 100% capture
- Charcoal
- Flare
- Permit issued by TCEQ, 10/19/01, 10/19/02
- County
- Funding fee = \$10,000,000

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**AN OVERVIEW OF
SOLID WASTE
MANAGEMENT
IN THE USA AND INDIA**

February 2, 2004
San Francisco, California, USA

Session 2

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**INTEGRATED SOLID WASTE
MANAGEMENT PLANNING**

WHY WE BOTHER TO PLAN:

- Improve public health & environmental conditions
- Provide for adequate facilities & services for reasonable costs, for ourselves & our children
- Raise public awareness of the problems & need for change to achieve solutions

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Why we plan, cont.

In India, planning helps municipalities meet Central Government (MOEF) guidelines for solid waste management:

- Collection
- Treatment
- Disposal

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Environmental Management

What does "INTEGRATED" Mean?

Best solution usually entails a MIX of:

Technologies

- Mechanical
- Biological
- Thermal
- Chemical

Participants

- Municipalities
- Consultants

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Environmental Management

SOLID WASTE PLANNING ELEMENTS

FORM THE PLANNING TEAM

UNDERSTAND LAWS & REGULATIONS

SET A VISION

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SOLID WASTE PLANNING ELEMENTS, Cont.

DEFINE PLANNING FRAMEWORK

INITIATE PUBLIC PARTICIPATION PROGRAM

INVENTORY CURRENT PRACTICES & COSTS

IDENTIFY SERVICE DELIVERY OPTIONS

DEFINE EVALUATION CRITERIA & PROCESS

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SOLID WASTE PLANNING ELEMENTS. Cont.

EVALUATE THE OPTIONS

SELECT BEST OPTION

DEVELOP STEPS TO ACHIEVE OBJECTIVE

DOCUMENT THE SOLID WASTE PLAN

IMPLEMENT THE PLAN

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Solid Waste Planning Elements

FORM THE PLANNING TEAM

Elected officials

Staff of government agencies

Professionals in private practice

Interested & interested parties

News media

PRESENTED BY
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Solid Waste Planning Elements

UNDERSTAND THE LAWS

Federal laws for text

State laws for guidance

Local ordinances for constraints

Consider new or modified ordinances

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Solid Waste Planning Elements:

A SOLID WASTE VISION

From this....



to this....

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Solid Waste Planning Elements

SET A VISION

Recruit supporters & SELL the Vision



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Solid Waste Planning Elements

DEFINE PLANNING FRAMEWORK

- Time frame: typically 15 to 25 years
- Define wastes to be managed in the next 1000
- Define plan participants
- Levels of service & quality of service
- frequency
- Consider and design alternatives for public and private entities

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Solid Waste Planning Elements

INITIATE PUBLIC PARTICIPATION

Involve specialists

Set and stick with consistent themes

Sell the VISION

Commit to long term public information

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Solid Waste Planning Elements

INVENTORY CURRENT PRACTICES

Waste
characterization

Find out what
quantity of waste

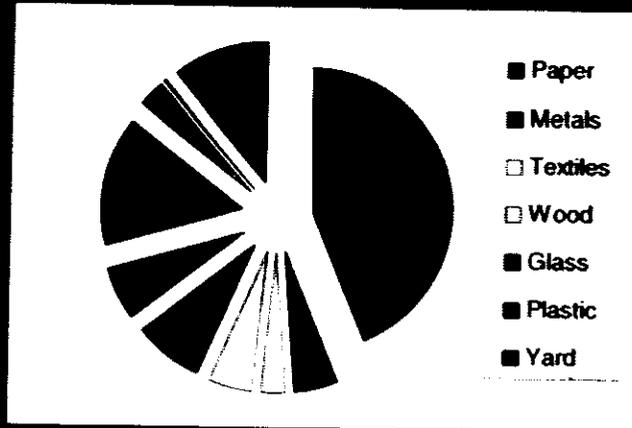
Est. Composition of
waste

Typical loads of
waste to & from
solid waste facilities



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TYPICAL COMPOSITION OF MSW IN THE USA



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Solid Waste Planning Elements

INVENTORY CURRENT PRACTICES

Waste handling practices

- Landfills
- Transfer stations
- Composting
- Recycling
- Energy recovery

Inventory handling

- Landfills
- Transfer stations
- Composting
- Recycling
- Energy recovery

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Solid Waste Planning Elements

IDENTIFY SERVICE DELIVERY OPTIONS

Service Providers

- Municipal agencies
- Private contractors
- Public-private partnership

Appropriate Technologies

- Collection & transfer
- Processing
- Disposal

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Solid Waste Planning Elements

DEFINE EVALUATION CRITERIA

Related to Objectives for achieving the Vision

E.g. "Degree to which 'Collection Option A' will minimize the creation of litter."

Evaluation Process

- Defining the criteria
- Assigning weights (relative importance)

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Solid Waste Planning Elements

SELECT BEST OPTION

Apply the evaluation criteria to all the proposed Service Delivery Options

Involve a range of people to evaluate

Tally and consider the ratings

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Solid Waste Planning Elements

EVALUATE AND SELECT FUNDING METHODS

Funding for capital expenditures

Funding for annual recurring costs (O&M)

Covered further in Session 4

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Solid Waste Planning Elements

DEVELOP STEPS TO ACHIEVE OBJECTIVES

- Specific tasks
- Schedule
- Milestones
- Organization
- Staffing
- Funding

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Solid Waste Planning Elements

DOCUMENT THE SOLID WASTE MANAGEMENT PLAN

- Often a multi-volume document
- A complete RFP is required in many states
- Plan to include public hearing

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Solid Waste Planning Elements

BEGIN PLAN IMPLEMENTATION

Reassign staff to new assignments

Hire new staff

Retain consultants

Continue to Public Information Program

Regularly brief elected officials

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SOLID WASTE PROGRAM

SERVICE DELIVERY OPTIONS

Waste Storage

Collection

Receiving

Transfer

Processing

Disposal

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SOLID WASTE PROGRAM

WASTE STORAGE OPTIONS

Objectives:

- Isolation of waste from environment
 - Vectors
 - Odors
- Compatibility with waste generation needs & collection methods
 - Adequate capacity
 - Not too heavy
 - Integration with automated collection system

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Waste Storage Options, cont.

Storage of residential wastes

- Bins
 - Manual loading
 - Automated loading
- Bags



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Waste Storage Options. cont.

Storage of commercial wastes

- Front-end loading bins
- Roll-off bins
- Dumpsters



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WASTE COLLECTION OPTIONS

Collection Considerations in general

- Efficiency of collection
- Quantity of waste
- Frequency of collection
- Location of waste
- Access to waste
- Storage of waste
- Equipment requirements
- Safety

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Waste Collection Options, cont.

Residential collection options

Manual

Rear-loading

Side-loading

Front-loading

Automated: Totally side-loading

Truck capacities from 5 to 35 cu yd

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Waste Collection Options, cont.

Commercial waste collection options



Rear-loading

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RECYCLING PRACTICES

Curbside

- Source separated
- Commingled

Drop off centers

Informal recycling



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TRANSFER PRACTICES

Why transfer waste?

- Consolidate shipments
- Reduce waste volume

Truck-to-truck transfer

Waste-by-Rail transfer

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WASTE TRANSFER, cont.

Typical transfer station



Project: [illegible]
Client: [illegible]
Location: [illegible]
Year: [illegible]

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WASTE TRANSFER, cont.

Waste-by-Rail System



Project: [illegible]
Client: [illegible]
Location: [illegible]
Year: [illegible]

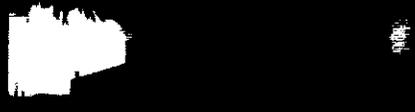
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WASTE PROCESSING

Materials recovery

Composting

Thermal oxidation



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Waste Processing

MATERIALS RECOVERY

Typically at a Material's Recovery Facility (MRF)

Mechanical
Flotation



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Waste Processing
COMPOSTING

Solid waste alone



Turned windrow composting

With sludge & other materials

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Waste Processing
THERMAL OXIDATION

Technologies

- Incineration
 - Low temperature
 - High temperature
 - Waste-to-energy
- Various designs for improved combustion
 - Fluidized bed
 - Rotary kiln
 - Stoker
- Gasification
 - Feedstocks: municipal solid waste, industrial waste
 - Gasification



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Waste Processing

THERMAL OXIDATION

Advantages

- Volume reduction (up to 90%)
- Heat recovery

Disadvantages

- High capital & O&M costs
- Air emissions
- Difficult to site (public opposition)

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RECAP OF SESSION 2

WASTE MANAGEMENT PLANNING

- Evaluate site conditions, waste types, and volumes
- Develop waste management plan

WASTE HANDLING METHODS & EQUIPMENT

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OVERVIEW OF SITE VISIT #2: "RECYCLE CENTRAL"

Tuesday, 8:30 AM

Location: Pier 96,
San Francisco

Waste throughput

Avg = 1,400 tpd

Max = 2,100 tpd



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OVERVIEW OF SITE VISIT #2: "RECYCLE CENTRAL"

Materials handled

- Office & mixed paper
- Cardboard
- Glass & plastic bottles
- Steel & Al cans
- Wood
- Solid metals



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OVERVIEW OF SITE VISIT #2: "RECYCLE CENTRAL"

Features

- 6 recycling lines
- Air conveyor
- 6 balers
- Air conveyor
- Spinning disk screen
- Eddy current separator
- 110 employees



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**EXPLORING LANDFILL GAS
PROJECT DEVELOPMENT, DESIGN,
AND FINANCING**

**Session 3A-
Landfilling and Open Dump Closure**

Steven M. Hamilton, P.E., P.

SOG ENGINEERS
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Outline

Introduction:

- Why proper disposal is important.
- Guidelines for landfill development

Landfill gas (LFG) emission control

Steps to take in closing existing dumps and developing new landfills.

FOR ENCL 11/11/13
11/11/13

Landfill Success Depends On

National and state regulatory requirements

Thoroughness of the site investigation and

design and construction of the landfill

Skilled and experienced personnel

Proper operation and maintenance of the landfill

11/11/13
11/11/13



Potential Environmental and Health Effects

Groundwater and surface water contamination.

Scavengers often in direct contact with dangerous materials

Landfill personnel exposure to received material.

Landfill gas generated from waste decomposition.

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Other Potential Effects

Smoke from burning solid waste.

Physical harm due to collapse of unstable slopes and waste related accidents.

Poor disposal areas and practices can affect adjoining property values.

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P.L.L.C.

ENVIRONMENTAL ENGINEERS
P.L.L.C.

Guidelines for Landfill Development

Purpose

- Improve waste disposal methods
- Decrease negative environmental impacts
- Control air pollution and waste self-ignition
- Reduce insects and other disease vectors
- Protect health and safety of the residents near dumpsites
- Protect worker health and safety

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Guidelines (cont'd)

Fence dumping areas to prevent unauthorized entry.

Offices for the landfill supervisors.

Water sprays for dust control

Garages for equipment storage and maintenance.

Maintenance workshops and storage.

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Guidelines (cont'd)

Truck scales for large disposal facilities.

Laborers for directing trucks.

Separate roads inside the site for slow animal-drawn carts.

Paved site entrances.

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OFFICE OF PUBLIC AFFAIRS

Guidelines (cont'd)

Access roads wide enough for vehicle movements in all directions.

Internal roads wide enough to allow for easy access to cell.

Maintenance of roads and drainage systems.

U.S. ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF PUBLIC AFFAIRS

GATE HOUSE & SCALES AT LANDFILL



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Guidelines (cont'd)

Recording of incoming waste (mass)

Nature, origin, weight

Prohibit site use after working hours.

inspections of waste before entry

Prohibit open burning of waste

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Guidelines (cont'd)

Recording of incoming waste forms

Nature, origin, weight

Prohibit site use after working hours

Inspections of waste before entry

Prohibit open burning of waste

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Guidelines (cont'd)

Cover waste with inert materials

Control insects and rodents

Areas for storing soil, mulches, Green Waste, construction and demolition debris, or other materials for use as daily cover

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Guidelines (cont'd)

Fuel stations inside or adjacent to the site with supplies for operating the site equipment for at least a week

Periodic equipment inspections and maintenance.

SLURRY WALLS
Environmental Remediation

Guidelines (cont'd)

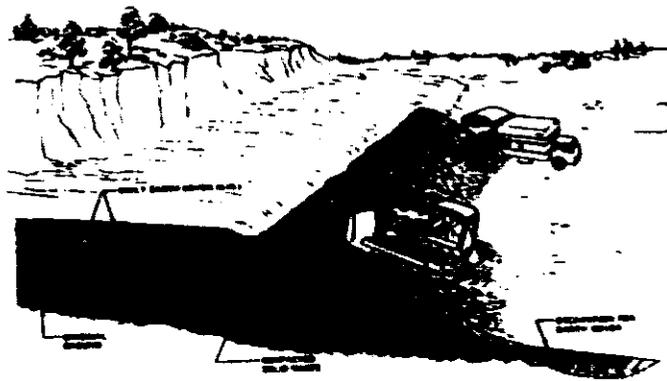
Designs for waste cells.

Waste separation procedures following environmental and health safety rules.

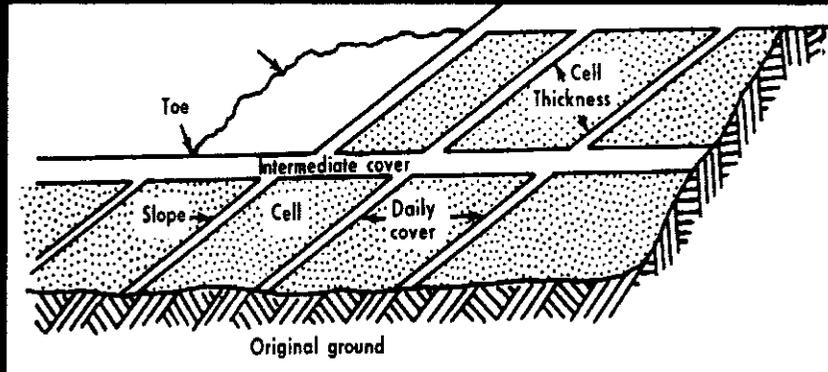
Waste cells at least 2 meters thick in layers of 30 centimeters.

BOE ENG. NEEDS
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Ramp Method Workface



BOE ENG. NEEDS
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Guidelines (cont'd)

- Protective gear for the laborers
- Appropriate tools for waste separators.
- Maintain and repair gaps/damage in the site fence.

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Disposal Area Classification

- Open dumps.
- Controlled dumps.
- Secure landfills.

ROBERT HERR
1998

Disposal Area Improvements

Can be used to improve the quality of the environment.

- Reduce the amount of waste that is disposed of.
- Reduce the amount of waste that is disposed of in a controlled manner.
- Reduce the amount of waste that is disposed of in an uncontrolled manner.

ROBERT HERR
1998

From Open Dumping To Controlled Dumping

- Reduce working area to manageable size.
- Cover with soil or any other material all areas that are not active.
- Eliminate fires.
- Establish on-site rules for scavengers.

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From Controlled Dumping To Controlled Landfill

Gradual adoption of engineering methods
to control surface water

Begin to regularly cover waste materials

Attempt to collect leachate into lagoons

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MANAGEMENT ASSOCIATION

From Controlled Dumping To Controlled Landfill (cont'd)

Spread and compact waste into small
layers.

Prepare new sections with excavation
equipment

Begin isolating waste from surrounding
geology and the future site

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MANAGEMENT ASSOCIATION

From Engineered Landfill To Sanitary Landfill

Standards used
that conform to
state of the art
landfill design
and operations.

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Conditions Affecting Landfill Siting

Leaching capacity of the soils or bedrock.
Depth of groundwater beneath the
disposal area.
Groundwater flow direction.
Seismicity.

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Conditions Affecting Landfill Siting (cont'd)

Proximity to:

- Wetlands or water bodies
- Airports
- Neighbors
- Cultural, Historic, or Environmentally Sensitive Areas

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Basic Design Conditions

- Full or partial hydrogeologic isolation
- Formal engineering design conditions
- Permanent construction
- Planned waste management program

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Sound Landfill Practices

Liners.

Leachate management and environmental impact minimization.

Landfill gas management and risk reduction.

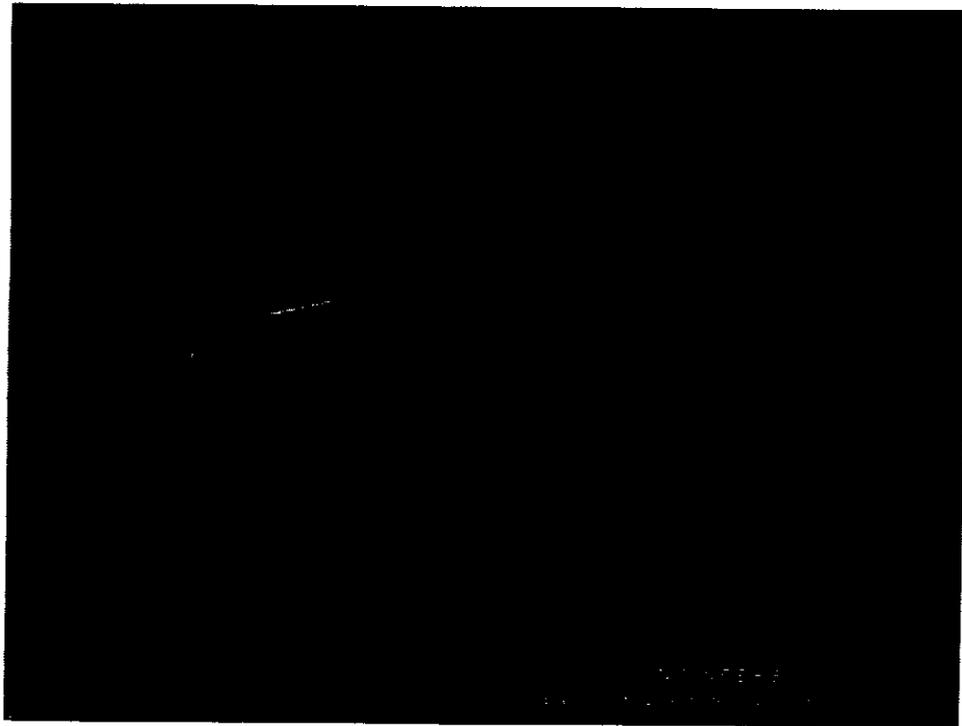
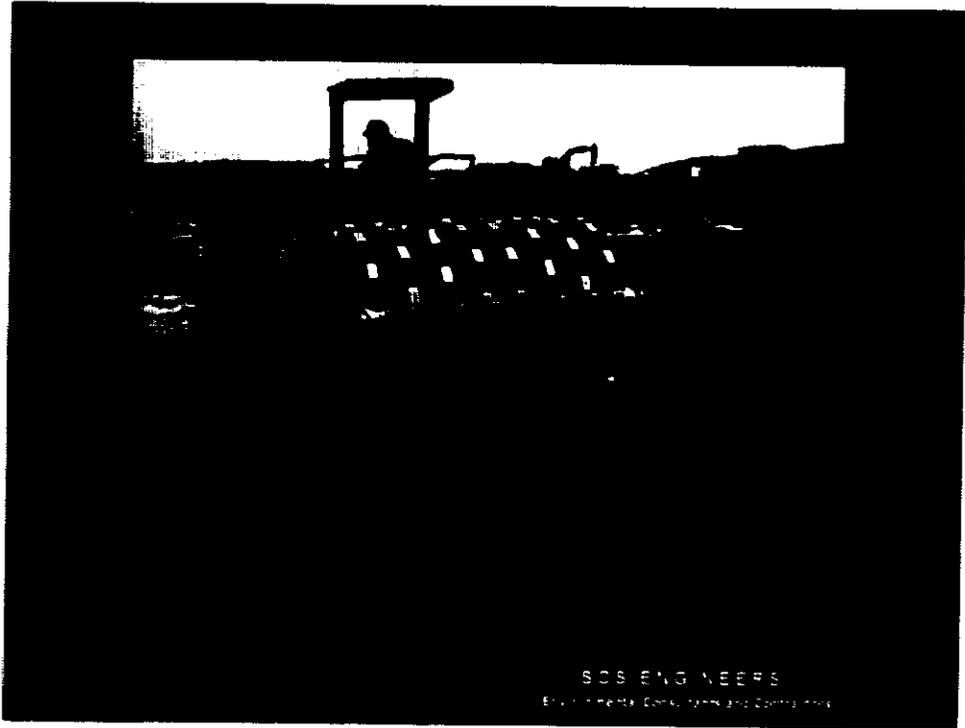
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Liners

Natural or processed soil materials such as clay.

Synthetic membrane materials such as high density polyethylene (HDPE).

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Leachate

Water is the "universal solvent".

Many components of solid waste organic and easily leached.

Other materials, such as metals, take longer but still leach.

Leachate contains dissolved organic and inorganic matter, suspended materials, and microorganisms.

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Landfill Gas

Byproduct of Anaerobic Decomposition of Solid Waste

~50% Methane

~50% Carbon Dioxide

Up to 200 Other Compounds in Trace Concentrations.

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Landfill Gas Management

Open Dumps:

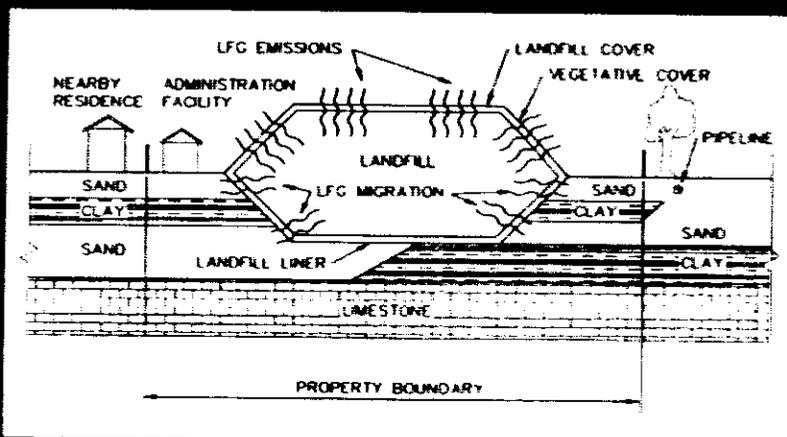
Landfill gas is not as much of an issue

Modern (Sanitary) Landfills:

Landfill gas will occur and must be managed

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Landfill Gas Movement



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Landfill Gas Migration

Migration:

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Landfill Gas Emissions

Emissions:

BCA ENGINEERS
Environmental Consulting Engineers Ltd.

U.S. Methane Emissions

Environmental Protection Agency
U.S. Environmental Protection Agency

Control Technologies

Flaring or Incineration

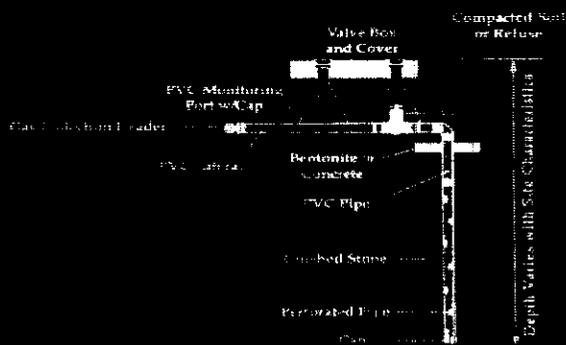
Energy Recovery

Both are Dependent on Collecting the
Landfill Gas

Environmental Protection Agency
U.S. Environmental Protection Agency

Landfill Gas Collection

GAS EXTRACTION WELL



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Landfill Gas Collection

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Landfill Gas Collection



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Landfill Gas Collection



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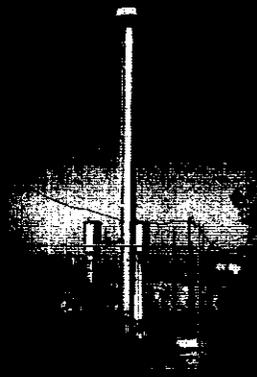
Collection Issues

- Differential Settlement
- Condensate Management
- Operations
- Vandalism
- Above-ground versus Below-ground
- Piping Material

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Landfill Gas Flaring

- Open or "Candle"
Flare
- Less Expensive
- Easier Operation
- Lower Destruction
Efficiency



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Landfill Gas Incineration

Enclosed or
"Ground" Flare
Temperature
Control
Retention Time
Higher Destruction
Efficiency

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Sound Landfill Practices

Access control.

Odor control.

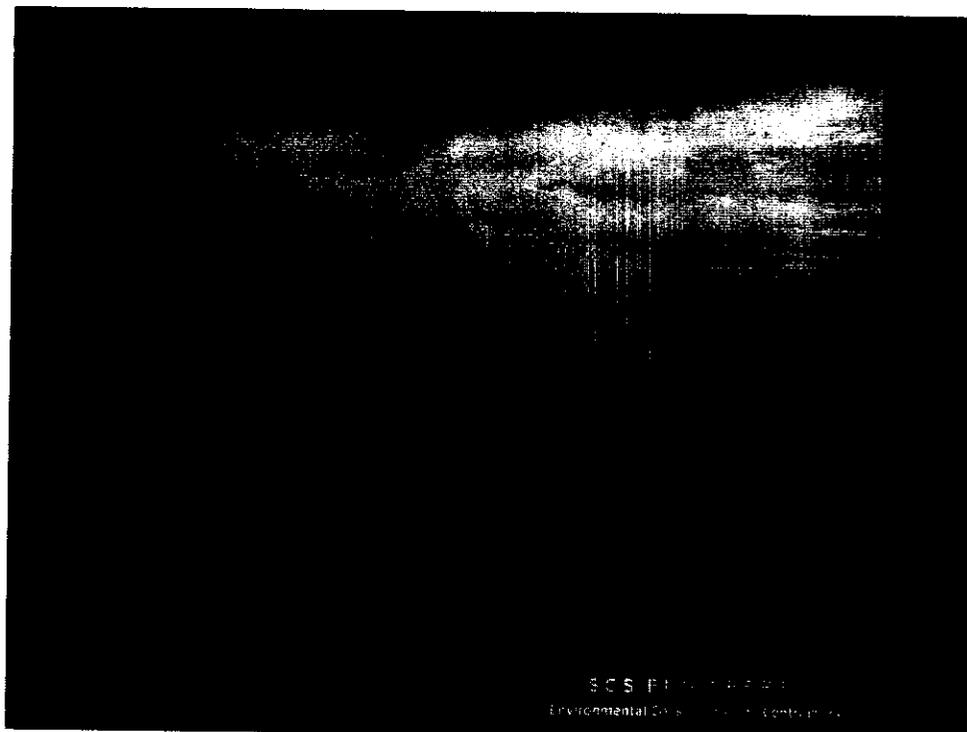
- Daily cover
- Interim cover
- Final cover
- Leachate collection and treatment
- Gas collection and treatment
- Landfill closure

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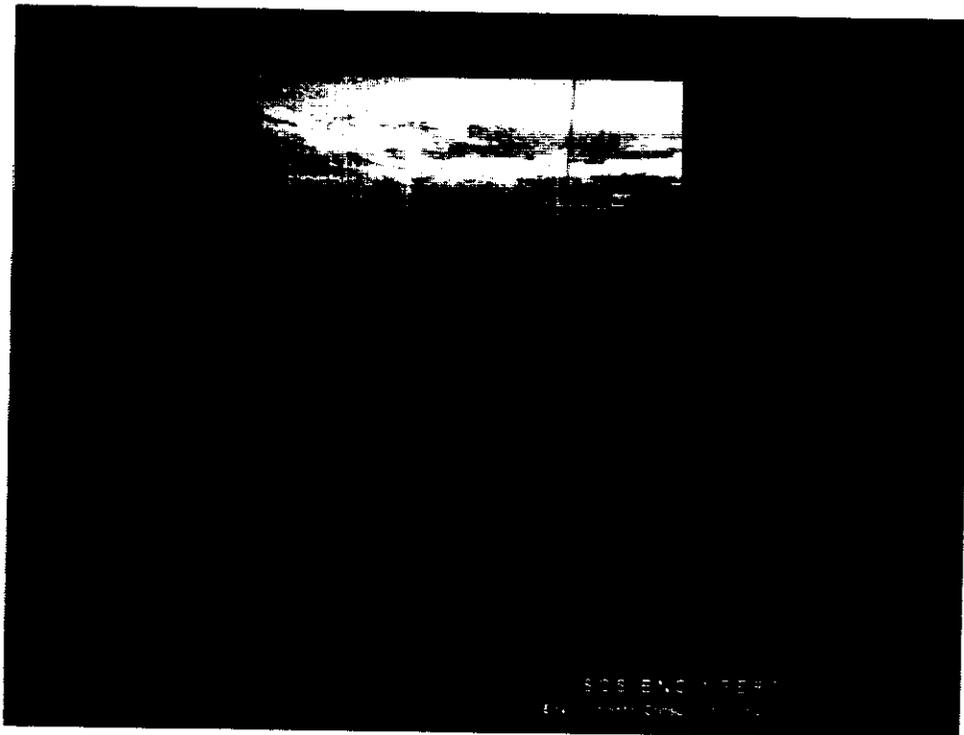
Sound Landfill Practices (cont'd)

- Record keeping to document operations.
- Establishment and maintenance of good community relations.
- Closure and post-closure planning.

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Step 1: Define and Evaluate Existing Disposal Practices

- Review applicable laws, regulations, and standards.
- Determine the types of waste being disposed.
- Determine the disposal methods being used.
- Identify the responsible parties.
- Evaluate the effectiveness of the disposal practices.

3/12

Step 2: Assess New Landfill Site Options

- Establish criteria for site identification
- Form a landfill siting committee
- Prioritize criteria
- Develop constraint mapping
- Develop site ranking system

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Step 3: Identify Potential Landfill Sites

- Perform initial surveys.
- Rank sites.
- Develop conceptual designs and plans.
- Perform detailed site investigations.

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Step 4: Compile Findings in an Assessment Report

Findings should provide clear basis for making necessary decisions.

3.17.10.10
10/10/10

Step 5: Select the Preferred Site

Should be based on easily understood, transparent criteria

Public education and engagement

3.17.10.11
10/10/10

Step 6: Close the Existing Open Dump Site

Define physical characteristics of the site to be closed.

Define land use after closure.

Prepare closure plan.

Establish post-closure monitoring requirement.

Close the existing dump site.

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Step 7: Start Operations at a New Landfill

Establish minimum design/operating criteria.

Construct all required infrastructure.

Develop landfill operations plan.

Coordinate with all solid waste operators.

Begin operations at the new disposal location.

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Developing Technical Specifications

Definitions.

General background.

Service specifications.

Minimum technical requirements.

ALL INFORMATION CONTAINED
HEREIN IS UNCLASSIFIED

Developing Technical Specifications (Cont'd)

Performance standards.

Performance monitoring.

Measurement and reporting.

Regulations.

ALL INFORMATION CONTAINED
HEREIN IS UNCLASSIFIED

Minimum Technical Requirements

Required landfill equipment and infrastructure

Landfill personnel

Procedures to be followed

Reporting requirements

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Performance Standards

RFT and resulting contract should specify the minimum standards by which contractor's performance will be measured.

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Performance Monitoring

RFT and contract should specify the manner in which the contractor's performance will be monitored

10/10/2011 10:00 AM
10/10/2011 10:00 AM

Measurement and Payment

RFT and contract should specify the manner in which the contractor will be paid for the service that they are providing

10/10/2011 10:00 AM
10/10/2011 10:00 AM

Penalties

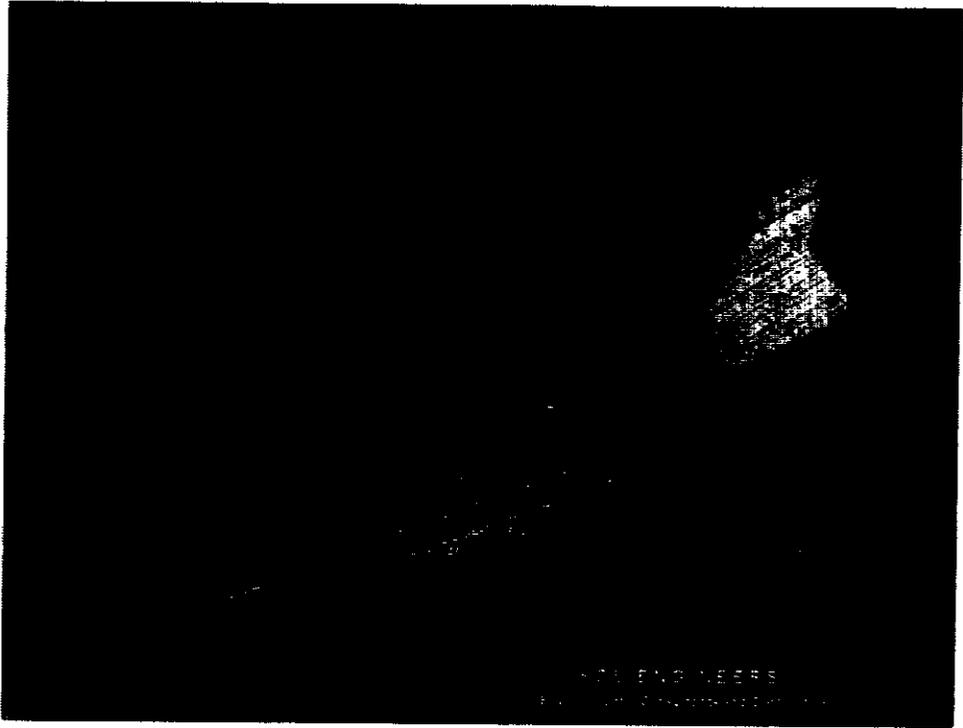
The penalties that the contractor will have to pay for poor performance should also be specified in the RFT and resulting contract

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Summary

Poorly site and operated disposal areas can cause major environmental damage
Siting a new disposal area is difficult.
Private contractors have successfully designed and operated landfills throughout the world

WILKINS & PARTNERS
Environmental Services and Remediation





**EXPLORING LANDFILL GAS
PROJECT DEVELOPMENT, DESIGN,
& FINANCING**

**Session 3B –
Landfill Gas-to-Energy**

Steven M. Hamilton, R.E.P.
SOC Engineers

SOC ENGINEERS
Environmental Consultants and Contractors

**LANDFILL GAS (LFG) TO ENERGY
RECOVERY**

in Atlanta, Georgia - 8/1

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LFG-TO-ENERGY RECOVERY

Provides a Beneficial Use for Collected LFG

Reduces Greenhouse Gas (GHG) Emissions

Displaces Fossil Fuel Use

SEE ALSO: 352-10000
352-10000-10000

LFG-TO-ENERGY RECOVERY

US Environmental Protection Agency
EPA-600/R-12/001

April 2012
EPA-600/R-12/001

SEE ALSO: 352-10000
352-10000-10000

LFG-TO-ENERGY RECOVERY

World Bank survey of 50 landfills in developing nations found only two operational projects.

Developing countries are making progress towards LFG utilization.

Large potential in India, Brazil, China, & Russia.

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Steps to LFG-to-Energy PROJECT DEVELOPMENT

Estimate LFG recovery potential
Conduct initial feasibility study

Evaluate project economics

Establish project structure

Draft Development Contract

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Steps to LFG-to-Energy PROJECT DEVELOPMENT. cont.

- Assess financing options
- Negotiate energy sales agreement
- Secure permits & approvals
- Contract for engineering, procurement, & construction, and O&M services
- Install project & start-up operations

SCIENCE & DESIGN
FOR THE FUTURE

LFG-TO-ENERGY RECOVERY

Proven Recovery Technologies

- Organic Acid
- Anaerobic Digestion
- Hydrolysis
- Fermentation

SCIENCE & DESIGN
FOR THE FUTURE

DIRECT USE of LFG

Medium Btu Gas

~ 18.6 kJ/m³

Remove Water

Remove Trace Hydrocarbons

Odorize

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DIRECT USE of LFG

Simplest Approach

Energy Customer Located on or Close to
Landfill

Customer Energy Demands Should Match
LFG Supply

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DIRECT USE of LFG

10/10/2007



10/10/2007

DIRECT USE of LFG



10/10/2007

LEACHATE EVAPORATION

Direct Injection

In-Direct Heat

Can Include
Condensate
Treatment

SEE VIDEO NEERS
Environmental Services, Inc. 2011-2012

ELECTRIC POWER

Generate Electricity On-Site

Sell Power into Grid, Directly to Nearby
User, or Use On-Site

Most Common Recovery Technology

SEE VIDEO NEERS
Environmental Services, Inc. 2011-2012

FUEL FOR ELECTRIC POWER

Internal Combustion (IC) Engines

0.5 Megawatt (MW) and greater

Turbines

3 MW and greater

Steam Cycle Boilers

© 2015 ENVIROSTAT
www.envirostat.com

TURBINE VS. IC

Advantages:

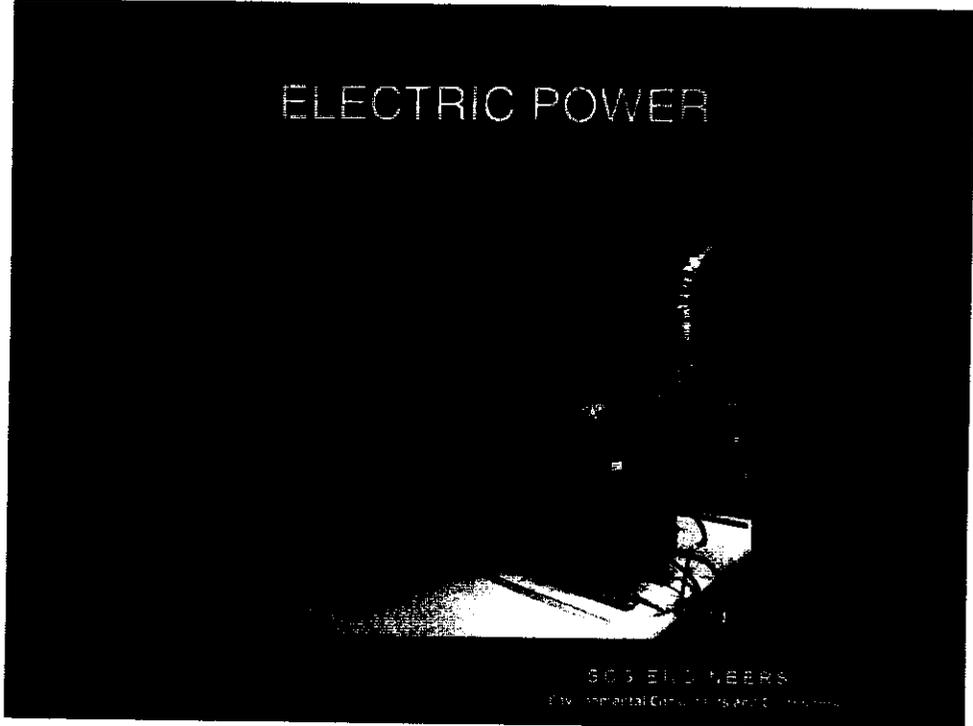
Compared to IC engines, turbines have low emissions and lower O&M cost

Disadvantages:

Higher emissions of NOx and SOx (approx. 10 times IC) and higher water consumption

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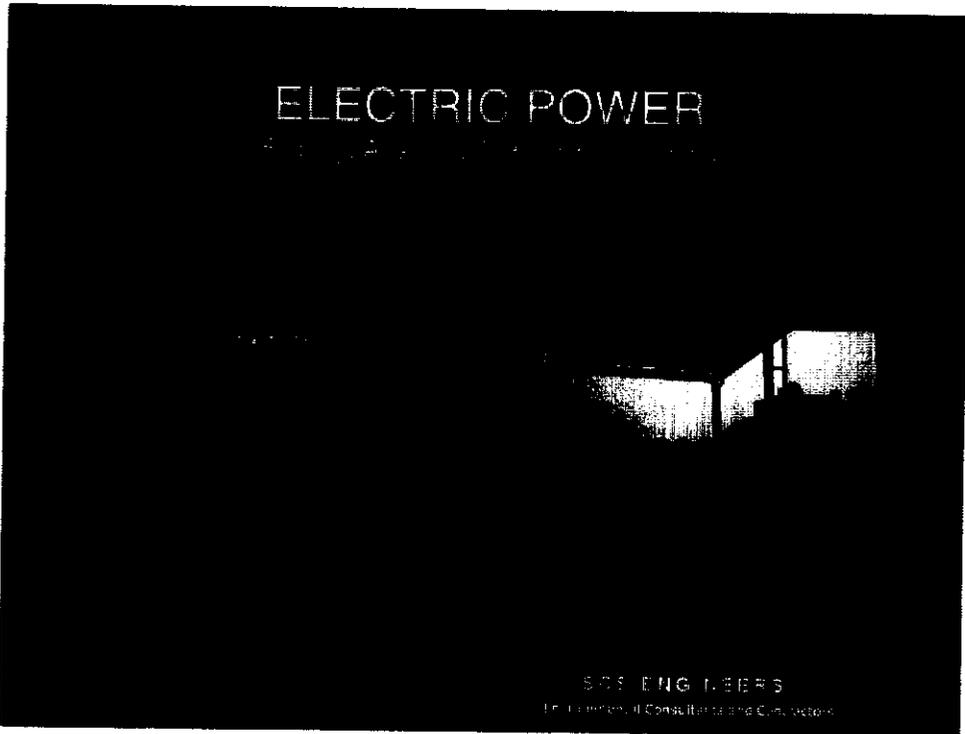
ELECTRIC POWER



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ELECTRIC POWER

Environmental Consultants and Contractors



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PIPELINE QUALITY GAS

CO2 Removal

Very Stringent Gas Quality Requirements

Limited Number of Sites

Very Capital & Operations Intensive

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PIPELINE QUALITY GAS

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LANDFILL GAS TO ENERGY RECOVERY

Emerging Recovery Technologies:

- Micro-turbines
- Vehicle Fuel
- CO₂ Recovery
- Fuel Cells
- Ethanol/Methanol

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MICROTURBINES

High-Speed Turbo-
Charged Generator

25 kW to 75 kW

Usually for On-site
Power Demands



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MICROTURBINES

Advantages

- Low emissions
- Multiple fuel capability
- Light weight small size
- Lower operations & maintenance costs

Disadvantages

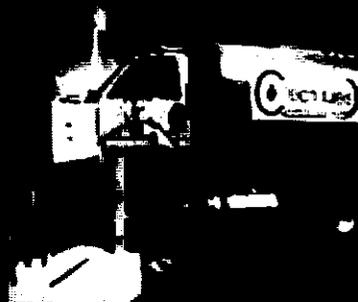
- Low efficiencies
- Limited LFG applications
- Capital cost per MW

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VEHICLE FUEL

Capital & operations intensive

Not yet done on a commercial scale



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FUEL CELLS

www.fuelcelltoday.com

Capital &
operations
Intensive

Not yet done on
a commercial
scale



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PROJECT DEVELOPMENT OPTIONS

- GASCO vs. GENCO
- Own & Operate Entire System
- Contracting Options

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MAJOR REASONS RECOVERY PROJECTS FAIL

- Can't Make Project Economically Feasible
- Over-Estimate LFG Recovery Volumes
- Poor Design Construction
- Poor Operations
- Permitting Issues

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LFG RECOVERY ESTIMATES

Why do Over-Estimates Happen?

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LFG SYSTEM DESIGN ISSUES

Capital vs. Operations Costs

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LFG SYSTEM DESIGN ISSUES

Site Geometry
Equipment Materials Specs

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LFG CONSTRUCTION ISSUES

Use an Experienced Contractor!

305 ENV NEER®
Environmental Engineering & Construction

LFG OPERATIONS ISSUES

Gas Quality is Key!

Higher Level of Operations

Trends Analysis

Leak - Free

305 ENV NEER®
Environmental Engineering & Construction

GHG EMISSIONS REDUCTION CREDIT OPPORTUNITIES

Landfill gas utilization projects are attractive GHG mitigation projects

Private GHG market has emerged

Participation may include sale of historic, current or future emissions credits

WORLD LEADERS
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SUMMARY

Landfill methane emissions will increase in India

LFG utilization can significantly reduce these emissions

These investments are win-win

LFG utilization provides a revenue stream

Improves safety at the landfill

Very cost-effective greenhouse gas mitigation projects

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AN OVERVIEW OF
**SOLID WASTE
 MANAGEMENT**
 IN THE USA AND INDIA

February 3, 2004
 San Francisco, California USA

Session 4

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**FINANCING
 SOLID WASTE SYSTEMS**



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- Capital expenditures
- Debt repayment (including interest)
- Operations & maintenance (O&M)
- Administration & engineering

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FINANCING SOLID WASTE SYSTEMS, cont.

REVENUE → to pay for service costs

- Taxes
- User fees
- Grants & loans (seed money)

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FULL COST ACCOUNTING

What is Full Costs Accounting?

- Recognition of ALL costs associated with the delivery of SW services

• Capital
• Operating

Reporting costs to the ratepayer

Analyze and produce financial and cost data

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Full Cost Accounting

Benefits of Full Cost Accounting

- Pertinent data is captured and evaluated
- Comprehensive cost data an important management tool & results in better Plans
- System-wide cost data helps agencies with support of ratepayers

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COSTS TO CONSIDER

Capital Costs for:

- Land
- Buildings
- Equipment
- Construction

Operating Costs for:

- Personnel
- Utilities
- Materials
- Maintenance

COSTS TO CONSIDER, cont.

Annual (recurring) costs:

- Principle & interest on invested capital
- Operations & maintenance (O&M):
 - Salaries & benefits
 - Utilities
 - Insurance
 - Repairs
 - Supplies
- Engineering, planning, & permitting
- Administration of solid waste program

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LIFE-CYCLE COSTS

Full Cost Accounting helps plan for the set-aside of funds for *sustaining* *solid waste management* indefinitely.

- Closure of existing facilities
- Long-term monitoring (e.g., closed landfills)
- Procurement of new sites & facilities

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TYPICAL COSTS IN USA

Collection

| | |
|------------------|------------------------|
| Contractor truck | \$100,000+ |
| O&M cost | \$200 to \$300 per ton |

Transfer

| | |
|------------------|-----------------------|
| Transfer Station | \$30 million to build |
| Transfer bins | \$135,000+ each |
| O&M | \$0.60+ per ton-mile |

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TYPICAL COSTS IN USA, cont.

Incineration

| | |
|--------------|--------------------------|
| Capital cost | \$30,000+ |
| O&M cost | \$30 to \$100 per ton |
| Residual | \$100,000 to \$1,000,000 |

WPCDF

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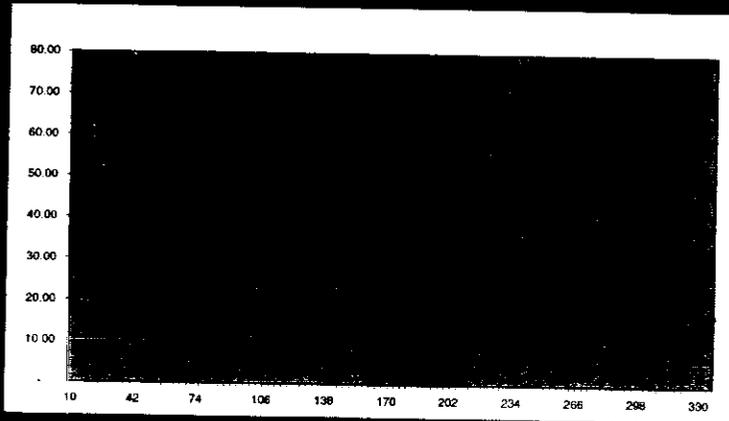
LANDFILL COST FACTORS

- Assumptions vary by site (labor, land, etc)
- Final ultimate capacity
- Compaction/waste density
- Average daily volume
- Land acquisition costs
- LFG system needs
- Leachate treatment
- Liner construction
- Environmental monitoring requirements

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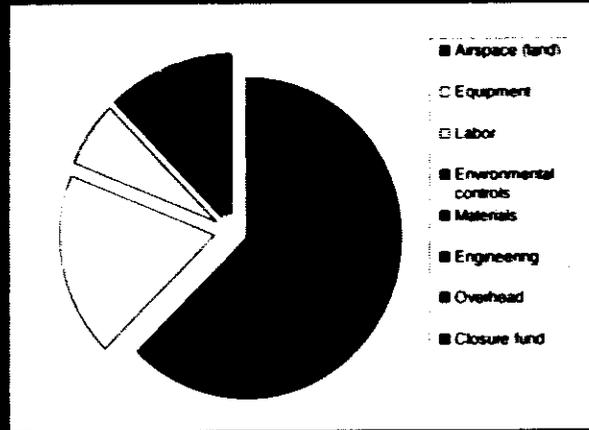
ECONOMY OF SCALE

Typical landfilling cost, \$ per ton



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Typical Costs for a 600 TPD Landfill



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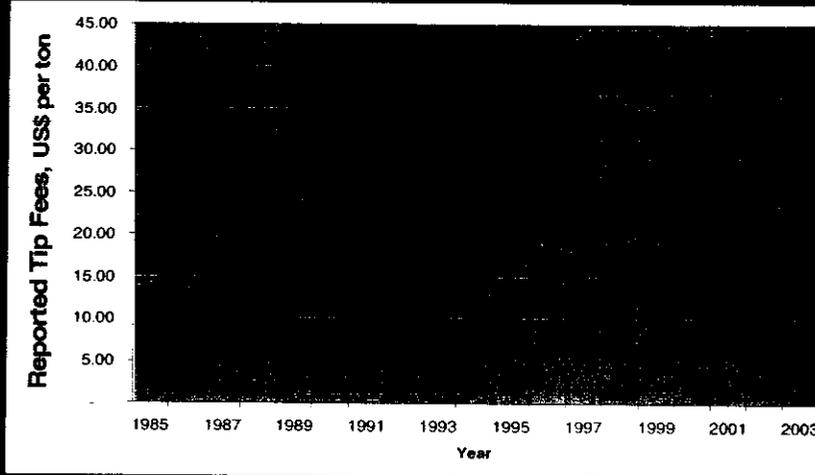
TYPICAL COSTS IN USA. cont.

Landfill costs

| Assumptions | Description | Cost | |
|--------------------------------------|------------------------------------------|-------------|--------------------------|
| 600 TPD 20 years 100% landfill | Development | \$3,410,000 | |
| | Construction | \$3,410,000 | |
| | Operation | \$1,705,000 | |
| | Post-closure | \$3,410,000 | |
| | Residual value | \$1,705,000 | |
| | Total (including 20% contingency) | | \$13,640,000 |
| | | | ~ \$17.00 per Ton |

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Landfill Tipping Fee Trends



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SOURCES OF CAPITAL

- Loans
- Tax-exempt Bonds
- General Obligation (GO) Bonds
- Project Revenue Bonds
- Taxable Municipal Bonds
- Public Funds
- Government grants
- Private Equity (via privatization)

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SOURCES OF REVENUE

Proceeds from sale of:

Secondary (recycled) materials

Energy

From WTE incinerators

From landfill gas systems

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SOURCES OF REVENUE. Cont.

But there's

NO GOLD IN GARBAGE.

So shortfall must come from citizens
who benefit from the solid waste
service

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SOURCES OF REVENUE, Cont.

Property Taxes

Utility Tax

Sales Tax

Special Tax

User Fees

- Uniform Rate

- Variable Rate

Subscription Fees

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Enterprise Funds

Agency responsible for delivery of MSW services - fee and/or payment made by provider of service

Fees derived from solid waste services used CNLX to support the solid waste enterprise

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SOURCES OF REVENUE, Cont.

TAXES as a source of revenue

Pros

- Established tax collection infrastructure
- Citizens feel stigma of paying tax, are reluctant to

Cons

- Obscure costs & benefits from the public
- Avoids fair allocation of costs to users
- Hinders identification and accountability

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USER FEES Best Approach

Direct charge to users for SW services

Fees set to cover all costs

Allocation of costs to users based on usage

Users are more likely to accept

Users are more likely to accept

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USER FEES, cont.

Fee itemized on residents & business monthly invoices

Fee schedule is published & updated periodically, as conditions change

Option: Set fee as surcharge on other utilities

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USER FEES, cont.

Pay-As-You-Throw (PAYT)

Variable rate, depending on

- Volume of trash generated per month
 - Fee: weight of solid waste
 - Quantity of recycling
- Example: fee in Long Beach for collection of residential wastes and recyclables US\$18.46 per month

Extra fee for extra cans or special collections

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USER FEES, cont.

PAYT: Emerging technology will enable fees based on actual waste generated

- Bar codes on containers to identify services

- On-board scales to weigh each load collected

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USER FEES, cont.

Tip Fees

- Transfer stations

- Landfills

- Incinerators

Integrated into user fee

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WASTE MANAGEMENT GROUP

PRIVATIZATION

MOTIVATIONS TO FORM PUBLIC/PRIVATE PARTNERSHIPS

- Provides access to private capital (in exchange for long-term contract)
- Brings specialized SW expertise
- Provides avenue for technology transfer

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ELEMENTS OF PRIVATIZATION

- Confirm authority of Implementing Entity
- Define ownership of existing facilities
- Define service areas
- Define scope of services to be privatized
- Commit to transparent procurement process

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ELEMENTS OF PRIVATIZATION

Determine procurement approach

- A/E design with subsequent contract by Turnkey, Construction
- Full-Service Construction & Operation

Financing arrangements to pay for contractor?

Allocation of risks to contractor & public

Define level of service to citizens (e.g.,

- Points of collection
- Frequency of collection

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ELEMENTS OF PRIVATIZATION

Set method of payment for services

- Flat or Uniform User Rate
- Volume or Water Quantity Based
- Subscriber Based

Implementation schedule

Development of the Agency's Contract Monitoring Unit

Public Education & Outreach

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CONSULTANTS ARCHITECTS

Case Study: **PRIVATIZATION PROCESS-- EGYPT**

National Government states policy to privatize

Large cities first

Rural areas where it makes sense

Typical Scope:

Collection of MSW at depot

Establishment & operation of compost plants

Operation of landfill

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Case Study **EGYPT**

Characterize Solid Waste infrastructure

Identify who performs what services

Compile information on solid & organic resources

Document MSW volumes & composition

Consider options for integrating the informal sector (scavengers) into the program

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Case Study EGYPT

Form Privatization Team: include

- Elected officials
- Agency administrators
- Citizen representative
- Engineers
- Attorneys
- Accountants

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Case Study EGYPT

Issue Request for Qualifications (RFQs) to international consultants

Develop Agreement for the Privatization of the

Company Privatization of the Company

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Case Study **EGYPT**

Launch and sustain the Public Bid Program

Create bid package in 2 separate parts

Proposals: Technical specifications

Business proposal

Evaluate the technical bids

Call references

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Case Study **EGYPT**

Reject bids that do not conform to instructions

Clarify issues/ask questions if needed

Rank the bidders

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Case Study EGYPT

Open and evaluate business proposals for the top-ranked bidders

Notify the bidder who offers lowest cost, technically qualified proposal

Initiate contract negotiations with the selected bidder

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Case Study EGYPT

Execute the contract

Assuming final contract award terms
Negotiate and execute contract

Establish the appropriate contractual relationship

Appoint a contract manager
Establish contract

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CONSULTANTS INC.

Case Study **EGYPT**

Plan for the transition of service from municipal forces to the private contractor

Conduct routine monitoring of contractor performance per terms of the contract

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Derivation of landfill cost estimate by element, presented on following slides:

Assumptions

Cost by element

- Development
- Construction
- Operations
- Closure
- Post-closure

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ASSUMPTIONS

FOR LANDFILL COST ESTIMATE

DESIGN ASSUMPTIONS

- 130 acre site, 100 acre fill
- Refuse density = 1,000 lbs cu yd
- Design capacity = 2 million tons
- Estimated life = 23.5 years
- Start operations: Current year

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ASSUMPTIONS

FOR LANDFILL COST ESTIMATE - CON

OPERATING ASSUMPTIONS

- Average daily volume = 300 tons
with 3.5 days per week
- On-site cover soil available
- 4 Major pieces of equipment
- Equipment 3 year useful life salvage
- 1 full-time employee

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ASSUMPTIONS

FOR LANDFILL COST ESTIMATE Cont

OPERATIONAL ASSUMPTIONS

- Single HDPE geomembrane liner
- Drainage layer = imported sand with LCS
- Leachate pretreatment = aeration, then to POTW
- 6 GW monitoring wells, LFG probes
- LFG collection system, simple flare

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ASSUMPTIONS

FOR LANDFILL COST ESTIMATE Cont

FINANCIAL ASSUMPTIONS

- Straight-line depreciation
- Depreciate land costs
- 6% borrowing rate on capital
- 4% discount rate (inflation)
- 30-year post-closure
- Start operations: current year

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Development Costs

| | Total | Unit | Per Unit | Cost |
|-----------------|-----------------|------|----------|-----------------|
| Land cost | \$ 715 | 23.7 | \$ 30.17 | \$ 715 |
| Engineering | \$ 165 | 23.7 | \$ 7.00 | \$ 165 |
| Legal | \$ 50 | 23.7 | \$ 2.11 | \$ 50 |
| Administrative | \$ 55 | 23.7 | \$ 2.32 | \$ 55 |
| Subtotal | \$ 1,025 | | | \$ 1,025 |

1000000000
1000000000

Construction Costs

| | Total | Unit | Per Unit | Cost |
|-----------------|-----------------|------|----------|-----------------|
| Land cost | \$ 715 | 23.7 | \$ 30.17 | \$ 715 |
| Engineering | \$ 165 | 23.7 | \$ 7.00 | \$ 165 |
| Legal | \$ 50 | 23.7 | \$ 2.11 | \$ 50 |
| Administrative | \$ 55 | 23.7 | \$ 2.32 | \$ 55 |
| Subtotal | \$ 1,025 | | | \$ 1,025 |

1000000000
1000000000

Operating Costs (pp 7)

| Item | Total (000's) | Life (years) | Annual | Cost/ton |
|------------------|---------------|--------------|-----------|----------|
| Equipment | \$1,050 | 10 | \$105,000 | \$1.22 |
| Labor | \$1,157 | 10 | \$115,700 | \$1.41 |
| Insurance | \$1,350 | 10 | \$135,000 | \$0.59 |
| Equip. Operating | \$2,224 | 10 | \$222,400 | \$2.68 |
| Facilities | \$3,000 | 10 | \$300,000 | \$0.06 |

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Operating Costs (pp 7)

| Item | Total (000's) | Life (years) | Annual | Cost/ton |
|------------------------|---------------|--------------|-----------|----------|
| Prof Svcs | \$1,180 | 10 | \$118,000 | \$0.21 |
| Monitoring | \$1,470 | 10 | \$147,000 | \$0.50 |
| Leachate LFG treatment | \$1,800 | 10 | \$180,000 | \$0.34 |
| Debt service | \$2,004 | 10 | \$200,400 | \$0.31 |
| Subtotal | \$1,854 | | \$185,400 | \$0.28 |

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Landfill Closure Costs

| Item | Quantity | Unit Price | Total Price | Notes |
|-----------------|----------|------------|-------------------|-------|
| Leachate System | 1 | \$ 300,000 | \$ 300,000 | |
| Leachate Pond | 1 | \$ 100,000 | \$ 100,000 | |
| Leachate Pond | 1 | \$ 500,000 | \$ 500,000 | |
| Leachate Pond | 1 | \$ 50,000 | \$ 50,000 | |
| Subtotal | | | \$ 950,000 | |

Prepared by: [Name]
Date: [Date]

Landfill Post-Closure Costs

| Item | Quantity | Unit Price | Total Price | Notes |
|-----------------|----------|------------|-------------------|-------|
| Monitoring | 1 | \$ 100,000 | \$ 100,000 | |
| Leachate Pond | 1 | \$ 500,000 | \$ 500,000 | |
| Leachate Pond | 1 | \$ 50,000 | \$ 50,000 | |
| Leachate Pond | 1 | \$ 50,000 | \$ 50,000 | |
| Subtotal | | | \$ 700,000 | |

Prepared by: [Name]
Date: [Date]

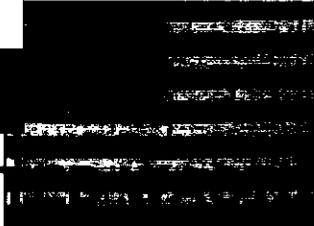
Total, Estimated Landfill Costs in the USA

| | |
|--------------------------------------------|------------------|
| Development | \$ 0.44 per ton |
| Construction | \$ 3.42 |
| Operating | \$10.60 |
| Closure | \$ 0.82 |
| Post-Closure | \$ 1.70 |
| Total (including permit and fees, etc.) | \$ 17.00 per Ton |

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**BROWN, VENCE AND
ASSOCIATES**

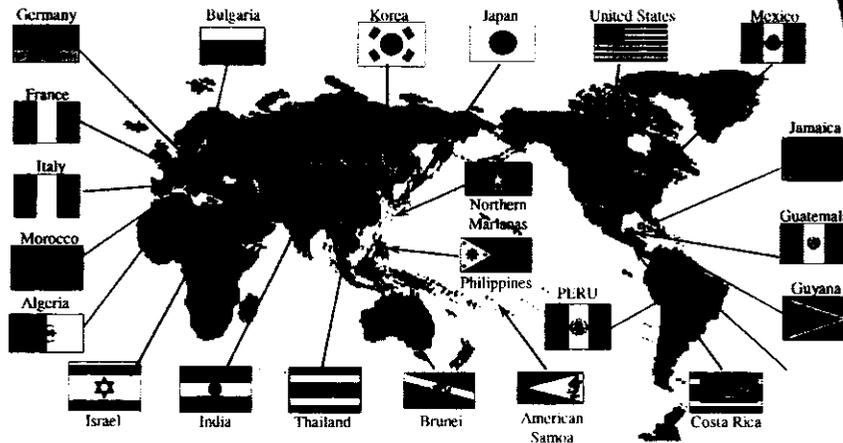
**“INTEGRATED WASTE MANAGEMENT
SYSTEMS”**



INTEGRATED MANAGEMENT SYSTEM

Brown, Vence and Associates
Presentation
February 2004

BVA Qualifications and Experience



- Specialists in implementing integrated waste management systems
- More than \$3 billion (USD) in completed projects
- Planning, engineering, construction, training and operational support
- Provide best technology available worldwide

Integrated System

Waste Sources

- Homes
- Commerce
- Industry
- Hospitals

Handling and Processing

- Material Recovery
- Transfer Stations
- Composting
- Medical Waste Sterilization

Final Disposal

- Sanitary Landfill
- Landfill Gas Utilization
- Waste-to-Energy
- Refuse derived fuel
- Power and heat

Sources: Homes and Apartments



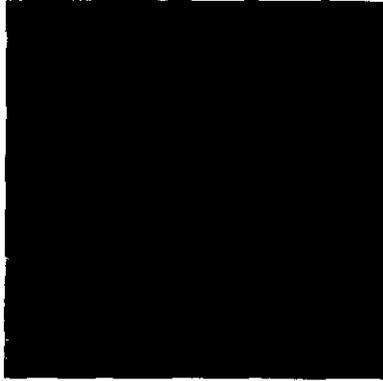
Immediate Needs:

- Proper containment
- Prompt, reliable collection
- Control of open dumping

Long Term Needs:

- Worker training
- Stable employment

Sources: Industry and Commerce



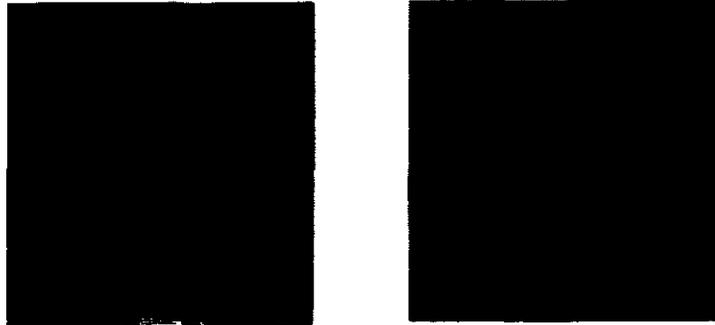
- On-site systems compact and contain wastes
- Waste exchanges allow beneficial use
- Recycling and reduction help control production costs

Materials Recycling & Transfer Facility



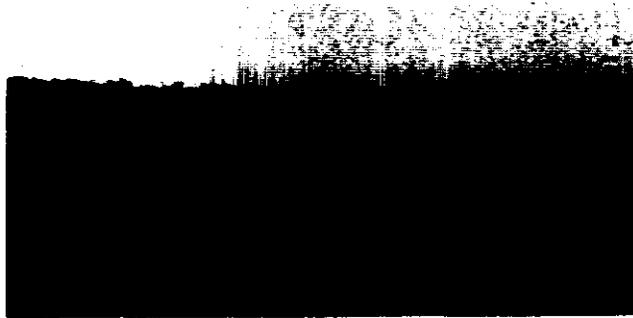
- Utilizes modern technology
- Reclaims up to 30% of wastes
- Reduces Transportation Costs

Materials Recycling Facility



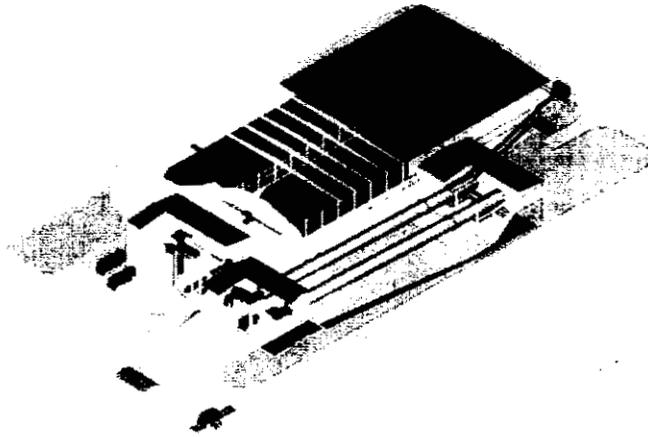
- Employs local labor
- Safe working conditions

Composting



- Controlled natural process
- Useful by-product
- Proper management essential for odor control

Typical Composting Facility



Sources: Hospital Wastes



- Significant threat to workers and the environment
- Requires proper management
- Education, inspection, enforcement

Sterilization & Incineration



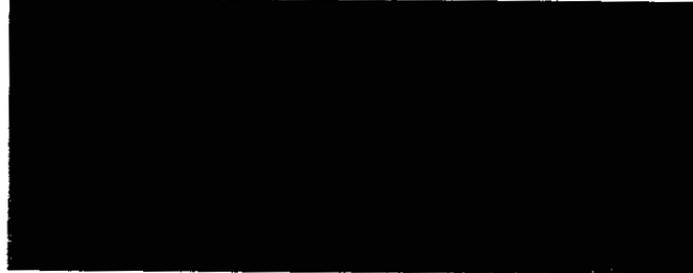
- Provides safe handling of hospital wastes
- Heat, chemicals or microwave energy kills pathogens
- Wide variety of systems available

Waste to Energy Systems



- Produce refuse derived fuel for cement kiln or industrial boiler applications
- Produce electricity, steam or hot water
- Significantly reduce waste volume
- Stack emissions require careful control

Sanitary Landfill



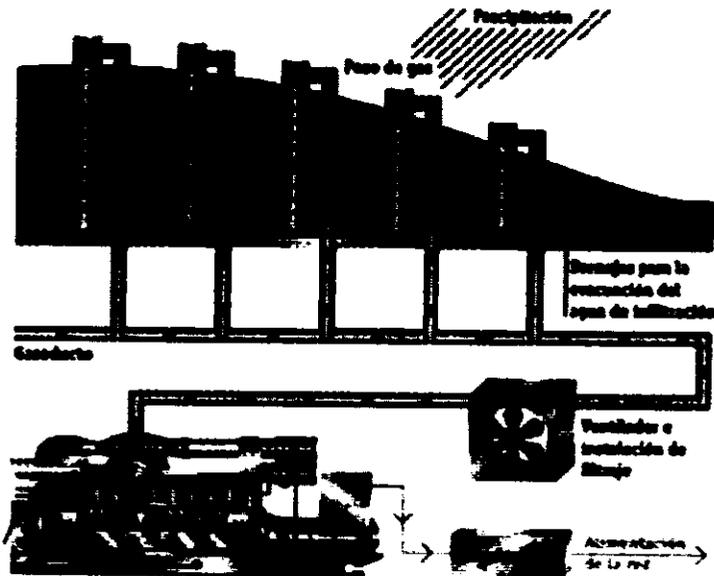
- Wastes compacted and covered
- Contact with water supply prevented
- Vermin and fires controlled
- Public health protected

Landfill Gas Control

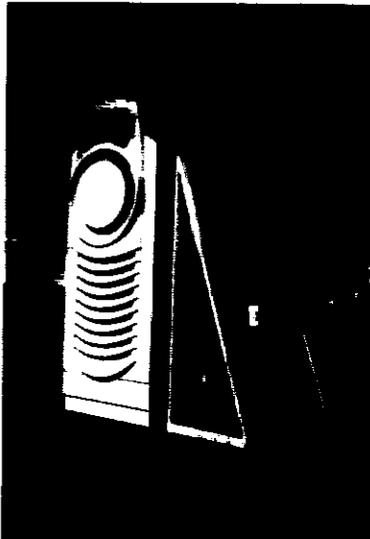


- Prevent spread of gases
 - explosion risk
 - health hazard
- Use gas as fuel
 - generate electricity
 - produce heat
 - power vehicles

3 MW RECIPRICATING ENGINE / GENERATOR:



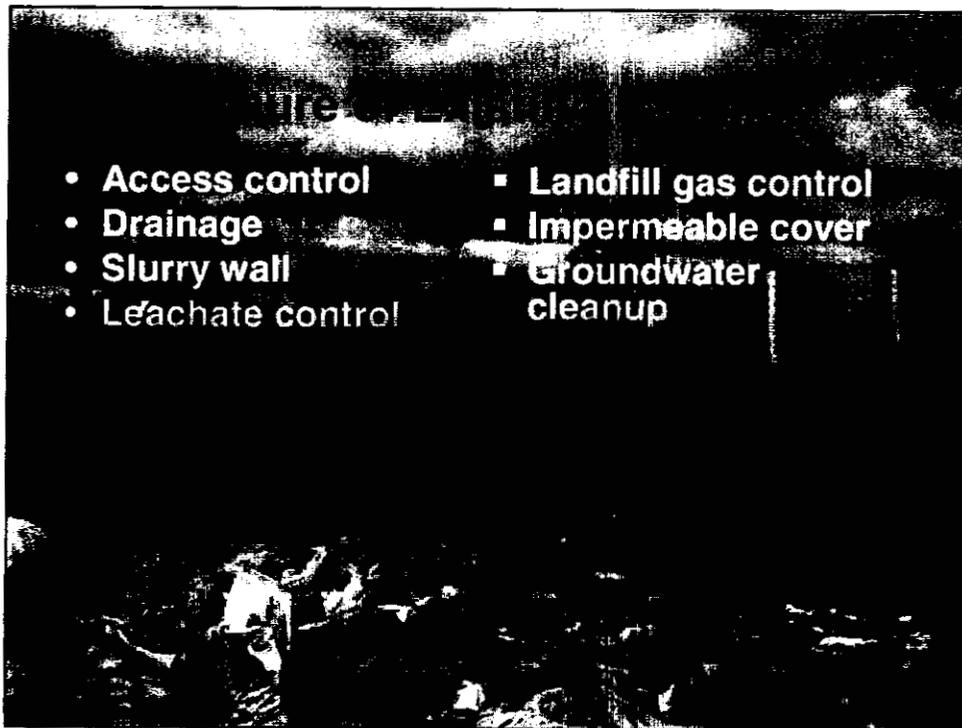
Microturbines



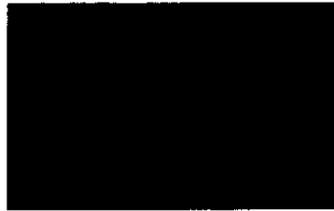
- 50 to 250 KW / unit
- Modular units combined for larger projects
- Also useful for gasification projects

Hazardous Waste Management

- Educate generators, collectors and workers
- Implement alternative programs
- Public drop-off areas
- Recycling
- Special landfill design



Human Resources



- Provide continuing employment
- Improve working conditions
- Develop technical skills

Education

- Public Education
- Worker Education



Integrated Waste Management Facility

Phase I



- Receive MSW
- Recover Recyclable Material
- Transfer to Landfill

Phase II

Options

- MSW Composting
- Refuse Recovered Fuel
- Electricity Production
- On Site Landfill

What BVA Can Do For You

- Plan an integrated waste management system
- Implement system components on a phased basis
- Provide financial assistance
- Market recycled products, compost and energy
- Provide training and staff support
- Arrange private operations, if desired

How to Site a Sanitary Landfill

Brown, Vence & Associates
February 2004



Background

- **Salinas Valley Solid Waste Authority (SVSWA) needed to identify a new regional landfill site**
- **Task Force comprised of governmental and industry leaders formed for the project**
- **BVA commissioned to develop and manage process**
- **BVA process used for 25 years; has now been certified by the USEPA**



Siting Process

Determine Federal, State and Local Restrictions

Task Force Prepares Own Exclusionary Criteria

Engineering Desktop Study and Site Visits

Task Force Development of Preferential Criteria

Evaluation of Potential Canyons Based on Preferential Criteria

Selection of Preferred Landfill Region

Federal and State Regulations

- **Airport Safety**
 - Cannot be constructed within 10,000 feet of an airport runway
- **Geologic Setting**
 - No impairment to the beneficial uses of surface water or groundwater
- **Ground Rupture, Seismic Impact Zones, and Unstable Areas**
 - No areas of rapid geologic change or unstable areas
- **Wetlands**
 - Including swamps, bogs and marshes
- **Flooding**
 - Including floodplains, or areas where solid waste is carried away by waters of a base flood

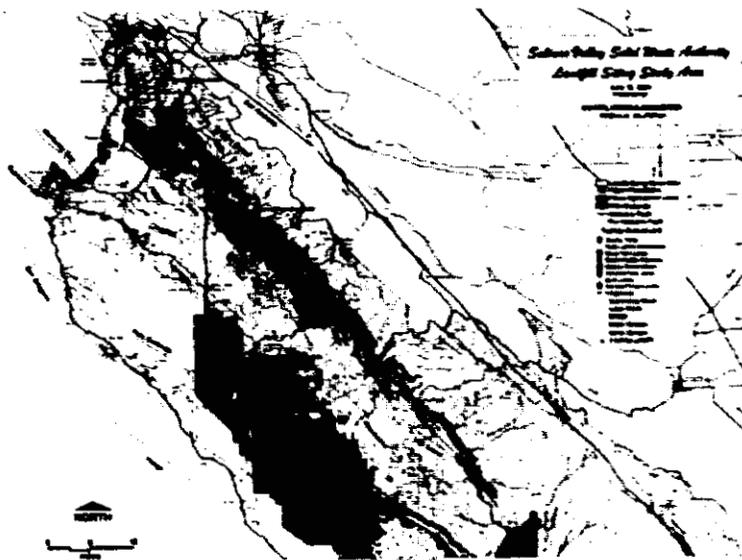


County Development Requirements

- Preservation of prime agricultural land
- Compatible land uses determined by zoning requirements
- Restricts development on certain slopes in erosion hazard areas and other areas.
- Lot line adjustments to comply with the General Plan
- Requires a development buffer
- Preservation of scenic views and historic areas



Excluded Areas



Task Force Criteria

- Shall not be located within a two mile radius of the expanded sphere of influence
- Shall not significantly impact the traffic level of northern areas of the Authority jurisdiction.
- Must have access from Highway 101.
- Primary transportation routes shall minimize the passing of sensitive receptor.

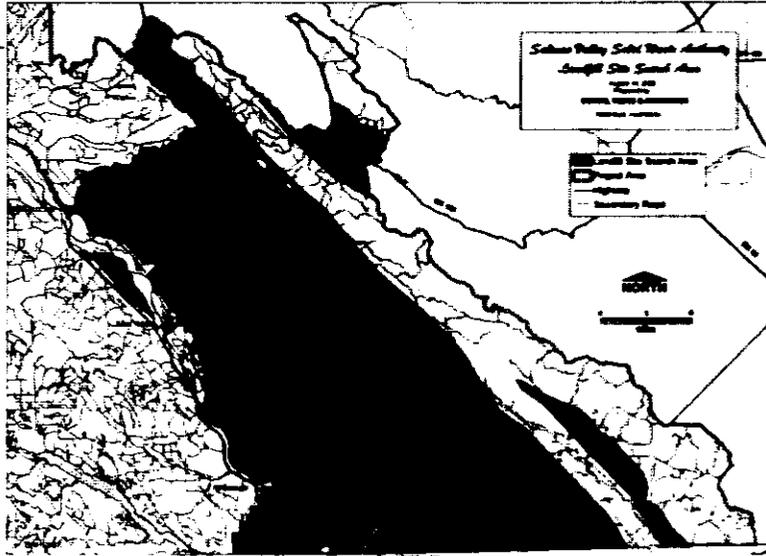


Task Force Criteria cont'd

- Primary transportation routes shall not pass through centers of high density population.
- Minimum capacity of 35 years.
- Shall not be located in canyons that serve as storm water discharge areas for a large watershed.
- Shall not be located in steep canyons near any known large faults whether Holocene or otherwise.



Landfill Search Area



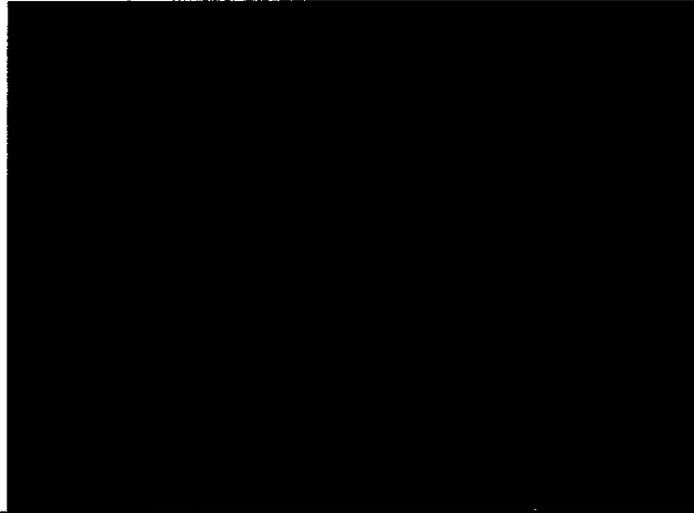
Desk Top Study and Site Visits

Determined 61 viable canyons based on:

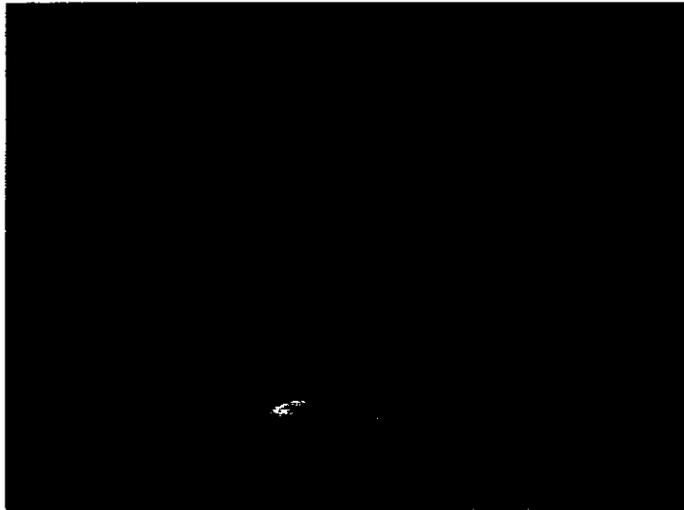
- Hydraulic isolation
- Headwater
- Canyon Opening Access
- Distance
- Canyon Slope and Depth
- Size
- Capacity
- Geographic Isolation



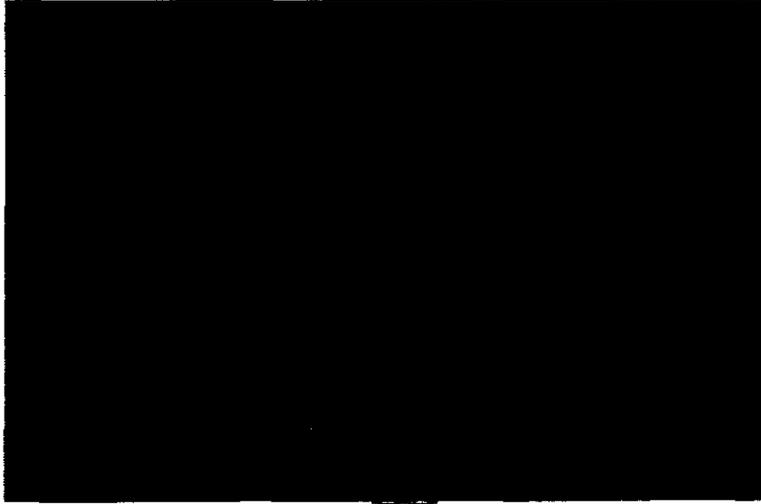
Highway 198 – Long Valley



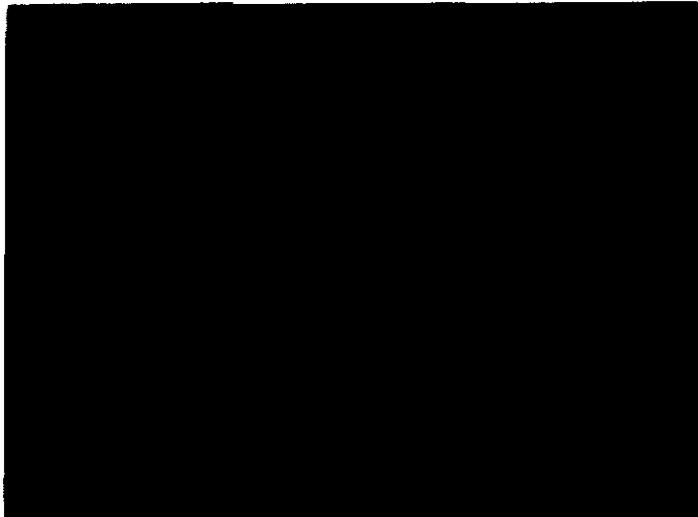
Canyon D



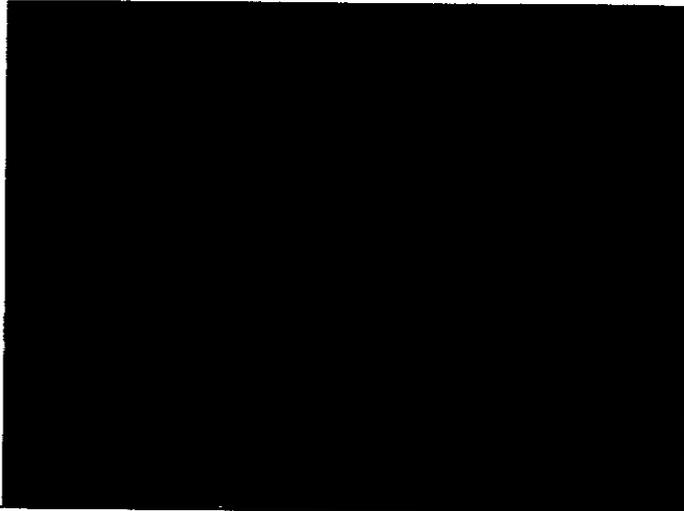
Canyon K



Canyon P



Canyon Z



Landfill Regions

| Landfill Region | Canyons Included |
|--------------------------|-----------------------------|
| Region 1: Highway 198 | A, A1, B, C, D, E, F, F1, G |
| Region 2: Pine Valley | H, I, J, K, L, M, N |
| Region 3: Pancho Rico | O, P, Q |
| Region 4: Lynch Canyon | R, S, T, U, V, W, X, Y, A1 |
| Region 5: Sargent Canyon | Z, AA, AB, AJ, AK, AL, AM |
| Region 6: Camp Roberts | AR, AX, AY, AZ, BA, BB, BG |
| Region 7: Indian Valley | AS, AT, AU |



Landfill Regions Map



Preferential Criteria

Ranked one through six in descending order of importance:

1. Distance to sensitive receptors including residential dwellings, schools, hospitals, and vineyards
2. Cost of the landfill – Life cycle economics
3. Greater than 35 years capacity
4. Transportation Routes: avoiding sensitive receptors including residential dwellings, schools, hospitals, and vineyards
5. Land availability
6. Visibility from Highway 101 and primary access road



Landfill Regions

The cost analysis was based on two factors:

- Transportation
- Road Improvements and Construction

| | | | |
|--------------------------|---------------|--------------|--------------|
| Region 1: Hwy 198 | \$89,500,000 | \$62,400,000 | \$46,100,000 |
| Region 2: Pine Valley | \$96,400,000 | \$67,400,000 | \$49,800,000 |
| Region 3: Pancho Rico | \$97,200,000 | \$67,900,000 | \$50,300,000 |
| Region 4: Lynch Canyon | \$121,900,000 | \$85,400,000 | \$63,400,000 |
| Region 5: Sargent Canyon | \$121,500,000 | \$85,100,000 | \$63,200,000 |

Landfill Study Results

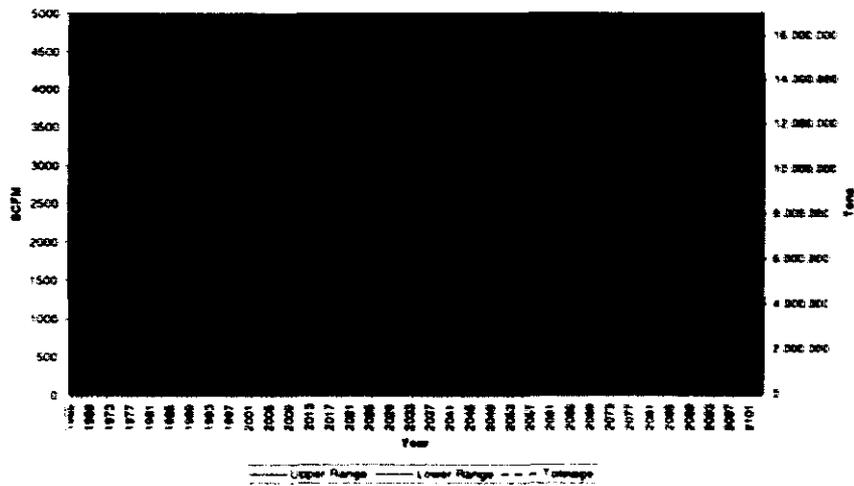
- Preferential criteria analysis favored Region 1: Highway 198
- Region 1: Highway 198 is most cost effective
- Task Force voted unanimously to recommend Region 1: Highway 198 for Phase 2 Canyon specific analysis
- Task Force recommends concentration of Phase II efforts on canyons A, A1, B, C & D

Hay Road Landfill

Landfill Gas to Energy February 2004



Predicted LFG Production



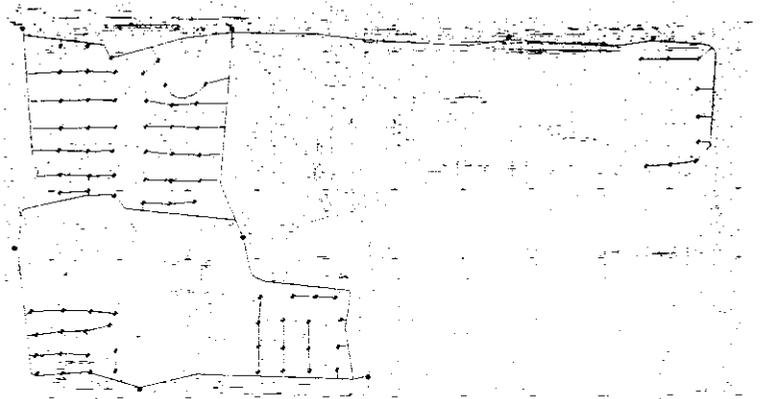
Collection System

Design Criteria

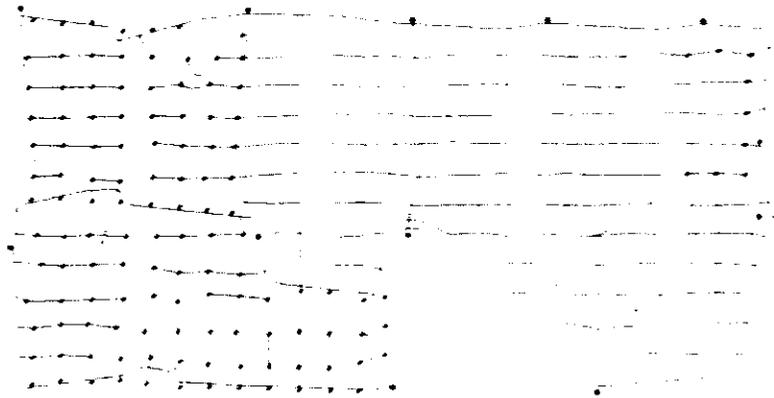
- Expandable
- Vertical Wells
- Header on Landfill Slope
- Header Sized for 20 Year Life
- Laterals Above Grade



Initial Collection System



Final Collection System



Collection System

| Component | Initial | Final |
|------------------|---------------|---------------|
| Wells | 81 | 260 |
| 14" Header | 15,780 lf | 24,700 lf |
| 4" Laterals | 16,700 lf | 41,100 lf |
| Condensate Traps | 8 | 11 |
| Flare | 1 @ 1500 scfm | 3 @ 1500 scfm |



Initial Collection System

Cost Estimate

| Item | Description | Units | Quantity | Installed Unit Price | Cost |
|-----------------------|------------------------------------------------|-------|----------|----------------------|---------------------|
| 1 | Gas Well Heads | LS | 81 | \$500.00 | \$ 40,500 |
| 2 | Condensate Sumps | LS | 8 | \$3,000.00 | \$ 24,000 |
| 3 | Header Isolation Valves | LS | 10 | \$1,000.00 | \$ 10,000 |
| 4 | 14" PVC Header Pipe | LF | 15,780 | \$14.00 | \$ 220,920 |
| 5 | 4" PVC Lateral Pipe | LF | 12,250 | \$5.50 | \$ 67,380 |
| 6 | Install Extraction Well | LF | 3,439 | \$45.00 | \$ 154,760 |
| 7 | Pneumatic Station | LS | 1 | \$10,000.00 | \$ 10,000 |
| 8 | Pneumatic Line | LF | 15,780 | \$2.00 | \$ 31,560 |
| 9 | Flare Station | LS | 1 | \$250,000.00 | \$ 250,000 |
| | | | | Sub total | \$ 809,120 |
| | Contingency | | | 15% | \$ 121,370 |
| | Consultants Design and Construction Assistance | | | 10% | \$ 80,920 |
| Total Estimate | | | | | \$ 1,011,410 |



Projected Electric Load and Cost Analysis Hay Road Landfill

| Projected Connected Load | kWh/yr | hrs/day | days/wk | Average Known (kW) | Total (kW) | Assumed Schedule | Average Rate | Estimated Cost |
|--------------------------|------------------|---------|---------|--------------------|----------------|------------------|-----------------|------------------|
| Exterior Lighting | 360 | 8 | 5 | 0.2 | | | \$0.1785 | \$64 |
| Pumps | 51,128 | 10 | 5 | 19.7 | | | \$0.1785 | \$9,126 |
| Offices | 88,385 | 10 | 5 | 34.0 | | | \$0.1785 | \$15,776 |
| Organic Compost | 18,000 | 24 | 7 | 2.1 | | | \$0.1785 | \$3,213 |
| Evaporator Pit | 217,740 | 10 | 5 | | 60.0 | A10 | \$0.1543 | \$33,597 |
| Reverse Air System | 4,703,280 | 24 | 7 | | 537.0 | E19 | \$0.1397 | \$667,142 |
| Electric Grinder | 72,710 | 0.5 | 5 | | 559.0 | E19 | \$0.1397 | \$10,159 |
| LFG Collection System | 163,310 | 24 | 7 | | 19.0 | A6 | \$0.1449 | \$23,669 |
| Pipeline Compressor | 163,310 | 24 | 7 | | 19.0 | A6 | \$0.1449 | \$23,669 |
| TOTAL | 5,478,223 | | | 55.9 | 1,194.0 | 1,249.9 | \$0.1417 | \$776,385 |



Analyzed Generation Technologies

- IC Engines
- Microturbines
- Fuel Cells



Generator Characteristics

| <u>Technology</u> | <u>IC Engines</u> | <u>Microturbines</u> | <u>Fuel Cells</u> |
|---------------------------|-------------------|----------------------|-------------------|
| Installed Cost \$/kW | ~\$1,500 | ~\$2,000 | ~\$4,500 |
| O&M Cost \$/mWh | ~\$20 | ~\$8 | ~\$10 |
| Heat Rate(BTU/kWh) | 10,300 | 12,600 | 9,600 |
| Efficiency | 35% | 30% | 37% |
| NO _x (lbs/mWh) | 5 | 0.7 | 0.01 |
| Demonstration level | Proven | Limited | Experimental |



Economic Performance

Energy Project at Landfill 10 Year Energy Cost Including Capital, O&M, & Purchased Power

| <u>Generator</u> | <u>Without Incentive</u> | <u>With PG&E Incentive</u> |
|------------------------|--------------------------|--------------------------------|
| 1-J312 594kW IC Engine | \$4.5MM | \$4.0MM |
| 10-70 kW Microturbines | \$4.1MM | \$3.3MM |
| 3-198 kW Fuel Cells | \$6.8MM | \$5.2MM |
| None | \$7.5MM | N/A |

Assumes no benefit from co-generation
Assumes collection system is not an eligible cost for incentive



Conclusions

- An effective LFG collection and destruction system could be installed for approximately \$1 million
- An energy project at the landfill meeting projected loads could save operator \$3 to \$4 million over the next ten years
- There is adequate LFG to serve one or more offsite customers as well

