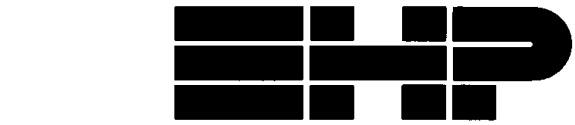

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ACTIVITY REPORT

No. 37

Lead Exposure Abatement Plan
for Egypt

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by
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ACRONYMS

CAIP	Cairo Air Improvement Project (USAID-funded activity)
CNG	compressed natural gas
CDC	U.S. Centers for Disease Control and Prevention
EEAA	Egyptian Environmental Affairs Agency, the environmental agency within MOSEA
EHP	Environmental Health Project
EPA	U.S. Environmental Protection Agency
FEI	Federation of Egyptian Industries
FETP	Field Epidemiology Training Program (a CDC program of technical assistance being provided to the MOHP)
GenMet	General Metals, smelting facility in Cairo operated by the Government of Egypt
GOFI	General Organization for Industrialization, within the Ministry of Industry
GOE	Government of Egypt
IEUBK	Integrated Exposure Uptake Biokinetic model of lead uptake, from U.S. EPA
IGSR	Institute of Graduate Studies and Research
ISC	Interministerial Steering Committee for LEAP
LE	Egyptian pound currency LE3.46 = US$1.00
LEAP	Lead Exposure Abatement Plan
LSAP	Lead Smelter Action Plan
MOHP	Ministry of Health and Population
MOI	Ministry of Industry
MOP	Ministry of Petroleum
MOSEA	Ministry of State for Environmental Affairs (see EEAA also)
MOST	Ministry of Supply and Trade

MOU	Memorandum of Understanding
MTBE	methyl tertiary butyl ether
NGO	nongovernmental organization
TCOE	Technical Cooperation Office for the Environment (a unit within MOSEA/EEAA)
USAID	U.S. Agency for International Development

Measurement and Units

dL	deciliter
Kg	kilogram
L	liter
mg	milligram
ppb	parts per billion
ppm	parts per million
μg	microgram

EXECUTIVE SUMMARY

The Lead Exposure Abatement Plan (LEAP) is a comprehensive, national strategy to reduce environmental lead exposure for the general population of Egypt. This plan is the product of numerous meetings, investigations, and workshops conducted from September 1996 through September 1997 in Cairo. These activities have included an institutional assessment, an environmental assessment, three workshops, dialogue among the key stakeholders, and the design of interventions to address the most important pathways for lead exposure.

All of the work has been performed under the auspices of the Technical Cooperation Office for the Environment of the Ministry of State for Environmental Affairs/Egyptian Environmental Affairs Agency, with assistance from the U.S. Agency for International Development and significant input from the Ministry of Health and Population. Other ministries, institutions, and nongovernmental organizations have also participated. The Ministry of State for Environmental Affairs/Egyptian Environmental Affairs Agency has adopted this document. It must also be approved by other concerned authorities before its adoption as a national plan is complete. Each chapter of the document is summarized below.

Introduction

In 1994, the Egyptian Environmental Affairs Agency (EEAA), which has recently become the Ministry of State for Environmental Affairs (MOSEA), and the U.S. Agency for International Development (USAID) collaborated in a study entitled "Comparing Environmental Health Risks in Cairo, Egypt." (Because of the organizational changes signified by the shift from EEAA to the MOSEA during this period, the acronym MOSEA/EEAA is used in this document to include reference to both titles.) The study reviewed available information on environmental conditions and associated health risks in Cairo and concluded that lead exposure was one of the city's three most important environmental health problems.

Prompted by these findings, the Government of Egypt (GOE) and USAID agreed to collaborate in developing two complementary plans for reducing sources of lead exposure in Egypt. The first was the Lead Smelter Action Plan, which described actions to reduce lead emissions and occupational hazards at large lead smelters in the Greater Cairo area. This document, the Lead Exposure Abatement Plan (LEAP), is the second.

This document summarizes available information on lead exposure to the general population of Cairo and actions that GOE has already taken to reduce the use of leaded gasoline, improve the operation of lead smelters, eliminate the use of lead-soldered food cans, and investigate the existing blood lead levels of children in Cairo. It then describes five new initiatives that the government will take to further decrease the Egyptian population's exposure to lead:

- reduce the amount of lead ingested through food;
- reduce the use of certain types of kohl (an eye cosmetic) that contain high levels of lead;
- reduce the production and use of lead-glazed ceramics that may release lead into food that is cooked or stored in them;
- ensure that manufacturers do not increase the use of lead additives in paint; and
- conduct a public awareness campaign to inform the general public and several specialized audiences of the health hazards associated with lead exposure and simple steps that can be taken to reduce such exposure.

Although the effect of lead exposure on individuals is fundamentally a health problem, most of the preventive solutions are achieved by changing environmental conditions—a process which in turn involves altering production, distribution, waste management behavior, and a variety of other activities. The nature of lead exposure requires that many different

organizations (both public and private) be involved in its abatement. Therefore, developing an effective LEAP must involve a variety of stakeholders; their collaboration is crucial to this effort**.**

Beyond the issue of stakeholder involvement, several other guiding principles have driven the design process:

- ensure that environmental data are sufficient to support the proposed actions;
- emphasize preventing exposure through controlling or eliminating lead sources;
- recognize and coordinate with existing activities and initiatives;
- develop commitment to cross-institutional cooperation and coordination;
- establish monitoring and evaluation systems for program implementation.

Lead Health Risks and Exposure Pathways

Lead is a toxic heavy metal present at background levels in many environments and at elevated concentrations in many cities of the developing and developed world. People who are exposed to lead by ingesting contaminated soil, dust, water, food, and other materials or by inhaling airborne particulate matter that contains lead develop elevated levels of lead in their body and may suffer from various health and developmental problems. Children are usually at higher risk than adults because their exposure is greater (i.e., they have more hand-to-mouth behavior), they absorb more lead than adults from the same level of exposure, and their developing bodies are more sensitive to the adverse effects of lead.

Although there is no internationally recognized acceptable blood lead level for children, research has shown that levels as low as 10 μg/dL are associated with learning disabilities and the loss of IQ points.

In preparation of this plan, an extensive environmental sampling survey was conducted in Cairo. The goal of the environmental assessment was to estimate the magnitude and extent of children's exposure to lead through various environmental media in the Greater Cairo metropolitan area. Investigators collected over 1,000 samples of soil, dust, drinking water, paint, various foods, cosmetics, traditional medicines, newspaper, and ceramics from locations throughout Cairo and analyzed the samples to determine their lead content. Results from the environmental sampling and subsequent use of these results to estimate blood lead levels in young children indicate that ingestion of some food items, use of kohl, and use of lead-glazed ceramics for food storage and cooking are very significant sources of potential lead exposure for children.

Modeling results based on data collected in Cairo indicate that approximately 64% of young children (ages 0 to 6) may have blood lead levels higher than 10 μg/dL, and approxi-mately 14% may have levels higher than 20 μg/dL. These estimates do not include expo-sure from the use of kohl or ceramics, since the model does not contain a mechanism for incorporating those exposure sources. Nor do they reflect the additional exposure that some children may experience if they live near a concentrated source (e.g., a smelter) or with an adult who works with lead in an occupational setting. For these reasons, the actual average blood lead level in young children could be higher than estimated, and individual levels are likely to be higher in some groups of children.

The Ministry of Health and Population (MOHP) is concerned about lead exposure and is currently conducting a study to determine the actual distribution of blood lead levels for children in Cairo and to identify potential risk factors for high blood lead levels. The U.S. Centers for Disease Control and Prevention (CDC) is providing technical assistance to MOHP through the Field Epidemiology Training Program (FETP). Data from this study will be used to validate model-based estimates of the magnitude and extent of children's exposure to lead and to identify additional risk factors that may not have been identified in the LEAP environmental assessment.

Current Initiatives to Reduce Lead Exposure in Egypt

The Government of Egypt recognized excessive exposure to lead as a potentially important public health issue in the early 1990s. The first two

major efforts it undertook to address this problem were the development of the Lead Smelter Action Plan (LSAP) by MOSEA/EEAA and the Ministry of Petroleum's actions to significantly reduce the use of leaded gasoline in Cairo. Other efforts have included MOHP's and the Ministry of Supply and Trade's (MOST) recent investigation of and plan for reducing sources of lead contamination in flour and actions by MOHP to reduce the use of lead solder in food cans.

The LSAP has three objectives, which are to be completed over the next five to seven years:

- upgrade the operation of large lead smelters;
- provide technical assistance to cooperative, licensed, small- and medium-sized lead smelters; and
- establish and enforce a comprehensive, national, long-term solution to pollution problems from lead smelters.

The Ministry of Petroleum (MOP) is pursuing an aggressive strategy to introduce unleaded gasoline throughout Egypt. It has succeeded in reducing the amount of lead content in gasoline by 50% in the first three years of its program. As of October 1996, MOP was able to ensure that 85% of the total gasoline consumption in Egypt was lead-free.

There was a recent episode of lead toxicity in one village. Staff from the FETP determined that it was caused by ingestion of lead-contaminated bread. The source of the lead was lead shims being used to repair milling equipment in the local flour mill. FETP's Assistant Director, working with some millers, has designed and implemented a mechanical retrofit to correct the situation in several private mills. FETP has since initiated an investigation to determine the extent of the problem in other parts of Egypt. Teams are currently sampling grain and flour at approximately 200 mills in six governorates (Aswan, Qena, and Sohag in Upper Egypt and Minouteya, Gharbiya, Daqahleya in the Delta). MOST has also announced that it will convert all government-run mills to a lead-free steel cylinder operation by the end of 1997.

In December 1995, after testing canned food samples, MOHP ordered the canning industry to stop using lead solder. In a recent regulation, MOHP issued comprehensive controls over the use of lead in food containers.

Aside from the initiatives described above, two additional policies provide formal support for the lead exposure reduction initiatives discussed later in this plan. Presidential Decree No. 798, issued in 1957, sets various limitations on the use of lead. Of immediate relevance, this decree prohibits the use of lead in flour mills (Article 6) and requires that ceramic glazes be free of lead, as measured by a standard test of acidic leachate (Article 7). The other policy, a Ministerial Decree of MOHP issued in June 1997, also prohibits the use of lead in repairing flour mills. These policies are both enforceable by MOHP.

Institutional Roles and Responsibilities

Reducing lead exposure is a challenge that falls under the discipline of environmental health. The principal institutions for environment and health are MOSEA/EEAA and MOHP.

For every intervention contained in this plan, either MOSEA/EEAA, MOHP, or both agencies together will serve as the lead institutions. For this reason, the plan requires that MOSEA/EEAA and MOHP continue to develop workable and productive mechanisms for ongoing collaboration.

MOSEA/EEAA and MOHP will adopt, as a matter of high priority, a Memorandum of Understanding specifying the full range of activities and coordination mechanisms between them. The two institutions will also establish a system of compliance monitoring to track implementation of LEAP. And since cooperation with business interests, especially the private sector, is crucial for interventions concerning bread, ceramics, kohl, and paint, MOSEA/EEAA and MOHP will develop a coordinated approach to informing and supporting businesses, including the informal sector, in efforts to reduce lead exposure.

Beyond its general responsibility for coordinating the joint implementation of LEAP, MOSEA/EEAA will be responsible for initiating the development of the public awareness campaign. MOSEA/EEAA will also conduct sampling efforts in coordination with MOHP to identify high-risk lead sources and populations; enhance its multimedia perspective to work at

reducing environmental lead hazards (especially via public awareness efforts); and conduct monitoring activities to track reductions in environmental exposure to lead.

The MOHP will complete the blood lead study currently underway in Cairo and conduct new blood lead screening of designated groups; evaluate blood lead and environmental data to identify high-risk sources and populations; coordinate prevention activities with MOSEA/EEAA; and ensure that medical and environmental follow-up services are provided for lead-poisoned children.

In addition to MOHP and MOSEA/EEAA, a number of other institutions will play significant supporting roles. These include the Ministries of Supply and Trade, Industry, Finance, Information, Education, Social Affairs, and Manpower and Migration, as well as the National Research Center and the nation's universities. MOSEA/EEAA will establish an Interministerial Steering Committee for LEAP implementation as a means of involving other government institutions, either throughout the period of plan implementation or as necessary at particular times. MOSEA/EEAA and MOHP both recognize the importance of coordinating with the other institutions as all of the planned activities move toward implementation.

The Federation of Egyptian Industries will have an important role in providing a regular and reliable set of linkages to the business community to enhance awareness and reduce lead use in manufacturing. This role involves connecting MOSEA/EEAA and MOHP and their intervention efforts with businesses involved in producing and marketing bread, kohl, ceramics, and paint.

There are many nongovernmental organizations (NGOs) in Egypt, including a large number with some interest in environmental or health issues. Very few have had experience in dealing with lead exposure reduction, however. Rather than identify specific NGOs for involvement in these critical tasks, this plan provides the criteria MOSEA/EEAA and MOHP will use to determine which NGOs to involve.

Single-Pathway Initiatives: Technical and Policy Interventions for Food, Kohl, Ceramics, and Paint

The plan describes a series of technical and policy actions to reduce lead exposure that arises from individual pathways: food, kohl, ceramics, and paint. The discussion for each pathway describes the following:

- the sources of lead contamination for the pathway in question;
- actions to reduce lead exposure, including rationale and stakeholders; and
- roles and responsibilities among organizations.

The interventions are coded with letters and numbers to assist in identifying the different types of actions that are necessary, as follows:

P= regulatory or economic **policy development and enforcement**
T= **technical interventions** (e.g., changes in manufacturing processes)
I = policy aimed at encouraging product-specific **information**
S = policy on **standard setting** and certification
A = **awareness**, education, and training
M = **monitoring**, evaluation, and coordination
D = additional **data gathering and analysis**, possibly leading to further intervention design

Table ES-1 summarizes all of the interventions and the institutions that will be involved in each. Chapters 5 through 8 present the interventions in greater detail. Some interventions can be categorized under more than one of the designated types. Retrofitting flour mills to reduce lead exposure, for instance, is both a *technical* intervention and an action that implements an existing *policy*. It is coded as Intervention T1/P1 to reflect both categories. Each intervention is also assigned a number. The numbers simply reflect the order in which they are introduced in the discussion; P3, for instance, designates the third policy intervention described in the plan.

Food

Initiatives to eliminate lead contamination in bread by retrofitting those flour mills susceptible to lead use are currently underway, with the goal of eliminating lead contamination at all such sites. This effort is being conducted at public- and private-sector mills as a matter of high priority.

In contrast, lead exposure from produce and from milk distributed in the informal sector does not lend itself easily to regulatory changes. For both produce and milk, the food item does not initially contain lead but becomes contaminated from surface dust or, in the case of milk, possibly from metal containers. The most appropriate form of intervention for these products is a public awareness campaign for consumers. Given adequate information, consumers can take actions on their own to limit their exposure by thoroughly washing produce and by seeking safer sources of milk. Reducing lead exposure from informally-vended milk may also require the introduction of lead-free, sealed containers.

Kohl

Kohl is an eye cosmetic widely used in Egypt and other countries. Some of the kohl samples contained almost no lead, but approximately half had extremely high concentrations (from 10% to over 60%). Those with very low lead levels are made mostly with ash from burning various plants, while those with high lead levels are made from galena, a naturally-occurring mineral that is mostly lead sulfide. The use of lead-containing kohl, especially with infants and children, is a serious public health problem. To address it will require promoting the production and use of the non-lead varieties of kohl.

The interventions for kohl focus on three types of action:

- designing a public awareness program for producers and consumers about the dangers of kohl with lead and the need to choose safer substitutes;
- developing a certification and labeling program for non-lead forms of kohl to provide information to consumers and help them make informed choices, and to create an incentive for producers to shift to non-lead ingredients; and
- controlling and eliminating the manufacture, distribution, and sale of kohl with lead in domestic production and through importation.

Ceramics

In Egypt, as in numerous other countries, traditional ceramics pose a health risk from lead that can leach from the glaze into foods. Lead-glazed ceramics have been used for centuries, however, and the general public does not consider them to be hazardous.

Because the pottery industry is very dispersed and many potters live at near-subsistence levels, trying to implement technical changes through regulations could create serious social and economic problems for them and their families.

Controls are necessary but must be accompanied by incentives for change and technical assistance to aid potters in changing their working conditions and production processes. The set of interventions is similar to those developed for kohl xand reflects this array of needs: public awareness, product labeling and incentives to change production processes, and prohibitions on the manufacture of lead-leaching ceramics.

Paint

At present, leaded paint is not a major problem in Egypt. The public paint manufacturer stopped using lead in residential and interior paints some years ago, but in the past few years, there has been significant privatization in the paint industry. There are now a few dozen domestic private manufacturers of paint, and their market share is growing.

There are currently no policy controls for the use of lead in paints, nor are there import or export restrictions regarding leaded paint. Some manufacturers are said to be using lead in their processes. Sampling conducted for this plan indicates that most paint available in

stores and markets is either lead-free or has low levels of lead. Only one sample (with a lead content of 19,200 ppm) was above the limit commonly used to define lead paint in other countries (5,000 ppm).

Controls on lead in paint will be enacted now. Although sampling results suggest that leaded paint is currently a minor issue, the fact that lead paint is beginning to appear on the market indicates that without controls, the problem will grow. As seen in other national settings, once the use of lead paint begins, it is a nearly intractable problem to solve: when the paint has been applied in thousands or millions of dispersed sites, there is no easy, inexpensive, and effective way to prevent exposure to children. Introducing controls on import, export, and manufacturing now is far superior to using remediation programs in the future.

Cross-Cutting Initiatives: Awareness and Educational Interventions

Increasing public awareness and understanding of the pathways of lead exposure, the health effects of lead, and simple measures that individuals can take to reduce their exposure is crucial to the success of this nationwide effort. Increasing public awareness is important for two reasons. First, a public awareness campaign can provide practical information so that individuals can change their behavior to reduce their own exposure to lead. In addition, a broader public awareness of hazards from lead will give the government greater leverage in implementing the anticipated technical and policy interventions for food, kohl, ceramics, and paint. The public awareness campaign will use several media (TV, radio, print) and messages that are based on appropriate social research and testing.

In addition to the awareness program for the general public, there will also be a focused program of specialized education and training for specific audiences. This effort will be aimed at the following audiences:

- bakers and flour millers
- producers, distributors, and vendors of kohl, ceramics, and paint
- health care providers
- religious leaders
- policymakers and decision-makers
- teachers and schoolchildren
- journalists.

Additional, more focused interventions are also included in support of other awareness efforts. These include transmission of data on lead exposure from the Ministry of Social Affairs Insurance Division to MOSEA/EEAA and MOHP; compiling and disseminating all current Egyptian legislation, decrees, and regulations regarding lead and lead exposure; and establishing a national clearinghouse in MOSEA/EEAA for information on lead exposure.

Initiatives to Strengthen Implementation: Monitoring, Evaluation, and Coordination

Once fully adopted by the relevant authorities beyond the MOSEA/EEAA, the Lead Exposure Abatement Plan will be implemented by the Government of Egypt over the next two to five years. As a first step, MOSEA and MOHP will develop a Memorandum of Understanding to clarify their respective roles, responsibilities, and points and mechanisms of coordination.

MOSEA/EEAA and MOHP will also work with the Federation of Egyptian

Industries to inform and support business, especially private companies and small-scale manufacturers, in reducing lead contamination in ceramics, kohl, bread, and paint. MOSEA/EEAA and MOHP will emphasize collaborative strategies and monitoring approaches that can be supported and/or implemented directly by segments of the business community, including the informal sector.

Finally, MOSEA/EEAA and MOHP will monitor environmental conditions and exposure levels to determine whether they are actually improving; this and other information will be evaluated to determine whether the program is achieving its objectives.

Initiatives to Close Gaps: Issues Needing Further Attention

Most of the interventions described in the plan are intended to reduce or eliminate sources of lead exposure that potentially affect a large proportion of the population. There are, in addition, some particular groups of individuals who have very high exposures to lead due to special circumstances. These are, primarily, people who have some association with a factory site in a lead-consuming industry: the workers, their families, and people who live near the sites. Work sites in the informal sector are also included in this category. Additional studies and interventions will be needed to address these situations.

Table ES-1

Table ES-1 cont'd.

Table ES-1 cont'd.

1 INTRODUCTION

1.1 Background

In 1994, the Egyptian Environmental Affairs Agency (EEAA) and the U.S. Agency for International Development (USAID) collaborated in a study entitled "Comparing Environmental Health Risks in Cairo, Egypt" (Sessions et al. 1994). The study reviewed available information on environmental conditions and associated health risks in Cairo and concluded that lead exposure was one of the city's three most important environmental health problems. Several earlier studies in the Greater Cairo area and elsewhere in Egypt found blood lead levels in older children, mothers, and industrial workers that exceeded guidelines established by the World Health Organization and the U.S. Environmental Protection Agency. Other studies have characterized, albeit in a limited fashion, the presence of lead in air, soil, and food in Egypt. The Ministry of Health and Population (MOHP) has recently begun an extensive survey of blood lead levels in children aged 2 to 6 years in the Cairo governorate (see Section 2.5).

Prompted by findings from the 1994 review, the Government of Egypt (GOE) and USAID agreed to collaborate in developing two complementary plans for reducing sources of lead exposure in Egypt. The first was the Lead Smelter Action Plan (LSAP), which describes actions for reducing lead emissions from, and occupational exposure in, large lead smelters in the Greater Cairo area. The second is this document, the Lead Exposure Abatement Plan (LEAP), which provides a comprehensive set of actions for reducing lead exposure from all other environmental sources.

Several agencies within the GOE are actively engaged in reducing lead exposure. Since 1994, the Ministry of Petroleum has instituted measures to greatly reduce the use of leaded gasoline throughout Egypt. The Ministry of Health and Population has issued rules to eliminate the use of lead solder in food canning and sources of lead contamination in flour. The Ministry of State for Environmental Affairs[1] has recently initiated the Cairo Air Improvement Project, under which parts of the Lead Smelter Action Plan will be implemented.

Despite these efforts, the GOE needs to implement a comprehensive Lead Exposure Abatement Plan because a substantial proportion of the Egyptian population's exposure to lead comes from sources other than automobile emissions and lead smelters. Lead is persistent in the environment and will remain in soils and dust for a long time after current automobile and smelter emissions are reduced. Lead that is already in the soil and dust presents an ongoing risk of exposure through several pathways. In addition, there are other sources of lead exposure—for example, some foods, ceramics, and cosmetics—that may be of equal or even greater importance than soil, dust, and air, particularly for children. For these various reasons, LEAP takes all GOE initiatives into account (see Chapter 3) and proposes mechanisms for coordinating

[1] The Egyptian government has recently established the Ministry of State for Environmental Affairs, of which EEAA is a subordinate organization. Because of the change in institutional relationships, this report uses the acronym MOSEA/EEAA to refer to both organizational units.

national lead-reduction efforts across all involved ministries.

The Lead Exposure Abatement Plan was prepared with technical assistance from the U.S. Agency for International Development Mission to Egypt, under USAID's Sector Policy Reform Program II. USAID provided its technical assistance through the services of the Environmental Health Project. MOSEA/ EEAA has adopted this document. It must also be approved by other concerned authorities before its adoption as a national plan is complete.

1.2 Purpose of This Plan

LEAP is a comprehensive national strategy to reduce environmental lead exposure for the general population of Egypt.

This document first summarizes available information on lead exposure in Cairo and actions that the GOE has already taken to reduce the use of leaded gasoline, improve the operation of lead smelters, and eliminate the use of lead-soldered food cans. (For three of the most relevant Egyptian decrees pertaining to lead, see Appendix A.) It then describes five new initiatives that the GOE will take to further decrease exposure of the populace to lead:

- reduce the amount of lead ingested through food;
- reduce the use of certain types of kohl (an eye cosmetic) that contain high levels of lead;
- stop the production of lead-glazed ceramics that may release lead into food that is cooked or stored in them;
- ensure that manufacturers do not increase the use of lead additives in paint; and
- conduct a public awareness campaign to inform the populace of the health hazards associated with lead exposure and simple steps that can be taken to reduce such exposure.

LEAP includes both technical and policy interventions to address these exposure pathways specifically and a public awareness program to address all potential exposure pathways. MOSEA/EEAA, MOHP, and other GOE agencies will use this plan over the next several years to guide the government-wide strategy for reducing lead exposure.

This plan does not address lead exposure to workers who are employed in industries that use lead, or the secondary exposures that may occur to the families of workers and people living in the vicinity of facilities that use lead. These problems are potentially serious and warrant additional action (see Chapter 8).

1.3 How the Plan Was Developed

As mentioned above, LEAP has been developed by MOSEA/EEAA, acting in coordination with MOHP and other GOE agencies, with technical support from USAID. USAID/Cairo commissioned the Environmental Health Project (EHP) to provide technical assistance to MOSEA/EEAA. Although lead exposure is fundamentally a health problem, most of the solutions are achieved in sectors other than health. The environment sector plays a central role, for example, as does industry and governmental regulation. Therefore, developing an effective LEAP must necessarily involve a variety of stakeholders. Stakeholder involvement has been a key to developing LEAP. Several guiding principles have driven the design process:

- sufficient environmental data collection;
- emphasis on prevention of exposure through control or elimination of lead sources rather than a curative approach;
- recognition of and coordination with existing activities and initiatives;
- commitment to cross-institutional cooperation and coordination;
- systematic monitoring and evaluation.

Early in the process, a working group with representatives from MOSEA/EEAA, MOHP, USAID, and EHP was established to share information and discuss activities. This group met periodically throughout the process and will likely continue to meet as the plan is implemented. EHP worked with MOSEA/EEAA to conduct three

technical assessments and several workshops over the past year, as described below.

- **LEAP Start-up Workshop, September 1996**
  MOSEA/EEAA hosted a start-up work-shop to announce the activity, provide basic information on lead exposure and health effects, and gather key stakeholders who would need to be involved in the process of developing the plan.
- **Institutional Assessment, September–December 1996**
  EHP conducted an institutional assessment to identify the organizations within the Government of Egypt and in the Egyptian private sector that will have important roles in lead abatement or that have important interests at stake in activities which contribute to lead exposure. Results of the assessment are reported in EHP Activity Report no. 31, *Institutional Assessment for Lead Exposure Abatement and Reduction in Cairo* (O'Toole et al. 1996). Key findings from the institutional assessment are reflected in Chapter 4 of this document.
- **Environmental Assessment, September 1996–June 1997**
  EHP conducted an extensive environ-mental assessment to characterize the distribution of lead in various environ-mental media throughout Cairo and to identify the most important routes of lead exposure for Cairo's residents. EHP collected samples of soil, dust, water, food, cosmetics, traditional medicines, ceramics, and paint from many locations in Cairo and tested them to determine their lead content. The analysis also included a con-sideration of airborne lead; for this source, data from a number of previous studies provided sufficient information to incor-porate into the larger investigation. No additional air sampling was required. The first round of sampling was conducted in November/December 1996; it included an extensive survey of lead levels in soil and dust and preliminary screening for lead in the other media. A second round of sam-pling was conducted in May/June 1997 to collect additional samples of food, kohl, ceramics, and paint. Results from both rounds were used with a lead exposure model to estimate the distribution of blood lead levels in children aged 0 to 6 years. Results from the environmental assessment are reported in EHP Activity Report no. 32, *Lead Exposure Abatement Plan for Egypt: Results of Environmental Sampling for Lead* (Chappell et al. 1997). Key findings from the environmental assessment are summa-rized in Chapter 2 of this document.
- **Second LEAP Workshop, July 1997**
  MOSEA/EEAA hosted a second workshop in which the LEAP stakeholders gathered to hear reports on current GOE initiatives to reduce lead exposure, discuss results from the environmental assessment, and begin developing a series of interven-tions to reduce lead exposures associated with food, kohl, ceramics, and paint. MOHP played a very important role at this workshop in describing in detail its lead-related activities to date, including a blood lead study of children in Cairo and its investigation of flour mills.
- **LEAP Interventions Design, July- August 1997**
  Beginning with ideas generated during the second workshop and continuing in close coordination with MOSEA/EEAA, an EHP team refined the series of interven-tions for

reducing exposure to lead from food, kohl, ceramics, and paint. The first draft version of the plan was prepared and distributed to MOSEA/EEAA, MOHP, and other key stakeholders for review.

LEAP Consultations and Final Workshop, September 1997
The Director of MOSEA/EEAA/TCOE[2] and EHP representatives presented the draft Lead Exposure Abatement Plan to the Minister of State for Environmental Affairs for her review and approval. The draft plan was then presented to all key stakeholders at the third LEAP Workshop on 30 September 1997. EHP staff revised the draft to reflect comments from MOSEA/EEAA, MOHP, and workshop participants. MOSEA/EEAA has estab-lished a Steering Committee of senior rep-resentatives of relevant concerned authori-ties. The committee's main functions will be to facilitate adoption of the plan by institutions represented on the committee and to oversee its implementation.

1.4 Overview of the Plan

The remaining chapters of the plan cover the following topics:

Chapter 2: Lead Health Risks and Exposure Pathways
Describes the major health effects of lead exposure and, based on the environmental data collected, the most significant exposure pathways. A description of MOHP's blood lead study is also included.

Chapter 3: Current Initiatives to Reduce Lead Exposure in Egypt
Reviews GOE efforts to date to reduce lead exposure from lead smelters, gasoline, cans, and bread.

Chapter 4: Institutional Roles and Responsibilities
Identifies the public and private sector institutions that will be involved in implementing LEAP. Because lead exposure is an environmental health problem, MOSEA/EEAA and MOHP both have major responsibilities for this effort.

Chapter 5: Single Pathway Initiatives: Technical and Policy Interventions for Food, Kohl, Ceramics, and Paint
Describes the source of lead contamination, actions to reduce lead exposure from several single pathways or media/products, and agreed roles.

Chapter 6: Cross-Cutting Initiatives: Awareness and Educational Interventions
Describes comprehensive public awareness and targeted educational campaigns for selected populations that address major potential exposure pathways; collection of materials for governmental and nongovernmental use.

Chapter 7: Initiatives to Strengthen Implementation: Monitoring, Evaluation, and Coordination
Describes specific techniques for monitoring the impact of implementing LEAP, evaluating progress, and coordinating efforts between institutions and with the business community.

Chapter 8: Initiatives to Close Gaps: Issues Needing Further Attention
Identifies potential actions to address occupational and "hot spot" lead exposure locations and pathways that were not part of the LEAP effort.

[2] TCOE is the Technical Cooperation Office for the Environment, which is part of the EEAA.

2 EXPOSURE PATHWAYS AND HEALTH RISKS

2.1 Health Effects of Lead in Children and Adults

Lead is a naturally-occurring, toxic heavy metal present at background levels in many environments. Because of its widespread use in industry, fuels, and consumer products, it is present at elevated concentrations in many cities of the developing and developed world. People are exposed to lead by ingesting contaminated soil, dust, water, food, and other materials and by inhaling airborne particulates that contain lead. Most people are exposed to lead from several sources over much of their lifetime and develop slightly elevated levels of lead in their body. Lead has no known physiologic value or function in the human body.

In adults, cumulative lead burdens are linked to serious health problems, including physiological effects on the central nervous system and kidneys at very high blood lead levels, increased infertility at moderate levels, and increased hypertension in men at levels as low as 30 μg/dL. Adults may suffer from fatigue, body aches, stomach colic, changes in behavior, hypertension (in men), and possibly decreased fertility. At very high doses, lead poisoning can cause seizures and death in adults and children.

Children are usually at greater risk than adults because their exposure is higher: they take greater amounts of lead into their bodies than adults, primarily through ingestion associated with hand-to-mouth behavior. Children also absorb more lead than adults from the same level of exposure, and they are more sensitive to the adverse effects of lead. Children are especially vulnerable to lead's harmful effects because their bodies are growing and much of the damage that occurs in their development is not reversible. Lead interferes with children's growth and development and can result in hearing loss, learning disabilities, and brain damage. Although lead poisoning is very common, it usually goes undiagnosed because the symptoms are not readily apparent.

The health effects of lead exposure in children are irreversible. It is critical, therefore, to adopt a public health approach based on eliminating sources of lead and preventing lead exposure before it occurs. Medical intervention is appropriate in only the most severe cases, and is effective only to reduce blood lead from very high to moderate levels. Furthermore, such treatment helps avoid future physiological damage, but is not able to reverse detrimental effects that have already occurred.

Over the years since the health hazards of lead were first recognized, research has demonstrated adverse health effects at lower and lower blood lead levels. Current information is summarized in Figure 1. Very severe lead exposure in children (resulting in blood lead levels of 80 micrograms per deciliter [μg/dL] or higher) can cause coma, convulsions, and even death. Lower blood lead levels cause adverse effects on the central nervous system, kidney, and hematopoietic system. Blood lead levels as low as 10 μg/dL are now known to have serious, sometimes irreversible effects on the neurological, social, and mental development of young children

Figure 1
Lowest Observable Adverse Effect Levels of Inorganic Lead

CHILDREN	Lead Concentration in Blood (ug/dL)	ADULTS
	150	
Death →		← Encephalopathy
		← Nephropathy
	100	
Encephalopathy →		
Nephropathy →		← Frank Anemia
Frank Anemia →		
Colic →		← Male Reproductive Effects
	50	← Hemoglobin Synthesis and Female Reproductive Effects
Hemoglobin Synthesis →	40	← Nerve Conduction Velocity
Vitamin D Metabolism →	30	← ⇑Blood Pressure ♂
		⇓ Hearing Acuity
		← Erythrocyte Protoporphyrin ♂
Nerve Conduction Velocity →	20	← Erythrocyte Protoporphyrin ♀
Erythrocyte Protoporphyrin →		
Vitamin D Metabolism(?) →		
	10	
Developmental Toxicity IQ, Hearing, Growth →		
Transplacental Transfer →		

Source: U.S. Centers for Disease Control

(CDC 1991, Needleman et al. 1996, Kim et al. 1995). Other effects that begin at these low levels include decreased growth, reduced hearing acuity, reduced ability to maintain steady posture, learning disabilities, and loss of IQ points.

The blood lead level deemed to be a threshold for concern has been steadily lowered over the last 25 years, as studies have demonstrated more and more subtle detrimental effects at lower levels. Although there is no internationally recognized "safe" lower limit below which lead does not cause harmful effects in children, the current consensus among many authorities is that blood lead levels of 10 μg/dL and higher should be cause for concern, and that levels of 20 μg/dL and higher warrant action to reduce the sources of exposure.

2.2 Lead Exposure Pathways in Cairo

As mentioned in Section 1.3, MOSEA/EEAA sponsored an extensive assessment of environmental lead concentrations and exposure pathways in Cairo. The study was conducted by USAID's Environmental Health Project. This section presents a brief summary of the results.

The goal of the environmental assessment was to estimate the magnitude and extent of children's exposure to lead through various environmental media in the Greater Cairo metropolitan area. To accomplish this goal, the investigation pursued two specific objectives:

- characterize the distribution of lead in various environmental media in Greater Cairo; and
- estimate the relative contribution of each exposure pathway to the total lead exposure of children in Greater Cairo.

Investigators collected over a thousand samples of soil, dust, drinking water, paint, various foods, cosmetics, traditional medicines, newspaper, and ceramics from locations throughout Cairo and analyzed the samples to determine their lead content.[3] Table 2-1 lists the number of samples by medium. The initial round of sampling was conducted in November and December 1996. Additional sampling to confirm and extend results from the initial round was conducted in May and June 1997. Investigators did not collect

The investigators then used data from this study and previously reported research in a lead exposure model to estimate the distribution of blood lead levels in young children in Cairo. Results from this analysis were then used to estimate the relative contribution of various exposure pathways to the expected mean blood lead levels.

The following list presents a brief summary of results from the environmental sampling activity. The text notes pathways that present significant risk of exposure, and median lead concentrations are given in Table 2-2. Results from the blood lead modeling are presented in Section 2.3, and and conclusions from the environmental assessment are presented in Section 2.4.

- *Soil and dust*. Median levels of lead in soil and dust (74 and 192 mg/Kg, respectively) are relatively low and do not present a significant risk to the average child. Samples at some locations, however, were over 1,000 mg/Kg and may result in significant exposure for children who live or play regularly in these areas.
- *Drinking water*. All drinking water samples were below 15 μg/L, the U.S. standard for lead in water at the tap.
- *Exterior paint (old).* Although lead was detected, values were substantially lower

[3] Air samples were not taken because sufficient data on lead concentrations in ambient airborne particulates were available from six studies conducted between 1982 and 1996.

Table 2-1
Environmental Analysis Sample Summary

Medium	Number of Samples
Exterior Dust	411
Soil	180
Drinking Water	90
Paint	31
Food	404
Cosmetics/Medicines	38
Ceramic Pottery	28
Newsprint	3
Total	**1,185**

Table 2-2
Median Environmental Lead Concentrations in Cairo and IEUBK Model-Estimated Child Lead Uptake Rates

Medium	Measured Median Lead Concentration	Estimated Lead Uptake Rate (in μg/day)	Percent of Total Estimated Uptake
Soil	74 mg/Kg	3.6-6.0 (soil and dust combined)[1]	15.0%
Dust	192 mg/Kg		
Diet	66.8 μg/day[2]	23.3-27.4	76.6%
Water	4 μg/L	0.29-0.99	2.4%
Air	3.4 μg/m^3	0.72-3.17	6.0%
Paint	0	0	0.0%
Total		27.9 - 37.6	100%

[1] Assumed Soil Ingestion Rate: 0.09-0.18 g/day
[2] Estimated daily intake based on a typical child's diet and median lead concentrations in various types of food

than those generally found in paint that contains lead as an additive (5,000 ppm).

- *Fresh paint (new)*. Of the 15 samples collected, only one (at 19,200 ppm) would be categorized as "leaded paint."
- *Food*. Significant levels of lead were found in several food items, including bread, leafy vegetables, other produce, and milk distributed by "informal sector" vendors. Consumption of these foods at rates typical of a child's diet could result in an average daily lead intake rate of 66.8 μg/day, compared to guidelines that range from 6 μg/day in the U.S. to 35 μg/day in Egypt. The apparent sources of lead contamination in food are as follows: for bread, flour milling equipment; for produce, deposition of airborne dust and adherence of soil particles; for milk, metal storage containers (most likely) or deposition of airborne dust and motor vehicle exhaust.
- *Kohl*. Kohl is an eye cosmetic used by women and children. Half of the kohl samples analyzed contained high concentrations of lead (more than 100,000 ppm); all others contained very small amounts. Kohl is a significant potential source of lead exposure for children and possibly for adult women also.
- *Ceramics*. Samples of "market pottery" commonly used in Egypt for cooking and storing food released significant levels of lead when treated with acidic solutions at acidity levels representative of some foods. Glazes used on ceramics were found to contain up to approximately 6% lead (60,000 ppm). Ceramics are a significant potential source of lead exposure for children and possibly for adults as well.
- *Medicines and newsprint*. Lead concen-trations in samples of several medicines and newsprint were not significant.
- *Air*. As mentioned earlier, lead concen-trations in airborne particulate matter were not measured; existing data were reviewed. Annual mean concentrations ranged from 0.15–3.4 μg/m^3, compared to international norms that range from 0.1 to 0.5 μg/m^3.

2.3 Estimated Blood Lead Levels in Children

Investigators used the Integrated Exposure Uptake Biokinetic (IEUBK) model (EPA 1994) to estimate the relative contribution of each pathway to total lead uptake and the distribution of blood lead concentrations for children in Greater Cairo. The model uses information about children's exposure to lead (daily intake rates) to predict blood lead levels. This multipathway model incorporates air, diet, drinking water, soil, dust, and paint concentrations and is most accurate when geometric mean or median environmental lead concentrations are utilized. The model does not include lead exposure resulting from the use of ceramics and kohl. Thus, actual average blood lead levels may be higher than predicted by the model, at least for children who use lead-containing kohl or lead-leaching ceramics.[4]

Table 2-2 presents model-based estimates of lead uptake rates for children in Cairo. The estimates indicate that diet is the most important pathway for lead. Children's average consumption of 66.8 μg/day of lead through various foods (see above) results in a net uptake of 23.3 to 27.4 μg/day, depending on the age of the child. Lead uptake from food constitutes over 75% of the total estimated exposure to lead, excluding kohl and ceramics. Soil and dust ingestion produces an average uptake of 3.6 to 6.0 μg/day (15% of total estimated exposure), and inhalation of airborne lead accounts for another 0.7 to 3.2 μg/day of uptake (6% of the total).

Figure 2 presents the next step of the analysis, the estimated distribution of average blood lead levels for children in Cairo generated by the IEUBK model on the basis of environmental

[4] Some participants in the LEAP workshops were concerned that the widespread occurrence of iron-deficiency anemia among Egyptian children could also affect the accuracy of blood lead levels predicted by the IEUBK model. Children and adults with iron-deficiency anemia tend to absorb lead from ingested food at a higher rate than people without this condition. Because the IEUBK model is based primarily on data collected in the U.S. where iron-deficiency anemia is not as common, it may underestimate the blood lead levels that will result in Egyptian children for any given level of exposure.

data. Results from this analysis indicate that approximately 64% of young children (ages 0 to 6) have blood lead levels higher than 10 μg/dL, and approximately 14% have levels higher than 20 μg/dL.

As stated earlier, the current consensus among many authorities is that blood lead levels of 10 μg/dL and higher should be cause for concern, and that levels of 20 μg/dL and higher warrant action to reduce the sources of exposure. The results of this analysis indicate, therefore, that more than half of the children in Cairo have blood lead levels that should be of concern to authorities, and a significant proportion have blood lead levels that warrant direct intervention to reduce those children's exposure to lead.

Readers should note that these results reflect an *indirect* estimate of blood lead levels, based on modeling and limited information about exposure pathways. The Egyptian Ministry of Health and Population is currently conducting a survey of blood lead levels in children living in Cairo, which will generate a direct estimate of lead exposure and may identify additional exposure pathways (see Section 2.5).

2.4 Conclusions from the Environmental Assessment

Results from the environmental assessment support the following conclusions:

- More than half of the children aged 0 to 6 years living in the Greater Cairo metropolitan area may have blood lead levels over 10 μg/dL, and a substantial proportion may have levels over 20 μg/dL. These levels justify public action to reduce lead exposure.
- Lead contamination in food contributes the highest proportion of estimated lead exposure.
- Lead contamination related to airborne emissions, including soil, dust, and airborne particulates, accounts for a substantial proportion of total estimated exposure to lead.
- Although it is not yet possible to estimate lead uptake rates from the use of kohl and ceramics in Egypt, evidence from other countries indicates that these sources may also contribute substantially to lead exposure in children and adults.
- Lead levels in soil and dust are relatively low and do not require remedial action to reduce exposure for the general public. (Lead concentrations in soil are high in certain locations, however, and remedial action may be warranted to reduce expo-sure for children who live or play there.)
- Lead in paint does not now present a significant exposure problem. Action is warranted, however, to ensure that lead levels do not increase in the future as private sector paint manufacturers increase their production.

2.5 Ministry of Health and Population Child Blood Lead Study

MOHP is currently conducting an extensive survey to determine the distribution of actual blood lead levels in children in Cairo and to identify the factors in children's environments and behaviors that contribute to their exposure to lead. The U.S. Centers for Disease Control and Prevention (CDC) is providing technical assistance to MOHP through CDC's Field Epidemiology Training Program (FETP).

The MOHP blood lead study includes the following three major components:

Figure 2
Predicted Distribution of Blood Lead Levels for Children in Cairo
Using the IEUBK Model

- measuring blood lead levels and testing for anemia in young children (2-6 years);
- collecting demographic and behavioral data to identify risk factors for the children whose blood lead is tested; and
- collecting environmental samples in and around households for a subset of the children whose blood lead is tested.

The MOHP blood lead survey began in March 1997. The complete survey will include all 22 zones of the Cairo Governorate. The first step is pilot-testing the survey in the Old Cairo zone, where approximately 240 children selected from randomly chosen households will be tested, once investigators obtain informed consent from parents. Preliminary results from the pilot survey should be available soon. Information collected during the pilot survey may result in procedural modifications. The survey will then be expanded to the remaining zones. MOHP anticipates that it will take approximately two years to conduct the entire survey.

The complete survey will provide a direct measure of blood lead levels in children aged 2 to 6 years. These data can then be used to validate model-based estimates of the magnitude and extent of children's exposure to lead and to identify additional risk factors that may not have been identified in the LEAP environmental assessment.

3 LEAD EXPOSURE IN EGYPT REDUCE

As discussed in Chapter 1, the GOE recognized excessive exposure to lead as a potentially important public health issue in the early 1990s. The first two major efforts undertaken by the GOE to reduce lead exposure were the development of a Lead Smelter Action Plan (LSAP) by MOSEA/EEAA and the Ministry of Petroleum's actions to significantly reduce the use of leaded gas in Cairo. More recent efforts have included MOHP's and the Ministry of Supply and Trade's investigation of and plan for reducing sources of lead contamination in flour and recent actions by MOHP to reduce the use of lead solder in food cans. These actions, as well as some additional policies, are described in more detail in the following sections.

3.1 Lead Smelters

MOSEA/EEAA has developed a Lead Smelter Action Plan (LSAP) to address the problem of pollution from secondary lead smelters in Cairo. Currently, the amount of lead recovered from batteries and other sources of lead by this industry is estimated to be between 35,000 and 45,000 tons/year. The demand for smelted lead is expected to increase steadily over the next decade, and MOSEA/EEAA is making efforts to control the amount of pollution released into the air by secondary smelters.

The LSAP has three objectives, which are to be met over the next five to seven years:

- upgrade the operation of large lead smelters;
- provide technical assistance to cooperative, licensed, small- and medium-sized lead smelters; and
- establish and enforce a comprehensive, countrywide, long-term solution to the lead pollution problem.

To date, a number of background studies have been completed, including a baseline study of the private-sector secondary lead smelters by MOSEA/EEAA and a technical analysis of the lead smelter industry completed by USAID as part of its preparations for the Cairo Air Improvement Project (CAIP).

The largest proportion of lead emissions from smelters will be eliminated under the first objective, upgrading the operation of large smelters, by mid-1998. The large smelters currently operating in Cairo (which include the government-owned General Metals facility and five smelters owned by one private-sector company) produce nearly 95% of the total smelted lead produced annually in Cairo. Under the LSAP, these two large lead producers will upgrade process equipment and install environmental control equipment. Assuming that emissions are proportional to the tonnage of lead produced, modernization should reduce stack emissions in Cairo by 80 to 90% and will be the most immediate and cost-effective means of achieving a large reduction in lead emissions. The steps to be taken under this objective, some of which are already underway, include reaching agreement on "state-of-the-art" process technologies and environmental control equipment, locating acceptable sites for relocation of the private-sector smelters (but not General Metals), identifying responsible parties for action items, deciding on whether imported scrap batteries are hazardous waste, identifying technical assistance needs for completion of a final upgrade design, locating funding sources for public- and private-sector construction, defining the construction process, and completing required training programs.

Seven smaller private smelters produce 5 to 10% of all smelted lead in Greater Cairo; they, along with the numerous smaller smelting

operations, will be the focus of an emissions reduction program under the second objective. Providing assistance to licensed small- and medium-sized lead producers is necessary to maintain the economic viability of both large and small smelters and to avoid introducing distortions in the smelting market. The small- and medium-sized smelters do not produce a large proportion of the smelted lead in Greater Cairo, but they are located in more densely populated areas and may have a greater impact on the neighboring populations than General Metals. Objective 2, assisting the small- and medium-sized smelters, has four main steps: selecting the most appropriate upgrade technology; locating funding sources for the implementation of smelter upgrades; providing technical assistance and training to the operators; and completing smelter upgrades and relocations. This objective will by completed by mid-July 2000.

LSAP's final objective, developing a comprehensive, long-term solution to the lead pollution problems associated with smelters, is to be completed by mid-July 2002. Within five years, all Egyptian companies engaged in lead smelting, forming and/or extrusion will meet a comprehensive set of enforced regulations at acceptable, permanent (long-term) sites, and existing sites will be remediated. This objective will be met through a series of activities:

- a review of all regulations and legislation;
- strengthened enforcement of legislation;
- development of a database and system to track the supply and demand of all lead-containing products and lead-bearing scrap;
- design and implementation of a public and media awareness campaign;
- development of remediation plans for all smelter sites;
- determination of the need for disposal sites;
- preparation of a contaminated soil disposal site;
- complete remediation at all sites;
- selection of sites for long-term smelter operations;
- development of an effective mechanism for protecting buffer zones;
- preparation and development of long-term sites for smelting operations;
- development of a comprehensive training program for all personnel involved in LSAP;
- revision of practices for collecting used batteries.

Some of these activities will be funded under CAIP. Funding and implementation mechanisms still need to be identified for other activities, including preparing contaminated soil disposal sites, completing remediation at the selected sites, preparing sites for long-term smelting operations, operationalizing the sites, and revising battery collection methods. It should be noted that the LSAP does not address unlicensed ("informal sector") smelters. They are probably an important source of lead pollution in some localized areas, although they do not account for a large proportion of smelted lead production.

3.2 Lead in Gasoline

The Ministry of Petroleum (MOP) has succeeded in reducing the amount of lead emitted from motor vehicles. The Ministry is reducing the lead content of gasoline by using non-lead gasoline additives (oxygenates), thus switching over to the use of unleaded gasoline. The Ministry achieved a 50% reduction in the lead content of gasoline in the first three years of this program. As of October 1996, MOP was able to ensure that 85% of the total gasoline consumption in Egypt was lead-free. The Ministry is using the oxygenate methyl tertiary butyl ether (MTBE) to substitute for tetraethyl lead and to improve combustion efficiency. This additive further reduces other noxious emissions. In order to switch over to unleaded gasoline, MOP has started upgrading the existing catalytic reformers in the refineries. Three new isomerization units are under construction, as is a new reformer in Upper Egypt.

MOP conducted a study with the Institute of Graduate Studies and Research at Alexandria University to investigate the contribution of leaded gasoline to lead in air pollution. This study was done in late 1995 before the complete phase-out of lead in Greater Cairo and some other cities. MOP is currently updating this study to determine the impact on air quality of the phase-out of lead from gasoline. Results should be available soon.

3.3 Lead Contamination in Bread

MOHP, through its Field Epidemiology Training Unit, recently investigated an episode of lead toxicity. Through an extensive investigation of blood lead levels and exposure factors, MOHP determined that the cause of the lead poisoning cases was ingestion of lead-contaminated bread, and that the source of the lead was a grain mill. Lead was being used to repair the axle assembly for grinding stones, and lead fragments were being shed into the flour as the mill operated. MOHP designed and implemented a mechanical retrofit to correct the situation in the implicated mill.

MOHP has subsequently initiated an investigation to determine the extent of the problem of contamination of flour during milling. Teams are currently sampling grain and flour at approximately 200 mills in six governorates (Aswan, Qena, and Sohag in Upper Egypt and Minouteya, Gharbiya, Daqahleya in the Delta). At each mill, three samples are being collected—one of grain, one of flour during milling, and one of flour produced by the mill. Each sample is large enough to allow for split analyses for interlaboratory comparison of results; each sample will be analyzed by both the MOHP Central Health Laboratory and a laboratory in the United States.

MOHP is also seeking approval from the Prime Minister for general application of the prototype retrofit applied to the mill in question. Retrofitting will require the Ministry of Industry to assure that the system works (i.e., does not jeopardize milling operations) and the MOHP to certify that it does in fact eliminate lead contamination. The cost of the retrofit ranges from LE350 to LE700, depending upon whether a new steel part is required. Previously, the Ministry of Industry had proposed certifying aluminum or epoxy as an appropriate substitute for lead. In discussions with MOHP, these options were rejected as impractical or no improvement in terms of potential public health problems.

The Ministry of Supply and Trade (MOST) has also announced that it will convert all government-run mills to an inherently lead-free steel cylinder operation by the end of 1997. This is not a viable conversion for smaller, private-sector mills for two reasons: the cylinder technology is considerably more complex to maintain and operate than the granite stone grinding technology; and the cylinder technology is only 65% efficient in producing bread flour (i.e., 35% of the grain by weight is milled into flour which is not suitable for bread), whereas stone-grinding mills are 95% efficient.

Most of the flour used for baking bread in Cairo and Alexandria is produced in government-run mills. If MOST phases out the use of stone-grinding by the end of this year, the remaining problems with lead contamination of flour will be in those areas of Egypt where private mills account for the larger fraction of flour production. This is the rationale behind MOHP's mill-sampling program.

3.4 Cans Used for Food Storage and Sale

Food cans manufactured with lead solder were used in Egypt in the past. Use of lead solder is known to be an exposure pathway for those consuming canned food, because lead often enters the food from the solder during the interval between packaging and consumption, particularly if the contents are acidic. In December 1995, after testing canned food samples, MOHP ordered the canning industry to stop using lead solders. In a relatively new regulation, Decree 85 (March 1997), MOHP has issued comprehensive controls over the use of lead in food containers. Article 1 of this decree prohibits the use of lead solder in food cans and directs that this method be replaced with electric welding. Article 2 stipulates that other food containers may be fitted with metal welding only if foodstuffs are packaged in bags made with suitable substances to isolate the food from the container's inner surface. (See Appendix A for a copy of this document.)

As a matter of policy, therefore, the Government of Egypt has addressed the issue

of lead in food containers and cans. MOHP's Central Laboratories conduct regular sampling and analysis of canned food to monitor this potential exposure route.

3.5 Other Policies

Aside from the initiatives described above, two additional policies provide formal support for the lead exposure reduction initiatives discussed later in this plan. One important 1957 Presidential Decree, Number 798, sets a number of constraints on the use of lead. Of most immediate relevance, this decree prohibits the use of lead in flour mills (Article 6) and requires that ceramic glazes be free of lead, as measured by a standard test of acidic leachate (Article 7). The other policy, a Ministerial Decree of MOHP proclaimed in June 1997, also prohibits the use of lead in repairing flour mills. These policies are both enforceable by MOHP. (See Appendix A for copies of these documents.)

Although the 1957 Presidential Decree is an important policy tool, its existence has not been widely known. It does, however, provide formal policy support for some of the measures adopted as a part of this plan, as explained in Chapter 5.

4 INSTITUTIONAL ROLES AND RESPONSIBILITIES

This chapter identifies the public- and private-sector institutions that will be involved in implementing the Lead Exposure Abatement Plan and describes the following:

- the role of each institution;
- the importance of coordination; and
- criteria for including NGOs.

4.1 Principal Institutions

Reducing lead exposure is a challenge that falls under the discipline of environmental health. The principal institutions for environment and health are the **Ministry of State for Environ-mental Affairs/Egyptian Environmental Affairs Agency** and the **Ministry of Health and Population**. These two institutions have in the past shared information on some activities and have begun to coordinate their activities in lead abatement. For every intervention contained in this plan, either MOSEA/EEAA, MOHP, or both together will serve as the lead institutions. For this reason, the plan requires that MOSEA/EEAA and MOHP develop workable and productive mechanisms for ongoing collaboration. (The institutional roles for each intervention are detailed in Chapters 5 through 7.)

There are several ways that MOSEA/EEAA and MOHP will establish links for coordination. First, for overall program coordination, each institution will designate a principal point of contact. The designated offices and individuals will provide joint leadership for implementing LEAP and for reviewing the program's progress on a regular basis.

MOSEA/EEAA and MOHP will adopt, as a matter of high priority, a memorandum of understanding (MOU) specifying the full range of activities and coordination mechanisms between them. The two institutions will also establish a system of compliance monitoring to track implementation of LEAP. And since cooperation with business interests, especially the private sector, is crucial for interventions concerning bread, ceramics, kohl, and paint, MOSEA/EEAA and MOHP will develop a coordinated approach to informing and supporting businesses, including the informal sector, in efforts to reduce exposure.

In addition, other more specific links are needed. Both the Environmental Quality and the Environmental Management sections within MOSEA/EEAA will be involved in implementing some of the interventions and, thus, will need to liaise with MOHP for executing and monitoring lead reduction efforts. The central department within MOSEA/EEAA for Environmental Awareness and Public Information will need to coordinate with the Health Education unit in MOHP to carry out the public awareness program. And finally, the Department of Environmental Health within MOSEA/EEAA must work collaboratively with the similarly titled department in the MOHP.

Additional units within each institution will be involved in executing the plan. In MOSEA/EEAA, the Technical Coordination Office for the Environment (TCOE) will continue to coordinate contacts with international donor agencies that are relevant to implementing the lead abatement plan. In MOHP, the Central Laboratory and the Maternal and Children's Health Department will be involved in testing, monitoring, and program development. MOHP has a more extensive formal structure than MOSEA/ EEAA and additional subunits that will have responsibilities for implementing LEAP activities still need to be identified. For example, the Department for Pharmaceutical Policies

should probably be involved in restricting the use of kohl made with lead, since this office has responsibility for registering cosmetics. In addition, the Occupation and Industry Division within MOHP's Preventive Health Sector should probably be involved in identifying and addressing lead exposure problems at work site locations.

4.1.1 Institutional Roles in Other Countries

MOSEA/EEAA and MOHP have examined the ways in which environmental and health agencies in other countries have shared responsibility for implementing lead abatement programs. The roles of the institutions are typically organized as follows:

- **Health agencies** and their field units usually ensure blood lead screening services for children, occupationally-exposed adults, and pregnant women; evaluate blood lead and environmental data to identify high-risk sources and populations; ensure that medical and environmental follow-up services are provided for lead-poisoned children; and coordinate preventive activities with environmental agencies.
- **Environmental authorities** usually identify high-risk lead sources and the populations to be examined in sampling efforts that are implemented jointly with health agencies; conduct monitoring, regulatory, licensing, and enforcement activities to reduce lead emissions into the environment and exposure of individuals to lead-contaminated media; and ensure that their regulatory programs reflect an integrated, multimedia approach to reducing environmental lead hazards.

MOSEA/EEAA and MOHP will adopt roles that are consistent with these international norms, to the extent of their regulatory authority.

4.1.2 Specific Responsibilities of Each Agency

This section describes in more detail the way in which responsibilities for specific interventions will be divided between MOSEA/EEAA and MOHP.

Beyond sharing responsibility for overall program coordination, MOHP will be responsible for completing the blood lead study currently underway in Cairo and for new blood lead screening of designated groups; evaluating blood lead and environmental data to identify high-risk sources and populations; coordinating prevention activities with MOSEA/EEAA; and ensuring that medical and environmental follow-up services are provided for lead-poisoned children. MOHP is also responsible for the following areas:

- providing leadership for retrofitting flour mills;
- developing intensified enforcement of existing controls on use of lead in cans, other food containers, and ceramics;
- helping to revise food intake standards for lead;
- enacting and enforcing new restrictions or prohibitions on lead use in kohl and paint;
- adjusting product labeling requirements to allow certification and labeling of kohl, ceramics, and paint;
- assisting in needed research;
- assisting in inducing technology change in the ceramics industry;
- contributing, along with several other institutions, to a carefully designed media campaign on lead awareness and refining the campaign as additional data become available;
- helping to close selected data gaps.

Beyond its general responsibility for joint implementation of LEAP, MOSEA/EEAA will selectively coordinate sampling efforts with MOHP, to identify high-risk lead sources and populations; enhance its multimedia perspective to work at reducing environmental lead hazards (especially via public awareness efforts); and conduct monitoring activities to encourage reductions in environmental exposure to lead.

MOSEA/EEAA must work collaboratively with other institutions, including MOHP, to strengthen direct regulatory controls on lead emissions and exposure. This point does not

diminish the crucial role MOSEA/EEAA has in implementing the Lead Exposure Abatement Plan. Indeed, it emphasizes MOSEA/EEAA's importance in developing and using supportive relations with business, including especially the private sector. Such ties are absolutely central for converting formally adopted interventions into working successes, and MOSEA/EEAA must be the lead institution for this initiative.

Among the additional specific responsibilities of MOSEA/EEAA in execution of the plan are the following:

- establishing restrictions prohibiting kohl manufactured with lead, galena intended for kohl manufacture, and lead paint from being imported into the country;
- requesting designation of kohl with lead as a hazardous substance;
- working with NGOs to communicate information regarding lead dangers, controls, and certification/labeling with the informal-sector organizations that produce and market kohl and paint;
- supporting and assisting the adoption of technical changes to reduce lead exposure hazards from ceramics;
- coordinating several other institutions in a carefully designed media campaign on lead awareness and refining the campaign as additional data become available;
- compiling all legislation, decrees, and regulations regarding lead and lead exposure, and distributing them to all relevant decision-makers and NGOs;
- taking the principal responsibility for establishing a joint MOSEA/EEAA-MOHP clearinghouse for information on lead exposure; and
- helping to close selected data gaps.

4.2 Other Government Institutions

Beyond MOHP and MOSEA/EEAA, a number of other institutions play significant supporting roles in LEAP. MOSEA/EEAA will establish an **Interministerial Steering Committee** for LEAP implementation as a means of involving other government institutions, either throughout the period of plan implementation or as necessary at particular times. MOSEA/EEAA and MOHP both recognize the importance of staying in touch with the other institutions as all of the planned activities move toward implementation.

The following institutions will be involved in implementing the plan. More information on the roles of these institutions is included in the descriptions of individual interventions in Chapters 5 through 7.

- **Ministry of Supply and Trade** plays a key role, along with MOHP, in executing an important intervention regarding the nation's flour mills and will also play a role in raising awareness among those who manufacture bread.
- **Agency for Standardization in the Ministry of Industry** will be active in altering or establishing sets of standards for lead consumption and lead use in manufacture. With the support of MOHP, the Agency will change the current food intake standards on lead to reflect the findings of more recent scientific evidence, establish a standard for lead paint to be used in regulatory enforcement, and adopt standards to be used in certification and labeling requirements for kohl, ceramics, and paint manufacture and marketing.
- **Ministry of Industry** will also be involved in setting up regulations that prohibit use of lead paint in toys or items intended for school use. And the Ministry's **General Organization for Industrialization** will be of use in helping to identify work sites where lead-containing materials are used.
- **Customs Authority of the Ministry of Finance** plays a significant role by enforcing the several import and export restrictions adopted by LEAP. In liaison with MOSEA/EEAA, Customs will provide surveillance to prevent importation of kohl with lead, galena intended for use in kohl manufacture, lead paint, and toys and school items with lead paint. With guidance from MOSEA/EEAA and MOHP, the Customs Authority is also to implement export controls regarding kohl with lead, ceramics

manufactured at low temperatures with leaded glaze, and any domestically produced lead paint. These latter controls are aimed both to restrict lead exposure beyond the Egyptian border and to create an incentive for manufacturers of these items to seek certification of no-lead or low-lead content and thus access to export markets.

- **National Research Center and the nation's universities** will be involved in selected data-gathering and analysis efforts, as deemed appropriate by MOSEA/EEAA and MOHP. The issues to be researched are as follows: finding suitable local substitutes for lead in ceramics frits fired at low temperatures, behavioral analyses of kohl and ceramics use, analyses of glazed ceramics, study of the ceramics industry, and selectively targeted additional sampling for lead content. Additional data on informal smelting operations would also be useful.
- **Ministry of Information** is to be centrally involved in public awareness efforts, as is the **Ministry of Education**. The latter institution may also develop materials that can be used to educate workers in the informal sector who use lead.
- **Insurance Division of the Ministry of Social Affairs** currently collects data on blood lead for purposes of monitoring occupational exposure; these data are to be transmitted to additional institutions under this plan. The division can also assist in the identification of work sites where lead exposure is now occurring, for use by other institutions in developing additional awareness efforts.
- **Ministry of Manpower and Migration** will help in expanded monitoring efforts as they relate to occupational exposure and will assist in the identification of work sites where lead exposure is now occurring, for use by other institutions in developing additional awareness efforts.

The nation's governorates will play a role in addressing issues needing further attention, including identifying work sites where lead is used and helping to implement interventions to reduce exposure and increase awareness.

4.3 Business and Nongovernmental Organizations

The **Federation of Egyptian Industries** (FEI) will have an important role in providing a regular and reliable set of links with the business community to enhance awareness and reduce lead use in manufacturing. This role involves connecting MOSEA/EEAA and MOHP and their intervention efforts with businesses involved in producing and marketing bread, kohl, ceramics, and paint.

FEI's role is pivotal for establishing liaison with the formal business community but cannot be expected to reach the broad informal sector, an issue likely to be a continuing and vexing challenge for LEAP implementation. This issue is particularly problematic since several of the lead exposure problems targeted by this plan find their roots in largely informal communities (kohl and ceramics production, in particular).

To reach this large and diffuse set of businesses, NGOs will have to play significant roles. Some NGOs have both the interest and the capacity to work with the informal sector to educate about policy requirements and opportunities (such as advantages of product testing and certification for some producers) and the dangers of lead exposure, as well as to assist in instituting appropriate technical changes. The key targeted parts of the informal sector are manufacturers and marketers of kohl, ceramics, and informal milk vendors. NGOs can also help with awareness efforts aimed at additional occupational exposure in the informal sector.

There are many NGOs in Egypt, including large numbers with some interest in environmental or health issues. Very few have had experience in dealing with lead exposure reduction, however. Rather than recommend specific NGOs for involvement in these critical tasks, this plan provides the criteria MOSEA/EEAA and MOHP will use to determine which NGOs to involve. NGOs with the following characteristics are likely to be effective partners in the LEAP effort:

- some experience with or strong interest in seeking lead exposure reduction;
- a strong and regular base in the community and willingness to work there;
- willingness to conduct careful assessments of community needs and resources;
- willingness to involve the communities of the informal sector in helping to design feasible solutions to lead exposure; and
- readiness to develop sufficient institutional capacity to be able to continue projects into the future.

5 TECHNICAL AND POLICY SINGLE-PATHWAY INITIATIVES: INTERVENTIONS FOR FOOD, KOHL, CERAMICS, AND PAINT

5.1 Introduction

This section of the plan describes a series of technical and policy actions to reduce lead exposure that arises from individual pathways: food, kohl, ceramics, and paint. The discussion for each pathway describes the following:

- the sources of lead contamination for the pathway in question;
- actions to reduce lead exposure, including rationale and stakeholders; and
- roles and responsibilities among organizations.

The interventions are coded with letters and numbers to assist in identifying the different types of actions that are necessary, as follows:

P = regulatory or economic **policy development and enforcement**
T = **technical interventions** (e.g., changes in manufacturing processes)
I = policy aimed at encouraging product-specific **information**
S = policy on **standard setting** and certification
A = **awareness**, education, and training
M = **monitoring**, evaluation, and coordination
D = additional **data gathering and analysis**, possibly leading to further intervention design.

Chapter 5 discusses interventions for individual pathways; Chapter 6 for cross-cutting efforts aimed at awareness and education; Chapter 7 for interventions aimed at strengthening monitoring, evaluation, and coordination; and Chapter 8 for a few issues needing further attention. A table is included at the beginning of each chapter listing the interventions discussed in that chapter. Table 5-1, for example, summarizes all of the technical and policy interventions for food, kohl, ceramics, and paint, including the institutions involved. For reference purposes, Appendix B lists all of the interventions by type (P, T, I, etc.) and by source (food, kohl, ceramics, and paint) along with the institutions involved.

The reader should note three additional organizational details. First, some interventions can be categorized under more than one of the designated types. Retrofitting flour mills to reduce lead exposure, Intervention T1/P1, for instance, is both a *technical* intervention and an action that implements an existing *policy*. It is coded to reflect both categories. Second, some distinctions are used to highlight helpful information rather than to establish rigid differences. Generating product-specific information (I) is obviously a kind of awareness and education initiative (A), but is coded separately because product-specific information has a somewhat different purpose than the usual kinds of awareness or educational efforts. Third, each intervention is assigned a number. The numbers simply reflect the order in which they are introduced in this discussion; P3, for instance, designates the third

Table 5-1 here

policy intervention described in this chapter. Table 5-1 summarizes all of the technical and policy interventions for food, kohl, ceramics, and paint, including the institutions involved.

5.2 Food

5.2.1 Sources of Lead Contamination

Some food items are significant sources of lead exposure in Cairo and, potentially, throughout Egypt. The extensive environmental assessment completed to support preparation of this plan identified three types of food that are important sources of lead exposure: bread, some types of produce, and milk that is distributed by informal-sector vendors.[5]

Using assumptions that reflect a typical Egyptian diet, the total estimated daily intake of lead via food is 66.8 μg/day for children aged 0 to 6 years. This daily intake level is considerably higher than the current Egyptian standard (35 μg/day) and 10 times the level now recommended on the basis of the most recent scientific evidence (6 μg/day). Furthermore, as shown in Table 2-2, when lead uptake from food is combined with exposure from soil, dust, air, water, and paint, the contribution of food to total lead uptake is estimated to be over 75%. (N.B. The IEUBK model used for these calculations does *not* include lead uptake from kohl or ceramics.)

Bread

Data generated by MOHP and MOSEA/EEAA clearly suggest that the principal source of lead in bread is the grain-milling process. There may be additional sources of contamination as well, such as the use of lead-containing fuels in bakery ovens and deposition of airborne lead-containing dust during transportation and vending, but the milling process is clearly the largest and most important source. Evidence from Egypt and other countries indicates that the source of lead in flour milling is lead shims that are used to repair a particular type of axle for millstones. As the shims wear away, they deposit fine lead particles into the flour during milling. Data from studies conducted by the MOHP indicate that cases of acute lead toxicity have been associated with consuming contaminated bread. Given the importance of bread in the Egyptian diet, this exposure route is a serious matter requiring immediate attention.

Produce

Significant levels of lead contamination were found on leafy vegetables (e.g., lettuce, kale, and parsley), potatoes, and cucumbers. The sources of lead contamination in produce appear to be dust that has settled onto the surface of the produce during its growth and harvesting, and soil particles from agricultural fields that adhere to the produce. Dust may be the more important source for leafy vegetables, because of their large surface area, and soil may be the more important source for potatoes (a root crop) and cucumbers (often grown with fruit lying on the ground). In all of these instances, the lead level can be greatly reduced by simple washing.

Milk from the informal sector

The term "milk from the informal sector" refers to fresh milk sold from bulk containers carried by private vendors on motorcycles. Samples collected from such vendors had consistently higher concentrations of lead than samples of fresh milk, processed milk, and other dairy products taken from commercial dairies and retail stores. The most likely source of lead in milk is lead-soldered metal storage cans. Metal containers are preferred for storage because they can be sterilized easily. However, milk is acidic and will leach lead from the cans if they have been sealed with lead solder. It is also possible that dairy cattle have a body bur-den of lead which contaminates fresh milk and, furthermore, that some lead contamination comes from roadway dust or particulate matter from vehicle exhaust during transport and

[5] The study also found low levels of lead in some samples of other foods, including processed meats, grains, beans, and dairy products. However, the data were not consistent and do not support defining interventions for these food items at this time. Several participants in the workshops also noted that milling equipment used to grind flour is also used to mill rice. Further study of these potential lead sources is warranted; see Intervention D4, Chapter 7.

vending. Additional study is needed to identify the source of lead in milk from informal vendors (see Intervention D4, Chapter 7).

5.2.2 Actions to Reduce Lead Exposure

Bread

Bread is a central part of the Egyptian diet and the number of people potentially affected by this pathway is very large. It is impossible to distinguish lead-contaminated from lead-free bread by visual inspection alone, so public awareness efforts would not be useful. The most appropriate intervention, therefore, is to eliminate the source of contamination by altering or replacing the relevant milling equipment in flour mills.

> ***Intervention T1/P1.*** Identify and retrofit all flour mills that currently have a design susceptible to lead use and, thus, flour contamination.

This is primarily a technical intervention. It will require inspecting several thousand mills in dispersed locations and retrofitting those that use the particular milling equipment known to be the source of the problem. An effective retrofit has been identified by MOHP and the Ministry of Supply and Trade (MOST). Cost estimates suggest that the retrofit can be implemented at a cost of several hundred Egyptian pounds per mill.

The MOHP and MOST have already begun inspecting public mills and the MOST is apparently committed to replacing equipment as needed in the largest public mills. Plans need to be developed for extending the inspection effort to private mills, particularly those that serve small cities and villages, and for providing technical and/or financial assistance to the owners of private mills in which the MOST may not be prepared to invest its own resources.

To the extent that private mill owners will have to bear the financial costs of retrofitting equipment at their mills, this is a policy intervention as well as a technical intervention. Two GOE policy actions address this issue. First, in 1957, Presidential Decree 798 established a now long-standing government policy prohibiting lead use in repairing flour mills. Forty years later, a June 1997 directive from the Minister of Health and Population stipulates that lead should not be used in repairing flour mills (both documents are included in Appendix A). These policies provide authority for requiring private mill owners to take the necessary actions.

Alerting flour millers to the problem and providing technical information on how to eliminate it will be an important part of the educational initiatives for specialized audiences, discussed in Chapter 6 as part of the public awareness program.

The stakeholders for this set of actions are numerous: all consumers of bread in the country; all milling operators using lead in their apparatus; and public authorities with jurisdiction and responsibility for flour milling, distribution, and public health. Public mills fall under the jurisdiction of the MOST, which has a Department of General Administration for Distribution, and within that unit, a Department for Flour.

Produce

Lead exposure from produce is not likely to be reduced through technical and policy changes. Rather, because the lead can be removed simply by washing the produce with water, the most appropriate form of intervention is public awareness campaigns among growers, vendors, and consumers. All three groups will be urged to wash produce, i.e., when it is harvested, before it is sold, and after it is purchased, respectively. Consumers can then take actions to limit their exposure by buying produce that has been washed and/or washing it after the purchase.

The stakeholders for this effort include consumers, producers, and vendors.

Milk from the informal sector

As indicated above, additional study is needed to identify the primary source(s) of lead in milk from the informal sector. The GOE has recently established a policy, MOHP Ministe-rial Decree 85 of 1997, which prohibits the use of lead solder in food cans and other food containers (see Appendix A). If the primary source is lead solder in metal cans, as suspected, reducing lead

exposure from informally vended milk might require introducing lead-free, sealed containers, which could be difficult to enforce and might result in higher prices to consumers. If something other than lead-soldered cans is the primary source of lead, then appropriate actions will need to be defined.

If the source of lead in milk cannot be eliminated, then the public awareness campaign should include messages encouraging people to use other sources of milk, particularly pregnant women and caretakers of young children. This may be difficult, however, because "fresh" milk is perceived by some consumers to be more nutritious and to have a better taste than processed, packaged milk.

The stakeholders for these actions are primarily consumers, informal sector vendors, and milk producers, plus the MOHP as the cognizant regulatory authority.

All Foods

Two additional policy or enforcement interventions pertaining to all types of food are also included in this plan. The first concerns food stored or distributed in cans and other metal containers:

> ***Intervention P2.*** Develop intensified enforcement of existing controls on lead use in food cans and other food containers (Ministerial Decree 85, Articles 1 and 2 [1997] of MOHP).

The principal stakeholders in this intervention are consumers of canned foods, the canning companies, and MOHP, which is charged with ensuring the safety of the food supply. Intervention P2 calls for regular monitoring of canning and food packaging processes in existing or new companies to make certain lead solder is not introduced. For companies that do not use lead solder, the monitoring will be sporadic; it is assumed that companies have little incentive to shift production processes to introduce or reintroduce lead solder in place of electric welding.

The second policy intervention concerning all types of food addresses guidance for limits on total lead exposure from food consumption:

> ***Intervention S1.*** Revise the lead intake standard for food from the equivalent of 35 μg/day to 6 μg/day.[6]

The Egyptian standard for acceptable lead intake needs to be lowered. The standard currently set in Egypt derives from older recommendations of the World Health Organization. WHO's most recent recommendations, however, state that no safe level of exposure has been found for lead and emphasize using a preventive approach to eliminate sources of lead to the maximum extent feasible.

The figure 6 μg/day is currently being used in the U.S. as an informal guideline, based on analyses with the IEUBK model which show that this level of intake, when combined with background intake levels for other media, results in over 90% of children having blood lead levels lower than 10 μg/dL. This figure (6 μg/day) has not been set as an acceptable maximum lead intake level in the U.S., since official policy reflects the fact that no safe level of lead consumption has been defined. Readers should recall that the analyses conducted to support development of this plan indicate that the current dietary lead consumption of a typical Egyptian child is 66.8 μg/day, far exceeding even the current Egyptian maximum.

Revising the lead intake standard would serve as an official statement from the government and a signal to other institutions about the importance of lead exposure. Its implementation, of course, will not by itself reduce lead exposure, but it would be a supportive step in encouraging changed behavior and reducing lead consumption.

Stakeholders for Intervention S1 include all Egyptians as food consumers, particularly children as the most vulnerable; MOHP; and the Agency for Standardization in the Ministry of Industry, which develops and enforces a variety of standards including those for heavy metals in food.

Finally, it must be said that improving the enforcement of existing policies is a major concern for lead abatement. The fact that bread

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[6] The current standard is stated in terms of weekly intake at a level equivalent to 35 μg/day.

contaminated with lead from flour milling is now an issue, despite the decree of 1957 which was designed to address this problem, points to the crucial role of enforcement in controlling lead exposure. Enacting policy provides only an initial step; it must be followed by effective and sustainable patterns of enforcement. This point underscores the need for decision-makers to stay better informed about existing policy. Intervention A3, discussed in Chapter 6, aims to assist in this regard in a comprehensive and general fashion.

5.2.3 Roles and Responsibilities

Intervention T1/P1 to resolve the problem of lead contamination from flour milling equipment is a matter of highest priority and will be implemented at once. MOHP is currently evaluating flour mills in Egypt to determine which are likely to produce lead-contaminated flour. MOHP and the Ministry of Supply and Trade have also investigated options and costs for retrofitting mills to eliminate the problem. These two authorities will coordinate their efforts closely to guarantee the successful resolution of this problem, and they will continue to monitor flour-milling operations to prevent its recurrence. Their initial efforts will focus on the public mills and those operated under contract to MOST. Plans still need to be prepared for extending a program of inspections and retrofitting to private mills, particularly the smaller mills that serve small cities and villages.

Intervention P2, enforcing the existing controls on lead in cans and other food containers, is completely within the jurisdiction of MOHP.

Intervention S1, establishing a new guideline for lead intake from food, is within the authority of the Agency for Standardization in the Ministry of Industry, and will be undertaken in cooperation with the MOHP. These institutions will then need to inform the appropriate audiences about the revised guideline.

5.3 Kohl

5.3.1 Sources of Lead Contamination

Kohl, a cosmetic, is a fine powder that ranges in color from black through various shades of grey to white. It is applied to the eyelids and has the appearance of mascara. It is typically applied to the inside of the eyelid (the conjunctival surface) by dipping an applicator rod into the fine powder and streaking it across the eyelid.

In Egypt, as in a number of other countries, kohl has a long history of use among some segments of the population. Its use is supported by a number of beliefs, including strengthening and protecting the eyes against disease, improving appearance, showing support for religious tradition, and warding off evil spirits. Kohl is used by adults and is also applied to the eyes of infants and small children. Sometimes it is used on the raw umbilical stump of newborns in the erroneous belief that it promotes a beneficial astringent action. Kohl traditionally had been made from antimony sulfide, but lead-based components have often been used in recent decades because of the scarcity of antimony. Lead sulfide, or galena, is now commonly used as a base material for preparing kohl.

Samples of domestic (Egyptian) and imported kohl were tested for lead content. Forty percent of the domestic samples and 70% of the imported samples contained high levels of lead; they were prepared from galena. The other samples contained almost no lead; they were apparently prepared with ash from burning various plant materials.

It appears that the dominant pathway for lead exposure from kohl is ingestion via the fingers. For children in particular, applying kohl causes their eyes to tear and, when they rub their eyes, particles of kohl adhere to their hands. Children commonly place their fingers in their mouths, thereby ingesting the lead. It is also possible that some of the material is washed into the nasolachrymal duct when tears form after kohl is applied. Adults preparing food with their hands can also contribute to ingestion indirectly by depositing fine grains of kohl from their hands onto food.

The health hazard associated with use of lead-based kohl has been demonstrated on many occasions and in many countries. Very high blood lead concentrations have been traced conclusively to kohl use; kohl has even caused death in some cases. Studies in several locations outside Egypt demonstrate that carefully matched sample populations, differing primarily in kohl use, can have very different blood lead concentrations, with kohl users having significantly higher lead levels.

In Egypt, the level of awareness about the dangers of lead exposure through kohl use is extremely low. And intervention efforts in other countries have shown that it is very difficult to curtail the use of kohl, a widely accepted traditional practice. It is also very difficult for a consumer to tell whether a given sample of kohl does or does not contain lead.

The modeling results used in the background work for this plan generated a predicted blood-lead distribution for children based on data from Greater Cairo. It is important to note that these results did not account for use of kohl (or ceramics), since these sources of exposure could not reliably be incorporated into the model. Thus, it is likely that the lead exposure for subsets of the population in Egypt (those who use kohl with lead and/or those using low-fired lead-glaze ceramics) is higher than the modeling results indicate. Kohl must be treated as a major source of lead exposure for those Egyptians who use it on a regular basis, particularly children.

How widespread the use of kohl is in Egypt is not clear. The product is readily available at many locations in Greater Cairo, suggesting that a large segment of the Cairo population purchases and uses kohl. Some people believe its use is even more common in rural areas. Domestically made kohl—often produced at home or in the informal sector—is in common use, and imported varieties including some proprietary products are also available. Samples analyzed from several markets in Greater Cairo indicate that different kinds of kohl—with and without lead—are often sold in the same shop. Kohl is often brought into the country from abroad by individual travelers, many of whom return from Haj with gifts of kohl for family and friends. In all these cases, kohl is not labeled to identify its lead content.

5.3.2 Actions to Reduce Lead Exposure

The use of lead-containing kohl, especially with infants and children, is a serious public health problem requiring active efforts to change behavior and eliminate the exposure. Because kohl is manufactured in many places, by many firms and individuals, it is difficult to address. It is also brought into the country by individual travelers whose small purchases abroad are nearly impossible to control. Its use dates back for centuries and is often woven into the fabric of traditions within families and communities. In other countries, efforts to educate kohl-using populations about the dangers from lead have had mixed, often disappointing, results in terms of changing behavior. Even in instances where family members have become seriously ill from kohl use, the practice has continued despite public health professionals' best efforts to alter it. Kohl use is associated with religious practices and is therefore even more difficult to change than other traditional practices. In Egypt, the current level of awareness about this issue is exceedingly low, even among public health experts.

Fortunately, the action needed is not eliminating the practice, but rather encouraging kohl users to purchase lead-free forms. All interventions, including awareness efforts, must avoid the argument that kohl *per se* is the problem. Challenging the use of kohl in general would likely discredit any intervention campaign, needlessly antagonize kohl producers and longtime users, and possibly provoke resistance and criticism from the religious community as well. Unfortunately, distinguishing kohl containing lead from forms without lead requires laboratory testing. For this reason, measures need to be instituted to control the production methods and distribution of kohl.

The interventions for kohl, therefore, focus on three types of action:

- developing awareness among producers and consumers about the dangers of kohl with lead and the need to choose safer substitutes;
- developing a certification and labeling program to provide information to consumers

to allow them to make informed choices and to create an incentive for producers to shift to non-lead ingredients; and

- controlling and eliminating the manufacture, distribution, and sale of kohl with lead in domestic production and through importation.

Producers and consumers are widely dispersed and difficult to regulate, and current practices are supported by centuries of tradition. For these reasons, interventions need to be implemented carefully and over a long period of time to have the intended impact. Short-term results may be disappointing and/or difficult to measure. The importance of the problem for public health, however, is sufficiently great to warrant every effort possible.

Two interventions specifically aimed at addressing the problem of lead in kohl are the following:

Intervention P3. Request designation of kohl with lead as a hazardous substance, prohibit lead use in kohl, prohibit importation of kohl with lead or of galena for kohl manufacture.

Intervention S2/I1. Adjust product labeling requirements to allow kohl manufacturers to seek certification and labeling of lead-free contents; establish access to certification centers in the community.

In part, Intervention P3 involves an extension of Presidential Decree 798 (1957) and existing MOHP authority to license and regulate cosmetics. It is likely that kohl with lead will continue to be a problem, however, despite authorities' best efforts to eradicate it. A realistic aim is to significantly reduce the availability and use of lead-contaminated kohl. Intervention P3 is feasible under the current extent and distribution of authority and procedures among several official bodies.

The stakeholders are producers and consumers of kohl; the governmental bodies that will be involved in control efforts—MOSEA/EEAA, MOHP, and Customs; and NGOs as liaisons with the informal sector. Users of kohl have an interest in well-enforced controls, to protect their health without requiring them to give up their use of the product. Some kohl producers, particularly those who sell kohl that does not contain lead, will benefit in a competitive sense by effective controls. Others, facing restrictions on their product, can be expected to try to evade the controls. For this group in particular, reinforcement of the controls with additional actions, sketched below, can help to encourage increased compliance. With careful effort, the costs of these control measures can be minimized.

The certification and product labeling action, Intervention S2/I1, is intended to create an incentive for kohl producers to remove lead from production. Stakeholders are producers and consumers of kohl, once again, as well as authorities concerned with the public health and official standards. Laboratories involved in certification processes are also potential stakeholders. And NGOs—to the extent that they are involved in contacts with the producing and consuming communities, particularly producers in the informal sector—may also be considered stakeholders.

As explained for Intervention P3, kohl consumers have much to gain through an intervention such as this. Readily available information can be used to guide their purchase and use decisions.

Producers' interests are more complex to assess. Intervention S2/I1 is designed to introduce an altered system of incentives into the production and marketing of kohl. Incentives can reduce the tensions between regulator and regulated by creating some commonality of interests. Producers could gain access to export markets, a point likely to be significant for a few of the larger manufacturers, but not for many of those in the informal sector. For all, however, an additional incentive is created indirectly via consumers. As consumers learn about the problems of lead exposure and especially about the contents of the kohl they purchase and use, some of them are likely to ask for non-lead products and to avoid producers and sellers whose products contain lead. Increased consumer knowledge is particularly likely if clear labeling measures are pursued, along with the awareness measures (discussed in Chapter 6). Much of the

production of kohl is carried out in the informal economy; producers are numerous and dispersed. Therefore, the certification and labeling intervention will be treated as an option, rather than a requirement, for producers. If certification becomes a requirement, it may drive the production process even further from contact with authorities, a result that benefits no one and makes behavioral change even more difficult over the long run.

Controls, even those supplemented with labeling and certification requirements, are likely to be relatively ineffective unless they are accompanied by an awareness campaign to alert the broader public to the hazards of kohl with lead. Creating public awareness also means providing clear information to kohl producers about how to comply without sacrificing profit or market—indeed, explaining why they may have something to gain by using safe ingredients. These awareness components are addressed in Chapter 6.

5.3.3 Roles and Responsibilities

Intervention P3 consists of a set of mutually supportive actions taken by several authorities. MOSEA/EEAA will use its existing authority to designate kohl with lead and galena intended for kohl manufacture as hazardous substances restricted for importation. Enforcement responsibility for this restriction rests with the Customs Authority. Kohl with lead could be banned from import, even by Egyptians returning from abroad, although it would be difficult to enforce such a measure.

MOSEA/EEAA will also formally inform the MOHP of its action and request, with evidence, that kohl be designated as a regulated cosmetic by the MOHP. This step by MOSEA/EEAA, warranted by available scientific evidence, will be taken and justified in a manner consistent with the MOSEA/EEAA general strategy for managing hazardous substances, now under development.

The MOHP's Department for Pharmaceutical Policies regulates cosmetics as part of its normal responsibilities and can include kohl in items under its supervision. There is ample evidence in the sampling results for this plan and in the accumulated scientific literature to designate lead-contaminated kohl as dangerous (see Chappell et al. 1997). Under these circumstances, MOHP has the authority to prohibit the production of kohl with lead.

MOSEA/EEAA and MOHP will initiate awareness efforts for the public as well as targeted information to the kohl-producing community. This action will serve primarily as an awareness step, for instance, by placing signs in airports, rather than as direct regulation *per se*.

Intervention S2/I1 is one of three labeling and certification interventions included in this plan. MOHP, an authority on product labeling, is the appropriate institution to determine which laboratories are or can be designated as approved certification facilities. Private laboratories may be considered, both to ease budget pressure on MOHP and to encourage the development of the market economy. The Agency for Standardization in the Ministry of Industry will be involved in determining specific standards to apply to the certification process. And the Customs Authority will enforce the export license provision. MOHP will take overall responsibility for this intervention. NGOs should be involved to work with the small and informal kohl producers. MOSEA/EEAA and MOHP will assist NGOs in communicating with the small producers about the regulatory requirements and health issues.

Intervention P3 can be approved and implemented without delay. Intervention S2/I1 will be implemented in coordination with the development of certification procedures and the approval of certification facilities for other pathways. MOHP will begin these efforts without delay, and the full certification and labeling program can then be implemented.

5.4 Ceramics

5.4.1 Sources of Lead Contamination

In Egypt as in numerous other countries, traditional ceramics pose a health risk from lead that can leach from the glaze into foods. Lead-

glazed ceramics have been used for centuries, and the general public does not identify such pottery or ceramics as a source of lead exposure.

Results from the environmental sampling in Greater Cairo, conducted as part of the background work for developing LEAP, strongly suggest that ceramic dishes and cookware with lead-based glazes are a potential source of lead exposure in Egypt. The values reported for the leachate test conducted as part of the environmental sampling for LEAP indicate that food cooked or stored in traditional, lead-glazed ceramics could be a highly significant source of lead exposure. Separate analyses of the glazes confirmed that the source of lead is the glazes.

Not all ceramics in Egypt are problematic. Ceramics made without lead glaze as well as those with lead glaze but fired at sufficiently high temperatures (above 990ºC) do not pose problems for food use, although if lead is used in the production process, workers are exposed to lead. Exposure for those using the ceramics originates if the ceramics with lead glaze are fired in traditional kilns at low temperatures (800-990ºC). A temperature range of 800-990ºC is sufficiently high to melt the lead but not high enough to bind the lead glaze permanently to the clay. Lead becomes available when the glazed surface comes in contact with mildly acidic substances (which are commonly consumed in Egypt, including such items as casseroles cooked with tomatoes).

It is difficult to estimate the impact of ceramics in the lead burden in children. In general, children and women who report using lead-glazed ceramics to cook and/or store food in countries other than Egypt have, on average, an excess of 3-4 μg/dL lead in their blood. However, cases of acute lead poisoning have been confirmed and reported in the scientific literature, for instance in Mexico.

The background sampling and analyses conducted for the plan did not include comprehensive studies of technical issues surrounding ceramics manufacturing in Egypt, the structure of the ceramics manufacturing community (although it is well known that many potters work in Greater Cairo, and a significant portion of the market is supplied by the informal sector), or the extent to which lead-glazed ceramics fired at low temperatures are in use in Egypt. It is clear, however, that a potentially significant portion of the ceramics intended for cooking and storing foods is susceptible to lead leaching and thus constitutes a risk of lead exposure to those using it.

As with kohl, there is little public awareness in Egypt of the dangers of lead exposure from ceramics. The large companies are managed by individuals knowledgeable about the issue, and some potters realize that avoiding lead makes their products more marketable, but the general public is almost completely unaware of the dangers, as are many small-scale potters.

5.4.2 Actions to Reduce Lead Exposure

The lead exposure problem arising from ceramics needs to be treated as a significant public health issue. Unfortunately, as with kohl, the problem is difficult to address effectively in the short term. Production of ceramics is dispersed, knowledge of the extent of lead use is limited, and public awareness of a problem from leaching is virtually nonexistent. Furthermore, many potters live at near-subsistence levels, and thus, trying to implement technical changes could create serious social and economic problems for them and their families.

The most appropriate set of interventions, therefore, needs to take into account this array of circumstances. Controls are necessary but must be accompanied by both incentives for change and technical assistance to aid potters in changing their working conditions and production processes. The interventions reflect this array of needs.

Intervention P4. Develop intensified enforcement of existing approved controls and testing procedures for glazed ceramics (Presidential Decree 798 [1957] Article 7).

Intervention S3/I2. Adjust product labeling requirements to allow ceramics manufacturers to seek certification and labeling of lead-free contents. Establish access to certification

centers in the community. Certification of lead-free products, which would create export opportunities, could be conducted by authorized private-sector certification facilities.

Intervention T2. Conduct studies of local ceramics materials to locate possible substitutes for lead in frits. Replace lead in frits with a suitable alternative.

A boron-based substitute is feasible in some locations.

Intervention T3/P5. Make changes in ovens for ceramics to assure firing at a temperature above 990ºC. Implementation can be encouraged through the use of economic incentives, if studies indicate this step is necessary and feasible.

For the full set of interventions specified, the principal stakeholders are large ceramics firms and micro-enterprises in the industry; potters and their families, both as producers and as workers susceptible to occupational or secondary exposure; the food-consuming public who use ceramics for cooking, food storage, and/or serving food; public health, standard-setting, and environmental authorities; researchers interested in developing more complete information on the ceramics issue; and NGOs interested in assisting communities of potters and their families as well as in helping the broader public.

All the above, except producers, have an unambiguous interest in changing ceramics production to solve the lead exposure problem. The interests of potters are more complex. Those already avoiding lead in production as well as those who have invested in high-temperature electric ovens will find their interests served by controls as well as the certification process. The large firms are already in this position. Potters using lead may suffer from lead exposure through work, as may their families. In many instances, the ceramics are made at workers' homes, and children as well as others assist during the process. All can be vulnerable to significant contamination. For this set of reasons, potters do have positive interests in seeing these interventions succeed.

The informal sector is the most important locus for action, since this segment of the ceramics-producing community is the major source of lead-glazed ceramics. But artisans often find it difficult to change production techniques and materials, especially when such changes are costly or require familiarity with new procedures or techniques. The resources needed for certification of lead-free products will also increase the price of producing ceramic ware. These factors will make it more difficult for artisans to make a profit; another disincentive to them is that the products are attractive now to consumers because of their low cost. So it can be expected that there will be some suspicion and resistance to new requirements, especially in the informal sector.

It is important to assess, in advance, the effects on the informal sector of decreasing the demand for lead-glazed ceramics. First, a segment of the population makes its living from the production of these ceramics; usually, it is their only source of income. An increase in controls and public awareness may lead to a collapse of this informal market, leaving many families of potters in poverty with no source of income. In addition, the cultural value of this craft should also be taken into account. It is possible that successful implementation of this set of interventions could damage a tradition that has national value. For these reasons, it is extremely important to consider how to preserve the informal sector's involvement in ceramics while assisting workers and artisans in making the products safe to use. An emphasis merely on control and decreasing demand would have significant negative consequences.

Intervention P4 highlights an existing policy that prohibits the use of lead in ceramics glaze; Presidential Decree 798 of 1957 specifies a procedure for testing ceramics leachate and thus checking compliance with the regulatory measure (see Appendix A for the text of the Decree). In recent years, however, this decree has not been enforced. As with flour milling, Intervention P4 calls for enforcement, rather than policy enactment. Enforcement in this case is likely to be difficult and require time, patience, and additional

knowledge about ceramics production in Egypt. The specific quantitative standards involved in Intervention P4 will be set at currently accepted international safety standards for enforcement.

For ceramics, Intervention S3/I2 is comparable to Intervention S2/I1 for kohl, with the same intent and design (see Section 5.3.2, above). Specifically, Intervention S3/I2 is designed to introduce an altered system of incentives into the production and marketing of ceramics. Incentives can ease the burden of controls by creating some commonality of interests between regulator and regulated. Potters will gain access to export markets, a point likely to be significant for some of them but not for many of the smallest producers, including those in the informal sector. For all, however, an additional incentive is created indirectly via the market. As consumers learn about the dangers of lead leaching from ceramics into food (both from labeling and the awareness campaign described in Chapter 6), some of them will become more selective in their purchases and use. These more knowledgeable consumers are likely to ask for non-lead and/or high temperature-fired products and to avoid producers and sellers who cannot provide safe products. This increased level of consumer knowledge is particularly likely if labeling is pursued along with the awareness measures. For ceramics as for kohl, a large portion of production is in the informal economy, and producers are numerous and dispersed. Therefore, the certification and labeling intervention will be treated as an option available for producers rather than a requirement. If it were a requirement, it could drive the production process even further from contact with authorities, a result which would benefit no one and would make behavioral change even more difficult over the long run.

Intervention T2 involves substituting another ingredient for lead in glazes. Promotion of new frit materials will also be needed. Suitable substitutes are heavily dependent on locally available materials, including composition of the local ceramics themselves. In some settings, a boron-based substitute can work well, but it is not yet known if this change is feasible in Egypt. Additional testing is required, but a substitution widely adopted could eliminate the problem for pottery that is newly marketed. A critical factor for this intervention is the number of suppliers of frit materials. If there are relatively few suppliers, the elimination of lead from glazes at their source would clearly be the preferred intervention.

Intervention T3/P5, upgrading the ovens used by many potters, has two main purposes: raising the temperature in ovens permanently binds the lead to the clay and reduces leaching, and the same increase in temperature enhances the possibility of substituting another substance for lead in the glaze. Electric ovens are available in Egypt, but many potters do not have them. Some potters who are using them are doing so illegally, thus complicating any regulatory or enforcement efforts. Intervention T3/P5 will be considered an incentive-based rather than a regulatory measure, since heavy-handed controls would probably have little impact and would reduce rather than increase contact between authorities and the informal sector. Making the technical changes necessary for this intervention will be costly for many potters, especially those existing in marginal circumstances. These individuals require information, technical help, and in some cases financial assistance to shift technology.

As alluded to above, this set of interventions must be supported by a public awareness campaign and a specific awareness program directed at potters. Without this two-pronged approach, these other measures are not likely to be effective.

5.4.3 Roles and Responsibilities

Intervention P4 will begin immediately. The MOHP and the field health structure have the authority, indeed the obligation, under existing policy to enforce controls. The health authorities will need to use sensitivity in addressing the precarious situation of many potters and encouraging them to alter production materials or processes rather than threatening to drive them out of business. But the controls will be treated as real requirements. (To carry out these steps, MOHP will need to enhance its inspector training program.)

Intervention S3/I2 is one of three labeling and certification interventions included in this plan. MOHP, an authority on product labeling, is the appropriate institution to determine which laboratories are or can be designated as approved certification facilities. Private laboratories can be considered, both to ease budget pressure on MOHP and to encourage the development of the market economy. The Agency for Standardization of the Ministry of Industry will be involved in determining what precise standards to apply to the certification process. And the Customs Authority will enforce the export license provision. MOHP will take overall responsibility for this intervention. If appropriate, NGOs can be identified to help reach the small and informal potter communities. MOSEA/EEAA and MOHP will work with such NGOs, assisting them in communicating with small producers.

Certification steps and procedures for ceramics will follow the same pattern used for kohl and other media. MOHP will begin these efforts without delay, and the full certification and labeling program will be implemented as soon as the specific features are developed.

The other two initiatives for ceramics, Interventions T2 and T3/P5, are primarily technical measures. The former, involving material substitution in potters' frits, requires focused research assistance by some combination of MOHP, MOSEA/EEAA, university scientists, and/or the National Research Center. MOHP along with MOSEA/EEAA will determine which participants will develop the information on substitutes for lead in ceramics. Getting potters to make the changes, once the knowledge is available, will require assistance from NGOs that are trusted in the local communities; these NGOs, in conjunction with MOSEA/EEAA and MOHP, will assist potters in the informal sector to change frits. As knowledge of substitutes develops within the potter communities themselves, the process of change should accelerate. The second technical change, upgrades or changes in ovens, is highly desirable from a public health standpoint but could be costly to potters, particularly those living and working in marginal circumstances. NGOs, working in conjunction with MOSEA/EEAA and MOHP, can assist in helping to change or upgrade ovens. In addition, MOSEA/EEAA will determine whether incentives might be provided from the Environmental Protection Fund.

Both technical interventions require early information-gathering, followed by action as soon as appropriate NGOs are identified and a plan of action among the MOSEA/EEAA, MOHP, and the various NGOs is established.

5.5 Paint

5.5.1 Sources of Lead Contamination

As mentioned in Chapter 2, leaded paint is not a major problem in Egypt. The public paint manufacturer stopped using lead in residential and interior paints some years ago, but in the past few years, there has been significant privatization in the paint industry. There are now a few dozen domestic private manufacturers of paint, and their market share is growing. One estimate is that these producers represent approximately 40% of the market. Some paint is also produced informally, although not a large portion of the total volume. There are currently no policy controls for the use of lead in paints, nor are there import or export restrictions regarding leaded paint. Some manufacturers are said to be using lead in their processes. Sampling conducted as part of the background analysis for this plan indicated that most paint appearing for sale is either lead-free or with low levels of lead. Only one sample, with lead at 19,200 ppm, was above the limit commonly used to define lead paint in other countries (5,000 ppm).

Paint on children's toys, materials used as school supplies, and other items manufactured specifically for use by children were not sampled. These items are priority areas for control of lead paint, however, since children chew on them and they represent pathways for ingestion of lead. In studies conducted elsewhere, lead paint has been found in significant quantities in toys and school equipment.

5.5.2 Actions to Reduce Lead Exposure

Adoption of controls on lead paint will occur now. Although sampling results suggest that leaded paint is currently a minor issue, the fact that lead paint is beginning to appear on the market indicates that without controls, the problem will grow. As shown in other national settings, once the use of lead paint begins, it is a nearly intractable problem to solve: when the paint has been applied in thousands or millions of dispersed sites, there is no easy, inexpensive, and effective way to prevent exposure to children. Controls on import, export, and manufacture are far superior to any remediation programs in the future.

Stakeholders (aside from those at risk of exposure, primarily children) of exposure are purchasers and manufacturers of paint. Purchasers should have little preference for lead paint since there are not likely to be major price differences in its favor, and good-quality residential and interior paint is manufactured without lead. Providing consumers with information about the dangers of lead in paint, at the time of purchase, can also serve to enhance awareness and strengthen preferences for unleaded paint. Since most paint manufactured in Egypt is now free of lead or low in lead content, enacting controls will not seriously disrupt most existing manufacturers or production processes. Resistance to such a policy, therefore, is expected to be modest. Thus, adopting and implementing control measures seems very feasible. Some support for and encouragement of ingredient substitutions for some of the private manufacturers now making lead paint are advisable to help reduce exposure and strengthen enforcement of the controls while limiting opposition.

This plan includes recommended interventions for prohibiting the manufacture of lead paint in Egypt in both the public and private sectors. The prohibitions will apply to paint for residential use and for internal use in other buildings. Application of leaded paint to protect certain structures, like bridges, will still be allowed. Controls on imports will protect the public from lead paint manufactured abroad. A prohibition on the use of lead paint on locally produced or imported toys, items for use in schools (such as pencils), and other selected items manufactured specifically for use by children will be enacted. This latter restriction puts special emphasis on children, the population group most sensitive to the adverse effects of lead ingestion. Finally, product-labeling requirements will ensure that lead-free paint is certified and labeled as such. This step will assist with controls, facilitate contact with the private business community manufacturing paint to help with any changes needed, and enhance awareness among producers and consumers. The added inducement of access to export markets for paints certified as lead-free should help some manufacturers.

The interventions proposed for paint consist of policy controls and information/ certification requirements.

Intervention P6. Prohibit paint with lead content greater than 5,000 ppm from being manufactured in Egypt or imported.

Intervention P7. Prohibit lead paint, whether domestically produced or imported, from being used on toys, items intended for use in schools (pencils, etc.), and other selected items manufactured specifically for use by children.

Intervention S4/I3. Adjust product labeling requirements to mandate paint manufacturers to seek lead-free certification and subsequent labeling. Establish access to certification centers for paint testing. Certification would also grant eligibility for export license and could be conducted by authorized private-sector certification facilities.

5.5.3 Roles and Responsibilities

Several institutions must take action to adopt and implement these interventions. For Interventions P6 and P7, MOHP will determine health impacts and establish controls to protect the public health. Accordingly, a ministerial decree will prohibit the manufacture of paints with a lead content exceeding 5,000 ppm and prohibit the use of leaded paint on any toys or items intended for school use whether produced in Egypt or elsewhere. This decree will be communicated to

the field health structure and also to paint manufacturers and the Ministry of Education, due to the importance of this issue for schoolchildren. Since the Agency for Standardization in the Ministry of Industry is charged with establishing production standards, it will adopt similar controls, communicate them directly to the manufacturing community, and enforce them. MOSEA/EEAA is authorized, by Law 4 of 1994, to restrict or prohibit import of substances which are deemed hazardous. MOSEA/EEAA will, therefore, add leaded paint, as well as toys and school items with lead paint, to the list of restricted materials. The Customs Authority will enforce the import restrictions.

Appropriate NGOs will be identified to communicate with the small and informal paint producers regarding these interventions, their rationale, and ways that small producers can comply with minimal disruption. MOSEA/EEAA will work with such NGOs in assisting and communicating with the small producers.

The certification and product labeling action, Intervention S4/I3, is structured similarly to interventions recommended in previous sections of this chapter, i.e., to create an incentive for producers to remove lead from products. Incentives can ease the burden of controls by creating some commonality of interests between regulator and regulated. Producers can gain access to export markets, a point likely to be significant for some but not all of them. Consumers will be able to learn about the contents of the paint they purchase and use, as well as gain awareness about the problems of lead exposure—particularly if labeling occurs along with the awareness measures outlined in Chapter 6. And increasing consumers' concern about lead creates an incentive for producers to avoid lead in production by adding market pressure. In the case of paint, unlike the situation with kohl or ceramics, most production is in the formal economy, and the number of producers is relatively limited. Therefore, the certification and labeling intervention will be a requirement placed on producers rather than merely an option available to them.

MOHP is the appropriate institution to determine which laboratories are or can be designated as approved certification facilities. Private laboratories will be considered, both to ease budget pressure on MOHP itself and to encourage the development of the market economy. The Agency for Standardization of the Ministry of Industry needs to be involved in determining what precise standards to apply to the certification process. And the Customs Authority will enforce the export license provision. MOHP will take overall responsibility for this intervention.

The first two paint interventions, P6 and P7, will be approved and implemented by MOHP without delay. The full certification and labeling program, Intervention S4/I3, can be implemented as soon as the certification features are fully developed.

6 CROSS-CUTTING INITIATIVES: AWARENESS AND EDUCATIONAL INTERVENTIONS

Increasing public awareness and understanding of the pathways of lead exposure, the health effects of lead, and simple measures that individuals can take to reduce their exposure are crucial to the success of this nationwide effort. Increasing public awareness is important for two reasons. First, a public awareness campaign can provide practical information to help individuals reduce their own exposure to lead. Second, a broader public awareness of hazards from lead will give the government greater leverage in implementing the various technical and policy interventions discussed in Chapter 5. Reducing exposure over the long run will call for two types of initiatives: a well-designed, comprehensive public awareness campaign and a focused program of specialized education and training for specific audiences.

6.1 Sources of Lead Contamination to be Addressed

Personal choices and behaviors are involved in most of the important exposure pathways for lead, and particular individual actions can help reduce exposure by washing produce, buying milk from certain vendors, buying and using particular kohl or ceramics, and selecting paint. Therefore, the public awareness campaign will provide information to the general public on how to address all of these sources.[7] More focused educational initiatives will be directed at producers of food, kohl, ceramics, and paint, as well as respected professionals (doctors, religious officials, etc.) who are able to influence institutional and individual choices. Table 6-1 gives a summary of interventions discussed in this chapter and the organizations involved.

6.2 Actions to Reduce Lead Exposure

> ***Intervention A1.*** Conduct a multimedia public awareness campaign and a specialized education program to provide citizens with information that will help them reduce their exposure to lead and increase public support for government actions to reduce lead emissions and exposure.

This intervention has two tracks:

- a general public awareness campaign and
- targeted training and educational actions for specialized audiences.

The following sections describe the rationale and objectives of these two avenues, the structure and mechanisms that will be used, and specific actions.

[7] Lead contamination in bread and flour will not be addressed in messages directed to the general public, since there is little that consumers can do to avoid purchasing contaminated bread. Technical information will be provided to millers and bakers as part of the specialized education program for targeted groups (see Section 6.2.2.).

Table 6-1 here

6.2.1 Broad Public Awareness Campaign

Public awareness campaigns have been used often in Egypt. To a limited extent, public awareness efforts have already been conducted about the dangers of exposure to lead. The Lead Exposure Abatement Plan adopts a broad, comprehensive, multimedia public awareness campaign to achieve the following goals:

- raise public awareness of lead exposure pathways;
- provide information about strategies for reducing individual and group exposure;
- encourage testing of children who may have been exposed; and
- encourage decision-makers and policymakers to reduce the broader population's exposure to lead.

The Egyptian population's general level of understanding about lead exposure is low, and findings from the background work conducted in preparation of the plan revealed that awareness of particular exposure pathways is almost nonexistent. For this reason, the awareness program will start with very basic information about lead and will be designed to achieve the following evolution in people's perceptions and behavior:

- first, moving people from a general lack of knowledge concerning lead to a simple *awareness* of its sources and effects;
- second, getting people to *acknowledge* that lead is a problem which affects them or their loved ones; and
- finally, to induce them to take *action* to reduce their exposure or the exposure of family members.

Encouraging individuals to move through these three stages and sustain changes in their behavior requires that messages be repeated over time and that multiple presentation techniques be used for the same message.

Initially, the broad awareness campaign will focus on the nature of the problem, health effects from lead exposure, and suggestions about ways to reduce exposure. The initial messages will convey that lead exposure is a potentially serious health problem and that children are especially vulnerable. Later in the campaign the emphasis will shift to discussion of other groups in the population that may be at increased risk, for example workers in certain occupations and people living near work sites that use lead. These later messages will build on the message that individuals can take specific steps to reduce their exposure.

Major stakeholders for this campaign include the general public and those whose livelihoods will be affected by changes in consumer behavior, such as those who sell milk in the informal sector, kohl producers and sellers, potters and those who sell pottery, and paint manufacturers. Additional stakeholders are the institutions involved in producing and directing the awareness campaign: MOSEA/EEAA, MOHP, Ministry of Information, and any organizations selected to assist in the campaign.

The general messages to be used in the broad awareness campaign are outlined below. It is important, however, that they be refined through a careful process of information-gathering, analysis, and testing before being used. The analysis and review process will attempt to identify barriers to changing people's behavior with regard to particular pathways and also the enabling factors that can be used to predict people's receptivity to specific messages.

- Lead is present in a variety of substances in everyday use—leafy vegetables, milk from the informal sector, some ceramics, some kohl—and even in soil and dust around the street and home. Exposure pathways involve ingestion.
- The lead exposure reduction logo (to be designed early in the campaign) displayed on containers of kohl, ceramics, or cans of paint tells consumers that the contents are free of lead. Customers should ask for lead-free products when shopping. If a provider does not have them, customers should say that they will find a supplier who does.

- # Lead is especially dangerous for young children because
  - all young children put their hands in their mouth frequently, and they get lead in their systems this way if they are in contact with lead sources;
  - once exposed, children retain more lead than adults because their young digestive systems absorb it more efficiently;
  - lead absorbed by children can adversely affect their growth, hearing, and mental development; and
  - many of the health effects of lead in children are irreversible.
- # Lead is dangerous for pregnant women; it can cause permanent damage to the fetus and even miscarriage.
- # Adults, too, experience health effects resulting from lead exposure. Increased lead levels decrease the number of productive members of society.
- # Exposure to lead can be reduced through simple steps: washing produce, buying products with the lead-free label or refraining from using lead-containing products, and reducing children's ingestion of soil and dust.
- # The government has already taken steps to reduce people's exposure to lead:
  - removing lead from gasoline;
  - initiating a program to move large lead smelters away from heavily populated areas;
  - ordering the removal of lead solder from cans and packaged food containers; and creating a "lead-free" label and providing certification centers at which manufacturers of kohl, ceramics, and paint can have their products tested.

It is anticipated that it will be particularly difficult to convince people of the risks from use of ceramics and kohl, since these products have been in common use throughout much of Egypt's history. In the case of ceramics, messages need to convey that lead-glazed ceramics fired at low temperatures pose health problems, and there are safe alternatives available.

For kohl, the messages will encourage the use of lead-free compounds rather than discourage the use of kohl entirely. Kohl users will be encouraged to visit community centers, such as mosques and health clinics, for advice about "safe" and "unsafe" kohl. In addition to radio and TV announcements, this kind of information is suitable for leaflets and posters throughout the cities, community centers, schools, and mosques. Detailed information can be provided through health care providers. Part of the kohl effort will include producing a video for health workers to show in communities. The World Health Organization may also be encouraged to assist in developing materials which describe the dangers of kohl with lead, since it is a problem in many countries of the region.

As the awareness campaign progresses, periodic monitoring will be conducted to assess which messages are being remembered, which seem credible and relevant to individuals' daily circumstances, and which help to induce action. This process of assessment will be used to refine the basic messages and to craft additional ones later in the campaign. Focus groups and surveys will be used as part of the assessment process.

The campaign is designed to employ multiple media. Especially important are radio and television, along with the use of a logo for those products which contain no lead. General awareness efforts must rely on approaches that do not depend on reading ability, as the illiteracy rate in Egypt is fairly high. The following communication media will be used:

- # television
  - documentaries
  - drama series episodes
  - public service announcements (ranging from 30 to 90 seconds)
  - women's shows
  - interviews, with question-and-answer format
  - existing shows like "Dear Consumer" and "What's the Reason?"
  - children's programs, including an Arabic-Egyptian version of Sesame Street
  - cartoons
  - health programs
- # radio
  - drama series
  - children's programming
  - religious programs
  - health and environmental programming
- # print
  - specific logo for lead awareness campaign (for lead-free products)
  - posters, graphics
  - advertisements in magazines, newspapers
  - articles featuring several aspects of the issue
  - photo novels and brochures

Both audiotapes and videos for distribution will be employed. At least two specific kinds of videos will be produced: an Arabic-Egyptian version of Sesame Street with a focus on lead exposure reduction, for children and parents; and an Egyptian-produced short video on kohl with lead.

If budget constraints preclude use of all these channels, emphasis will be placed on approaches and programs that are most credible and seem most likely to trigger the three-step movement toward action. For instance, introducing persuasive messages into the story lines of dramas, like soap operas, is an accepted method of public information in Egypt, probably even more widely used than public service announcements. Also, it will be important to target certain messages and their locations to specific portions of the general public. For instance, messages about children's vulnerability to lead and the special problems lead causes for pregnant women are best communicated in connection with women's programming, children's shows, and in magazines and locations that tend to be used by parents.

6.2.2 Targeted Awareness, Education, and Training

As mentioned above, Intervention A1 includes two tracks—the general public awareness program and a program of specialized education for selected groups, described in this section.

The targeted awareness track consists of a series of direct educational and training interventions involving face-to-face interactions with individuals, some of whom will be prepared to train others in turn about lead exposure and prevention. During these face-to-face initiatives, two tasks will be undertaken:

- # Messages from the general awareness campaign are to be repeated, re-explained, and re-emphasized.
- # The messages will be refined for specific issues, and appropriate behaviors will be demonstrated.

The face-to-face character of this track will increase participants' understanding about lead exposure so that they are willing and able to make the behavioral changes recommended in the targeted campaign. Accordingly, members of the targeted groups need to be included in the design of specific portions of the campaign and in the dissemination effort as well. Spokespersons must be perceived as credible and trustworthy, and they should have characteristics common to the targeted groups they will work with later on. Keeping these considerations in mind greatly increases the chances of moving those in the target groups—and those with whom they, in turn, interact—along the three steps that lead to behavior change.

The following describes initiatives aimed at each of several audiences.

Bakers and Flour Millers

These groups need clear, practical information about how milling equipment can contaminate flour and how to eliminate the problem. Their training is especially important, since information about bread and milling will not be disseminated in the public campaign. LEAP includes a technical/policy intervention aimed at eliminating the milling problem (see Intervention T1/P1). Training for millers and bakers is a key element of this intervention.

Directly Impacted Occupational Groups

Special occupational groups will be targeted to support and assist them in making a transition to lead-free products. This set of interventions is designed to help keep their jobs steady in commercial areas or products which are topics of the public awareness campaign.

*Food-Related*

- food vendors
- food transporters (especially those who sell milk in the informal sector)

Information will be provided on the importance of washing vegetables and keeping them dust-free, and keeping food out of contact with vessels containing lead during storage, transport, and cooking.

*Kohl-Related*

- producers and sellers of kohl

Information will focus on the health effects of using kohl with lead, the formulation of lead-free kohl, sources of materials for making lead-free kohl, and the steps for obtaining certification and labels for lead-free kohl.

*Ceramics-Related*

- potters and their families
- pottery vendors
- shop owners who sell cooking vessels

This portion of the campaign will focus on the hazards to consumers of lead-glazed ceramics fired at low temperatures, the hazards to potters and their families of working with lead-based glazes, sources and use of lead-free glazes, practical means of increasing firing temperatures, and the steps for obtaining certification and labels for lead-free ceramics.

*Paint-Related*

- paint manufacturers and distributors

Paint manufacturers and other relevant audiences (i.e., toy manufacturers) will receive information about the hazards of leaded paints, the regulations prohibiting their manufacture, import, and use, and the mechanisms the GOE will use to enforce these regulations.

Another important target audience consists of all workers in lead-related industries, their families, and residents of adjacent neighborhoods. The set of issues raised by occupational, secondary, and neighborhood exposure is addressed in Chapter 8.

Health Care Providers

Health care providers warrant special attention in the targeted awareness and training activities. These providers have a unique opportunity to design and implement preventive programs for those most at risk from lead exposure. In addition, some of the responsibility for communicating information through broad health campaigns will fall upon these providers. Despite their training, many health care providers have not received adequate information about lead in their formal education. They will need information on broader concerns about lead exposure and its consequences, as well as specific information about exposure pathways via produce, milk from the informal sector, kohl, ceramics, and possibly paint. Before these providers can be asked to inform and assist the public, they must receive supplemental training on lead exposure and its effects.

Religious Leaders

Religious leaders can be instrumental in the campaign. Religious institutions are highly respected in Egypt, and many religious organizations in the community have significant political and social power. For this reason, raising awareness and providing training for religious leaders about lead exposure, particularly from kohl and ceramics, are two important activities. Kohl in particular is associated in the minds of many Egyptians with religious tradition. The Prophet Mohamed is said to have used kohl, and

some portions of the Islamic religious community associate the use of kohl, with proper and serious religious observance. It will be important for the campaign to convey the message that kohl, *per se*, is not the problem: kohl was originally made with antimony sulfide, and the use of lead sulfide (galena) for making kohl was introduced some time later. A lead-free formulation for kohl is now available, so people may still observe religious traditions in a manner that is consistent with the latest scientific and health information. This message is best imparted with the help of respected religious leaders.

Policymakers and Decision-makers

In part, because of the importance of the lead issue and because there has not been widespread recognition of the significant sources of exposure in Egypt, policymakers and other important decision-makers (officials at national and governorate levels) will be considered a priority target group for increased awareness and education. The overall structure of the plan will be explained and discussed with them. They will be informed about how they themselves can be helpful during implementation.

Teachers and Schoolchildren

Children can directly reduce their own exposure to lead, and they can also serve as educators for other family members. Teachers and schoolchildren are, therefore, a priority group for awareness and education. With the assistance of the Ministry of Education, school curricula will be adapted to include information on sources and pathways of lead exposure and ways to avoid the health dangers.

Journalists

Broadcast and print media will play an immense role in the public awareness campaign. Few Egyptian journalists have a thorough understanding of lead exposure as a problem or how it can be rectified. The Environmental Writers' Association, however, an organization of environmental journalists, has been attempting to educate its members on the subject and will be a vehicle for improving reporting on such issues. Journalists outside this group will also be targeted. The goal will be to increase understanding of the health effects of lead, lead exposure pathways, and why certain populations are at greater risk.

6.2.3 Later Steps in the Awareness Campaign

The initial broad awareness campaign will almost certainly need to be refined and messages evaluated carefully. New ones will be added as time goes on. Later steps, which will comprise interventions, include the following:

> ***Intervention A2.*** Refine the public awareness campaign, as appropriate, as new data become available. Refinements may include identifying additional target audiences—and developing additional media channels and messages—regarding kohl, ceramics, and certain food items.

Intervention A2 represents a refinement of its predecessor, A1, based on additional data and analysis on specific issues. Stakeholders for Interventions A1 and A2 are the same. New data will come from the MOHP blood lead study and other future studies, described in Section 7.1.

Three additional, more focused interventions are also included in support of other awareness efforts.

> ***Intervention A3.*** The Insurance Division of the Ministry of Social Affairs will, on a regular basis, transmit to MOSEA/EEAA and MOHP the blood lead monitoring data which it currently gathers.

This intervention calls for the transmission of currently collected data on lead exposure to MOSEA/EEAA and MOHP. The purpose is to increase awareness and provide data to the two principal institutions regarding occupational exposure. MOSEA/EEAA and MOHP can assess the reliability of these data and determine their potential utility in the monitoring program. The data may also be useful in the development of new interventions, as needed. Lead-using

industrial firms and their workers are the principal stakeholders.

> ***Intervention A4.*** Compile all current Egyptian legislation, decrees, and regulations regarding lead and lead exposure; systematize; reproduce in a form that can be useful to decision-makers today; distribute to all relevant ministries, governorates, and interested NGOs; update periodically.

Intervention A4 recognizes that well-designed policies exist on such issues as flour milling, ceramics, and food packaging, but they are not widely known or enforced, even among those charged with responsibility for enforcement, environmental protection, and the protection of the public health. Existing policies and controls will be compiled, systematized, reproduced in an easily used format, and distributed to the most immediate stakeholders: relevant ministries, the governorates, and interested NGOs. It is important that this activity not be simply a one-time effort but that there be periodic updates.

> ***Intervention A5.*** Establish a national clearinghouse on lead exposure; compile and disseminate information on lead-related studies and information.

This intervention establishes the base for a longer-term, sustainable system for awareness into the future. Such a clearinghouse is relatively simple to initiate and involves primarily one institution to be responsible for the intervention over time.

6.3 Roles and Responsibilities

Intervention A1, including the two tracks—public awareness campaign and the targeted awareness, training, and education program—is a central and very high priority element of the Lead Exposure Abatement Plan. The MOSEA/EEAA will have lead responsibility for initiating the development and implementation of the public awareness program. As in other parts of the LEAP initiative, MOSEA/EEAA will collaborate closely with MOHP to ensure the most effective use of the resources available at both institutions.

Work on developing initial messages and selecting specific communication channels for the first phase of the campaign will begin immediately. MOSEA/EEAA will start to seek priority status with the Ministry of Information for media time. The three involved institutions, possibly working with contracted consultants, will hone the messages to be used for the initial awareness efforts, seek placement of the messages in as many of the communication channels as possible, and begin the process of testing the messages and their impact via surveys and focus groups.

The Ministry of Information will be involved in granting access to the broadcast media and apportioning price-discounted air time. Although Intervention A1 will begin immediately, it is expected that it will take a few months, or even longer, before the campaign becomes widely visible to the public. The preparatory work, necessary for a well-executed campaign, will be the focus of efforts at the outset.

A working-level coordinating group will be established for planning the awareness campaign, probably including institutional representatives and awareness specialists from MOSEA/EEAA and MOHP, plus representatives of the Ministries of Information and Education. It is crucial that the group include individuals with expertise in the development of awareness, educational, and training efforts. A series of planning meetings will be set up to develop the necessary steps to take action. The following issues must be addressed early in the planning phase:

- setting a more detailed schedule and timetable for the campaign;
- identifying and tasking a design group;
- planning and then initiating the request to obtain priority status for use of broadcast media from the Ministry of Information;
- identifying appropriate media spokespersons;
- devising a plan for identifying nonmedia spokespersons (for instance, users of kohl);
- developing a full strategy for funding the intervention; and
- designating a campaign coordinator.

Once these issues have been addressed, much of the work for further campaign design can be assigned by the campaign coordinator. The coordinator needs to stay apprised of actions on the other interventions in this plan and ensure that the awareness campaign remains closely coordinated with and supportive of the other elements. Liaisons from MOSEA/EEAA and MOHP, as well as from the Ministries of Information and Education, will be appointed to work with the campaign coordinator to track tasks falling under the responsibility of each agency or ministry in question. These individuals will meet on a regular basis with the coordinator to exchange updates on progress and address any coordination needs.

MOSEA/EEAA will have lead responsibility for ensuring that awareness, education, and training efforts encompassed in Intervention A1 move forward. The campaign coordinator will provide regular reports to MOSEA/EEAA and to the Interministerial Steering Committee for LEAP implementation. The campaign coordinator will ensure that resources available from MOHP are used to full advantage in the campaign.

Three ministries will play the roles sketched above: Ministry of Information for assistance with and facilitation of media access and production; Ministry of Education for development of curriculum and supporting efforts to train teachers and educate school-children; and MOST to help in training mill operators and bakers regarding lead exposure through flour. The Environmental Writers' Association is also expected to play a useful role working with environmental journalists.

Intervention A2 is designed to begin one or two years from the initiation of Intervention A1. The same institutions mentioned for Intervention A1 will be involved in the refinement of the campaign. In addition, some combination of MOSEA/EEAA, MOHP, Egyptian universities, and/or the National Research Center will do the data gathering and analysis, as discussed in Section 7.1. MOSEA/EEAA and MOHP will work together to identify which research questions are priorities and which institutions will address them. The essential difference between Interventions A1 and A2 is the incorporation of additional data developed through well-designed programmatic research.

Intervention A3 simply requires a coordinated plan to transmit information from the Insurance Division of the Ministry of Social Affairs to MOSEA/EEAA and MOHP. The latter two agencies will in turn use this information to assess occupational exposure and determine whether the results should influence any interventions. The intervention can be implemented, beginning with the current fiscal year, by agreement among the administrative units involved.

Intervention A4—compilation and dissemination of relevant legislation, decrees, and regulations regarding lead and lead exposure—is a matter of high priority for the plan. Indeed, it is difficult to imagine how even the enhanced enforcement interventions of the plan (Interventions P1, P2, and P4) can be executed effectively without first ensuring that Intervention A4 is completed as an initial step. Furthermore, the results of this intervention may yield additional information regarding current policy that is instrumental in strengthening lead exposure reduction efforts as the plan is implemented. The responsible institution for this intervention is MOSEA/EEAA, which has the capacity to execute the intervention immediately.

Establishing the clearinghouse (Intervention A5) is important for providing an information base for many of the other interventions. The resources and institutional demands for this intervention are not excessive, thus the effort should proceed with minimal difficulty. The most important consideration is to be sure the two principal institutions, MOSEA/EEAA and MOHP, are committed to supporting it over a sustained

period. The bibliography of background information on lead submitted by EHP to MOSEA/EEAA, supporting studies developed as background for this plan (O'Toole et al. 1996, Chappell et al. 1997), and previous research on lead use and exposure in Egypt are useful initial materials to be included as the clearinghouse begins its work. Reports on monitoring results and the compilation of current policies, as these develop, will also be included among the materials available for review and dissemination from the clearinghouse. MOSEA/EEAA is the responsible institution for this intervention and has the capacity to begin the intervention immediately.

The clearinghouse will serve as a reference library for individuals and institutions working on LEAP implementation. Furthermore, access to human resources can also be facilitated through this unit. Lists of individuals and institutions who have participated in LEAP development and implementation will be useful in ongoing activities. A goal for the clearinghouse will be for it to serve in the future as an information source for individuals and institutions beyond those directly involved in the design effort of LEAP over the past two years. If the clearinghouse takes on this long-range approach, there is a far greater chance that efforts to improve general awareness of lead exposure risks will be sustained. The information which the clearinghouse gathers will be available to schools, institutions of higher education, religious educational institutions, and other social agencies serving the public.

7 IMPLEMENTATION: INITIATIVES TO STRENGTHEN MONITORING, EVALUATION, AND COORDINATION

Monitoring and evaluation are an important part of any government program to improve environmental conditions. Environmental conditions and exposure are monitored to determine whether they are actually improving, and this and other information is evaluated to determine whether the program is achieving its objectives. This section of the plan describes steps that MOSEA/EEAA and MOHP will take to monitor changes in lead exposure in Egypt, evaluate progress in implementing the LEAP, and ensure effective coordination between MOSEA/EEAA and MOHP.

7.1 Monitoring and Additional Studies

The program of interventions, described in previous chapters, is designed to reduce the availability of lead in the environment and to change people's behavior so that they are exposed to lead less frequently. Reductions in environmental lead and changes in behavior will help to reduce people's exposure to lead, which in turn will gradually be reflected in lower blood lead levels in the Egyptian population. Intervention M1 addresses monitoring for changes in environmental lead concentrations and behavior, and Intervention M2 addresses monitoring for blood lead levels.

Intervention M1. Develop a full system of compliance monitoring to track implementation of LEAP interventions with benchmarks of progress.

7.1.1 Monitoring Reductions in Environmental Lead Concentrations

The previous chapters of this plan describe actions by various agencies of the Government of Egypt to reduce the use of leaded gasoline, reduce emissions from lead smelters, eliminate lead contamination in bread, reduce the availability of kohl and ceramics that contain lead, and ensure that the use of lead in food storage cans and paint does not increase. "Environmental lead" includes lead that is available for exposure to humans via each of the commercial products themselves and lead contamination in water, air, and soil that results from the production, use, and disposal of these products.

MOSEA/EEAA, MOHP, and other organizations cooperating in the LEAP program will develop a coordinated monitoring plan to periodically determine the concentrations of lead in each of the relevant commercial products and environmental media and to determine whether appropriate benchmarks have been achieved. Primary responsibilities for monitoring are as follows:

- gasoline—Ministry of Petroleum;

- food, kohl, ceramics, and cans—MOHP (in coordination with MOST); and
- paint, air, water, and soil—MOSEA/ EEAA.

It would be too expensive to conduct large surveys for each of these media, so the

Table 7-1 here

monitoring programs will consist primarily of targeted studies in limited geographic areas.

7.1.2 Monitoring Changes in Behavior Related to Lead Exposure

The public awareness program described in Chapter 6 will encourage specific types of changes in people's behavior, such as washing produce to remove surface dust, reducing the use of lead-containing kohl and ceramics, and reducing children's ingestion of dust and soil that may contain lead. Focus groups and other methods will be used to ensure that the individual messages and materials used in the public awareness program are appropriate. Beyond this initial testing, however, the government also needs to determine whether the overall public awareness campaign is effective in changing people's behavior.

MOSEA/EEAA will, therefore, design and conduct a set of observational studies and questionnaire-based surveys to determine whether the targeted behavior changes in selected populations are occurring. Such surveys may be conducted as independent studies or as a component of population-based blood lead surveys in collaboration with the MOHP (see below).

7.1.3 Monitoring Reductions in Blood Lead Levels

Intervention M2. Develop a plan for regular blood lead screening.

The best evidence of success for the entire LEAP program would be a gradual decrease in average blood lead levels in the Egyptian population as a whole, or in specific population groups that currently have elevated exposure levels or higher susceptibility to health damages, such as young children, pregnant women, and occupationally exposed workers and their families. As described earlier, the MOHP is currently conducting a large survey of blood lead levels of young children throughout the Greater Cairo Metropolitan Area.

When the Cairo study has been completed and the MOHP has determined baseline blood lead levels for the population studied, it will then develop a plan for periodically screening blood lead levels in the future to measure long-term trends in exposure, and possibly also to observe shorter-term trends in highly exposed groups. This screening program will be implemented primarily by MOHP through its field apparatus. MOHP will also collaborate with the Ministry of Manpower and Migration and other ministries as needed to ensure adequate blood lead screening in high-risk occupational groups.

One of the objectives of the public awareness program is to encourage the public and physicians to test individual children for ele-vated blood lead levels if they are exposed to known lead sources. If successful, this could result in an increased demand on analytical laboratory capacity for blood lead screening in Egypt. MOHP has recently improved the analytical and quality control capabilities at its central laboratory for analyzing lead in various biological and environmental media, and is improving similar capabilities at its regional laboratories as well. If the demand for analyses from physicians grows quickly, MOHP may examine the possibility of certifying commer-cial laboratories to perform such analyses. MOHP and MOSEA/EEAA will coordinate their efforts to ensure increased laboratory capacity for lead in biological samples and for operating the product certification and labeling programs for kohl and ceramics.

7.1.4 Additional Studies to Support LEAP Implementation

This plan reflects the most current knowledge of lead sources and exposure pathways in Egypt. It is based on recent research sponsored by MOSEA/EEAA and MOHP and on infor-mation available from research studies con-ducted in Egypt over the past 15 years. None-theless, as with any program that involves environmental conditions, human behavior, and human health,

there are still important gaps in our knowledge of the problems and consequences associated with lead exposure. Several additional studies will be conducted over the next two years to fill some of these information gaps, and appropriate modifications will then be made to relevant aspects of the lead exposure abatement program.

Intervention D1. Conduct a study (or studies) to determine the patterns of use of lead-containing kohl and ceramics in Egypt. Questions to be covered in such research include who uses it; how frequently is it used and under what conditions; and what practices and beliefs are associated with the product(s).

Intervention D2. Conduct a more extensive study of lead levels in glazed ceramics and the resulting exposures in Egyptian households (e.g., by collecting ceramics from households included in the MOHP blood lead survey).

Intervention D3. Develop information on the characteristics of the ceramics industry in Egypt: its organization, technology, types of kilns and materials used, number of persons involved, and the feasibility and impacts of promoting changes in the indus-try. Develop comparable information on the characteristics of kohl manufacturing sector, its organization, number of persons involved, and the feasibility and impacts of promoting changes in ingredients by producers.

Intervention D4. Conduct additional sampling of selected food pathways to identify or confirm the source of lead contamination (produce, milk from informal vendors) or to determine whether they are important sources of lead intake (dairy products, beans, processed meats, milled rice and other grains). Test other items not yet examined to determine if they are also a source of lead exposure (e.g., other cosmetics, hair dyes, printing inks and printed materials, painted children's toys, pencils, other items manufactured specifically for children).

7.1.5 Incorporating Results of Studies in Progress

As described in Chapter 2, MOHP is conducting a study of blood lead levels in children aged 2-6 years in the Greater Cairo Metropolitan Area. Intervention D5 ensures that the results from this study are taken into account in modifying interventions already described during their implementation or adding new interventions if appropriate.

Intervention D5. Incorporate results of blood lead study currently underway by MOHP in developing further any necessary interventions.

This activity obviously involves MOHP in a lead role, in collaboration with MOSEA/EEAA.

7.2 Evaluation

The Government of Egypt will be implementing the provisions of this plan over the next two to five years. During this time, the government will need to evaluate its progress periodically and re-examine the activities being pursued.

MOSEA/EEAA will prepare and publish two LEAP program reports periodically. The preparation and review of these two reports will be the primary mechanism for evaluating the progress of the program. MOSEA/EEAA will have the principal responsibility for preparing the reports, and will collaborate closely with MOHP and other participating agencies to ensure that the information reported is accurate, current, and complete. The Interministerial Steering Committee to be established to guide LEAP implementation will review and approve the reports before they are published.

- *Annual Report of LEAP Activities*
  Each year, MOSEA/EEAA will prepare a report describing the LEAP activities conducted during the previous year and provide a brief summary of the status of each

intervention. The report will also include a current bibliography of reports, journal articles, and other sources in which the participating agencies have published information relevant to LEAP.

Biannual Evaluation of LEAP Progress Every two years, MOSEA/EEAA will prepare a report analyzing the progress that has been achieved in reducing lead exposures. The report will include results from the monitoring program to demonstrate successes that the program may have achieved (e.g., reductions in environmental lead concentrations, improvements in exposure-related behavior, and reductions in blood lead levels). The report will also include qualitative information and conclusions regarding the effectiveness of efforts to date and recommendations for future actions to reduce the population's exposure to lead.

7.3 Coordination

Effective coordination between MOSEA/ EEAA, MOHP, and other participating organizations is essential to LEAP's success. Formal interventions will be used to establish coordinating mechanisms between the two lead institutions and with relevant sectors of the business community.

> ***Intervention M3.*** Develop and approve a Memorandum of Understanding (MOU) between MOSEA and MOHP to clarify roles, responsibilities, and points and mechanisms of coordination for implementing the Lead Exposure Abatement Plan.

MOSEA and MOHP will prepare the MOU as a matter of highest priority. This step must be completed before any aspect of the plan can be implemented. The agreement will address the details of working relations be-tween these institutions, including establishing a mechanism for frequent communication, sharing results from studies in progress, incor-porating results into ongoing interventions, developing and implementing the monitoring program, evaluating progress, and obtaining resources for implementing the plan. MOSEA/ EEAA will also establish an Interministerial Steering Committee to guide LEAP implementation.

It is worth noting that MOSEA and MOHP need to work more closely on a broad range of environmental health issues which, by definition, involve environmental conditions under the jurisdiction of MOSEA and health consequences, the treatment and prevention of which are within the jurisdiction of MOHP. MOSEA and MOHP regard developing an MOU for collaboration on lead exposure abatement as a valuable investment for both institutions, and intend the MOU to serve as the basis for additional coordinated action on other issues.

> ***Intervention M4.*** Inform and support businesses, including especially private companies and small-scale manufacturers, in reducing lead contamination in ceramics, kohl, bread, and paint. Emphasize collaborative strategies and monitoring approaches that can be supported and/or implemented directly by segments of the business community, including the informal sector.

Intervention M4 is also an essential element in LEAP's success. With the exception of MOHP's dealings with parts of the food industry, neither MOSEA/EEAA nor MOHP has had extensive contact with businesses that contribute to lead exposure in Egypt, especially those in the newly emerging private sector or the informal sector. Substantial efforts will be needed to reach out to the firms and small-scale manufacturers that produce kohl, ceramics, bread, and paint. Supportive and collaborative bridges must be built because regulation alone will not be effective, and awareness campaigns often do not address the needs of the producers. Many producers will respond with

suspicion and evasion unless they can see some advantage in supporting the program.

The MOU between MOSEA and MOHP will delineate the responsibilities of each institution for establishing contacts with producers of kohl, paint, bread, and ceramics. Collaboration with the Federation of Egyptian Industries will be essential for paint and may be useful as a first step for ceramics, bread, and kohl as well. For ceramics and kohl, NGO involvement will probably be helpful and maybe even necessary as a means of getting information to informal sector producers.

8 INITIATIVES TO CLOSE GAPS: ISSUES NEEDING FURTHER ATTENTION

The Lead Exposure Abatement Plan focuses its attention on reducing lead exposure in Egypt's general population. The interventions described in previous chapters are intended to reduce or eliminate sources of lead exposure that potentially affect a large proportion of the population. Produce, kohl, ceramics, and (to a lesser degree) paint are widely available and are consumed or used by a large number of Egyptians. Similarly, previous efforts by the Egyptian government to reduce the use of leaded gasoline and to eliminate the use of lead-soldered cans for storing food have also focused on sources of exposure that affect the general public.

There are some small groups of Egyptian citizens who are exposed to special circumstances and have, or potentially have, extremely high exposures to lead. These are, primarily, people who have some association with a factory site in a lead-consuming industry: the workers, their families, and people who live near the sites. This section describes these situations in general terms and highlights the need for additional studies and interventions to address the problems.

8.1 Work Site Exposure

Many industries and occupations in Egypt involve contact with lead or lead-contaminated waste products. Examples include secondary lead smelting (e.g., battery recycling); pipe and ceramics manufacturing; trades such as plumbing, automobile repair, and jewelry-making; preparing cosmetics and traditional medicines; and disposing or scavenging industrial and household solid waste. Some of these occupations or trades occur in large, well-organized, formal industries, both publicly and privately owned. Others occur around small-scale industries and informal work sites. Whether public or private, formal or informal, the owners, supervisors, and workers in all of these situations pay relatively little attention to controlling or monitoring their own exposure to on-the-job hazards, let alone to the potential exposures of their families and neighbors.

For example, workers in the large secondary lead smelters rarely wear respirators or protective clothing. They routinely smoke and eat at the work site without taking precautions to avoid ingesting lead. They return home without changing clothes or using shower facilities, and thus transport lead dust into their homes. Many of the factory work areas are open bays with inadequate controls on ventilation and dust, so large amounts of lead-laden dust are transported into neighborhoods surrounding the factories, creating an exposure hazard for children playing outside and probably for transporting dust into households as well.

In another example, ceramics are made mostly in small-scale, informal-sector factories. Leaded glazes are used to coat the pots; preparation areas and kilns are located near residences; the enterprise is generally a family affair involving the owners' young children; and no one wears respiratory protection or changes their clothes before returning to their residence. This creates a large potential exposure for all of the people

directly involved and for people living near the factory as well.

Table 8-1 here

8.2 Potential Interventions

There are many actions that could be taken to reduce lead exposure related to work sites at which lead or lead-containing products are used. The specific actions would vary with the particular industry, group, and location. The actions to be initiated are also dependent on additional information, which is necessary to target and design interventions effectively to address the most significant work site-related exposure problems. Two such data-gathering initiatives are included in this plan:

> ***Intervention D6.*** Identify work sites in the formal sector and the highest priority work sites in the informal sector at which lead-containing materials are used or produced.
>
> ***Intervention D7.*** Develop information to be used for designing technical and policy interventions for reducing occupational exposure at small-scale and informal-sector factories that use lead-containing materials, and for reducing secondary exposure to workers' families and people living near the facilities. Small-scale ceramics factories and secondary lead smelters[8] will receive the highest priority.

The identification of work sites is to be a coordinated effort led by the Occupation and Industry Division within the Preventive Health Sector of MOHP, in conjunction with the General Organization for Industrialization (GOFI) within the Ministry of Industry; the Ministry of Manpower and Migration, which conducts work site inspections; and the Insurance Division of the Ministry of Social Affairs, which gathers blood lead data on occupational exposure in selected industries for purposes of implementing government policy on disability benefits to injured workers. All of these organizations will have information to contribute to a combined inventory of work sites to consider for further interventions.

MOSEA/EEAA and MOHP will identify the specific questions to be addressed in Intervention D7. Industrial process experts at GOFI may also be able to contribute useful information to this process. Data gathering and analysis can also involve the National Research Center and the nation's universities. Informa-tion from Intervention D7 will be used to develop technical and policy interventions that should prove helpful in reducing work site-related exposures to workers, their families, and those living in the vicinity of such facilities.

The work site information produced through Intervention D6 and, to a lesser extent, the technical and policy design work accomplished through Intervention D7 can support additional targeted awareness and training efforts to address work site-related exposures, including the following:

> ***Intervention A6.*** Develop and implement a training program for workers and supervisors in formal-sector facilities to help identify, prevent, and avoid occupational lead exposure hazards.
>
> ***Intervention A7.*** Develop and implement a training program for managers of formal sector facilities on managing occupational lead exposure hazards.
>
> ***Intervention A8.*** Develop and conduct an awareness campaign on lead exposure hazards in informal-sector industries. Use appropriate intermediaries, such as NGOs, and materials and media appropriate for illiterate workers. Materials should focus on means of avoiding ingestion and inhalation of fumes and dust and of transporting dust that settles on clothing and other surfaces.
>
> ***Intervention A9.*** Develop educational materials for people living in the vicinity of lead-consuming work sites, to provide information on the nature of the exposure hazards and ways of reducing and avoiding exposure, especially in young children.

[8] The Lead Smelter Action Plan includes interventions that will address these issues for the largest formal sector smelters, but defers actions on the smaller and informal sector smelters.

These initiatives, like the other awareness activities covered earlier, are to be coordinated by MOSEA/EEAA, with the assistance of the MOHP and its field health structure. The Ministry of Industry will need to be involved as well, probably through GOFI. The Ministry of Education will contribute to developing educational materials. As in other interventions dealing with the informal sector, NGOs and other potential intermediaries are likely to be significant partners in these communication, education, and training activities. Finally, the governorates will need to be thoroughly involved in disseminating the information generated in the interventions, because of their primary role for inspections and enforcement.

These awareness and training efforts are to be based on the same principles and design features outlined earlier in Chapter 6 of this plan.

REFERENCES

CDC. 1991. *Preventing lead poisoning in young children*. Atlanta, Ga.: Centers for Disease Control and Prevention, DHHS. 108 pp.

Chappell, R., P. Billig, E. Brantly, S. Ault, and H.S. Ezzeldin. 1997. *Lead exposure abatement plan for Egypt: Results of environmental sampling for lead*. EHP Activity Report no. 32. Arlington, Va.: Environmental Health Project.

EPA (U.S. Environmental Protection Agency). 1994. *Guidance manual for the integrated exposure uptake biokinetic model for lead in children*. Office of Solid Waste and Emergency Response, Publication 9285.7-15-1, EPA/540/R-93/081, PB93-963510.

EPA. 1995. A longitudinal study of chronic lead exposure and physical growth in Boston children, *Envir. Health Perspect.* 103: 952-957.

Kim R. et al. 1995. A longitudinal study of chronic lead exposure and physical growth in Boston children, *Envir. Health Perspect.* 103: 952-957.

National Academy of Sciences (NAS). 1983. *Measuring lead exposure in infants, children, and other sensitive populations*. Washington, D.C.: National Academy Press.

Needleman, H. L. et al. 1996. Bone lead levels and delinquent behavior. *J. Am. Med. Assoc*. 275:363-369.

O'Toole, L. J., J. A. Phoenix, and M. W. Gamaleldin. 1996. *Institutional assessment for lead exposure abatement and reduction in Cairo*. EHP Activity Report no. 31. Arlington, Va.: Environmental Health Project.

Sessions, S., M. Gaffen et al. 1994. *Comparing environmental health risks in Cairo, Egypt*. Vols I and II. Washington DC: PRIDE.

Appendix A

Egyptian Laws and Decrees

Pertaining to Lead

1. Ministry of Health and Population decree 85/997 (1 page)
2. Ministry of Health and Population decree 44/1992 (1 page)
3. President's decree 789/1957 (4 pages)

Appendix B

LEAP Interventions by Type and Source

Interventions

This Appendix contains a full list of the interventions included in this plan. They are presented in two formats: first, by type of intervention; and second-- for those intended to influence the single pathways covered in Chapter 5 of this plan--, by pathway. In each case, some interventions are listed more than once for instances in which they span types or pathways.

To assist in understanding the types of interventions included in the plan, all are coded with letters and numbers to assist in identifying the different kinds of actions that are necessary, as follows:

P = regulatory or economic **policy development and enforcement.**
T = **technical interventions** (e.g., changes in manufacturing processes).
I = policy aimed at encouraging product-specific **information.**
S = policy on **standard setting** and certification.
A = **awareness**, education, and training.
M = **monitoring**, evaluation, and coordination.
D = additional **data gathering and analysis** leading to further interventions design, where applicable.

Interventions by Type:

P

Intervention T1/P1. Identify and retrofit all flour mills that currently have a design susceptible to lead use and, thus, flour contamination.

Intervention P2. Develop intensified enforcement of existing controls on lead use in food cans and other food containers. (Ministerial Decree 85, Articles 1 and 2 (1997) of MOHP).

Intervention P3. Request designation of kohl with lead as hazardous substance, prohibit lead use in kohl, prohibit importation of kohl with lead or of galena for kohl manufacture.

Intervention P4. Develop intensified enforcement of existing approved controls and testing procedures for glazed ceramics (Presidential Decree 798 [1957] Article 7).

Intervention T3/P5. Make changes in ovens for ceramics to assure firing at a temperature above 990^0C. Implementation can be encouraged through the use of economic incentives, if studies indicate this step is necessary and feasible.

Intervention P6. Prohibit paint with lead content greater than 5000 ppm from being manufactured in Egypt or imported.

Intervention P7. Prohibit lead paint, whether domestically produced or imported, from being used on toys, items intended for use in schools (pencils, etc.), and other selected items manufactured specifically for use by children.

T

Intervention T1/P1. Identify and retrofit all flour mills that currently have a design susceptible to lead use and, thus, flour contamination.

Intervention T2. Conduct studies of local ceramics materials to locate possible substitutes for lead in frits. Replace lead in frits with a suitable alternative.

Intervention T3/P5. Make changes in ovens for ceramics to assure firing at a temperature above 990ºC. Implementation can be encouraged through the use of economic incentives, if studies indicate this step is necessary and feasible.

I

Intervention S2/I1. Adjust product labeling requirements to allow kohl manufacturers to seek certification and labeling of lead-free contents; establish access to certification centers in the community.

Intervention S3/I2. Adjust product labeling requirements to allow ceramics manufacturers to seek certification and labeling of lead-free contents. Establish access to certification centers in the community. Certification of lead-free products, which would create export opportunities, could be conducted by authorized private-sector certification facilities.

Intervention S4/I3. Adjust product labeling requirements to mandate paint manufacturers to seek lead-free certification and subsequent labeling. Establish access to certification centers for paint testing. Certification would also grant eligibility for export license and could be conducted by authorized private-sector certification facilities.

S

Intervention S1. Revise the lead intake standard for food from the equivalent of 35 μg/day to a guideline of 6 μg/day.

Intervention S2/I1. Adjust product labeling requirements to allow kohl manufacturers to seek certification and labeling of lead-free contents; establish access to certification centers in the community.

Intervention S3/I2. Adjust product labeling requirements to allow ceramics manufacturers to seek certification and labeling of lead-free contents. Establish access to certification centers in the community. Certification of lead-free products, which would create export opportunities, could be conducted by authorized private-sector certification facilities.

Intervention S4/I3. Adjust product labeling requirements to mandate paint manufacturers to seek lead-free certification and subsequent labeling. Establish access to certification centers for paint testing. Certification would also grant eligibility for export license and could be conducted by authorized private-sector certification facilities.

A

Intervention A1. Conduct a multimedia public awareness campaign and a specialized education program to provide citizens with information that will help them reduce their exposure to lead and increase public support for government actions to reduce lead emissions and exposure.

Intervention A2. Refine the public awareness campaign, as appropriate, as new data become available. Refinements may include identifying additional target audiences--and developing additional media channels and messages--regarding kohl, ceramics, and certain food items.

Intervention A3. The Insurance Division of the Ministry of Social Affairs will, on a regular basis, transmit to MOSEA and MOHP the blood lead monitoring data which it currently gathers.

Intervention A4. Compile all current Egyptian legislation, decrees, and regulations regarding lead and lead exposure; systematize; reproduce in a form that can be useful to decision-makers today; distribute to all relevant ministries, governorates, and interested NGOs; update periodically.

Intervention A5. Establish a national clearinghouse on lead exposure; compile and disseminate information on lead-related studies and information.

Intervention A6. Develop and implement a training program for workers and supervisors in formal-sector facilities to help identify, prevent, and avoid occupational lead exposure hazards.

Intervention A7. Develop and implement a training program for managers of formal sector facilities on managing occupational lead exposure hazards.

Intervention A8. Develop and conduct an awareness campaign on lead exposure hazards in informal-sector industries. Use appropriate intermediaries, such as NGOs, and materials and media appropriate for illiterate workers. Materials should focus on means of avoiding ingestion and inhalation of fumes and dust and of transporting dust that settles on clothing and other surfaces.

Intervention A9. Develop educational materials for people living in the vicinity of lead-consuming work sites, to provide information on the nature of the exposure hazards and ways of reducing and avoiding exposure, especially in young children.

M

Intervention M1. Develop a full system of compliance monitoring to track implementation of LEAP interventions with benchmarks of progress.

Intervention M2. Develop a plan for regular blood lead screening.

Intervention M3. Develop and approve a Memorandum of Understanding (MOU) between MOSEA and MOHP to clarify roles, responsibilities, and points and mechanisms of coordination for implementing the Lead Exposure Abatement Plan.

Intervention M4. Inform and support businesses, including especially private companies and small-scale manufacturers, in reducing lead contamination in ceramics, kohl, bread, and paint. Emphasize collaborative strategies and monitoring approaches that can be supported and/or implemented directly by segments of the business community, including the informal sector.

D

Intervention D1. Conduct a study (or studies) to determine the patterns of use of lead-containing kohl and ceramics in Egypt. Questions to be covered in such research include who uses it; how frequently it is used and under what conditions; and what practices and beliefs are associated with the product(s).

Intervention D2. Conduct a more extensive study of lead levels in glazed ceramics and the resulting exposures in Egyptian households (e.g., by collecting ceramics from households included in the MOHP blood lead survey).

Intervention D3. Develop information on the characteristics of the ceramics industry in Egypt; its organization, technology, types of kilns and materials used, number of persons involved, and the feasibility and impacts of promoting changes in the industry. Develop comparable information on the characteristics of kohl manufacturing sector, its organization, number of persons involved, and the feasibility and impacts of promoting changes in ingredients used by producers.

Intervention D4. Conduct additional sampling of selected food pathways to identify or confirm the source of lead contamination (produce, milk from informal vendors) or to determine whether they are important sources of lead intake (dairy products, beans, processed meats, milled rice and other grains). Test other items not yet examined to determine if they are also a source of lead exposure (e.g., other cosmetics, hair dyes, printing inks and printed materials, painted children's toys, pencils, other items manufactured specifically for children).

Intervention D5. Incorporate results of blood lead study currently underway by MOHP in developing further any necessary interventions.

Intervention D6. Identify work sites in the formal sector and the highest priority work sites in the informal sector at which lead-containing materials are used or produced.

Intervention D7. Develop information to be used for designing technical and policy interventions for reducing occupational exposure at small-scale and informal-sector factories that use lead-containing materials, and for reducing secondary exposure to workers' families and people living near the facilities. Small-scale ceramics factories and secondary lead smelters will receive the highest priority.

Interventions to Lead Exposure Pathways and LEAP Program Management

Intervention Code	Intervention Description	Bread	Produce	Milk - Informal Sector	Other Food	Kohl	Ceramics	Paint	Work sites	Program Mgmt.
T1/P1	Identify and retrofit those flour mills with designs susceptible to lead use	X								
P2	Intensify enforcement of controls for lead in food cans and containers			X	X					
P3	Regulate kohl to eliminate lead content and prohibit importation of kohl with lead					X				
P4	Enforce standards and testing of glazed ceramics						X			
T3/P5	Changes in ovens for ceramics to raise firing temperature above 990^{o}C						X			
P6	Prohibit paint with lead content above 5000 ppm							X		
P7	Prohibit use of lead paint on toys and school items							X		
T2	Replace lead in frits with alternative materials						X			
S1	Revise lead intake standards to 6 ug/day from food	X	X	X	X					
S2/I1	Certification and labeling standards for lead-free kohl					X				

Intervention Code	Intervention Description	Bread	Produce	Milk - Informal Sector	Other Food	Kohl	Ceramics	Paint	Work sites	Program Mgmt.
S3/I2	Certification and labeling standards for lead-free ceramics						X			
S4/I3	Certification and labeling standards for lead-free paints							X		
A1	Multi-media awareness campaign for general public and specialized programs for several audiences	X	X	X	X	X	X	X	X	
A2	Refine awareness campaign based upon data findings	X	X	X	X	X	X	X	X	
A3	Transmit blood lead data from Ministry of Social Affairs to EEAA and MOHP									X
A4	Compile and transmit all lead and lead exposure legislation, decrees, and regulations									X
A5	Establish a national clearinghouse on lead exposure									X
A6	Training program in worker hazard communication								X	
A7	Training program in hazard management at worksites								X	

Intervention Code	Intervention Description	Bread	Produce	Milk - Informal Sector	Other Food	Kohl	Ceramics	Paint	Work sites	Program Mgmt.
A8	Awareness program on lead hazards for informal sector workers	X				X	X	X	X	
A9	Educational materials for residents living near affected work sites								X	
M1	Compliance system to track LEAP implementation									X
M2	Plan for regular blood lead screening									X
M3	Develop/approve Memorandum of Understanding for coordination between MOSEA and MOHP									X
M4	Inform/support businesses in achieving lead reduction in products	X				X	X	X		
D1	Behavioral analysis for use of kohl and ceramics					X	X			
D2	Additional sampling of low-temperature-fired ceramics						X			
D3	Study of the ceramics industry and kohl manufacturing					X	X			
D4	Additional sampling of selected foods and other media		X	X	X					

Intervention Code	Intervention Description	Bread	Produce	Milk - Informal Sector	Other Food	Kohl	Ceramics	Paint	Work sites	Program Mgmt.
D5	Incorporate blood lead study results in additional interventions									X
D6	Identify work sites at which lead-containing materials are used								X	
D7	Technical and policy interventions for occupational lead exposure at small-scale and informal work sites					X	X		X	