ENVIRONMENTAL HEALTH PROJECT

ACTIVITY REPORT

No. 45

Summary of Activities in Zlatna, Romania,
1994–1997:
A Cross-Sectoral Approach to Environmental and
Occupational Health Improvements

January 1998

by
Patricia Billig

Prepared for the USAID Mission to Romania
under EHP Activity No. 224-RC

Environmental Health Project
Contract No. HRN-Q-03-93-00037-03, Project No. 936-5994
is sponsored by the Bureau for Global Programs, Field Support and Research
Office of Health and Nutrition
U.S. Agency for International Development
Washington, DC 20523

CONTENTS

ACKNOWLEDGMENTS

Many people contributed to the success of this project from the original vision, to programmatic planning, to implementation and overall accomplishments. The original vision and program support came from USAID's Europe and Newly Independent States (ENI) Bureau. Recognizing the special circumstances and needs in Eastern Europe, the ENI Bureau understood and supported the need for major commodities assistance along with technical support. Richard Hough and Mary Ann Micka, at USAID/Romania during most of this activity, provided networking support with key Romanian health and environment ministry personnel and, more importantly, critical guidance and support to EHP. They contributed substantially to the success of the activity.

The implementation of this activity involved numerous EHP team members, listed on the following pages, in collaboration with many Romanian counterparts. Some team members were involved for only a short time while others provided periodic support throughout the life of the activity. All are committed professionals who, uniformly, were impressed by the dedication and commitment of their Romanian counterparts and supported their success in many formal and informal ways. Cindy Becnel and Ralph Moltzau were especially dedicated to coaching and supporting the OHS Working Group and the Air Working Group, respectively.

The overall accomplishments of the activity would not have been possible without the cooperation, support and enthusiasm of the partner institutions. These included the Ministry of Industry, Ministry of Environ-ment, and Ministry of Health. Mr. Alexandru Georgescu from the Ministry of Industry, Mrs. Serena Adler from the Ministry of Environ-ment, and Dr. Cucu from the Ministry of Health took a special interest in the activity and helped to provide national recognition and support. Dr. Eugen Gurzau, former director of the Institute for Public Health (IPH), provided some of the initial data for the WEC report and mobilized the efforts of several IPH specialists who became members of the intersectoral working groups, including Dr. Didi Surcel, Dr. Emelia Niciu, Dr. Alin Sinca, Mrs. Ecaterina Bodor, and Dr. Dana Farian.

At the Judet level, the Prefect's office was very supportive in providing meeting space and guidance, and the Sanitary Police and Judet EPA provided needed technical support and collaboration with the working groups. Although the membership of the three working groups changed somewhat over time, the following individuals provided much of the local leadership to ensure the accomplishments of their group: Child Lead Exposure Reduction (Dr. Vultur/Zlatna Hospital; Mrs. Puiulet and Mrs. Prata/Kindergarten Directors; Mr. Ponoran/Zlatna Mayor; Dr. Candrea/Sanitary Police), Air Monitoring (Mr. Clepan, Mrs. Stoica, Mrs. Maier/Aba Judet EPA; Mr. Dreghiciu/Ampellum Plant) and OHS (Mr. Filimon, Ms. Szakas, Mr. Montean, Dr. Chiorean/Ampellum OHS staff).

Many members of a local NGO, Albamont, led by Ms. Marioara Puscas, provided invaluable logistical support and guidance on several important issues, from assisting with environmental sampling to working with local newspapers and radio stations.

Finally, EHP's local coordinators, Liviu Ionescu during the first year and Mihai Maracineanu during the second two years, were also critical to the success of the activity. They provided not only superb translation services, including late night informal discussions with participants, but also invaluable coaching of EHP staff, which markedly increased the effectiveness of the activity. They were also very helpful in problem-solving, as various difficulties arose.

Given that EHP never placed any resident staff in Romania during this activity, the activity depended heavily on these local coordinators. Their contributions also received high praise from participants.

ABOUT THE TEAM

Zlatna, Romania Team Member Descriptions

Patricia Billig was the overall Team Leader for the activities in Zlatna. She initiated the baseline blood level survey, developed the blood lead reduction program, and provided overall coordination for the three intervention areas. Ms. Billig, an environmental toxicologist with Camp Dresser & McKee International in the area of public health and ecological risk assessment, is an expert in the area of metal toxicity at mining sites and has conducted over 100 public health and ecological risk assessments, including air, water, and soil pathways for heavy metals, pathogens, organic chemicals, asbestos, and radioactive waste. Ms. Billig is also the Senior Technical Director for the Environmental Health Project.

Liviu Ionescu was the EHP Local Coordinator in Romania during the first year of the activity. As the liaison between the local collaborators and the EHP team, Mr. Ionescu facilitated the travel and working visits to Zlatna. He is a graduate of the Mechanical Engineering Faculty of the Polytechnical Institute in Bucharest and the coordinator for WEC projects in Romania.

Mihai Maracineanu was the EHP Local Coordinator in Romania for the last two years of the activity. As the liaison between the local collaborators and the EHP team, Mr. Maracineanu facilitated the travel and working visits to Zlatna. He has a Master's of Science degree from the Academy of Economics and serves as the coordinator for another EHP activity in Romania, which pertains to development of environmental health curricula for medical students and health practitioners.

John Borrazzo is a Johns Hopkins University Health and Child Survival Fellow working in the Environmental Health Division of the USAID Office of Health and Nutrition, Bureau for Global Programs. Since 1992, he has worked with USAID in defining new programs in the areas of air pollution, risk assessment, and hazardous materials exposure. Among USAID-assisted countries, these issues are of particular significance in Central and Eastern Europe, as well as the former Soviet Union. In Zlatna, Dr. Borrazzo participated in the initial scoping visits to define the air monitoring and control activities.

Alan Hurwitz is a consultant in strategic planning and organizational/institutional development. He has worked on many environmental and training activities, with a focus on bringing together different actors to improve the results of their collective actions. Dr. Hurwitz works with large private corporations, local and national governments, and nonprofit organizations. He has worked on international development and other projects in more than 30 countries, including almost every country in Latin America and many countries in Africa, Europe, the Caribbean, and Asia. Dr. Hurwitz facilitated the first major stakeholder meeting at the beginning of the activity.

Kirsten Senturia conducted the market research analysis for a social marketing campaign to reduce the blood levels in children. She is a Ph.D. candidate at UCLA in Medical Anthropology and had been an instructor for two training programs in Romania on rapid assessment procedures for health promotion planning and community assessment. She also had field experience as an investigator of health issues in Albania.

Richard Pollard, a mass media specialist, analyzed data collected by Kirsten Senturia and designed a public health social marketing campaign for the lead reduction program. Mr. Pollard is a social marketing consultant to the World Bank, USAID, and British ODA. His area of expertise is in the application of marketing management to the planning, execution, and evaluation of social development programs.

Barbara Popovich, a health education specialist, worked with Richard Pollard and the Lead Working Group to insure that the contents of the social marketing messages were accurate and based

on successful experiences in similar copper smelting towns with lead poisoning problems. Mrs. Popovich is a clinical education coordinator for childhood lead poisoning prevention in the Butte, Montana, Health Department.

Richard Chappell, an environmental health specialist, conducted a physical exposure assessment for lead. Mr. Chappell is a geochemist with CDM; his expertise is in the area of geochemical modeling of the migration of hazardous materials in the water/soil environment. He has designed, implemented, and supervised sampling programs for physical assessments of hazardous materials in the environment.

Bart Eklund, an air pollution specialist, conducted the air quality monitoring program training for the Air Monitoring Working Group and provided follow-up technical assistance with the air monitoring units during the first year of the activity. Mr. Eklund is a chemist and Senior Project Manager for the RADIAN Corporation. His work focuses on the measurement, modeling, and control of air emissions from fugitive area sources; his expertise lies in the areas of air pathway assessments, air monitoring, methods development, and air emissions from remediation activities.

Randy Parmley, a senior staff engineer at RADIAN, worked with Bart Eklund in conducting training for the Air Monitoring Working Group. Mr. Parmley works in the environmental analysis department at RADIAN; his work includes managing atmostpheric analysis studies.

Ralph Moltzau, an air quality specialist and owner of Moltzau Environmental, worked with the Judet EPA and the Ampellum plant on air quality monitoring. He assisted with identification and purchase of additional equipment and provided the training necessary for sustainability of the air monitoring portion of the project. Mr. Moltzau's expertise is in the field of air quality and meteorological monitoring and emission monitoring and testing.

Jan Matousek, an environmental engineer, worked with the plant management to identify options for modifying industrial processes and increasing control of air pollution emissions during the first year of the activity. Mr. Matousek is a Senior Metallurgical Engineer with Kilborn International, Inc., responsible for providing technical consulting services to plant managers.

Martin Silberschmidt, an occupational health specialist, collaborated with the Ampellum plant management and personnel during the first year of the activity to develop a worker health and safety program. Dr. Silberschmidt is a physician with extensive experience in environmental/occupational health throughout Eastern Europe and the Newly Independent States. Most recently, he has worked on occupational health and safety programs in the Baltic nations for the World Health Organization.

Dennis Murphy, a Senior Staff Scientist with RADIAN Corporation, was responsible for coordination of all industrial hygiene and safety assistance during the first year of the activity. He worked on training and monitoring aspects of occupational safety, including the use of industrial hygiene monitoring equipment.

Cindy Becnel, an occupational health and industrial hygiene specialist, assisted with the design and facilitation of the worker health and safety training course. She then continued to work with the OHS Working Group, providing technical assistance and coaching for the duration of the activity.

Omer Berger, a Professor of Clinical Pediatrics at Children's Hospital in Cincinnati, Ohio, taught a one day seminar at the Institute for Public Health in Cluj on current concepts and practices in chelation therapy for children. Participants in the seminar included pediatricians from Zlatna and Baia Mare. Dr. Berger has been involved in the screening and management of lead poisoning in children for many years and, recently, has participated in clinical trials to evaluate the effectiveness of various chelation therapy drugs and regimens in children in the United States.

ACRONYMS

EAPS	USAID-sponsored Environmental Action Program Support Project
EHP	USAID-sponsored Environmental Health Project
ENI	Europe and Newly Independent States (USAID Bureau)
EPA	Judet Environmental Protection Agency
ETP	USAID-sponsored Environmental Training Program
GOR	Government of Romania
IPH	(regional) Institute of Public Health
KAP	knowledge, attitudes, and practices (survey)
NGO	nongovernmental organization
NIH	U.S. National Institutes of Health
OHS	occupational health and safety
S.O.	Strategic Objective (USAID policy goal)
SO_2	sulfur dioxide
USEPA	U.S. Environmental Protection Agency
WEC	World Environment Center

EXECUTIVE SUMMARY

The cross-sector activity in Zlatna, a community of approximately 10,000 people in the Transylvanian region of Romania, combined commodities procurement and technical assistance to begin solving the environmental health problems associated with exposure to emissions from a copper smelter. Sponsored by USAID's Europe and Newly Independent States (ENI) Bureau, the activity supported two of USAID/Romania's Strategic Objectives: S.O. 3.2, "Child Protection and Reproductive Health," and S. O. 3.3, "Reduced Exposure to Contaminants in Severely Polluted Areas."

This activity is viewed as a very successful one for EHP and USAID in that it reached all of its initial goals. The success of the activity would not have been possible without the enthusiastic participation and leadership of Romanian counterparts from private and public sectors who were willing to embrace a totally new style of working together to improve the future for their children and their community.

Activity Title: Innovative Cross-Sectoral Approach to Reduce Exposure of Children and Workers to Industrial Contaminants and Improve Air Quality Monitoring

Country/Region: Romania/Alba Judet

USAID S.O.s:

3.2 - Child Protection and Reproductive Health
3.3 - Reduced Exposure to Contaminants in Severely Polluted Areas

Schedule: June 1994 to October 1997

OVERALL GOALS

Through a series of workshops and group and individual meetings, three cross-sectoral working groups were formed and developed the following goals:

Reduce the Exposure of Young Children to Lead (Lead Working Group)

Rationale: Young children (0-6 years) are very sensitive to lead due to the status of their neurological development. They are also typically more exposed to lead in their environment due to their natural tendency to play in the dirt or on the floor and to put their hands and other objects in their mouth. International guidelines currently specify blood lead levels of 10 to 15 Fg/dL in young children as "levels of concern," i.e., blood lead levels which are associated with irreversible neurological effects. Limited sampling of young children in Zlatna indicated a blood lead level range of 20 to 65 Fg/dL.

Improve Air Quality Monitoring Capacity and Data Management (Air Working Group)

Rationale: The foundation for any long-term air quality regulatory and management program is adequate air quality monitoring that is useful for both the regulatory agency and the regulated industry. At the beginning of this activity, the Judet EPA's attempts to monitor air quality (sulfur dioxide only) in the vicinity of the copper smelter, Ampellum S.A., in Zlatna were primitive and the subject of great controversy between the EPA and the plant. It should be noted that improving the Judet EPA's air monitoring capabilities, which accounted for approximately half of the entire activity budget, was not directly related to USAID/Romania's Strategic Objectives for this activity. This goal was considered by USAID/Romania to be directly related to building the capacity of the Judet EPA to respond to future air quality regulations and to work with the plant to monitor and improve air quality.

Improve Occupational Health and Safety at the Smelter (OHS Working Group)

Rationale: The magnitude and frequency of gross lead poisoning in workers was, from a

western point of view, shocking. Focusing on a lead exposure reduction program for workers was determined to be an appropriate vehicle for addressing a range of exposure problems. Also, in a one-company town like Zlatna, the workers and their families comprise most of the community. Thus, awareness and behavior change efforts with workers would likely benefit the whole community, if workers were convinced of the value of reducing exposure to the most vulnerable population, their own young children.

INTERVENTION SUMMARY

Following is a list of the major aspects of each intervention. Most of these tasks were completed by Romanian counterparts, with EHP staff providing technical assistance as well as organizational and management assistance.

Reduce the Exposure of Young Children to Lead

- Establishment of a multidisciplinary Lead Working Group which included kindergarten teachers from Zlatna and Patrengeni, Zlatna doctors, an NGO called EcoZlatna, Alba Judet Sanitary Police Health Education Laboratory, and environmental health specialists from the regional Institute of Public Health
- Procurement and delivery of an atomic absorption spectrophotometer unit adapted for simultaneous analysis of 200 blood lead samples to the regional IPH and enrollment of its staff in the International Blood Lead Proficiency Testing Program, sponsored by the U.S. Centers for Disease Control
- Training in the health effects of lead exposure on young children and methods for identifying the most important lead exposure pathways
- Collection and analysis of baseline and follow-up environmental and blood lead data
- Collection and analysis of baseline and follow-up knowledge, attitude, and practices information
- Training in sampling program design and the analysis and interpretation of environmental and blood lead data
- Development of a health education program for the kindergartens and for families to reduce lead exposure to children
- Development of a community awareness program by the Judet Health Education Laboratory, utilizing newspaper, magazine, radio, and television outlets
- Collaboration between local government, teachers, parents, local doctors, the plant, the U.S. Peace Corps, and EHP to improve hygiene conditions at the Zlatna kindergarten
- Institution of a family lead awareness counseling program implemented by a newly formed NGO in Zlatna (EcoZlatna)
- Provision of a summer health education camp for children and parents sponsored by EcoZlatna and local contributions

Improve Air Quality Monitoring Capacity and Data Management

- Establishment of a Air Working Group, including members from the Judet EPA and the local copper smelter, to oversee development of an air quality monitoring program and ensure that adequate program and logistical details were completed prior to the installation of two new fixed air monitoring stations in Zlatna and downwind of the plant

- Delivery of a four-day air quality management and air monitoring training program for local EPA staff, Ampellum staff, the Ministry of Environment Air Quality Specialist from Bucharest, local government representatives and industry, and EPA representatives from another Judet
- Procurement, delivery, and installation of two state-of-the-art air monitoring stations
- Operations and maintenance training and follow-up

Improve Occupational Health and Safety at the Smelter

- Establishment of a seven-member OHS Working Group for improvement of occupational health and safety at Ampellum, consisting of OHS and medical representatives from the plant, the Judet Sanitary Police, and the regional Institute for Public Health (IPH), and the Judet representative for the Ministry of Labor
- Collaboration between the OHS Working Group and EHP on the selection of topics, design, and implementation of a six-day training program on worker health and safety. The primary topics for the training were lead intoxication and sulfur dioxide exposure.
- Equipment procurement and delivery, in association with the training program, that permitted the plant and the Sanitary Police to conduct hazardous exposure assessments, provide respirators for 50 exposed workers, and conduct fit testing to assure proper fit of respirators.
- Establishment of a medical surveillance program by OHS staff at the plant, which is now coordinated with worker blood lead sampling results from the regional IPH and with their hazardous exposure characterization measurements
- Provision of training programs, conducted by OHS staff, for workers; and providing workers with the results of workplace air monitoring results and blood lead testing. (Previously, no information or data was shared with workers.)

CRITICAL SUCCESS FACTORS

Although the three major goals of this activity differed markedly in terms of technical issues and stakeholders, they had six critical success factors in common. Generally, the extent to which the success factors were optimized was a good predictor of the relative success of each aspect of the activity. These success factors are described in more detail in Chapter 3.

- Commodity provision combined with technical assistance
- A comprehensive process to identify cross-sector stakeholders
- Collaborative goal identification and strategy development
- Baseline and follow-up assessments
- Leadership development/mentoring of key counterparts
- Program flexibility

PRIMARY RESULTS

Numerous intermediate results, identified in this report, also contributed to the achievement of the following primary results:

- The average child blood lead level in Zlatna has been reduced 25%, from 40 Fg/dL to 28 Fg/dL.
- The Judet EPA has successfully operated and maintained a two-station air monitoring network for two years, including establishment of a data management and analysis system.

- There has been a 75% reduction in the number of workers in hazardous areas exceeding the U.S. guideline for worker blood lead levels.

MAP OF ZLATNA, ROMANIA

1 BACKGROUND

The activity in Zlatna, Romania, was undertaken in response to a request to USAID from the Government of Romania (GOR) at an international donors' meeting in Lucern, Switzerland, in 1993. The request identified Zlatna, in Alba Judet, as a "hot spot" in Romania and asked for help in upgrading the local copper smelter, reducing emissions, and improving the health of plant workers and the community. The principal source of employment in Zlatna is the copper smelter and refinery operations of Ampellum S.A. The smelter is also a major source of atmospheric pollution in the area, especially sulfur dioxide (SO_2) and lead.

USAID's ENI Bureau responded to the request with an initial visit to Zlatna by staff of the World Environment Center (WEC) in March 1993; in April 1993, USAID and the GOR selected Zlatna and the Ampellum plant as a demonstration site for the USAID-supported Environmental Action Program Support (EAPS) Project. The following October, a four-person WEC team of experts conducted an assessment of the environmental and workplace conditions at the Ampellum plant and nearby copper mines and the potential human health risks associated with the smelter operations. These assessments, based on a limited set of data and meetings with researchers from a regional institute for medical research, identified the following environmental, human health, and workplace safety problems:

- Contamination of air, surface water, and soil in Zlatna by emissions from the copper smelter. Arsenic, lead, and SO_2 posed the greatest health risks, the most likely adverse health effects being respiratory problems and lead poisoning.
- Preliminary and limited data indicating that children in Zlatna, when compared to other children in Alba Judet, were experiencing significant adverse health effects, likely as a result of exposure to lead, including:
  - Reduced growth rate (25% smaller)
  - Higher blood pressure (15 mm higher)
  - Higher prevalence of musculoskeletal problems (30% higher)
  - High blood lead levels (up to 65 µg/dL, based on only 5 samples)
- Preliminary and limited data indicating that the general population in Zlatna, compared to the general population in other parts of Alba Judet, was experiencing significant adverse health effects, likely as a result of exposure to SO_2, including:
  - Higher prevalence of tuberculosis (50% higher)
  - Higher prevalence of upper respiratory tract disease, both acute (49% higher) and chronic (41% higher)
  - Higher rates of bronchial asthma (103% higher)
- Significant occurrences of lead poisoning in smelter workers and extreme respiratory and eye irritation due to exposure to fugitive SO_2 emissions
- Hazardous workplace environments in the mines and copper smelter. Such conditions can result in toxic exposures as well as physical stress and injury.

In April 1994, due to delays in the implementation of the EAPS Project, USAID's Office of Environment and Natural Resources in the ENI Bureau requested that the Environmental Health Project (EHP) provide the Ampellum copper smelter and the local community in Zlatna and Alba Iulia with technical and equipment assistance. (Alba Iulia is the Judet capital, located approximately 30 kilometers downwind from Zlatna.) The objective was to investigate the

potential for emission reductions at the plant and to reduce the environmental and human health problems associated with the smelter. In January 1996, EHP published a report which provides a detailed review of activities that occurred during the first year (1994-95). In June 1995, due to the success and momentum gained during the first year, a second year of the activity was funded for EHP to continue work with the Lead and OHS Working Groups. Activities with the copper smelter and the Air Monitoring Working Group were transferred to EAPS.

This current report summarizes the entire EHP activity (1994-97). Appendix A lists all EHP interim, workshop, and trip reports that provide detailed information on specific field visits and events, such as workshops and seminars.

2 GOALS AND STRATEGY

2.1 Topics of Concern

USAID/Romania has two Strategic Objectives that relate to environmental health problems in Zlatna:

- S.O. 3.2 - Child Protection and Reproductive Health
- S.O. 3.3 - Reduced Exposure to Contaminants in Severely Polluted Areas

Although several concerns were identified in the WEC report, such as acid mine drainage into surface water in the surrounding areas, the general state of health of Zlatna's population and the Judet EPA's lack of air monitoring capacity were preliminarily considered to be the most important. The available data suggested that lead intoxication of children and workers was the most immediate health issue. Although gross lead intoxication was recognized in workers (and considered an unfortunate but unavoidable outcome for some workers), lead intoxication in children was almost completely unrecognized as a problem.

Experts have been studying this issue of blood lead levels in children for years. The question researchers ask is, "What is the level of lead exposure at which damage occurs in children?" Blood lead levels deemed to be of concern for young children have been dropping significantly in the last 10 years, as illustrated in Figure 2-1. This lowering of "the level of concern" is based on research results which have demonstrated that blood lead concentrations as low as 10 or 15 Fg/dL are significantly associated with learning disabilities and loss of IQ points, and that the effects appear to be irreversible. In addition, it has been shown that, due to their natural behaviors, young children are typically more exposed to lead in their environment and absorb more lead through their gut than older children or adults. Figure 2-2 illustrates the health effects associated with elevated blood lead levels in children and adults. Preliminary data from Zlatna indicated that young children had blood lead levels in the 20 to 65 Fg/dL range, well above the level associated with developmental toxicity. In addition, there is evidence that fetal exposure may be significant for pregnant women who are occupationally exposed to lead, such as smelter workers.

Based on USAID/Romania's Strategic Objectives, current knowledge about the lifetime effects of low levels of lead exposure, discussions at the initial start-up workshop with Romanian counterparts, and areas of concern identified in the WEC report, a one-year EHP activity was designed to address the following three issues:

- High blood lead levels of children in Zlatna
- Poor health and safety conditions for workers at the copper smelter
- Inadequate monitoring of ambient air quality

In addition, in the first year, EHP assumed the task of investigating the feasibility of reducing smelter emissions. EHP activities in 1994-95 included a pollution prevention audit to identify emission reduction opportunities at the plant. EHP also provided equipment for monitoring stack emissions in anticipation of

Figure 2-1
Changes in Blood Lead Levels of Concern for Children # 6 years

Source: CDC 1991, p.8.

EAPS technical assistance to support collaboration between the Judet EPA's ambient air monitoring efforts and emission reduction efforts at the plant.

In June 1995, this emissions reduction task was assumed by the EAPS Project. USAID and EAPS staff worked closely with the plant, the National Mineral Institute, and the Ministry of Industry to identify potential emission reduction equipment and vendors. Emissions control equipment has not been procured, however, and Ampellum's management is currently considering several options identified for improving plant efficiency and reducing emissions.

Figure 2-3 illustrates the close connection between industrial issues and community health problems, not uncommon in the former Soviet bloc states. It shows how industrial restructuring and environmental health interventions can complement each other and support economic and health improvements in locations where antiquated industries cause unacceptable risks to health. Bulleted items indicate the general types of activities involved in working with industry and environmental health issues, as occurred in Zlatna.

2.2 Initial Survey, Stakeholder Identification, and Information Dissemination

Although many topics of concern were identified by WEC, there had been no opportunity for discussions with community members, little assessment of institutions, and no dissemination of the WEC report when the

Figure 2-2
Blood Lead Levels Associated with Adverse Health Effects

CHILDREN	Lead Concentration in Blood (ug/dL)	ADULTS
	150	
Death !		2 Encephalopathy
		2 Nephropathy
	100	
Encephalopathy !		
Nephropathy !		2 Frank Anemia
Frank Anemia !		
Colic !		2 Male Reproductive Effects
	50	2 \Hemoglobin Synthesis and Female Reproductive Effects
	40	
\Hemoglobin Synthesis !		2 \Nerve Conduction Velocity
	30	
\Vitamin D Metabolism !		2 Elevated Blood Pressure
		2 [Erythrocyte Protoporphyrin %
	20	
\Nerve Conduction Velocity !		2 [Erythrocyte Protoporphyrin &
[Erythrocyte Protoporphyrin !		
\Vitamin D Metabolism(?) !		
	10	
Developmental Toxicity !		
\IQ, \Hearing, \ Growth		
Transplacental Transfer !		

Source: U.S. Centers for Disease Control, 1991

Figure 2-3

EHP team arrived in June 1994. The report had, in fact, been tightly held by the smelter plant manager who had arranged the WEC visit.

In retrospect, one of the most important and critical success factors for this entire activity was to accomplish three tasks quickly— over a period of two weeks in October 1994:

- Conduct a community-based knowledge, attitudes, and practices (KAP) survey
- Conduct an informal institutional and leadership assessment to identify sectors and participants for cross-sectoral working groups for each topic of concern
- Begin to disseminate the findings of the WEC report

As part of this effort, EHP staff also provided numerous formal and informal presentations and facilitated discussions regarding the less obvious health effects of lead exposure, a subject that, at the time, was not well understood in Romania, even within the medical community.

The results of the KAP survey indicated that workers and local residents had general, nonspecific concerns about the potential health effects of emissions from the plant, but that open discussion of the topic did not occur due to the community's reliance on the plant for employment and feelings of powerlessness in general about the possibility of changing conditions in Zlatna. The informal institutional and leadership assessment identified individuals who should logically be involved in addressing the issues of concern and potential leaders for each topic area; the assessment also revealed the depth of distrust between institutions. In addition, it was clear that most potential participants were intrigued by but had no experience with (and were reluctant to participate in) a process of open discussion to address their concerns.

2.3 Goal Development

Through a series of workshops and group and individual meetings, three cross-sectoral working groups were formed to address lead exposure, health and safety of workers, and inadequate air data. Discussions regarding specific technical issues was less important initially than building trust and openness between participants and their respective institutions. It is important to note, however, that most participants were quite well educated and thoughtful in reviewing and absorbing technical information. After considerable discussion and exchange of perspectives and information, the three working groups had no trouble reaching consensus on the following goals:

- **Reduce the Exposure of Young Children to Lead (Lead Working Group)**
  Rationale: In contrast to older children or adults, young children (0-6 years) are typically more exposed to lead in their environment due to their natural tendency to play in the dirt or on the floor and to put their hands and other objects in their mouth. They are also much more sensitive to lead due to the status of their neurological development processes. In addition, the adverse health and neurological effects on children are irreversible.

- **Improve Air Quality Monitoring and Data Management (Air Working Group)**
  Rationale: The foundation for any long-term air quality regulatory and management program is adequate air quality monitoring that is useful for both the regulatory agency and the regulated industry. At the beginning of this activity, the Judet EPA's attempts to monitor air quality (sulfur dioxide only) were primitive and the subject of great controversy between the Judet EPA and the plant. It should be noted that improving the Judet EPA's capability to monitor air quality, which accounted for over half of the entire budget, was not directly related to USAID/Romania's Strategic Objectives for child protection and reduction of exposure to contaminants. USAID/Romania considered the air quality monitoring goal to be tied to capacity-building for the Judet EPA, to increase its ability to work with industries and to respond to new air quality regulations.

- **Improve Occupational Health and Safety at the Smelter (OHS Working Group)**
  Rationale: The magnitude and frequency of gross lead poisoning in workers was, from a western point of view, shocking. Focusing on a lead exposure reduction program for workers

was determined to be an appropriate vehicle for addressing a range of exposure problems. Also, in a one-company town like Zlatna, the workers and their families comprise most of the community. Therefore, awareness and behavior change efforts with workers could also benefit the community by supporting efforts to reduce exposure to the most vulnerable population, young children.

2.4 Strategy for Achieving Each Goal

Development of a strategy to achieve each goal began with stakeholder identification and the formation of cross-sector working groups. Specific EHP staff were also designated to work with each group. These topic groups were similar to the Strategic Objective teams that are now common in USAID missions. In the process of developing a strategy for the three goals, the groups also assessed what types of results could be measured. USAID's interest in measurable results for field activities had just recently began to reach the field level in Romania, and EHP, along with Romanian counterparts, sought to identify measurable results that were feasible (see Appendix B). Romanian participants had seldom, if ever, received or shared such information under the communist system. Although suspicious at first, ultimately they were very eager to participate in gathering and disseminating information.

Mutual agreements regarding resources were an important early step between USAID/EHP and each working group. For each goal, EHP agreed to provide the following types of assistance:

- Equipment (ultimately, totaling more than $500,000 worth, or approximately half the project budget)
- Technical assistance/training
- Cross-sector team development
- Technical support for Romanian institutions and the Zlatna community in implementing action plans developed during the activity

Romanian counterpart institutions agreed to provide time for those employees involved in working on each goal. A local NGO, Albamont, agreed to provide numerous types of logistical support locally as well as substantive guidance to EHP team members and local participants regarding working with the media and political environment in Alba Judet. Albamont members had received substantial training through USAID's Environmental Training Program (ETP), and the Zlatna activity greatly benefited from Albamont's informal as well as formal involvement.

Two events which included all three working groups were a U.S. study tour and a workshop entitled "Environmental Data Analysis, Interpretation, and Applications." The study tour, which included several members from each working group, focused on mining areas in the western United States where communities are addressing problems very similar to those in Zlatna. Tour participants had the opportunity to visit with occupational health and safety staff at smelters and community lead exposure reduction program staff, as well as attending a seminar in hazardous waste and environmental management. The environmental data workshop, described in Report for the File No. 56 (see Appendix A), provided an opportunity to update participants on current sampling design and statistical methods as well as introduce the concept and practice of quality control.

Following is a brief description of the overall strategy developed for achieving each goal. Appendix B includes a more detailed scope of work for each working group.

2.4.1 Reducing the Exposure of Young Children to Lead

Achievement of this goal required the most diverse working group and the most complex set of tasks. The Lead Working Group included the directors of the Zlatna preschool/kindergartens, two Zlatna pediatricians, a representative from the mayor's office, the director of the Judet Level Health Education Laboratory, and representatives from the regional medical research institute. After approximately a year and a half, a new NGO, EcoZlatna, was formed in Zlatna, independent of any EHP initiative, and became an important participant in the Lead Working Group.

The key activities and events for the Lead Working Group included the following:

 # Baseline Blood Lead Survey and Knowledge, Attitude, and Practices (KAP) Survey

Completion of these surveys required substantial capacity-building within the regional medical research institute, including provision of both equipment and technical assistance. Experience in the United States and internationally has shown that efforts to reduce blood lead levels in children require three fundamental components: 1) the ability to measure blood lead levels accurately and conveniently, both to establish a baseline (nature and magnitude of the problem) and to measure the results of subsequent interventions; 2) the ability to conduct an exposure pathway analysis through a combination of environmental and KAP surveys, especially when multiple exposure pathways are possible; and 3) a comprehensive and targeted education and behavior-change program based on the data generated from the initial surveys.

While the staff at the medical research institute were well educated, the technologies and equipment they worked with were quite old. Their knowledge of recent research on exposure to toxics, including the effects of environmental lead exposure on children, was extremely limited; topics such as quality assurance were virtually unknown. EHP provided an atomic absorption unit with a graphite furnace and a high-volume autosampler which allowed staff to analyze 200 to 300 samples per week. EHP also facilitated the medical research institute's enrollment in CDC's International Blood Lead Proficiency Testing Program to ensure the accuracy and quality of the blood lead results. Techniques of conducting an exposure pathway analysis and KAP survey skills were developed with specific skill-building workshops, with such topics as environmental data analysis, interpretation, and applications, accompanied by intensive one-on-one mentoring.

For the Lead Working Group, technical assistance included 1) workshops demonstrating how to present, interpret, and share data with each other, 2) identification of potential roles and responsibilities of each member, in working with each other individually as well as within their respective organizations, to develop and implement a comprehensive education and behavior-change program.

 # Exposure Pathway Evaluation

Although the smelter is the primary source of environmental lead in Zlatna, most of the exposure of children occurs through ingestion via secondary pathways, such as soil and dust. Earlier testing had determined that the water supply was clean and, although leaded gas is still prevalent in Romania, there is relatively little vehicle traffic in Zlatna,

indicating that gasoline lead is not a major exposure pathway.

Blood lead data, combined with hygiene behavior data and environmental lead data, indicated that direct ingestion of soil and dust and ingestion of unwashed produce were the primary exposure pathways for children. Unpaved streets and a lack of vegetation and groundcover make the outdoor environment, including play areas for children, quite dusty. In mining areas in the United States, indoor dust has been shown to be a significant exposure pathway for young children throughout the year. In Zlatna, however, as well as in Romania generally, thorough, daily wet mopping inside the house is the norm. As a result, indoor dust sampling teams had great difficulty finding enough dust to sample, indicating that indoor dust may not be a significant exposure pathway.

In addition, as shown in Figure 2-4, samples of washed and unwashed locally grown fruits and vegetables indicated that lead concentrations in the plant tissues are low, but that exposure to lead could be significant if unwashed produce is consumed. As shown in the figure, it is particularly important for households in Zlatna to wash vegetables and fruit. Supporting the potential significance of this exposure pathway is the fact that children of parents who reported that they did not wash fruits and vegetables had blood lead levels 5 Fg/dL higher on average than children whose parents reported washing fruits and vegetables.

Comprehensive Education and Behavior Change Program

The initial task in this area involved reviewing existing data and information, both international and local, with members of the Lead Working Group to improve their understanding and knowledge of the international concern regarding the exposure of young children to environmental lead. The second task was to ensure that the key messages regarding health effects and exposure reduction were consistent with the available data from Zlatna, including the exposure pathway analysis. Third, it was important to determine the potential roles and responsibilities for all participating organizations in developing and implementing a comprehensive education and behavior-change program that provided consistent messages for parents and children regarding health effects and exposure reduction, whether they were interacting with the schools, local pediatricians, or promoting a more public communication process.

Although it is widely accepted that child blood lead levels as low as 10 to 15 Fg/dL are associated with impaired neurological and physical development, it was important in this activity to consider the resources of the community to deal with the problem and the fact that all the children tested had blood lead levels above 20 Fg/dL. A practical and realistic set of guidelines for the local pediatricians and family counselors was needed. It had to relate blood lead levels to messages and actions. Figure 2-5 illustrates the family counseling messages that were developed to accompany blood lead testing results for Zlatna. The risk groupings reflect a balance between international guidance documents, resources available to the health and educational community at the time, the magnitude of the problem, and opinions of the local counterpart organizations. It should be noted, however, that the Lead Working Group and all the other medical and educational professionals involved received up-to-date information regarding the current status of knowledge regarding the health effects of lead exposure on young children.

Figure 2-4

Figure 2-5

A major delay resulted about one year into the activity when the GOR disbanded the health education laboratories. A cadre of health education laboratory staff from Alba Judet, who had been trained in the effects of lead exposure and techniques for identifying and reducing lead exposure pathways, were forced to move to other regions or other departments. Thus, they were no longer available to the Zlatna program at the time when the family counseling program was about to be launched. Six to eight months later, however, EcoZlatna, a newly formed NGO, was eager to take on the family counseling program as its first activity. EHP provided a short, intensive training program for EcoZlatna staff, and the group was very successful in helping to mobilize parents and other community members to reduce lead exposure to children. Appendix C provides a copy of the family counseling brochure developed by the Lead Working Group and utilized by EcoZlatna. In retrospect, using a local NGO was a more sustainable approach, in view of the changes in governmental support from the Judet laboratory. However, the general feeling of powerlessness that pervaded the community at the start of the activity would have made formation of such a local NGO difficult. The timing of EcoZlatna's appearance midway through the activity was fortunate.

In summary, local pediatricians counseled families at the Zlatna clinic and hospital; the preschool/kindergarten teachers developed puppet shows, coloring books, and other educational activities for the children and counseled parents; the Judet health educational laboratory assisted in the design and production of a series of public and family-oriented brochures as well as promotional materials for other media, including radio, television, and newspapers; and EcoZlatna provided family counseling in homes and convened neighborhood group meetings.

 # Creation of Clean Play Areas and Improved Hygiene at the Zlatna Kindergarten

This activity focused on the preschool/kindergarten facilities and outdoor play areas and became one of the collaboration highlights of the whole program. One of the early and significant contributions to this effort was the provision of a soil remediation workshop by USEPA. USEPA has considerable experience addressing lead exposure reduction in mining areas in the western United States, and this workshop presented a variety of low-cost soil and dust abatement techniques which are now being adopted in Zlatna.

Although the initial focus was on cleaning up outdoor play areas, it also became apparent that the lack of hot water and the very limited washing facilities were making personal hygiene difficult at the schools. Subsequently, collaboration between the schools, the parents, USAID/EHP, the Peace Corps, the city government, the plant, and the mines accomplished dramatic improvements at the school, as discussed in Section 4.1 of this report.

 # Improvement in Treatment Alternatives

Exposure reduction is the only long-term solution for reducing blood lead levels. For a small number of children with very high blood lead levels (60 Fg/dL and above), however, it is also desirable to have treatment options in addition to exposure reduction efforts. Treatment typically involves chelation, an intensive drug treatment that strips lead from various compartments in the body. Subsequent to this treatment, however, blood lead levels may rise even higher unless the immediate sources of lead exposure are removed or substantially mitigated.

At the time this activity began, the most common and convenient chelation drug used

for children in the United States and internationally, Succimer, was not even registered in Romania, much less available. Therefore, one of the minor activities undertaken by EHP was, through informal inquiries with the drug manufacturer, to determine the status of the registration process and, through contacts with Ministry of Health, to provide use and protocol information from contacts at the U.S. National Institutes of Health. In October 1996, EHP provided a seminar at the medical research institute, conducted by an NIH researcher and practicing clinician, on the role of chelation in pediatric lead poisoning. By the end of 1996, Succimer was registered in Romania.

2.4.2 Improve Air Monitoring Capacity and Data Management

Achievement of this goal required greater exchange and collaboration between the local EPA and the plant, as well as air monitoring equipment for both. The Air Working Group consisted of the local EPA director and two of his staff, the technical director and health and safety director from the plant, the air quality specialist from the Ministry of Environment in Bucharest, and a representative from the Judet Prefect's office.

The key activities and events for the Air Working Group included the following:

 # Air Quality Monitoring and Management Training

A training seminar was conducted in November 1994, as one of the first events for the Air Working Group. (The content of the seminar is detailed in EHP Report for the File No. 8, listed in Appendix A.) This training event provided the context for collaboration between the plant and the Judet EPA, the subsequent development of equipment specifications, purchase and set-up of air monitoring stations, and data collection and management.

 # Air Monitoring Equipment and Training

The local EPA was provided with two fixed air monitoring stations, one in Zlatna adjacent to the plant and one downwind of the plant in the small community of Patrengeni. These stations collect continuous ambient sulfur dioxide data and weekly data on ambient lead particulate concentrations. Accessory equipment also included data loggers and computer equipment to track and manage the data. The plant was provided with a mobile stack emissions monitoring unit for real time assessment of the impact of operation adjustments on emissions quality. Operations and maintenance training was provided for all equipment and followed up periodically to ensure continued operation.

 # Data Collection and Management

Oversight of data management and collection continued periodically until November 1996, when the air quality portion of the activity was transferred to the EAPS Project. USAID felt that the air quality monitoring activity fit well with the plant emissions control activity. In fact, EHP had no further involvement with the Air Working Group, though the group did participate in the final workshop for the Zlatna activity sponsored by USAID/EHP in October 1997.

2.4.3 Improve Occupational Health and Safety

Meeting this goal required a coordinated effort between plant management, health and safety staff at the plant, occupational health specialists from the Judet Sanitary Police, and occupational specialists from the regional medical research center. Representatives from these four groups constituted the OHS Working Group.

The key activities and events for the OHS Working Group included the following:

 # Equipment and Training

As with the other goal areas, providing adequate equipment was a critical component for addressing occupational health and safety. Early efforts with the working group focused on assessing the current protocols and equipment used to characterize workplace conditions and exposure. This is a major issue because workers receive "hazard pay," beyond their base salary, for working in hazardous

environments. The health and safety staff at the plant assess workplace environments to determine who should receive hazard pay, and the occupational health specialists from the Sanitary Police must independently confirm the plant's assessment. Any workplace monitoring equipment provided to the plant was also provided through this activity to the Sanitary Police to ensure consistency of measurement.

The OHS Working Group determined which workplace locations were considered most hazardous and the types of measurements that would be most useful in conjunction with a worker health and safety program and provision of personal protection equipment. For example, there was agreement that lead exposure needed to be measured, since lead poisoning diagnoses had been based, up to that time, primarily on gross symptoms. Detailed operations and maintenance training was provided with all equipment.

 # Worker Health and Safety Training

This training, described in EHP Report for the File No. 17, occurred simultaneously with the delivery of workplace monitoring and personal protection equipment. In addition to those directly involved in the Zlatna activity, participants also included occupational health staff and specialists from Baia Mare and Bucharest. Development of the content and delivery of the training was a collaborative effort between EHP and the OHS Working Group members. The group chose to focus the training on sulfur dioxide, lead exposure, and associated health effects. Romanian specialists delivered those portions of the training that covered current Romanian regulatory conditions and issues.

 # Baseline Worker Blood Lead Levels and KAP Survey

The same resources and trained personnel for the child blood lead baseline survey and the community KAP survey were utilized for developing baseline worker blood lead levels and conducting a KAP survey for workers.

 # Respiratory Protection and Lead Exposure Reduction Program Planning and Implementation

Oversight for these activities continued throughout the activity, with technical assistance and mentoring of OHS staff provided by EHP. Periodic meetings with the OHS Working Group assessed progress and assisted in overcoming obstacles.

3 CRITICAL SUCCESS FACTORS

Although the three major components of this activity differed markedly in terms of technical issues and stakeholders, there were certain critical success factors that characterized all components. Generally, the extent to which these success factors were optimized was a good predictor of the relative success of each aspect of the activity.

3.1 Commodity Provision Combined with Technical Assistance

For a country like Romania, with a well-educated population seeking to join the European Union and close a 50 year technology gap, assistance with commodities is essential. Provision of commodities needs to include all specification details and requirements as well as operations and maintenance issues, to ensure optimal and continued use of equipment to achieve the desired goals. In the Zlatna activity, initially, the interest and attention of the Romanians were almost exclusively focused on equipment. Ultimately, however, USAID's provision of material aid became a lever for strengthening and connecting the institutional and community systems in ways that people wanted but had not had the experience or skills to bring about on their own. Thus, certain skill-building and institution-building efforts were integral parts of provision of much-needed equipment. For every major piece of equipment purchased during this activity, specifications were reviewed in detail with counterparts before purchase, and technical assistance with operations and maintenance included follow-up troubleshooting as well as initial installation. As a result of this assistance, all the new equipment continues to be used regularly, and budgets for operation and maintenance are well defined. Most of the organizations that received equipment have a detailed equipment tracking system, once an item becomes part of their "patrimony," and all recipient organizations signed memoranda of understanding that stipulated how the equipment would be used.

3.2 A Comprehensive Cross-Sector Stakeholder Identification Process

One of the most critical success factors was using a process to identify stakeholders in a rapid and collaborative manner, identifying those who could contribute to achieving each of the major goals and also charting graphically, with participants, the relationships between the different stakeholder groups. It became clear that participants had no experience in describing the interrelationship of their organization and others. What initially started out as an exercise to educate the EHP team about existing organizational structures became a defining and stimulating experience for the participants. The chart that was developed by the participants of the Lead Working Group to show these organizational interrelationships is shown in Figure 3-1.

Figure 3-1

3.3 Collaborative Goal Identification and Strategy Development

Collaborative goal identification and strategy development were the first major tasks for each working group, along with reviewing and reaching consensus on equipment specifications. Among the most challenging aspects for participants were (1) simply discussing topics like roles and responsibilities for different stakeholders, and (2) the mechanics of working together and sharing information to produce and implement a plan. The Romanians were enthusiastic about the new equipment, but they had no experience crossing sectoral or agency lines and were not used to sharing information. Over time, the participants came to trust this "new" collaborative process and to appreciate the sincerity of USAID/EHP's efforts to discuss problems openly and give all stakeholders a hearing.

Some of the key lessons from this aspect of the activity were the following:

- **Keep the solution to the problem as local as possible.** The best example of this was the family counseling team, discussed in Section 2.5.1. In retrospect, development of a local family counseling team in Zlatna could have been considered at the start, rather than as a substitute when the Judet Health Education Laboratory disbanded. Zlatna is a very stable and close-knit community, and EcoZlatna's family counseling team knew the best ways to approach families and caretakers.
- **Model and encourage leveraging of other resources.** EHP modeled leveraging locally and regionally by assisting participants in identifying other resources within their own institutions or across sectors. In addition, EHP leveraged resources from the U. S. Peace Corps, to assist with kindergarten hygiene improvements, and from USEPA, to provide a soil remediation workshop in Zlatna.
- **Don't change the goals in midstream.** When the Zlatna activity began, plant emission reductions were targeted to support a health goal. When that portion of the activity was transferred to EAPS, emission reductions were considered to support an economic goal. At that point, moving ahead with emissions reductions became dependent on the economic viability of the plant. This shift created many contingencies that needed to be met before USAID would assist the plant with emission control equipment. As a result, five years after the initial request from the Romanian government to assist with upgrading the plant, emissions have not been reduced and the plant is still operating. Ironically, if emission controls had continued to be pursued as part of the initial health goal, uncertainties about the future of the plant would likely have been reduced because environmental concerns would have been mitigated. The antiquated environmental operations of the plant are currently a factor in decisions being made regarding its future.

3.4 Baseline and Follow-Up Assessments

Baseline assessments as well as follow-up assessments were critical to the success of this activity. Initially, as discussed in Section 2.2, it was important for EHP to conduct a KAP survey and informal institutional assessment to effectively begin the activity.

In addition, EHP quickly began working with the regional IPH and the Judet Health Education Laboratory to build capacity for conducting baseline and follow-up assessments. Having baseline blood lead, environmental lead, and additional KAP data from the community early in the process was critical not only for measuring the results of activities but also for informing working group members at the outset. This baseline information provided a compass for educational and behavior change programs and for weighing potential solutions.

3.5 Leadership Development/ Mentoring Key Counterparts

Identifying and mentoring leaders in each working group was an informal goal for EHP staff. While

mentoring is easily part of specific meetings such as seminars or workshops, it is more difficult between events. In the Zlatna activity, at least one key EHP staff member kept in touch with each working group, communicating and mentoring from a distance or through EHP's local coordinator. This informal and ongoing mentoring contributed significantly to the long-term sustainability of the activities.

In addition, participants at every workshop and seminar included a variety of health, environment, and NGO representatives from other Transylvanian communities that were experiencing lead exposure problems.

3.6 Maintenance of Program Flexibility

The Zlatna activity included a no-cost extension for a third year when it was thought that emission controls might still be addressed. Although that did not happen, the national political party in power changed in November 1996, the third year of the activity, resulting in changes in the management of the plant and key Judet leadership positions. New personnel, more supportive of the approaches taken in the Zlatna activity, are now in place. These changes provided EHP and Romanian participants with the opportunity to work with the new leadership prior to and during the final workshop to ensure continued high-level (or even increased) support.

4 RESULTS

The results of this activity exceeded the expectations of everyone involved. Not only were the ultimate goals achieved and confirmed, but participants frequently commented that this activity had fundamentally changed how they approached problem-solving on both a personal and professional level.

The results for each area are briefly summarized in the following sections.

4.1 Reducing the Exposure of Young Children to Lead

Results for this goal included substantial reductions in blood lead levels; changes in knowledge, attitude, and practices; and a collaborative community effort to improve hygiene conditions at the Zlatna kindergarten.

4.1.1 Reduction of Blood Lead Levels

Baseline blood lead sampling of approximately 300 children in Zlatna in 1995 (aged 1-11 years) showed that children six years and younger had an average blood lead level of 40 Fg/dL, with values for individual children ranging as high as 70 Fg/dL.

As illustrated in Figure 4-1, recent (1997) follow up blood lead testing of the same population shows that the mean blood lead level for the same population of young children has been reduced approximately 25 percent, from 40 to 28 Fg/dL. This is a dramatic improvement compared to typical results achieved in United States or other international blood lead reduction programs, especially given the fact that emissions from the smelter have not been reduced. Of particular significance is the fact that in 1995, half of the children were in the medium high risk group (35-59 Fg/dL), while in 1997, only one in five was in this risk group. The proportion of children in the low risk group (<20 Fg/dL) increased from only one in a hundred to more than one in ten. For the 59 children who participated in both surveys, it was possible to look at individual changes in blood lead levels. Figure 4-2 illustrates the predominance of blood lead level reductions by case.

Confidence in the results is strengthened by the fact that the baseline data were collected in March 1995, a time of year when blood lead levels would be expected to be at their lowest point, while the follow-up sampling was done in September 1997, a time of year when blood lead levels are typically at their peak. Winter blood lead levels are usually low due to frozen and snow-covered ground and the fact that children tend to play inside where, as discussed previously, exposure to indoor dust is likely to be minimal. Fall blood lead levels often reflect exposure resulting from a summer of outdoor play.

4.1.2 Changes in Knowledge, Attitude, and Practice

Accompanying the reductions in blood lead levels are changes in the knowledge, attitudes, and practices (KAP) of the community. In 1995, 129 families were randomly selected and participated in a KAP survey, while in 1997, 100 families were randomly surveyed. Figure 4-3 illustrates the dramatic change in awareness,

Figure 4-1

Fig 4-2

Fig 4-3

while Figure 4-4 illustrates the sources of information which the families cited. The sources of information appear to directly reflect the cross-sector nature of the Lead Working Group and the more intense mentoring of medical and education counterparts.

Figure 4-5 illustrates some of the changes in hygiene behaviors reported by respondents. Many hygiene behavior changes illustrated the same degree of change. Although further analysis of the data may reveal which behaviors are more correlated with reductions in blood lead levels, given the total array of changes reported, it seems clear that changes in knowledge (increased awareness) and behavior (new practices) have combined to reduce blood lead levels significantly.

4.1.3 Collaborative Community Effort to Improve Kindergarten Hygiene

One of the highlights of this activity was the collaborative effort to reduce contamination and improve hygiene conditions at one of the preschool/kindergartens. This was truly a spin-off activity, in which EHP's role was only facilitating some of the initial thinking. The kindergarten director actually became the driving force behind the collaboration, which ultimately included the following components:

- Provision of a gas line to the kindergarten to allow generation and use of hot water
- Purchase of a hot water heater
- Enlarged washroom with 10 new sinks for handwashing and clean-up activities
- A designated space set up for children to change their shoes when entering or leaving the building
- New radiators for the new spaces (handmade by parents)
- Clean-up of outdoor play areas, including revegetation and provision of clean sand
- New (handmade) outdoor play equipment for children and benches for parents, to make an attractive play area
- New educational materials

The total cost for all of these improvements was approximately $20,000 (90 million lei). Figure 4-6 illustrates the proportions of cash contributions from the various collaborators. This amount does not include the labor contributed by parents and teachers. Also, in addition to the leadership of the kindergarten director, a Peace Corps volunteer from Alba Iulia (the Judet capital, 30 km from Zlatna) provided extremely valuable coordination and technical assistance. (The Peace Corps 'Small Project Assistance fund also made a $5,000 contribution.)

4.2 Improve Air Monitoring and Data Management

Bridging a more than 50-year gap in environmental monitoring and data management technologies is a challenge on many levels, especially operationally. Every step in the process of designing, acquiring, operating, and maintaining the air quality monitoring system was fraught with technical details. As with other technical components of this activity, however, the EHP team found the Romanian counterparts to be well-trained technicians and very committed professionals, but extremely out-of-date regarding current practices in the environmental field.

4.2.1 Installation, Operation, and Maintenance of Air Quality Monitoring System

The two ambient air quality stations, installed in the spring of 1995, are located in Zlatna (adjacent to the plant at the Zlatna General School) and Patrengeni (approximately 2 km downwind of the plant). Their general configuration is shown in Figure 4-7. The Alba Judet EPA has operated and maintained the

Figure 4-4

Fig 4-5

Fig 4-6

Fig 4-7

two air stations with very little outside support beyond the first six months of operation. In addition, it has made the necessary contacts with vendors and suppliers and is budgeting for supplies and technical support. According to the Ministry of Environment's air quality specialist, the Alba Judet's air quality monitoring program is the most advanced in the country and is now the national model.

4.2.2 Management and Analysis of Air Quality Data

Management and analysis of air quality data are also proceeding well. Recordkeeping and data retrieval systems are working smoothly, and the Judet EPA staff are now able to identify and begin to evaluate trends, a capability that will allow them to work more effectively with the plant in the future. Data are also routinely shared with local health officials and the plant managers, an openness that was unheard of two years ago. Figures 4-8 and 4-9 illustrate the types of data outputs utilized by the Judet EPA.

4.3 Improve Occupational Health and Safety

Although the Ampellum plant had in place an organizational structure that included OHS staff and a toxicology laboratory, maintaining worker health and safety was simply not an actual management goal and received little attention. The Soviet system, which has been followed for many years, placed a great emphasis on recordkeeping but no emphasis on using the data to identify problems and improve conditions. The status of OHS at the plant was summed up at an early meeting with the plant director, who has since been replaced. He proclaimed that the Director of Health and Safety, a metallurgist by training, knew everything he needed to know about OHS because he had been directed to read all the pertinent regulations.

Over the course of the activity, improvements in OHS occurred in three categories: 1) acquisition, operation, and maintenance of workplace monitoring and personal protection equipment, 2) increased capacity and improved focus of health and safety staff, 3) reductions in blood lead levels and improvements in knowledge and practices of workers.

4.3.1 Acquisition, Operation, and Maintenance of OHS Equipment

OHS staff at the smelter and Romanian Sanitary Inspectors were involved in all aspects of acquiring, operating, and maintaining equipment for conducting workplace hazardous exposure assessments and for fitting and testing respirators for the most exposed workers at the smelter. The equipment has been well maintained and well used for the purpose of improving OHS at the plant. Appendix D lists the equipment purchased for the OHS portion of the Zlatna activity.

4.3.2 Increased Capacity and Improved Focus of OHS Staff

As a direct result of the training and one-on-one coaching and mentoring of key staff, the OHS staff at the plant established a medical surveillance program. They have been able to coordinate this program with worker blood lead sampling results from the regional medical research institute and with hazardous exposure assessments conducted by the plant itself and Romanian Sanitary Inspectors. They also routinely share information with workers about air monitoring results and blood lead testing. Previously, no information or data were ever shared with workers, and blood lead testing, as a screening test for workers, was simply not done.

Figure 4-8
Monthly Variations in Air Lead Concentrations
in Zlatna and Patrengeni in 1996

Fig 4-9

In addition to using the equipment provided, the OHS staff have become more involved, especially with the new plant management (as of early 1997), in actually changing workplace conditions and increasing personal protection. For example, they have reduced pollution at the convertor by procuring ventilation hoods and have budgeted in 1998 for additional respirators. There are also plans for new building and street cleaning equipment, which will be shared with the municipality.

4.3.3 Reductions in Blood Lead Levels and Improvements in Knowledge and Practices of Workers

Testing of workers early in the program showed that approximately 31% of workers in hazardous areas had blood lead levels well above the standard of 40 Fg/dL for U.S. workers. As illustrated in Figure 4-10, recent follow-up testing shows that blood lead levels of only about 8% of workers who participated in the program currently exceed the U.S. standard.

Figure 4-11 illustrates the relationship between individual blood lead levels in 1996 and 1997 and workplace air lead concentrations in 1997 for those workers who were provided with personal air monitoring devices. OHS staff and the plant doctor used these data in educational activities developed by the staff. For most workers, there was a significant reduction in blood lead level. In cases where blood lead levels did not decrease or even increased, staff found that those workers were either not wearing their respirators or were wearing them improperly. The data provided information that helped correct those problems.

Qualitative knowledge, attitudes, and practices (KAP) surveys of workers were conducted in 1994 and 1997. Approximately 100 workers in seven focus groups were interviewed for each survey. Although there were increases in knowledge and changes in some practices regarding hazards at the plant and how to reduce exposure, most workers felt powerless to change anything and were primarily concerned about keeping their jobs. In addition, although the respirators were appreciated, it was felt that many more were needed along with basic equipment such as adequate coveralls, boots, and gloves.

The greatest impact of the OHS activity was clearly on the OHS staff and the recently hired plant doctor. At the start, OHS staff had limited knowledge of modern OHS practices and little respect or authority from their managers or the workers. With limited resources, they have now developed a basic OHS program for some of the more hazardous work areas and hope to begin developing additional worker education programs.

Fig 4-10

4.4 Participant Evaluations

Participant evaluations were completed for each major workshop or training event, which helped guide subsequent activities. At the final workshop, attended by approximately 60 participants and senior health, environment, and NGO representatives from Bucharest and Alba Judet, evaluation forms were completed by more than 50 people. Their responses to scaled questions were as follows:

1. On a scale of 1 (not accomplished) to 5 (fully accomplished), how would you rate the accomplishment of the initial goals of the activity?

Goal	*Average Response*
Reduce lead exposure in children	3.9
Increase Judet EPA air monitoring capability	4.2
Improve OHS at the smelter	3.6

Fig 4-11

2. On a scale of 1 (no impact) to 5 (substantial impact), how would you describe the impact of this activity on your approach to future environmental health activities?

   Average Response: 4.5

More open-ended questions regarding the most valuable parts of the program and what could have been done better elicited a wide range of responses covering most aspects of the activity. They indicated a great appreciation and strong feelings of satisfaction at what has been accomplished, but also a widespread realization that much remains to be done. The lack of emission reductions at the plant is clearly a source of major frustration for everyone involved in the program.

By far, however, the greatest number of responses were elicited by a question regarding the activities that participants thought would continue. Most of the current activities were mentioned along with several activities that they envisioned growing out of this activity, such as more cross-sector collaboration on other pollution problems and expanded educational and community awareness programs to improve understanding throughout the general population.

Following are some specific comments from key participants:

It was an extraordinary experience that changed the way I approach, evaluate, and solve environmental health problems as well as how I train my staff. Realizing the need to involve government officials, mass-media, NGOs, and other decision makers to elaborate new environmental health strategies and policies was also extremely helpful.
Dr. Eugen Gurzau, Former Director, Institute for Public Health (IPH)

The most important result is that I learned a lot about environmental health and the effects of lead on children, so that I am now credible for parents and the community.
Mrs. Elena Puiulet, Director, Zlatna Kindergarten

Professionally, I learned how to approach the assessment of the health status of a population, how to transfer that information to the community and use teamwork to solve problems.
Dr. Dana Farian, Epidemiologist, IPH

The most important result of the Zlatna activity is that I learned how to approach environmental protection and health problems in the workplace, which helped me very much in my work.
Mr. Vladimir Filimon, OHS Director, Ampellum

Personally, I learned how to approach and present a problem to a group of people in a clear and reliable manner. I also improved my skills in diagnosing a disease only after considering all environmental and behavioral aspects and that collaboration between many institutions is necessary to achieve the common goal of healthy people in a healthy environment.
Dr. Claudia Vultur, Physician, Zlatna Hospital and President of EcoZlatna

The Zlatna activity increased my confidence in our ability to reduce pollution and protect the health of people living in industrial areas through technical and educational means.
Mr. Alexandru Georgescu, Ministry of Industry

5 PROSPECTS FOR SUSTAINABILITY

The prospects for sustainability of this activity were well-illustrated at the final two-day workshop in October 1997. There was considerable networking among the participants prior to the workshop, which resulted in participation and commitments for support by senior ministry officials from Bucharest and senior Judet-level officials for each working group. Senior Judet and local government leaders also praised current efforts and offered support.

At the October workshop, the Working Groups shared experiences, accomplishments, and lessons learned. They presented what they intended to do in the coming year and what that meant in terms of commitments and resources, with due attention to sources of funding as USAID support was drawing to a close. (Likely sources of support in the future are the plant itself, the local and national EPA, and government health, education, and municipal funds. Private or donor funding will also be sought.) A representative of the Regional Environment Center attended the workshop and, afterwards, spent another day with members of the Lead Working Group to help them prepare for submitting a proposal.

In addition to this networking, the three working groups gave excellent presentations (EHP staff had worked with each group on their presentation skills as well as on technical issues) which emphasized lessons learned and their planned next steps and potential sources of support. Plans for each working group include the following:

5.1 Plans for the Lead Working Group

- Continue to sponsor annually a one-week health education camp which was started in the summer of 1997 for all children with blood lead levels above 35 Fg/dL and parents. In addition to outdoor activities in a clean mountain environment, participants at the camp received instruction in lead exposure reduction, dietary improvements, and the role of vitamins and minerals.
- Conduct health assessments, including blood lead screening, and continued health education and hygiene behavior change programs for children at risk (all children in Zlatna).
- Sponsor additional collaborative efforts, such as occurred at the Zlatna kindergarten, at the other kindergartens and in other play areas to reduce dust and improve hygiene.
- Initiate a national program to improve nutrition for children in lead-contaminated areas.

5.2 Plans for the Air Working Group

- Maintain the air quality monitoring systems and use the data to develop an acceptable emissions control and operations strategy with the plant.
- Continue the data exchange program with the plant and the Sanitary Police.
- Work with the Sanitary Police to use the data to evaluate human exposure and develop a public communication approach.

5.3 Plans for the OHS Working Group

- Continue efforts to reduce exposure at high-risk locations at the plant and monitor results.

- # Purchase additional respirators in 1998.
- # Mobilize building and street cleaning equipment in the plant and in the community to reduce dust levels.
- # Maintain the new medical surveillance and respiratory protection program for workers in hazardous areas.

6 POTENTIAL NEXT STEPS FOR USAID

6.1 Emission Reductions at the Plant

The major disappointment for all of the stakeholders, by far, is that emissions from the plant have not been reduced. USAID has made a large investment in assessing the feasibility of various options for emissions reduction. In mid-1996, all of the parties involved agreed on the best approach, but since then USAID has not communicated with the plant. Plant officials understand that USAID has decided not to provide any emission control equipment, but they would greatly benefit from a final visit from the EAPS copper smelter expert with whom they had been working to finish preparing control equipment specifications for a bid package. They would also like some assistance in putting together a financial package for international investors who have recently shown interest in the plant. Providing this type of assistance may be appropriate for USAID to achieve a sense of closure to its four years of interactions with the plant. USAID's overall investment in Zlatna has been considerable. This final step in assisting the plant to address the emissions problem would be reasonable and wise.

6.2 Air Monitoring

USAID/Romania's Environment Office has recently conducted a needs assessment for all the Judet EPAs. If the resulting set of capacity-building activities includes an air quality management component, a special effort should be made to include the Alba Judet and the Mara Mures Judet (Baia Mare) EPAs. Both Judets have serious air quality problems, and their EPA staffs have more experience with air monitoring than staffs of most other Judets.

6.3 Scale-Up

In March 1996, as part of this activity, USAID/Romania requested EHP, EAPS, and USEPA to develop an integrated work plan for scaling up the lessons learned in Zlatna for Baia Mare, Mara Mures Judet. An integrated work plan was developed with a cross-sector group of Romanian counterparts in Baia Mare, and EHP and USEPA provided an initial risk assessment workshop. This was followed by a training program for Health Education Laboratory staff in KAP survey methodologies, conducted by EHP and personnel from the regional IPH who had been trained in the Zlatna activity. The EAPS also completed several activities at the local smelters, including development of a respiratory protection program with OHS plant staff and technical assistance to improve plant operations.

Through USAID/Romania's Health Office, EHP is currently conducting a limited, one-year effort to continue the scale-up of child lead exposure reduction efforts in Baia Mare and Copsca Mica (Sibiu Judet), with assistance from participants in the Zlatna activity.

Although child blood lead reduction and occupational health and safety may no longer fit into USAID/Romania's strategic objectives, the mission will

probably continue in its efforts to strengthen institutions in the country. The activity which EHP coordinated in Zlatna resulted in new collaborative relationships, between "ordinary citizens" and local institutions, and among various institutions themselves. The EHP team that worked in Zlatna recommends that USAID continue to encourage other locales in Romania to embark on such an effort. The organizations and individuals who led the successful Zlatna activities would be useful and articulate spokespersons for future scaling-up activities.

Photo 1: Stacks from Ampellum copper smelter; Zlatna is located to the right of the stacks.

Photo 2: Final workshop focused on broad collaboration and sustainability of interventions.

Photo 3 (above): Preschool/kindergarten class in Zlatna.

Photo 4 (right): Zlatna Kindergarten Director with a puppet used in children's lead education program.

Photo 5 (below): Zlatna children at lead awareness/health education summer camp.

Photo 6 (right): New handwashing facility in Zlatna Kindergarten.

Photos 7 and 8 (top and bottom): New playground equipment built by parents included swings, basketball hoop, soccer goals, benches for parents and increased grass cover, as part of effort to create safe, attractive play areas.

Photo 9 (top left): Air monitoring station exterior meteorological equipment

Photo 10 (below): Air monitoring station exterior high volume air particulate sampler

Photo 11 (top right): Air monitoring station interior data recording unit.

Photo 11 (left): Copper smelter employee utilizing half-face respirator to prevent inhalation exposure to lead

Photo 12 (below): Worker wearing a personal air monitor to measure his exposure to lead.

Appendix A
EHP Reports on Zlatna, Romania, Activities

Activity Report 13. *Summary of Activities in Zlatna, Romania, 1994-1995 (Lead Exposure in Young Children; Air Quality Monitoring and Control; Occupational Health and Safety)*, Billig, Patricia. Act. 108-RC, EHP, Arlington, Va., January 1996.

Report for the File 7. *Romania: The Environmental Health Project Air Quality Monitoring and Control Task: Trip Report (October 28 - November 5, 1994)*, Eklund, Bart. Act. 038-RC, EHP, Arlington, Va., November 1994.

Report for the File 8. *Romania: Environmental Health Project Air Quality Seminar, October 31 - November 3, 1994: Presented at Alba Iulia*, Eklund, Bart. Act. 038-RC, EHP, Arlington, Va., November 1994.

Report for the File 9. *Romania: Zlatna Activity Progress Report No. 1*, Billig, Pat. Act. 037-RC, 038-RC, and 039-RC, EHP, Arlington, Va., November 29, 1994.

Report for the File 10. *Romania: Zlatna Activity Progress Report No. 2*, Billig, Pat. Act. 037-RC, 038-RC, and 039-RC, EHP, Arlington, Va., March 1995.

Report for the File 16. *Romania: Trip Report, July 3, 1995*, Eklund, Bart. Act. 038-RC, EHP, Arlington, Va., July 1995.

Report for the File 17. *Romania: Trip Report, Worker Health and Safety, Zlatna; June 6, 1995*, Murphy, Dennis. Act. 039-RC, EHP, Arlington, Va., June 1995.

Report for the File 19. *Romania: Trip Report: Technical Visit to the Copper Smelter of Ampellum S.A., Zlatna, Transylvania; October 31-November 3, 1994*, Matousek, J. W. Act. 038-RC, EHP, Arlington, Va., November 1994.

Report for the File 20. *Zlatna, Romania: Trip Report #1, October-November 1994*, Pollard, Richard. Act. 037-RC, EHP, Arlington, Va., November 1994.

Report for the File 21. *Zlatna, Romania: Trip Report #2, Lead Education, Behavior Change, and Social Marketing*, Pollard, Richard. Act. 037-RC, EHP, Arlington, Va., December 1994.

Report for the File 22. *Romania: Trip Report, October/November 1994, Zlatna*, Senturia, Kirsten D. Act. 037-RC, EHP, Arlington, Va., November 1994.

Report for the File 23. *Romania: Trip Report, Activity Start-up and Agency/Public Consultation Process, June 27-July 1, 1994, Zlatna*, Billig, Pat, Hurwitz, Alan, and Borrazzo, John. Act. 018-RC, EHP, Arlington, Va., July 1994.

Report for the File 25. *Final Trip Report for Activities 037 RC - Reduction of Lead Exposure to Young Children; 038 RC - Air Quality Monitoring and Control; and 039 RC - Worker Health and Safety*, Billig, Pat. Act. 037-RC, 038-RC, 039-RC, EHP, Arlington, Va., June 1995.

Report for the File 28. *Environmental Health Project Air Quality Seminar*, Eklund, Bart. Act. 038-RC, EHP, Arlington, Va., October 31 - November 3, 1994.

Report for the File 29. *Air Quality Monitoring System Installation for the Alba Iulia (Romania) Environmental Protection Agency*, Moltzau, Ralph H. Act. 038-RC, EHP, Arlington, Va., July 1995.

Report for the File 34. *Zlatna, Romania: Industrial Hygiene Course and Workbook*, Murphy, Dennis. Act. 039-RC, EHP, Arlington, Va., August 1995.

Report for the File 35. *Zlatna, Romania: Trip Report #3, Lead Education, Behavior Change, and Social Marketing* , Pollard, Richard. Act. 037-RC, EHP, Arlington, Va., May 1995.

Report for the File 38. *Worker Health and Safety Course: 8-13 May 1995, Zlatna, Romania*, Murphy, Dennis. Act. 018-RC, EHP, Arlington, Va., November 1995.

Report for the File 44. *Zlatna, Romania: Trip Report #4, Lead Education, Behavior Change, and Social Marketing* , Pollard, Richard. Act. 224-RC, EHP, Arlington, Va., November 1995.

Report for the File 52. *Zlatna, Romania; Trip Report, November 11-18, 1995*, Becnel, Cindy A. Act. 224-RC, EHP, Arlington, Va., November 1995.

Report for the File 55. *Trip Report, Zlatna, Romania/ November 13-15, 1995*, Billig, Patricia. Act. No. 224-RC, EHP, Arlington, Va., November 1995.

Report for the File 56. *Zlatna, Romania: Workshop on Environmental Data Analysis, Interpretation, and Applications*, Chappell, Richard. Act. 224-RC, EHP, Arlington, Va., November 1995.

Report for the File 70. *Zlatna, Romania: Trip Report #5, Lead Education, Behavior Change, and Social Marketing* , Pollard, Richard. Act. 224-RC, EHP, Arlington, Va., February 1996.

Report for the File 72. *Zlatna, Romania: Trip Report #6, Lead Education, Behavior Change, and Social Marketing* , Pollard, Richard. Act. 224-RC, EHP, Arlington, Va., April 1996.

Report for the File 85. *Trip Report; Romania: Zlatna Activity, May 15-21, 1996*, Billig, Pat, Alison, Kathy, and Maracineanu, Mihai. Act. 224-RC, EHP, Arlington, Va., May 1996.

Report for the File 105. *Trip Report: Air Quality Monitoring System Support for the Alba Iulia (Romania) Environmental Protection Agency, November 12-20, 1995*, Moltzau, Ralph H. Act. 224-RC, EHP, Arlington, Va., January 1996.

Report for the File 115. *Trip Report, Zlatna, Romania Activity, February 18-25, 1997*, Billig, Patricia, LaVelle, J., and Maracineanu, Mihai. Act. 224-RC, EHP, Arlington, Va., March 1997.

Appendix B
Scopes of Work for Each Goal

Reducing the Exposure of Young Children to Lead

Purpose
To reduce childhood exposure to lead, thereby reducing blood lead levels in children and mitigating lifelong adverse neurological effects.

Potential Measurable Results
Reduction of blood lead levels in children in Zlatna and changes in knowledge, attitudes, and practices of children and their parents regarding the mechanisms and consequences of childhood exposure to lead.

Tasks
- # Communication, coordination, and collaboration with Romanian counterparts at the Center for Medical Research (CMR) in Cluj, the Zlatna Hospital and Dispensary, and within the community in Zlatna.
- # Oversight of the design and implementation of a childhood blood lead study in Zlatna, with associated environmental lead sampling, to provide baseline information for the development of a health education and social marketing program and to identify children at risk.
- # Oversight of the development of a community-based public health education and social marketing program in Zlatna to educate both parents and children regarding the source and potential health effects of exposure to lead and to promote techniques and strategies for reducing exposure.
- # Acquisition of an atomic absorption spectrophotometer with a graphite furnace for analyzing blood samples for lead.
- # Acquisition and development of educational materials that support implementation of the health education and social marketing program.

Improved Air Quality Monitoring and Control

Purpose
To improve confidence in ambient air monitoring data and reduce plant emissions from the new smelter, through the use of an SO2 process analyzer on the acid plant.

Potential Measurable Results
- # Implementation of an ambient air monitoring program for SO2 and particulate that can be used for regulatory purposes and is endorsed by both Alba Judet EPA and Ampellum plant management.
- # Installation of an SO2 process analyzer for the acid plant and implementation of a plan for reducing SO2 emissions.
- # Initiation of an ambient air monitoring recordkeeping system that is understandable by the public.

Tasks
- # Communication, coordination, and collaboration with Romanian counterparts at the Alba Judet EPA and Ampellum during all phases of the program.
- # Training in and oversight of the development of a regulatory ambient air monitoring program with clearly defined goals and objectives.
- # Acquisition and installation of ambient air monitoring equipment to support the monitoring program.

- Acquisition and installation of an SO2 process analyzer for the acid plant, and development of a plan for using information from the analyzer to reduce SO2 emissions.
- Oversight of the development of an ambient air monitoring recordkeeping system for use by all interested parties.

Improved Occupational Health and Safety

Purpose

To assist plant management, the plant doctor, union representatives, and the sanitary police in improving health and safety conditions and workplace monitoring practices.

Potential Measurable Results

- Implementation of a health and safety plan for all plant workers that utilizes workplace monitoring equipment and personal protective equipment to develop and sustain both long- and short-term improvements in worker health and safety.
- Initiation of a health and safety record-keeping system that will allow formal tracking of changes in numbers or types of worker health and safety incidents and health measurements such as blood lead levels.
- A list of locations and processes where hazards to workers have been minimized by engineering controls, administrative actions, and/or use of personal protective equipment.

Tasks

- Communication, coordination, and collaboration with Romanian counterparts at the CMR in Cluj, the Alba Judet Sanitary Directorate and Police, plant management and union representatives for all phases of the program.
- Training in and oversight of the development of a practical plant health and safety plan that clearly defines the roles and responsibilities of plant management personnel, plant health and safety workers, the plant physician, and Ministry of Health officials, including Sanitary Police and the CMR in Cluj.
- Acquisition of workplace and personal monitoring equipment to support the training program and implementation of the health and safety plan.
- Oversight of plant acquisition of personal protective equipment that is readily available in Romania.
- Development and implementation of an on-site occupational health and safety training program that integrates the use of personal protective equipment, workplace monitoring equipment, and administrative actions to control hazards.
- Oversight of the development of a health and safety recordkeeping system that will allow documentation of baseline conditions, comparison of old and new smelter operations, and comparison of health outcomes to monitoring results.

Appendix C

Family Counseling Brochure

50

51

52

53

54

55

56

57

58

59

60

61

62

63

64

65

66

Appendix D
Commodities Provided

Lead Working Group

Atomic absorption spectrophotometer, vacutainers and needles (Regional Institute for Public Health)

Computer, printer (Alba Judet Health Education Laboratory)

Hematofluorometer, vacutainers and needles (Zlatna Hospital)

Fax machine, computer, printer, Denver II developmental test kit (EcoZlatna NGO)

Audiovisual, educational materials (Kindergarten/Preschools)

Air Working Group

Two fixed air monitoring stations with associated meteorological equipment, continuous SO_2 monitor, high volume air sampler for measuring lead particulate concentration, data loggers, and calibration kit (Alba Judet EPA)

Computer, printer (Alba Judet EPA)

Portable stack emissions monitoring unit (Ampellum Plant)

Occupational Health and Safety

Work place air monitoring equipment, calibration kit (Alba Judet Sanitary Police)

Work place air monitoring equipment, calibration kit (Ampellum Plant)

Fifty respirators with associated cartridges, parts, and filters (Ampellum Plant)

Personal air monitoring pumps (Ampellum Plant)

Respirometer (Zlatna Hospital)