



- PN-ACH-674

104929



# **Environmental Policy and Technology Project**

**For the New Independent States  
of the Former Soviet Union**

**Contract No. CCN-0003-Q-00-3165-00**

**CENTRAL ASIAN REPUBLICS**

**FINAL REPORT**

**Delivery Order No. 12**

**Central Asian Republics**

**Sustainable Water Management in the Aral Sea Basin**

**Prepared for:**

**Bureau for Europe and the New Independent States  
U.S. Agency for International Development**

**Prepared by:**

**Environmental Policy and Technology Project  
A USAID Project Consortium Led by CH2M HILL**

- 1 -

## PREFACE

Under the 1992 Freedom Support Act, the United States Congress initiated a program to provide assistance to new independent states (NIS) of the former Soviet Union. Cooperative Agreements were signed between representatives of the U.S. government and each country in which assistance was to be undertaken. The U. S. Agency for International Development (USAID) was given the responsibility to coordinate all U. S. Government assistance to the NIS under the Act. The strategic objectives of USAID's assistance to the NIS were to promote:

1. Environmentally sound, sustainable economic development during the transition to a market based economy;
2. Reduction in pollution-related risks to health; and
3. Reduction of the threats to the global and regional environment.

Through competitive bidding, USAID awarded a multi-year contract to a team managed by CH2M HILL International Services, Inc. (CH2M HILL) to support implementation of an environmental assistance program to republics of the former Soviet Union. Under this contract, termed the Environmental Policy and Technology (EPT) Project, CH2M HILL was to assist USAID's missions in Moscow, Kyiv, and Almaty undertake a program to promote environmental improvements in the NIS.

The CH2M HILL team included the following organizations:

- Center for International Environmental Law
- Clark Atlanta University/HBCUMI Environmental Consortium
- Consortium for International Development
- Ecojuris
- Environmental Compliance, Inc.
- Harvard Institute for International Development
- Hughes Technical Services Company
- International Programs Consortium
- International Resources Group, Ltd.
- Interfax Newsagency
- K&M Engineering
- Ogden Environmental and Energy Services Company
- World Wildlife Fund (US).

The USAID mission in Almaty supports environmental, and other, assistance programs to the Central Asian Republics. CH2M HILL established an office in Almaty, Kazakhstan to manage and support activities in the Central Asian Republics under the EPT Project, including country-specific activities in Kazakhstan, Turkmenistan, and Uzbekistan and region-wide activities benefitting all five republics. As appropriate, field offices were established at specific project sites within the republics. The project's headquarters office in Washington, D.C. provided overall direction and management support for project activities in all regions.

This report was prepared as a contractually required deliverable under the contract between USAID and CH2M HILL. Although work on this report was conducted in cooperation with the assisted governments and USAID, the findings and recommendations are those of the CH2M HILL team. They do not necessarily represent official positions of the governments of the assisted countries nor of USAID.

For additional information regarding the EPT Project, please contact:

### CH2M HILL

1250 H Street, N.W.; Suite 575  
Washington, D.C. 20005 USA

**Telephone:** 202-393-2426  
**Fax:** 202-783-8410  
**E-Mail:** jshaikh@ch2m.com  
**Contact:** Jean Shaikh, EPT Project Director

## Table of Contents

<b>Section</b>	<b>Page No.</b>
1. Introduction	4
1.1 Overview of the U.S. Aral Sea Program	4
1.2 Introduction to Delivery Order No. 12	5
2. Delivery Order Objectives and Scope	6
2.1 Delivery Order Objectives	6
2.2 Evolution of Delivery Order Scope	6
2.3 Delivery Order Scope	6
2.4 Project Goals and Strategic Objectives	8
3. Delivery Order Deliverables	12
4. Delivery Order Accomplishments	13
4.1 Environmental Health and Clean Water	13
4.1.1 Kazakhstan	13
4.1.2 Turkmenistan	17
4.1.3 Uzbekistan	13
4.1.4 Actions in all Three Countries	20
4.1.4.1 Water Quality Laboratory Follow-On	20
4.1.4.2 Economic and Financing Evaluation	21
4.1.4.3 Additional Equipment and Supplies	22
4.2 Water Management Policies	23
4.2.1 Issues Papers	24
4.2.2 Regional Cooperation Agreements	25
4.2.3 Water Pricing Policy	25
4.2.4 Toktogul Reservoir Operating Procedures	26
5. Delivery Order Lessons Learned	28

### Appendix

Appendix A: Status of Deliverables

## Section 1 Introduction

### 1.1 Overview of the U.S. Aral Sea Program

The Aral Sea is a major environmental disaster in Central Asia which directly affects Kazakhstan, Uzbekistan, and Turkmenistan, and indirectly the Kyrgyz Republic and Tajikistan. Thirty years ago the Aral Sea was the fourth largest inland lake in the world. Today the sea level has fallen 12 meters, the surface area has been reduced by one-half, and the salinity levels have tripled. The effects of these changes include: destroyed ecosystems; an end to commercial fishing; a dramatic decline in agricultural productivity brought on by increased soil salinity and localized climate change leading to a drastically shortened and much drier growing season; contaminated ground water; and a severe public health crisis in the areas surrounding the Aral Sea. These effects combine to create one of the world's largest environmental disasters, caused as a direct result of decisions taken during the Soviet era to focus primarily on the production of cotton and rice.

In August 1990, Senator Al Gore visited the Aral Sea region of the Central Asia Republics to witness the "impact of a poor irrigation strategy." As Vice President he has made the Aral Sea disaster zone a high priority for the United States Agency for International Development (USAID) assistance.

In March 1993, the presidents of the five Central Asian Republics met in Kyzyl-Orda, Kazakhstan and established an Interstate Council for the Aral Sea (ICAS), pledging one percent of the GDP in each country to be devoted to addressing problems of the Aral Sea. In July 1993, Secretary of State Warren Christopher recommended the execution of bilateral programs and the support of multilateral programs for international cooperation on Aral Sea projects to: provide technical support to improve water quality; address immediate public health needs; and develop effective regional water management policy mechanisms.

In October 1993, the Environmental Policy and Technology (EPT) Project contract, designed to support implementation of USAID's environmental assistance to the republics of the former Soviet Union, was awarded to a team managed by CH2M HILL International Services, Inc. (CH2M HILL). Four delivery orders for work to support the Aral Sea Program were executed under the EPT Project contract in 1994:

*Delivery Order No. 2 - Potable Water System for Tashauz Oblast: Turkmenbashi Water Treatment and Dispensing System (Turkmenistan);*

*Delivery Order No. 4 - Predesign Activities for Potable Water Projects in the Aral Sea Basin and Environmental Action Plan (EAP Activity) (Kazakhstan and Uzbekistan);*

*Delivery Order No. 6 - Potable Water Treatment Plant/Distribution System and Public Health Improvements for Khorezm Oblast (Urgench) and the Republic of Karakalpakistan (Nukus) (Uzbekistan);*

*Delivery Order No. 7 - Potable Water Distribution System and Public Health Improvements for Kzyl Orda Oblast and the Cities of Aralsk and Kazalinsk (Kazakhstan);*

*Delivery Order No. 8 - Central Asian Republics: Regional Water Management and Cooperation Project (five Central Asian Republics).*

Delivery Order No. 12 - *Sustainable Water Management in the Aral Sea Basin* - covering all five Central Asian Republics was awarded in 1995. This delivery order provided for the expansion of the country-specific potable water and public health and sanitation activities initiated in Kazakhstan, Turkmenistan, and Uzbekistan under Delivery Order Nos. 2, 4, 6, and 7 and for the initiation of activities specifically aimed at enhancing the sustainability of these efforts. It also provided for the expansion of the regional water management and cooperation activities initiated under Delivery Order No. 8.

Delivery Order No. 14 - *Water and Environmental Management Policy in Uzbekistan* - was awarded in 1996.

## **1.2 Introduction to Delivery Order No. 12**

Delivery Order No 12 provided for the expansion of a number of the country-specific potable water and public health and sanitation activities initiated in Kazakhstan, Turkmenistan, and Uzbekistan under Delivery Order Nos. 2, 4, 6, and 7 and for the initiation of activities specifically aimed at enhancing the sustainability of these efforts. It also provided for the expansion of the regional water management and cooperation activities initiated under Delivery Order No. 8.

Delivery Order No. 12 was modified several times, most significantly in May 1996, when three of the region-wide tasks were deleted from the scope of work, in September 1996, when a new industrial waste minimization task for Uzbekistan was added to the scope of work, and in September 1997, when a new scope of work, focused on regional water management policy development, was specified for the period September 27, 1997 - September 28, 1998.

This report reviews the scope of work, deliverables and major accomplishments of and lessons learned from the work carried out under Delivery Order No. 12. The body of this report contains four main sections : II. Delivery Order Objectives and Scope; III. Deliverables; IV. Major Accomplishments; and V. Lessons Learned.

## **Section 2**

# **Delivery Order Objectives and Scope**

### **2.1 Delivery Order Objectives**

Delivery Order No. 12's activities built on and continued ongoing efforts to address the significant environmental related problems of the Aral Sea Basin. The delivery order's objectives were:

1. To improve and monitor the quality of the region's drinking water
2. To improve community health and sanitary practices;
3. To improve governments' abilities to manage their water resources; and
4. To alter policies that contribute to the misuse of these resources.

### **2.2 Evolution of Delivery Order Scope**

Delivery Order No. 12 was modified several times, most significantly in May 1996, when three of the region-wide tasks were deleted from the scope of work (Modification 2), in September 1996, when a new industrial waste minimization task for Uzbekistan was added to the scope of work (Modification 3), and in September 1997, when Modification 6 specified a new scope of work, focused on regional water management policy development, for the period September 27, 1997 - September 28, 1998.

It is the scopes of work as outlined in the original delivery order and in Modifications 2, 3, and 6 that were actually implemented and are reported herein.

### **2.3 Delivery Order Scope**

The major elements of the scope of work for this delivery order were :

1. Work Plans and Reports
2. Environmental Health and Clean Water
  - Kazakhstan
    - Rehabilitation of Well Fields. Design and implement a comprehensive plan to rehabilitate up to 30 wells in the Kosaman and Berdykol well fields.
    - Sanitation Facilities. Develop a sanitation program which includes health outreach services and construction of facilities.

- Turkmenistan
  - Expand Distribution of Water from Reverse Osmosis Plant. Develop and implement a plan to expand the distribution system for water produced at the reverse osmosis (RO) treatment plant under construction under DO 2.
  - Expand Operation and Maintenance Coverage at Reverse Osmosis Plant.
  - Sanitation Facilities Progress. Develop a sanitation program which includes health outreach services and construction of facilities.
  
- Uzbekistan
  - Identify Improvements to Water Transmission Lines. Conduct an engineering evaluation of the main water transmission lines from the water treatment plants in Nukus and Urgench to determine improvements needed to the transmission lines and pump stations.
  - End-of-Pipeline Chlorination. Procure and install chlorination equipment at the end of pipelines supplying treated water to Nukus, Urgench, and other cities.
  - Extend Operational Services. Provide technical assistance and limited process equipment needed to improve operations of the water treatment plants in Nukus and Urgench.
  - Sanitation Facilities. Develop a sanitation program which includes health outreach services and construction of facilities.
  - Policy Sustainability for Industrial Waste Minimization. Identify and implement the steps necessary to ensure that an effective policy framework at the national and local levels is developed to support the extension and promulgation of successful waste minimization experiences (Modification 3).
  
- Actions In all Three Countries
  - Water Quality Laboratory Follow-on. Perform inspections of equipment provided to water quality laboratories in Kazakhstan, Turkmenistan, and Uzbekistan under DO 2, DO 6, and DO 7. Train counterparts in inspection techniques and certify analysts. Investigate the use of locally-available chemicals to replace pre-packaged reagents. Work with laboratories to develop a data-management system for each laboratory.
  - Economic and Financing Evaluation. Determine the O&M costs of the

water facilities addressed in Delivery Order Nos. 2, 6, and 7. Develop recommendations for long-term financing of the O&M activities in each country. As necessary to ensure sustainability of potable water system improvements undertaken under DO 2, DO 6, DO 7, and DO 12, provide technical assistance with regard to the economic evaluation of operating, maintaining and distributing water and alternative methodologies and strategies for financing such operations (Modification 6).

- Additional Equipment and Supplies. Develop recommendations for purchase and installation of additional equipment or facilities in Kazakhstan, Turkmenistan, and Uzbekistan.

### 3. Water Management Policies

- Issues Papers. Prepare up to 20 issues papers and one synthesis report analyzing water-related policy issues in the Aral Sea Basin and recommending new or revised policies.
- Regional Cooperation Agreements. Provide technical assistance to the riparian states of the Syr Darya toward the adoption of a long-term agreement for the Toktogul Reservoir and additional long-term water resource cost-sharing arrangements between Central Asian states (Modification 6).
- Water Pricing Policy. Provide technical assistance to facilitate the adoption of laws and regulations relating to water pricing and water conservation and the adoption of an environmental damage assessment model for the Aral Sea (Modification 6).
- Toktogul Reservoir Operating Procedures. Provide technical assistance to the cognizant entity (the BVO Syr Darya) to document the current operating requirements for the reservoir, evaluate the current rules and regulations for reservoir operation to determine relevancy and recommend alterations (Modification 6).
- Coordination with Other Donors and Implementors (Modification 6).

## 2.4 Project Goals and Strategic Objectives

Throughout 1996 and 1997, the EPT Project participated in the USAID Almaty Mission process of developing objectives, targets and indicators for its environmental program. The work of DO 12 was conducted under the Agency's strategic objective 3.3, "Reduced Environmental Risks in Public Health," associated with the indicators of improved reliability and availability of potable water, adoption of sound sanitation practices, and increased regional cooperation in water resources management in the Aral Sea Basin and industrial and urban pollution abatement. Specifically, the work performed under DO 12 was linked to IRs 3.3.1, 3.3.2, 3.3.3 and 3.3.4 of this objective:

**IRs. 3.3.1 and 3.3.2: Mitigation of negative environmental impacts of the Aral Sea disaster on local populations.**

- *Indicators:* Improved: (a) reliability and availability of potable water; and (b) adoption of sound sanitation practices.
- *Indicator definition:* Population with improved access to (a) potable water; and (b) public health education and information
- *Unit of measurement:* Number of people benefitted

**IR 3.3.1.1 - USAID water supply improvement activities leverage other donor support**

- *Indicators:* Other donors making significant investments into water supply and treatment infrastructure
- *Definition:* Ability of USAID to leverage other donor investments to enhance overall project impact
- *Unit of measurement:* Number of dollars invested/programmed
- *Target (Kazakhstan):* \$25 million by 1998  
*(Uzbekistan):* \$25 million by 1998  
*(Turkmenistan):* \$10 million by 1998

**IR 3.3.1.2 - Water supply facilities managed on a sustainable basis**

- *Indicators:* Adequate recurrent budget provided by host country government for sustained O&M of water treatment facilities
- *Indicator definition:* USAID-assisted water treatment facilities function effectively on a yearly basis
- *Unit of measurement:* Percent of O&M costs covered by local authorities
- *Target (Kazakhstan):* 25% by 1996; 75% by 1997  
*(Uzbekistan):* 25% by 1996; 75% by 1997  
*(Turkmenistan):* 25% by '996; 75% by 1997

**IR 3.3.1.3 - Water supply and treatment facilities improved**

- *Indicators:* Quality, quantity and reliability of potable water increased due to rehabilitated facilities
- *Indicator definition:* USAID-assisted rehabilitation of selected water treatment facilities completed

- *Unit of measurement:* Number of improved pump stations, water wells, and treatment plants
- *Target (pump stations, CAR):* 7 by 1997
- (*water wells, CAR*): 32 by 1997
- (*treatment plants, CAR*): 2 by 1997
- (*RO plants, CAR*): 1 by 1997

**IR 3.3.2.1 - Information on local water quality available and widely disseminated**

- *Indicators:* Water quality monitoring and reporting improved
- *Indicator definition:* Labs provided with adequate equipment, training, and reagents issuing periodic reports
- *Unit of measurement:* Number of improved labs operating
- *Target (Kazakhstan):* 5 by 1997
- (*Uzbekistan*): 3 by 1997
- (*Turkmenistan*): 2 by 1997

**IR 3.3.2.2 - Adequate information disseminated on public health as it relates to potable water in the Aral Sea disaster zone**

- *Indicators:* Health education programs and public health demonstration projects increased
- *Indicator definition:* Areas receiving public health information and health demonstration projects
- *Unit of measurement:* Number of rayons and health demonstration projects
- *Target (raions, CAR):* 6 by 1997
- *Target (projects, CAR):* 20 by 1997

**IRs. 3.3.3 and 3.3.4: Development of legal and regulatory framework conducive for reducing environmental risks to public health**

- *Indicators:* Legal and regulatory regimes supports sustainable environmental management
- *Indicator definition:* Appropriate laws, decrees, and/or IRRs drafted
- *Unit of measurement:* Number of decrees, laws and IRRs

**IRs 3.3.3.1 and 3.3.4.1 - Environmental policy (water and non-water) recommendations of selected progressive groups adopted**

- *Indicators:* Improved quantity/quality of analysis and advocacy supporting high priority environmental policy and legislation
- *Definition:* CAR-U.S. analytical research/policy advocacy efforts in water management and other selected topics
- *Unit of measurement:* Number of joint analytical/advocacy efforts implemented
- *Target:* 4 by 1998

**Section 3**  
**Delivery Order Deliverables**

Reports /Deliverables of Delivery Order No. 12 and their status is presented in Appendix A.

## Section 4

# Delivery Order Accomplishments

## 4.1 Environmental Health and Clean Water

### 4.1.1 Kazakhstan

#### 4.1.1.1 Rehabilitation of Well Fields

Under Delivery Order Nos. 7 and 12, the EPT Project assisted in rehabilitating the existing Aral-Sarybulak Water Supply System (ASWWS). This system was designed in the 1970s and built in the 1980s as a centralized system to supply drinking water to the population in and around the cities of Aralsk and Novokazalinsk, an area near the Aral Sea in the Kzyl Orda Oblast. The entire water system was to be based on the deep Tolagai groundwater aquifer tapped by two well fields near Kosaman and Berdykol northwest from Aralsk. The completed components of the ASWWS included two well fields at Kosaman and Berdykol, a main transmission pipeline between Kosaman, Berdykol, Aralsk, and Novokazalinsk, six booster pump stations serving the main transmission pipeline, and the City of Aralsk Pump Station. Because of the high quality of groundwater extracted from the Tolagai aquifer, no water treatment except for disinfection was required. To provide disinfection capacity, chlorine-based systems were installed at every booster pump station along the pipeline.

The poor quality of construction and installed equipment and materials caused significant operating problems since the ASWWS was constructed. As a result, the uninterrupted use of the system was virtually impossible since the first day of system operation, and the condition of the system gradually declined over time. EPT Project assessment teams visiting the area in 1994 and 1995 found the system to be in critical condition. In June of 1995, only 15 of the 38 wells in the two well fields were in operating condition. At the pump stations, most of the existing pumping and electrical equipment was in a state of disrepair. System outages from pumping equipment breakdowns were common and often resulted in complete shutdowns of water service. The main transmission pipeline was also in critical condition. Water disinfection systems at the pump stations and at the Novokazalinsk Water Treatment Plant were out of operation or operating improperly, with equipment leaking chlorine, endangering the operators, causing rapid equipment corrosion, and wasting chlorine.

Under DO 7, the EPT Project completed a program to rehabilitate the system's 7 pump stations, procured and installed disinfection systems, and provided needed maintenance equipment. A pilot activity to rehabilitate the well fields was also initiated under DO 7. Large-scale rehabilitation of the well fields was undertaken and completed in 1996 under Delivery Order No. 12.

The rehabilitation program was designed to restore the original capacity and to improve the reliability of the well fields and addressed each of the 38 wells using a rehabilitation scenario modified for specific considerations at each well. First, existing wells and well screens were logged for actual depth. Attempts were made to remove any foreign objects found in the wells.

Each well was hydraulically tested using the airlift method or, if operable, by the existing pumping equipment. For wells showing low efficiency during testing, mechanical or chemical redevelopment methods were applied. Several wells had to be abandoned due to low yield, poor water quality, high sand content, or foreign objects that could not be removed. In each suitable well, a new submersible pump with a motor was lowered into the well interior suspended on a new pump column. Each new pump was provided with a surface-mounted control panel that included multiple electrical protection devices. In wells suffering from high sand content, submersible sand separators or new well screens were installed. New wellhead fittings were installed, electrical service to the wellhead was restored, and pump houses were constructed at all rehabilitated wells.

Work was performed by local drilling contractors funded by the Government of Kazakhstan (GOK) and working under the supervision of EPT Project staff.

Twenty-nine wells were rehabilitated, and the capacity of the pumping equipment installed at the well fields doubled from 285 lps (4,517 gpm) to 587 lps (9,300 gpm).

The overall objectives of this task were met through the completion of the following activities:

- Installation of 29 U.S.-manufactured pumps, motors, and control panels, which provided reliable pumping equipment for the well fields. Power consumption at the well fields was reduced by 40 percent because of the use of more efficient, properly selected submersible pumping equipment
- Installation of 15 U.S.-manufactured submersible sand separators at selected wells, which protected the new pumping equipment from the effects of sanding
- Mechanical and chemical redevelopment of 25 selected wells, which improved well efficiency and increased well yields by 25-31 percent
- Installation of new well screens at two selected wells, which protected the new pumping equipment
- Operator training and provision of a Russian-language operations and maintenance manual, which enhanced operator competence
- Provision of spare pumps, motors, electrical components, and other spare parts and tools, which enabled continued well field operation.

#### 4.1.1.2 Sanitation Facilities

Under DOs 2, 6, and 7, a health education and material development program comprising in-country needs assessments and in-country inter-agency planning seminars was implemented in Kazakhstan, Turkmenistan, and Uzbekistan between mid-1994 and mid-1994. This program culminated in the development of a health action plan, including a comprehensive training program and support for the implementation of twenty grass-roots health demonstration projects,

proposed for implementation under Delivery Order No. 12. The purpose of the small demonstration projects was to improve water supply to kindergartens, schools, health care centers, farms, and factories in five rayons: Dashhovuz, Turkmenistan; Urgench, Uzbekistan; Beruni, Karakalpakstan, Uzbekistan; Aralsk, Kazakhstan; and Kazalinsk and Kzyl Orda, Kazakhstan. It was agreed that the EPT Project would provide material for these projects, while labor and project implementation would be the responsibility of the local communities. Generally, these projects were focussed on installing pipes within facilities or on connecting main pipelines to facilities. Some projects required extensive engineering; some were interior plumbing.

Under DO 12, a four-week workshop for 30 individuals responsible for planning, implementing, and evaluating health education programs in Kazakhstan, Turkmenistan, and Uzbekistan, nine of whom were from Kazakhstan, was held in Almaty, Kazakhstan in mid-1996. The workshop was designed to help participants:

- Communicate via the media and other channels to promote health and sanitary practices
- Design and implement educational programs that promote healthy behaviors that focus on, but are not limited to, water and sanitation problems
- Use participatory methods to involve individuals and groups in health education programs
- Use effective management procedures to plan and implement health education programs
- Organize communities, local groups, and agencies to use local resources in health demonstration projects
- Collaborate with governmental and non-governmental organizations and sectors such as health, education, public information, and agriculture, to implement health education programs
- Provide training and support for regional and local health and other personnel responsible for public health education
- Use appropriate methods to evaluate the effectiveness of health education projects and programs
- Collaborate with other Central Asian Republics in the development and implementation of regional health education programs.

The major outputs of the workshop were four work plans produced by the participants (who were organized into three country teams) using the knowledge and skills in planning, organizing, implementing, and evaluating health education programs acquired during the workshop:

- Health education program plan
- Health education training plan
- Organizational plan
- Regional media plan.

Health demonstration project planning continued, with the project agreeing to provide polyethylene pipe for 14 health demonstration sites according to a materials assessment prepared by a local engineer. The pipe stock was obtained from Russia, and the pipes were manufactured at a factory in Kazakhstan and were delivered to each of the rayon administrations in April and May 1997.

In order to provide local administrations with immediate examples of improvement in health and sanitation, the project offered small contracts to each of the rayon administrations. These contracts were for locally purchased materials to be used by the administrations for specific improvements that did not require substantial engineering effort, such as had been required for pipe installation, and required completion in 30-60 days. Seventeen small contracts, for a total of \$20,000, were completed in June 1997, enabling local administrations to provide filtered water (to remove the saline taste) for cooking and drinking in local schools. They also provided bathing facilities for kindergartens and health facilities. One contract was to raise a large storage tank and install a pump and piping at a 1,000 bed hospital. Several latrines at schools were repaired or rebuilt.

At the initial seminars, EPT proposed that specific audio-visual equipment be provided to several agencies, including Health Centers and SES Laboratories. Health education materials, equipment, and additional technical support were provided in late 1996.

In January 1997, EPT supported the publication of *News on Health*, a national newspaper of the Ministry of Health, Kazakhstan. The issue was devoted to water, sanitary, and environmental health issues of the Aral Sea and 20,000 copies were distributed throughout the Central Asia Republics. Material was obtained from local SES offices and from EPT project participants. Brief health education inserts were included as tear-outs. UNICEF contributed posters it had prepared on breastfeeding and childhood diarrheal diseases. This newspaper was an example of the health communication activity which was proposed in the regional workshop in July 1996.

#### **4.1.2 Turkmenistan**

##### **4.1.2.1 Expand Distribution of Water from Reverse Osmosis Plant**

Under Delivery Order Nos. 2 and 12, the EPT Project designed and installed a Reverse Osmosis (RO) water treatment plant to provide a potable water supply for the Turkmenbashi Etrap in northern Turkmenistan, provided U.S.-based and on site operations and maintenance training, and developed a Russian-language operations and maintenance manual.

Under DO 2, the EPT Project prepared an analysis of water delivery options and provided three 5.4 cubic meter water tanker trucks for water hauling. Twelve 3.9 cubic meter capacity tanker trucks were provided by the UN in August 1996. The Government of Turkmenistan uses these tanker trucks, in addition to private trucks from collective farms, as a major part of the potable water distribution system.

Under DO 12, a distribution plan was prepared, approved by the local officials, and presented to the Government of Turkmenistan. Under the plan ultimately adopted by the GOT, each village is assigned a truck and receives water roughly once a day, depending on its distance from the plant. Area residents are also able to obtain water directly from the plant. In support of this plan, the EPT Project provided thirty-six large stainless steel water storage tanks for installation in schools, the hospital, and kindergartens in the area as well as 25,000 large plastic potable water containers for residents' use in collecting, transporting, and storing potable water.

#### 4.1.2.2 Expand Operation and Maintenance Coverage at Reverse Osmosis Plant.

DO 2 specified technical assistance services for the operations and maintenance of the Reverse Osmosis plant, and extensive management, operator and technical training was provided in order to create sustainable operations and maintenance capability for local personnel. In March 1996, at the plant's turn-over to the Government of Turkmenistan, the GOT requested that USAID continue the operations and maintenance technical assistance, and this assistance was provided under DO 12. The reverse osmosis water treatment facility was officially turned over to the Government of Turkmenistan in April 1997, with a fully trained local management and operational staff; sufficient expendable supplies for two years; and the procedures for replenishing these expendable supplies.

#### 4.1.2.3 Sanitation Facilities Progress

Health education and sanitation program accomplishments in Turkmenistan are described in detail in section 4.1.1.2 above. However, the rayon administration of Dashhovuz, Turkmenistan decided not to take advantage of the project's small contract offer, ostensibly on the basis that the small value of these contracts did not allow the administration enough scope for its planned rayon-wide improvements.

### 4.1.3 Uzbekistan

#### 4.1.3.1 Identify Improvements to Water Transmission Lines

The Tuyamuyun-Nukus and Tuyamuyun-Urgench water treatment plants are the most significant source of water for the population of the Khorezm Oblast and the Republic of Karakalpakistan in the Uzbekistan portion of the Aral Sea crisis zone. The plants draw surface water from the Tuyamuyun Reservoir, which was built on the Amu Darya River for irrigation purposes. Although the water suffers from high turbidity and possibly from the presence of organic and inorganic contaminants, the plants were designed to treat river water using only conventional technology based on coagulation/flocculation/sedimentation, filtration and disinfection processes. The entire water scheme in the Khorezm Oblast and the Republic of Karakalpakistan depends on

the two plants, especially the population in Urgench, Nukus, and other larger settlements. The water is delivered from the plants to distribution networks via two long transmission pipelines. EPT Project assessment teams visiting the area in 1994 and 1995 found that the two plants were unable to continuously provide water of acceptable quality largely due to improper design, poor construction practices, and installation of poor quality process equipment combined with lack of proper equipment maintenance and poor operating practices at all process units. Subsequent activities implemented under DOs 6 and 12 were aimed at improving the operation of the two plants, including this activity which focused on evaluating transmission pumps when The World Bank undertook the broader transmission pipeline evaluation that was originally conceived. As a way to leverage EPT Project experiences across countries and with the enthusiastic support of both USAID/Almaty and USAID/Moscow, the transmission pump evaluation was implemented via a subcontract executed with the Novokuznetsk Vodokanal (a Russian water utility assisted by the project under Delivery Order No. 10) and involved local experts from Tashkent. Recommendations were made on improving pump station operations, including by upgrading electrical and instrumentation and control systems and replacing pumps, and a comparison was made of two equipment replacement alternatives (Russian-manufactured pumps and U.S.-manufactured pumps).

#### 4.1.3.2 End-of-Pipeline Chlorination.

The cities of Nukus and Urgench are approximately 200 and 100 kilometers downstream from their source water treatment plants. Treated water is delivered from the water treatment plants to the cities via steel transmission pipelines and discharged to reservoirs at city booster pump stations, which provide pumping capacity for water delivery to consumer points through the city distribution networks. Free chlorine is used as the primary disinfectant at both source plants. Typically, a chlorine concentration of between 0.5 and 1.0 mg/l is maintained in the plant effluent. The chlorine residual must, ideally, be in the same range at all points of use within the two cities for the water to be safe for human consumption. However, residual chlorine concentrations typically decline as the water travels between treatment plants and the various points of use, with the rate of dissipation varying depending on the season, water temperature, flow rate, and several other factors. Consequently, increasing the residual chlorine concentration near the consumption point in the system was necessary, and, under DO 12, new chlorination equipment was installed at the booster pump stations in the two cities at the terminus of the main transmission pipeline.

The situation was similar in the cities of Kegeili and Chimbai, which are approximately 75 and 50 kilometers north of Nukus respectively. Both cities receive drinking water from the booster pump station in Nukus. As with Nukus and Urgench, the residual chlorine usually dissipated while traveling between Nukus and Kegeili and Chimbai. Therefore, under DO12, chlorination systems were installed at the booster pump stations in both cities to increase chlorine concentrations before final delivery to consumers.

The systems installed at all four booster pump stations are gas-feed systems with an identical design philosophy. Chlorine is withdrawn in a gaseous form at a controlled rate from storage cylinders. The gas moves under vacuum to ejectors where it is combined with pressurized water to form a solution. The chlorine solution is then piped to application points at each facility. The

systems were designed for continuous, uninterrupted gas-feed chlorination. Several safety measures were incorporated into the design of the systems to prevent against or warn of chlorine leaks.

The Muynak Vodokanal facility provides drinking water to the city of Muynak, near the former southern shore of the Aral Sea close to the delta of the Amu Darya. The city's water source is the Karatbai Canal, where the water is stored and pumped to Pump Station No. 3 in downtown Muynak. Pump Station No. 3 has three water reservoirs and a pump station building equipped with pumps that deliver water directly to the city distribution network. The EPT Project assessment team visiting the facility in late 1996 found that the existing disinfection system was incapable of properly disinfecting drinking water. This system consisted of an old bathtub where manual mixing of powdered calcium hydrochlorite took place and from which the hydrochlorite solution was gravity-fed through leaky, corroded piping into the one reservoir connected to the system. Under DO 12, a disinfection system was installed that made use of locally available calcium hypochlorite with improved methods of solution mixing and feeding. A conventional, reliable system, consisting of components - mixing tanks, mixers, centrifugal transfer pumps, and positive displacement feed pumps - that can be easily repaired was selected. The Muynak Vodokanal constructed a building for the new disinfection equipment according to specifications developed by EPT Project staff. Vodokanal staff also prepared trenches for discharge piping and provided water, power, and sewer service to the new building. EPT staff connected the equipment skids to the new piping, performed system testing, and the entire start-up. Following system start-up, local operator staff were trained in the use of the equipment. O&M manuals with operating instructions and equipment were developed and translated into Russian. A supply of health and safety equipment and supplies necessary for safe handling of calcium hydrochlorite were provided.

#### 4.1.3.3 Extend Operational Services

Operational services to the Nukus and Urgench water treatment were provided under DO 12. Extensive operations and maintenance training was provided to plant operators and managers in May-June 1997. Training consisted of a two-week classroom training and a four-week practical operations training. During the classroom training, staff of the two plants were instructed on basic water treatment processes and on principles of coagulation/flocculation/sedimentation, filtration and disinfection. Russian-language instruction materials were developed for future reference. The four-week practical operations training session provided practical training in the operation and maintenance of the newly installed USAID-funded equipment.

#### 4.1.3.4 Sanitation Facilities

Health education and sanitation program accomplishment in Uzbekistan are described in detail in section 4.1.1.2 above.

#### 4.1.3.5 Policy Sustainability for Industrial Waste Minimization

This small task was added to Delivery Order No. 12 by Modification No. 3 in September 1996 as a complement to the water policy tasks specified in Delivery Order No. 14, *Water and*

*Environmental Management Policy in Uzbekistan.* Its purpose was to coordinate with and build upon the successful waste minimization projects carried out by the World Environment Center (WEC) at selected heavy industrial pollution sites in the Fergana Valley in order to assist the GOU set up a sustainable waste minimization program. Under this task, training in basic waste minimization strategies and techniques was provided to the State Committee for Nature Protection, demonstration waste minimization audits were performed at the Ohangaron Cement Plant and at ElectrochemProm, and a joint waste minimization training seminar was held with WEC. This seminar, for approximately 80 representatives of industries, regional and national committees for Nature Protection, and industry-specific institutes, highlighted successful results of waste minimization audits and trained others to perform them.

#### **4.1.4 Actions In All Three Countries**

##### **4.1.4.1 Water Quality Laboratory Follow-on.**

The EPT Project provided analytic instruments, manuals, reagents and training to a number of laboratories in Kazakhstan, Turkmenistan, and Uzbekistan under DOs 2, 6, and 7. Under DO 12, the project conducted assessment inspections at each laboratory in September and October 1997 and July 1997 and provided the following additional support:

- Development of procedures for compiling comparative analytical data between the new and existing methodologies;
- Development of a mechanism for the revision of the current GOST standards to incorporate the WHO guidelines for drinking water quality;
- Provision of additional training in conducting basic water quality analyses (pH, turbidity, free chlorine, TDS, and coliform bacteria), to improve the efficiency of water treatment plant efficiency processes and monitor the water quality in the distribution systems;
- Provision of additional training in conducting more advanced water quality analyses (arsenic, lead, pesticides and herbicides) for regional water quality monitoring;
- Development of procedures for a reagent replacement system for the laboratories that use conventional chemicals;
- Assistance in the certification of HACH instruments and methodologies including through a three-day seminar in Almaty; and
- Development of procedures for the implementation of a computerized program for the compilation of analytical data generated by each laboratory.

Assistance was provided to the following laboratories:

- Kazakhstan
  - Kzyl-Orda Sanitary and Epidemiological Services (SES) Laboratory
  - Aralsk SES Laboratory
  - Aralsk Administration for Water and Sewerage System (AWSS) Laboratory,
  - NovoKazalinsk SES Laboratory
  - NovoKazalinsk AWSS Water Treatment Plant Laboratory
- Turkmenistan
  - Turkmenbashi SES Laboratory
  - Turkmenbashi Reverse Osmosis Water Treatment Plant Laboratory
- Uzbekistan
  - Nukus SES Laboratory
  - Tuyamuyun-Nukus Water Treatment Plant Laboratory
  - Tuyamuyun-Urgench Water Treatment Plant Laboratory

#### 4.1.4.2 Economic and Financing Evaluation

Beginning in January 1997, the project undertook extensive economic and financing evaluations of the following major potable water system improvement projects: pump stations, well fields, chlorinators, laboratories and water transmission pipelines in Kazakhstan; laboratories, reverse osmosis water treatment plant and water delivery distribution system in Turkmenistan; and pump stations, laboratories, water transmission pipelines and two water treatment plants in Uzbekistan. The reports of these evaluations, *Financial Sustainability of EPT Potable Water Supply Projects. I. Kazakhstan; II. Uzbekistan; III, Turkmenistan*, completed in June 1997, provided detailed findings and recommendations on how host country governments could recoup operations and maintenance costs for the above listed activities.

In July 1998, more than one year after completion of all potable water system improvement activities, project-conducted sustainability assessments found that the earlier sustainability recommendations have been adopted to varying degrees in the three countries.

In Kazakhstan, because of GOK and water utility financial problems, the well fields and pump stations improved under the project have operated only intermittently, and most of the chlorination systems have not been operating at all. The responsible water utilities, which are

facing severe financial problems caused by the poor collection of water service fees and the lack of government funding, have amassed and are unable to service their large debts and to finance the most basic aspects of their operations. Because of their inability to pay for power used by the pump stations, over the past year, the power company activated power lines to the water facilities only after a cash advance by the utility was made or when an administrative order was issued by the local government. The assessment report concluded that while the long-term solution to the area's water service problem rests with enhanced revenue collection and reduction of operating expenses by the water utilities, in the short term, only a new injection of government funding into these utilities will protect the water supply systems.

In Turkmenistan, on the other hand, the GOT is providing the necessary resources, including operator salaries, to keep the RO plant functioning and the trucks delivering water. However, problems with currency exchange severely restrict the ability of the GOT to purchase supplies and equipment from companies outside the former Soviet Union, and the facility has not located sources for some supplies that will be needed soon, as those provided under the project are depleted. The assessment team found that, in line with current water pricing policy in Turkmenistan, consumers are not charged for the water service and that efforts to develop a Water Users Association have not been well received by local officials in the face of the refusal of the GOT to give permission to form one. The assessment report concluded that earlier EPT Project cost recovery suggestions, including bottling and selling some water while keeping the bulk available gratis to the population or instituting a coupon system to gradually introduce the concept that water has value, should be reconsidered.

In Uzbekistan, the GOU appears to be providing the necessary resources to keep the project-provided equipment operating. Chemicals necessary for the operation of the water treatment plants, such as chlorine, alum, and coagulant are available and are reportedly being supplied with little difficulty. While, here too, problems with currency exchange severely restrict the ability of the GOU to purchase supplies and equipment from companies outside the former Soviet Union, the Ministry of Communal Services is currently finalizing a supply and service contract with the U.S. manufacturer of the EPT-provided chlorination equipment. This contract is to be funded by the Government of Uzbekistan which is, apparently, keen to procure additional U.S.-manufactured equipment and services that were successfully introduced into the country under the project. The assessment team found that the water supply systems are not yet self-sustaining, however. Water service collections from individual and organizational consumers cover only approximately 50 percent of the utility operating expenses, and the goal of achieving full cost recovery was, reportedly, extended from 2000 to 2003.

#### 4.1.4.3 Additional Equipment and Supplies

Recommendations for purchase and installation of additional equipment or facilities were made throughout the DO 12 period of performance and resulted in such additional activities as the Muynak, Uzbekistan water system improvement activity described in section 4.1.3.2.

## 4.2 Water Management Policies

The EPT Project's Regional Cooperation in Water Management Program for Central Asia,

implemented under both Delivery Order No. 8 and Delivery Order No. 12, was designed to address the root causes of the Aral Sea disaster, namely lack of cooperation among the five Central Asian Republics in improving water use and sharing practices. Between 1994 and mid-1996, the project sponsored seminars, workshops, and international conferences on information management, water management policies, water pricing, and water quality management under DO 8. By June 1996, however, it became clear that little progress could be made in the areas of data sharing, water quality management, and energy and water sharing at the national level to improve water use efficiency without the benefit of international agreements dealing with aspects of these issues among the Republics.

One of the principal surface water sources of the Aral Sea is the Syr Darya River. The sources of this river are in the mountainous Kyrgyz Republic and Tajikistan. In this basin, water use for winter energy production in the upstream Kyrgyz Republic competes with that for summer agricultural production in the downstream countries of Kazakhstan and Uzbekistan. During the Soviet era, management of the Syr Darya River was an intra-national issue, and the river was used to maximize the benefits to all of the republics in the basin. The primary benefit derived from the management of the river was the provision of water for irrigated agriculture in Uzbekistan and Kazakhstan. Upon the collapse of the Soviet Union in 1991, the river basin was split among the four sovereign nations with competing interests in the river's waters. The Kyrgyz Republic's primary objective in managing the river is to satisfy their winter energy needs through the production of hydroelectric power from the Naryn-Syr Darya Cascade. In conflict with this are the objectives of the downstream countries, which are to maximize the use of water for irrigation during the summer growing season. This situation produced both political tensions over water depletions as well as extreme water losses for the region.

To resolve the problem, the Interstate Council of Kazakhstan, the Kyrgyz Republic, and the Republic of Uzbekistan (ICKKU)<sup>1</sup>, a regional trade and development organization, mediated bartering arrangements among the three republics in 1995 and 1996. While these agreements resolved an impending crisis in the winter of 1995-1996, the agreement between Kazakhstan and the Kyrgyz Republic ultimately failed and, as a result, when the Governments met to develop an agreement for 1997, they were unable to develop a consensus. At this time, the project offered to assist the ICKKU in developing a multilateral agreement on energy and water uses for the river basin. The Council, taking up the offer, worked with the project, USAID, and the Prime Ministers of the four republics to form the Energy and Water Uses Roundtable that included high-level members from the water and energy sectors of the riparian states. From June 1996 through the project's end in October 1998 activities implemented under DO 12 were heavily focused on providing support for this effort.

#### **4.2.1 Issues Papers**

Seven issues papers, including a synthesis report, were prepared under DO 12, as follow:

---

<sup>1</sup> The organization subsequently became the Interstate Council of the Republic of Kazakhstan, the Kyrgyz Republic, The Republic of Tajikistan, and the Republic of Uzbekistan (ICKKTU).

- *Issue Paper 1: Environmental Damage Assessment of the Aral Sea Disaster*, by Robert Anderson
- *Issue Paper 2: Valuation of Water Uses as a Tool for Resolving Water Sharing Issues in Central Asia*, by Robert Anderson
- *Issue Paper 3: International Perspectives on Managing Water Resources of the Aral Sea Basin*, by John Keith
- *Issue Paper 4: Optimization of Water Use: The Naryn- Syr Darya Cascade*, by Daene McKinney
- *Issue Paper 5: Synthesis Report: Issues and Perspectives on the Development of a Multi-Year Agreement on the Operation of the Toktogul Reservoir of the Naryn- Syr Darya Cascade*, by Barbara Britton
- *Issue Paper 6: Analysis of Water Laws in the Republics of CAR*, by S. Bakenova
- *Issue Paper 7: Options Analysis of the Operation of the Toktogul Reservoir*, by John Keith and Daene McKinney

Issue Paper 1 was suggested by the Water Pricing Technical Working Group in July 1996 as a good basis for developing water prices attributable to degradation in water pricing. Issue Papers 2 and 3 answered the critical questions posed by the Energy and Water Uses Roundtable as it met for the first time in October 1996 to develop a workplan for developing a multi-year agreement for the operating regime of the Toktogul Reservoir:

- How are water use tradeoffs dealt with in other international settings?
- What are the bases for the exchanges that occur when contending with tradeoffs in water usage in other international agreements?
- What is the norm in international experience for the administration of treaties and agreements?
- How are costs allocated in international agreement for water systems and services serving more than one republic?

To support the Energy and Water Uses Roundtable's deliberations, the project prepared an analysis of Central Asian water laws (Issue Paper 6). It also developed an optimization model for the Naryn-Syr Darya Cascade, tailoring an analysis of trade-offs and estimates of associated economic benefits to the Central Asian Context. The options for operating the Cascade, considering a variety of flows to the Aral Sea, included regimes to: (1) optimize agricultural production; (2) optimize for both irrigation and power; and (3) optimize for power production. The analysis was further refined, and resulting benefits were calculated. The results supported the earlier conclusion that the operating rules of the entire Cascade could be optimized to support

both the energy and irrigation water needs of all the republics. These analyses are the subject of Issue Papers 4 and 7.

#### **4.2.2 Regional Cooperation Agreements**

The EPT Project sponsored six meetings of the Energy and Water Uses Roundtable over 18 months. The first meeting in October 1996 was organizational. In December 1996 the group met to discuss world experience in management of upstream/downstream concerns on international river systems and economic trade-offs associated with values of different water uses. In July 1997 the project sponsored a negotiation session, and the group drafted principles that formed the basis of a draft agreement. In September 1997 the Roundtable drafted an energy and water sharing agreement. In January 1998, the group traveled to the United States to study institutional issues related to international river management commissions. In July 1998 the group met to develop an implementation plan for the final agreement that the Prime Ministers signed in March 1998.

The March 1998 Agreement on “The Use of Water and Energy Resources of the Syr Darya Basin” is the first multi-year, multi-state agreement involving water sharing among the Central Asian Republics to be signed at the Prime Ministerial level since independence of these countries. It includes provisions for Kazakhstan and Uzbekistan to share equally in the purchase of summer hydropower from the Kyrgyz Republic that is in excess of its needs. Payments for summer hydropower can be made either through deliveries of coal and natural gas or through monetary means equivalent to the cost of replacement fuel to meet the Kyrgyz Republic’s winter heating needs. The agreement also includes provisions for guarantees to exchanges in the form of lines of credit and has provisions for dispute resolution through arbitration courts to be convened by member republics. While only three of the four republics of the Syr Darya were signatories, Tajikistan will eventually become signatory to the agreement.

The adoption of the Energy and Water Uses Agreement alone will promote stabilization of water and energy supplies in Central Asia. It also provides a framework for the republics to use in preparing agreements relating to integration of resources in the energy sector as well as an ideal model for adoption in reaching agreement on other water sharing issues along the Syr Darya. In addition, the President of Tajikistan expressed keen interest in adaptation of the agreement to the Amy Darya, and its Government has already drafted initial versions.

#### **4.2.3 Water Pricing Policy**

Throughout the project, water pricing and financing mechanisms were stressed both as a management tool to promote conservation and as a way of ensuring the smooth operation and maintenance of water systems.

Under DO 8, the project organized regional conferences on water pricing in 1995 and 1996 and, in 1996, conducted an evaluation of the status of water pricing in each of the republics. It was found that while the concept of pricing water is well accepted at the national level, any discussion of pricing in the international setting brings deadlock to regional discussions about water.

In mid-1997 the project explored a range of cost-sharing scenarios for the major reservoir of the Syr Darya and found that cost-sharing related to the operation and maintenance of facilities serving more than one republic is ill-accepted in the region. An attempt was made to address this issue for the Toktogul Reservoir, but the parties were clearly far from consensus on this issue.

In mid-1998 the project examined the progress made among the republics in initiating water pricing schemes and concluded that effective pricing of water on the national level will require national level reforms leading to privatization of land and farms to ensure that farmers have an economic incentive to control inputs such as water in crop production. The organization of water users associations, underway in Kazakhstan and the Kyrgyz Republic, will be needed throughout the region to facilitate this process and promote water pricing.

#### **4.2.4 Toktogul Reservoir Operating Procedures**

The framework for regional cooperation established by the interstate water agreement signed in March 1998 creates a systematic means of solving water management problems in the Syr Darya River Basin. It sets up a basis for compensation between the upstream and downstream states associated with a water release schedule that takes into account both upstream winter power supply needs and downstream demands for summer irrigation water. However, many important questions relating to the specifics of this agreement's implementation remain to be answered. In 1998, the project held two workshops and sponsored one meeting of the Energy and Water Uses Roundtable to begin to address these questions.

The March 1998 agreement calls for the analysis of the operation of the Syr Darya basin hydrotechnical facilities, and its implementation will require the use of computer models to calculate benefits and costs (damages) to its various parties. Thus, in March and May 1998, the project conducted seminars on water and energy resources modeling. These seminars were designed to train technical representatives of the Energy and Water Uses Roundtable in water resource systems modeling and apply that knowledge to the Naryn-Syr Darya Cascade operation. Participants were instructed in the use of the optimization software (GAMS) and the specifics of the Naryn-Syr Darya optimization model developed under the project and had the opportunity between the seminars to closely study the model and make recommendations for adaptations needed to permit its use in supporting release schedules for the Toktogul Reservoir and the operating rules for the Cascade. Participants recommended that a Creative Working Group be established to develop a system of modeling tools for use in these decision processes.

At the July 1998 meeting of the Energy and Water Uses Roundtable a number of critical issues affecting implementation of the Syr Darya Agreement were addressed, including: (1) development of a common information database as an aid to energy and water use decision-making; (2) institutional options for solving inevitable disputes and misunderstandings as they arise in the framework of the Agreement; (3) approaches to incorporating water quality management into interstate agreements; and (4). Economic factors affecting implementation of the Syr Darya Agreement, including the evolving Central Asian experience with water pricing for irrigation and other uses. The meeting participants adopted a plan of action for full implementation of the March 1998 Agreement, including:

- Addition of Tajikistan to the compact.
- Agreement to move toward a multi-year water release schedule and a set of associated compensatory measures.
- Agreement to establish a common set of data and an agreed-on basin-wide model describing the water and energy resources to be managed, accessible to all parties to the Agreement
- Agreement to pursue several measures to encourage monetization of exchanges and linkages to a regional power pool
- Agreement to explore water quality issues and to develop proposals for national policy reforms and amendments to the Agreement. Including the possibility of the imposition by Kazakhstan on the salinity levels of the waters it receives from upstream states.

## Section 5

# Delivery Order Lessons Learned

As indicated earlier in Section 2, the key objectives of the delivery order were to improve and monitor the quality of the region's drinking water; improve community health and sanitary practices; improve governments' abilities to manage their water resources; and alter policies that contribute to the misuse of these resources. Significant progress in meeting all these objectives was made with the accomplishment of the tasks under Delivery Order No. 12, as detailed in Section 4.

The water supply improvements made in Kazakhstan, Turkmenistan, and Uzbekistan under Delivery Order No. 12 and its predecessors, DOs 2, 6, and 7 unquestionably improved the quality of the region's drinking water. At DO 12's completion, the water supply from the Kosaman and Berdykol well fields in Kazakhstan was certainly more reliable and safe due to the new pumps and chlorination systems installed on the main water transmission pipeline. In Turkmenistan, the RO plant was providing safe drinking water to the Turkmenbashi Etrap's population, with each village receiving water roughly once a day. In Uzbekistan, the water supply from the Nukus and Urgench treatment plants was meeting or exceeding standards due to improvements made in the coagulation, flocculation, sedimentation, filtration, and chlorination processes. Prior to the improvements, frequently no measurable residual chlorine was detected in the water supply network. After the improvements, residual chlorine was detected in the water distribution network, which indicates that a better quality of water was now supplied to the population. In all three countries, the laboratory equipment and extensive training provided to numerous laboratories will allow the laboratories to conduct basic water quality analyses.

Delivery Order 12 included a wide variety of efforts to prolong the benefits realized from these improvements, from training operators in the maintenance and repair of the equipment installed, to providing spare parts and treatment chemicals to last several years, to determining medium- and longer-term operations and maintenance costs and recommending cost recovery alternatives. Yet, as detailed in section 4.1.4.2, in all three countries the long-term sustainability of at least some project components is threatened due, in large part, to the fact that national policies which severely limit the ability of local water authorities to charge their customers for the services they provide have not changed even in the face of government inability to provide these services free of charge. By design, the EPT Project's water improvement and project sustainability activities were directed at the local (oblast and rayon) levels. While some of the project's counterparts have proven extraordinarily successful in obtaining scarce resources from their central governments, none has had ability to influence national policy. Also by design, the project's water pricing activities were designed to enhance regional cooperation, not foster national-level policy change. In the future, USAID may want to consider including a national-level activity through which issues identified during field implementation of assistance projects can be effectively resolved by bringing them to the attention of national-level agencies, particularly through the preparation of policy recommendations and similar actions. A model might be the Work Group activity of the *Program to Promote Sustainable Development in Ukraine* (included in Delivery Order Nos. 9 and 15), which proved to be very effective in highlighting at the national level issues identified through implementation of the EPT Project's local-level activities

with the Lviv and Bachcisaraj water utilities. For example, it became evident that due to financial unviability and excessive central bureaucratic regulation, public health was threatened because of the inability of these utilities to fulfill their responsibility of providing municipal water sector services to their customers and that this situation was most probably common throughout Ukraine. Based upon the local findings, recommendations were prepared by the Work Group and accepted by the government regarding modification of the tax code and institutional reform of the water sector.

The adoption of a multi-year agreement on energy and water use exchanges of the riparian republics of the Syr Darya River Basin is no small accomplishment. Why did this effort succeed when other, larger, efforts in the region have not? The answer may lie in the following factors:

1. The local counterpart, the ICKKTU, was a strong manager for the process and was committed to a balanced process that served the interests of all the participating republics.
2. The ICKKTU was successful in enlisting support for the activity from the Prime Ministers of all four Republics.
3. The Energy and Water Uses Roundtable members were at high levels (deputy ministers and above), which enabled them to speak for their governments.
4. Once membership was established, the process called for their consistent participation throughout the development of the assigned task.
5. The insight that participants gained from examples of basin management in other international settings was essential to the Roundtable members' assessment of options to address their own situation.
6. Optimization modeling and economic analysis provided the pivotal analysis that aided the Roundtable participants better understand the situation they faced and also provided a new range of options that had not been previously considered.
7. The use of interest-based bargaining could, perhaps, be considered the "linchpin" of the process as it overcame years of talking past each other to enable the Roundtable members to have a real conversation about solutions to problems of competition over water.
8. The Roundtable members' visit to the U.S. that moved the discussions of world experience to practical reality provided members with the assurance they needed that the draft agreement they had crafted had a "real world" basis to it.
9. The continuous prodding and support from USAID Regional Mission in Central Asia was among the most critical elements to success of the process and provided assurance to the Roundtable members and their governments that the world is watching and does care about what happens to them.

The method used to develop the 1998 Syr Darya Agreement can be adopted to deliberations of

other basin management issues such as water quality and water allocation. It could be applied using a step-by-step approach to address outstanding issues in a fair and equitable process to form a comprehensive basin agreement. The preliminary components recommended for a process model that would be necessary for addressing each issue would include:

- Buy-in at the highest levels of government for the process;
- Local counterpart organization dedicated to efficient management and balanced participation of all parties;
- A high-level interdisciplinary core group, whose members can speak for their governments, to debate policy issues;
- High quality technical analysis, provided, perhaps, by a supporting technical group to the policy body;
- High quality technical assistance from experts with knowledge of international experience and the ability to analyze economic and river basin information to form the basis of dialogue for agreement;
- Exposure to experience in contending with similar issues in other international settings;
- Once analysis and planning have occurred, use of an interest-based approach to negotiating differences to reach final settlement on outstanding issues; and
- Diligence in ensuring that agreements are reached by consensus.

Appendix A  
**Status of Deliverables**

32

Task	Delivery Order Deliverables	Status of Deliverables
<b>Work Plan And Reports</b>		
1.A	Draft work plan	Report provided: <i>Final Draft Work Plan, Delivery Order 12: Sustainable Water Management in the Aral Sea Basin</i>
1.A	Oral presentation of the draft work plan	Completed
1.A	Final work plan	Report provided: <i>Final Work Plan, Delivery Order 12: Sustainable Water Management in the Aral Sea Basin</i>
1.A	Revised work plan	Report provided: <i>Final Work Plan, Delivery Order 12: Sustainable Water Management in the Aral Sea Basin</i>
1.B	Monthly status reports	Reports provided: <i>EPT Project Weekly Reports on Accomplishments and Issues, 1995, 1996, 1997</i> <i>EPT Project Deliverables Updates, 1997, 1998</i> <i>EPT Project Monthly Summary Reports, 1993, 1994, 1995</i> <i>EPT Project Quarterly Summary Reports, 1996, 1997, 1998</i> <i>EPT/CAR Monthly Project Activity Reports, 1996, 1997, 1998</i>
1.C	End-of-project report	Report Provided: <i>Final Report, Delivery Order No. 12: Central Asian Republics, Sustainable Water Management in the Aral Sea Basin</i>
<b>Kazakhstan Activities</b>		
2.A.1	Report on survey of groundwater resources	Report provided: <i>Groundwater Survey and Hydrological Characteristics of the Kosaman and Berdykol Wellfields, Kazakhstan</i>
2.A.2	Report on rehabilitation plan for well fields	Report provided: <i>Proposed Rehabilitation Program for the Kosaman and Berdykol Wellfields, Field Research. Kazakhstan</i>
2.A.2	Report on fall 1995 work on the well field rehabilitation pilot program	Reports provided: <i>Proposed Rehabilitation Program for the Kosaman and Berdykol Wellfields, Field Research. Kazakhstan</i> <i>Status of Wellfield Rehabilitation Program: Kosaman and Berdykol Wellfields, Kazakhstan</i>
2.A.2	Report on implementing full rehabilitation plan (including costs)	Reports provided: <i>Operations and Maintenance Manual for Well Pumps, Kosaman and Berdykol Wellfields, Kazakhstan</i> <i>Operation and Maintenance Manual, Kosaman and Berdykol Wellfields</i> <i>Completion of Rehabilitation Program for the Kosaman and Berdykol Wellfields</i>
2.A.2	Report on training for operators of well field	Report provided: <i>Completion of Rehabilitation Program for the Kosaman and Berdykol Wellfields</i>
2.A.2	Report on the 1996 well field rehabilitation activities	Report provided: <i>Completion of Rehabilitation Program for the Kosaman and Berdykol Wellfields</i>
2.A.3	Report on the design of sanitation program	Reports provided: <i>Training in Health Education and Promotion, Water and Sanitation, Kazakhstan, Turkmenistan, and Uzbekistan</i> <i>Health and Sanitation Activities in Kazakhstan, Turkmenistan, and Uzbekistan</i>
2.A.3	Report on the implementation of sanitation program (accomplishments)	Reports provided: <i>J. Rittmann. Trip Report, Kzyl Orda, Kazalinsk and Aralsk, Kazakhstan, April 28 - May 2, 1997</i> <i>Health and Sanitation Activities in Kazakhstan, Turkmenistan, and Uzbekistan</i>
<b>Turkmenistan Activities</b>		
2.B.1	Report on options to expand the distribution system for RO plant	Report provided: <i>Water Distribution Plan for Reverse Osmosis Plant, Turkmenbashi, Turkmenistan</i>
2.B.1	Report on the implementation of the expansion of water distribution	Reports provided: <i>Water Distribution Plan for Reverse Osmosis Plant, Turkmenbashi, Turkmenistan</i> <i>P. Shaikh. Trip Report, Water Distribution, Turkmenbashi Reverse Osmosis Plant, July 1997</i>
2.B.1	Report summarizing the operation of the new distribution system	Reports provided: <i>P. Shaikh. Trip Report, Water Distribution, Turkmenbashi Reverse Osmosis Plant, July 1997</i> <i>Water Distribution, Turkmenbashi Reverse Osmosis Plant, Turkmenistan</i>

33

Task	Delivery Order Deliverables	Status of Deliverables
2.B.2	Report on the inspections of the RO plant - 1st visit	<p>Reports provided:  P. Shaikh. <i>Trip Report, Turkmenistan and Uzbekistan, March 1996</i>  P. Shaikh. <i>Trip Report, Turkmenistan and Uzbekistan, March 1997. October 23, 1997</i>  P. Shaikh. <i>Trip Report, Organize and Prepare the O&amp;M Hand-Over of the Reverse Osmosis Plant, April 4-10, 1997</i>  S. Mahmood. <i>Trip Report, Turkmenbashi, Turkmenistan and Nukus and Urgench, Uzbekistan, April 7-13, 1997</i></p>
2.B.2	Report on the inspections of the RO plant - 2nd visit	<p>Reports provided:  P. Shaikh. <i>Trip Report, Evaluate the Performance of the Reverse Osmosis Plant, May 23-30, 1997</i>  P. Shaikh. <i>Trip Report, Water Distribution, Turkmenbashi Reverse Osmosis Plant, July 1997</i></p>
2.B.2	Report on lessons learned on expanded O&M coverage	<p>Reports provided:  <i>Plant Maintenance Program: Turkmenbashi Reverse Osmosis Water Treatment Plant</i>  P. Shaikh. <i>Trip Report, Water Distribution, Turkmenbashi Reverse Osmosis Plant, July 1997</i></p>
2.B.3	Report on the design of sanitation program	<p>Reports provided:  <i>Training in Health Education and Promotion, Water and Sanitation, Kazakhstan, Turkmenistan, and Uzbekistan</i>  <i>Health and Sanitation Activities in Kazakhstan, Turkmenistan, and Uzbekistan</i></p>
2.B.3	Report on the implementation of sanitation program (accomplishments)	<p>Reports provided:  J. Rittmann. <i>Trip Report, Urgench, Uzbekistan; Beruni &amp; Karakalpakistan, Uzbekistan; and Dashovuz, Turkmenistan (Health Demonstration Projects), March 31 - April 6, 1997</i>  <i>Health and Sanitation Activities in Kazakhstan, Turkmenistan, and Uzbekistan</i></p>
<b>Uzbekistan Activities</b>		
2.C.1	Report on the engineering evaluation of the transmission lines	<p>Report provided:  <i>Evaluation of the Technical Status of Equipment at the Tuyamuyun-Nukus Pumping Station and Recommendations to Replace the Equipment</i></p>
2.C.2	Report on the design of end-of-pipeline chlorination	<p>Reports provided:  R. Hoffman. <i>Trip Reports, Uzbekistan, (1) March 8-28, 1996, (2) September 29 - October 5, 1996, (3) October 26 - November 9, 1996, (4) December 13-19, 1996, (5) January 19-26, 1997</i>  <i>Proposed Water System Improvements, City of Muynak</i></p>
2.C.2	Report on the training for operators of chlorination equipment	<p>Reports provided:  R. Hoffman. <i>Trip Reports, Uzbekistan, (1) March 8-28, 1996, (2) September 29 - October 5, 1996, (3) October 26 - November 9, 1996, (4) December 13-19, 1996, (5) January 19-26, 1997</i>  S. Mahmood. <i>Trip Report, Tashkent, Uzbekistan, February 24-27, 1997</i>  S. Mahmood. <i>Trip Report, Turkmenbashi, Turkmenistan and Nukus and Urgench, Uzbekistan, April 7-13, 1997</i>  <i>Trip Reports, Operations and Maintenance Training at Water Treatment Plants, Nukus and Urgench, Uzbekistan. W. Geirer, May 4 - June 17, 1997; T. Dokken and D. Brachly, May 4 - June 17, 1997; I. Godes, May 17 - June 17, 1997; C. Gueswel, May 17 - June 17, 1997</i></p>
2.C.2	Report on the procurement and installation of chlorination equipment	<p>Reports provided:  R. Hoffman. <i>Trip Reports, Uzbekistan, (1) March 8-28, 1996, (2) September 29 - October 5, 1996, (3) October 26 - November 9, 1996, (4) December 13-19, 1996, (5) January 19-26, 1997</i>  R. Meleski. <i>Trip Report, Chlorination Systems Installation - Khorezm Oblast and Republic of Karakalpakistan, Uzbekistan, July -December 1996</i>  S. Mahmood. <i>Trip Report, Tashkent, Uzbekistan, February 24-27, 1997</i>  S. Mahmood. <i>Trip Report, Turkmenbashi, Turkmenistan and Nukus and Urgench, Uzbekistan, April 7-13, 1997</i></p>

34

Task	Delivery Order Deliverables	Status of Deliverables
2.C.3	Report on equipment and expanded operational services	<p>Reports provided: R. Hoffman. <i>Trip Reports, Uzbekistan, (1) March 8-28, 1996, (2) September 29 - October 5, 1996, (3) October 26 - November 9, 1996, (4) December 13-19, 1996, (5) January 19-26, 1997</i> Draft <i>Chlorination Operations Manual: Nukus and Urgench, Uzbekistan</i> Draft <i>Chlorination Operations Manual: Kegelli and Chimbai, Karakalpakistan, Uzbekistan</i> <i>Drawings and Sequence of Operations: Polymer and Alum Feed Facilities</i> S. Mahmood. <i>Trip Report, Tashkent, Uzbekistan, February 24-27, 1997</i> S. Mahmood. <i>Trip Report, Turkmenbashi, Turkmenistan and Nukus and Urgench, Uzbekistan, April 7-13, 1997</i> <i>Expanded Operational Services Tuyamuyun-Nukus and Tuyamuyun-Urgench Water Treatment Plants, Karakalpakistan and Khorezm Oblast, Uzbekistan</i></p>
2.C.4	Report on the design of sanitation program	<p>Reports provided: <i>Training in Health Education and Promotion, Water and Sanitation, Kazakhstan, Turkmenistan, and Uzbekistan</i> S. Mahmood. <i>Trip Report, Tashkent, Uzbekistan, February 24-27, 1997</i> <i>Health and Sanitation Activities in Kazakhstan, Turkmenistan, and Uzbekistan</i></p>
2.C.4	Report on the implementation of sanitation program (Accomplishments)	<p>Reports provided: S. Mahmood. <i>Trip Report, Tashkent, Uzbekistan, February 24-27, 1997</i> J. Rittmann. <i>Trip Report, Urgench, Uzbekistan; Beruni &amp; Karakalpakistan, Uzbekistan; and Dashovuz, Turkmenistan (Health Demonstration Projects), March 31 - April 6, 1997</i> <i>Health and Sanitation Activities in Kazakhstan, Turkmenistan, and Uzbekistan</i></p>
2.C.5	Brief written report outlining recommendations developed and/or implemented to ensure development of an effective policy framework to support extension and promulgation of successful waste minimization experiences	<p>Reports provided: T. Higgins. <i>Trip Report, Waste Minimization Activity in Uzbekistan, January 12 - February 6, 1997</i> T. Higgins. <i>Trip Report, Waste Minimization Activity in Uzbekistan, April 28 - May 3, 1997</i> T. Higgins. <i>Trip Report, Waste Minimization Training Seminar with WEC, September 5-12, 1997</i> <i>Policy Sustainability for Industrial Waste Minimization: Recommendations Report</i></p>
<b>Actions in All Three Countries</b>		
2.D.1	Report on the inspections of three laboratories	<p>Reports provided: <i>Assessment of Water Quality Laboratories in Nukus and Urgench, Uzbekistan</i> <i>Assessment of Hach Water Quality Laboratories, Follow-On Training, and Recommendations for SES and Vodokanal in Kyzylorda Oblast</i></p>
2.D.1	Report on the training for laboratory analysts and technicians	<p>Reports provided: <i>Assessment of Water Quality Laboratories in Nukus and Urgench, Uzbekistan</i> <i>Assessment of Hach Water Quality Laboratories, Follow-On Training, and Recommendations for SES and Vodokanal in Kyzylorda Oblast</i> <i>Training in Using Hach Water Quality Laboratories for SES in S. Turkmenbashi Etrap, Dashovuz Velayat</i> T. Gueveva, E. Zaika and V. Blazys. <i>Field Report, Hach Water Quality Laboratories: Training Program for Installing, Utilizing, and Maintaining, August 1997</i></p>
2.D.1	Report on visits, locally available chemicals, and needs for additional analytical equipment	<p>Reports provided: <i>Assessment of Water Quality Laboratories in Nukus and Urgench, Uzbekistan</i> <i>Assessment of Hach Water Quality Laboratories, Follow-On Training, and Recommendations for SES and Vodokanal in Kyzylorda Oblast</i></p>
2.D.1	Report on the procurement of equipment, supplies, and chemicals	<p>Reports provided: <i>Assessment of Water Quality Laboratories in Nukus and Urgench, Uzbekistan</i> <i>Assessment of Hach Water Quality Laboratories, Follow-On Training, and Recommendations for SES and Vodokanal in Kyzylorda Oblast</i></p>
2.D.1	Manuals and guides for three data-management systems	<p>Report provided: M. Khotuleva and E. Zaika. <i>Field Report, Hach Water Quality Laboratories: Development of Local Capacity in Technical Issues and Data Management, June 29 - July 7, 1997</i></p>

Task	Delivery Order Deliverables	Status of Deliverables
2.D.1	Summary report on laboratory results and accomplishments	Report provided: <i>Final Report, Delivery Order No. 12: Central Asian Republics, Sustainable Water Management in the Aral Sea Basin</i>
2.D.2	Report on the determination of O&M costs for water facilities	Reports provided: T. Van Epp. <i>Trip Reports, Delivery Order 12, Task 2.D.2, October-November 1996; January-February 1997; July-August 1997</i> D. Wichelns. <i>Trip Reports, Delivery Order 12, Task 2.D.2, October 5-29, 1996; November 30 - December 24, 1996; February 1997</i> <i>Interim Report: Institutional Sustainability of EPT Drinking Water Projects in the Central Asian Republics</i> <i>Financial Sustainability of EPT Potable Water Supply Projects. I. Kazakhstan. II. Uzbekistan. III. Turkmenistan</i>
2.D.2	Report on the determination of O&M costs for water facilities	Reports provided: T. Van Epp. <i>Trip Reports, Delivery Order 12, Task 2.D.2, October-November 1996; January-February 1997; July-August 1997</i> D. Wichelns. <i>Trip Reports, Delivery Order 12, Task 2.D.2, October 5-29, 1996; November 30 - December 24, 1996; February 1997</i> <i>Interim Report: Institutional Sustainability of EPT Drinking Water Projects in the Central Asian Republics</i> <i>Financial Sustainability of EPT Potable Water Supply Projects. I. Kazakhstan. II. Uzbekistan. III. Turkmenistan</i>
2.D.2	Report on the determination of O&M costs for water facilities	Reports provided: T. Van Epp. <i>Trip Reports, Delivery Order 12, Task 2.D.2, October-November 1996; January-February 1997; July-August 1997</i> D. Wichelns. <i>Trip Reports, Delivery Order 12, Task 2.D.2, October 5-29, 1996; November 30 - December 24, 1996; February 1997</i> <i>Interim Report: Institutional Sustainability of EPT Drinking Water Projects in the Central Asian Republics</i> <i>Financial Sustainability of EPT Potable Water Supply Projects. I. Kazakhstan. II. Uzbekistan. III. Turkmenistan</i>
2.D.3	Report on the determination of O&M costs of additional equipment and services	Reports provided: T. Van Epp. <i>Trip Reports, Delivery Order 12, Task 2.D.2, October-November 1996; January-February 1997; July-August 1997</i> D. Wichelns. <i>Trip Reports, Delivery Order 12, Task 2.D.2, October 5-29, 1996; November 30 - December 24, 1996; February 1997</i> <i>Interim Report: Institutional Sustainability of EPT Drinking Water Projects in the Central Asian Republics</i> <i>Financial Sustainability of EPT Potable Water Supply Projects. I. Kazakhstan. II. Uzbekistan. III. Turkmenistan</i>
2.D.3	Report on the determination of O&M costs of additional equipment and services	Reports provided: T. Van Epp. <i>Trip Reports, Delivery Order 12, Task 2.D.2, October-November 1996; January-February 1997; July-August 1997</i> D. Wichelns. <i>Trip Reports, Delivery Order 12, Task 2.D.2, October 5-29, 1996; November 30 - December 24, 1996; February 1997</i> <i>Interim Report: Institutional Sustainability of EPT Drinking Water Projects in the Central Asian Republics</i> <i>Financial Sustainability of EPT Potable Water Supply Projects. I. Kazakhstan. II. Uzbekistan. III. Turkmenistan</i>

36

Task	Delivery Order Deliverables	Status of Deliverables
2.D.3	Report on the determination of O&M costs of additional equipment and services	Reports provided: T. Van Epp. <i>Trip Reports, Delivery Order 12, Task 2.D.2, October-November 1996; January-February 1997; July-August 1997</i> D. Wichelns. <i>Trip Reports, Delivery Order 12, Task 2.D.2, October 5-29, 1996; November 30 - December 24, 1996; February 1997</i> Interim Report: <i>Institutional Sustainability of EPT Drinking Water Projects in the Central Asian Republics</i> <i>Financial Sustainability of EPT Potable Water Supply Projects. I. Kazakhstan. II. Uzbekistan. III. Turkmenistan</i>
2.D.3	Report on the determination of O&M costs of additional equipment and services	Reports provided: T. Van Epp. <i>Trip Reports, Delivery Order 12, Task 2.D.2, October-November 1996; January-February 1997; July-August 1997</i> D. Wichelns. <i>Trip Reports, Delivery Order 12, Task 2.D.2, October 5-29, 1996; November 30 - December 24, 1996; February 1997</i> Interim Report: <i>Institutional Sustainability of EPT Drinking Water Projects in the Central Asian Republics</i> <i>Financial Sustainability of EPT Potable Water Supply Projects. I. Kazakhstan. II. Uzbekistan. III. Turkmenistan</i>
<b>Water Quality Monitoring</b>		
3.A	Report on four draft strategies for monitoring drinking water quality	Deleted by MOD 8
3.A	Report on agreements with officials to conduct long-term monitoring	Deleted by MOD 8
3.A	Report on the four final strategies for monitoring water quality	Deleted by MOD 8
3.B	Report on four draft sampling and analysis plans	Deleted by MOD 8
3.B	Report on four final sampling and analysis plans	Deleted by MOD 8
3.B	Report on procurement of equipment and supplies	Deleted by MOD 8
3.B	Report on the implementation of four monitoring programs	Deleted by MOD 8
3.C	Report on the training for chemists and technicians	Deleted by MOD 8
3.C	Report on long-term monitoring plans for three laboratories	Deleted by MOD 8
3.D	Report on data and results of water quality	Deleted by MOD 8
3.E	Report summarizing results and accomplishments of monitoring	8
<b>Data Management</b>		
4.A	Report on the procurement of computer equipment and software	Deleted by MOD 8
4.B	Report on methodologies for data collection	Deleted by MOD 8
4.C	Report on three training workshops and demonstrations of the World Bank's data base	Deleted by MOD 8
4.D	Report on data needs and statistical tests	Deleted by MOD 8
4.E	Report summary on results and accomplishments	8
<b>Enhancing Professional Capabilities</b>		
5.A	Report on the inspections of water treatment plants	Deleted by MOD 8
5.A	Report on the implementation of NET action plans	Deleted by MOD 8
5.A	Summary report on the plant inspections	Deleted by MOD 8
5.B	Report on three health education-training assessment plans	Deleted by MOD 8
5.B	Report on periodic visits to training sessions and assistance in implementation	Deleted by MOD 8
5.B	Report summary on the results of the education campaign	Deleted by MOD 8
<b>Water Management Policies</b>		
6.A	Synthesis report on policy analyses	Report provided: <i>Issue Paper #5: Synthesis Report: Issues and Perspectives on the Development of a Multi-Year Agreement on the Operation of the Toktogul Reservoir of the Naryn-Syr Darya Cascade</i> , by B. Britton

37

Task	Delivery Order Deliverables	Status of Deliverables
6.B	Report on the workshop for policy analysts	<p>Reports provided:</p> <p><i>1997 Working Meeting of the Third Energy/Water Uses Roundtable, June 30 - July 5, 1997</i></p> <p>B. Bushley. <i>Trip Report, Water and Energy Users Roundtable Working Meeting in Issy-Kul, Kyrgyzstan, July 1-5, 1997</i></p> <p>D. McKinney. <i>Trip Report, Water and Energy Working Group, Tashkent, Uzbekistan, Bishkek, Kyrgyz Republic, Almaty, Kazakhstan, August 3-27, 1997</i></p> <p>D. McKinney. <i>Trip Report, Water and Energy Working Meeting, Almaty, Kazakhstan, September 29 - October 3, 1996</i></p> <p>G. Appel. <i>Trip Report. Fourth Meeting of the Water and Energy Uses Roundtable Working Session, August 30 - September 19, 1997</i></p> <p>C. Barnes and J. Barnes. <i>Trip Report, Fourth Meeting of the Water and Energy Uses Roundtable Working Session, August 30 - September 19, 1997</i></p> <p>B. Bushley. <i>Trip Report, Fourth Regional Water and Energy Uses Round Table Working Session, September 8-12, 1997</i></p>
6.C	Up to 20 issues papers or reports, as specified by the USAID Regional Mission for Central Asia	<p>Reports provided:</p> <p><i>Issue Paper #1: Environmental Damage Assessment of the Aral Sea Disaster</i>, by R. Anderson</p> <p><i>Issue Paper #2: Valuation of Water Uses as a Tool for Resolving Water Sharing Issues in Central Asia</i>, by R. Anderson</p> <p><i>Issue Paper #3: International Perspectives on Managing Water Resources of the Aral Sea Basin</i>, by J. Keith</p> <p><i>Issue Paper #4: Optimization of Water Use: The Naryn-Syr Darya Cascade</i>, by D. McKinney</p> <p><i>Issue Paper #6: Analysis of Water Laws in the Republics of CAR</i>, by S. Bakenova</p> <p><i>Issue Paper #7: Options Analysis of the Operation of the Toktogul Reservoir</i>, by J.E. Keith and D. C. McKinney</p>
2B1	Reports on up to 4 regional meetings, workshops, and/or conferences related to regional cooperation agreements	<p>Reports provided:</p> <p><i>Central Asian Republics Water Uses Study Tour, January 19-30, 1998</i> (Washington, D.C., Portland, Oregon, and Santa Fe, New Mexico)</p> <p><i>International Seminar on the Rational Use of Water and Energy Resources in the Central Asian Region, Issy-Kul, Kyrgyz Republic, July 21-24, 1998</i></p>
2B2	Reports on up to 4 regional meetings, workshops, and/or conferences related to establishment and implementation of water pricing policy	<p>Reports provided:</p> <p><i>Review of Water Pricing Policies in the Central Asian Republics Pertaining to Irrigation, Hydropower, and Instream Flow</i></p> <p><i>Municipal and Industrial Water Pricing in the Central Asian Republics</i></p>
2B3	Report on proposed alterations in rules and regulations for Toktogul Reservoir operation	<p>Reports provided:</p> <p>D. McKinney. <i>Trip Report, Seminar on Water Resource System Modeling with Application to the Naryn-Syr Darya Cascade, March 10-24, 1998</i></p> <p>D. McKinney. <i>Trip Report, Second Seminar on Water and Energy Resources Monitoring with Application to the Naryn-Syr Darya Cascade, May 7-31, 1998</i></p> <p><i>International Seminar on the Rational Use of Water and Energy Resources in the Central Asian Region, Issy-Kul, Kyrgyz Republic, July 21-24, 1998</i></p>
2B4	Reports on up to 4 regional meetings, workshops, and/or conferences relating to operation and maintenance of dams and reservoirs of the Syr Darya and collaboration with ICKKU	<p>Reports provided:</p> <p><i>International Seminar on the Rational Use of Water and Energy Resources in the Central Asian Region, Issy-Kul, Kyrgyz Republic, July 21-24, 1998</i></p>
All	Assessment report on progress made in achieving DO12 objectives	<p>Report provided: <i>Synthesis Report: Issues and Perspectives on Regional Cooperation in the Aral Sea Basin</i>, by B. Britton and C. Barnes</p>