



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 2

Turkmenistan

**Potable Water System for Tashauz Oblast Turkmenbashi
Water Treatment and Dispensing System**

**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**

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.

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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 Kzyl-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 2

Delivery Order No 2 (DO 2) followed from the Memorandum of Understanding (MOU) signed between the Government of Turkmenistan (GOT) and the Government of the United States of America (USAID Project No 110-0003) on February 20, 1994. Delivery Order No 2 was signed on May 11, 1994 and established the contract terms between USAID and CH2M HILL for completion of the work set forth in the MOU.

The MOU was based on conclusions of a USAID team, accompanied by counterparts from the Government of Turkmenistan, that made a rapid field assessment of environmental and health problems in the Turkmenbashi Etrap (Tashauz Oblast) in northern Turkmenistan in December 1993. Conclusions made by this assessment team included the following:

1. There is an abnormally high incidence of infant mortality (approaching 60 deaths per 1,000 births) in the region. This is five times the U.S. rate and almost three times the rate in other republics of the former Soviet Union.
2. Statistics further indicate that the population, particularly women and children, is chronically sick. Rates of sanitation-related illnesses such as non-specific diarrheas and hepatitis, particularly hepatitis A, are abnormally high when compared to western standards.
3. These morbidity and mortality rates are indicative of poor environmental sanitation (poor conditions of water supply, human waste management and other factors) observed in the region.
4. People in the rural areas obtain their drinking water from irrigation and drainage canals which are fed by the Amu Darya river. This water is high in total dissolved solids, ranging from 2,000 to 3,000 mg/l, and high in coliform bacteria, reportedly in excess of

2,800/1,000 ml

- 5 At present, water is a free commodity. The long term success of a potable water system will be contingent upon the generation of capital for maintenance and capitalization of system expansion.

These observations led the team to the conclusion that the most effective way to rapidly improve public health in the Turkmenbashi Entrap was to construct a reverse osmosis (RO) water treatment plant to improve drinking water, conduct health training seminars on disease transmission, and construct pit privies to reduce fly borne infections. These conclusions and recommendations were adopted in the MOU and formed the basis of Delivery Order No. 2.

Work begun under DO 2 was continued under Delivery Order No. 12.

This report reviews the scope of work, deliverables and major accomplishments of and lessons learned from the work carried out under Delivery Order No. 2. 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

The objectives of Delivery Order No 2 were

- 1 To provide safe drinking water to the approximately 100,000 people living in towns, villages, and collective farms of the Turkmenbashi Etrap in northern Turkmenistan by construction of a new 200,000 gallon per day (gpd) reverse osmosis water treatment (RO) plant,
- 2 To provide supporting activities that promote environmental sanitation including public health education materials, health training seminars, and construction of new pit privies

2.2 Delivery Order Scope

The scope of work for DO 2 included two components

Component 1 - Potable Water Treatment and Packaging/Dispensing System, including the design of an RO plant, fabrication and testing of the plant in the U S , shipping of all materials from the U S to Turkmenistan, and construction of the plant using local (Turkmen) labor forces and equipment Concrete, steel, asphalt, and other site work materials were to be purchased locally

Component 2 - Supporting Activities in Environmental Sanitation, including development of public health education materials, training of Sanitary and Epidemiological Service (SES) staff to implement public health education/sanitation materials, installation of 1,000 pit privies, and the provision of laboratory equipment for the plant and regional SES laboratories In a modification to the delivery order dated September 30, 1996, the provision of pit privies was deleted, with budget reallocated to provide for additional operational assistance for the RO plant

Additionally, the scope of work included transportation, vehicle procurement, logistic arrangements, and progress reporting related to the above activities

2.3 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 2 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 and adoption of sound sanitation practices Specifically, the work performed under DO 2 was linked to IRs 3.3.1 and 3.3.2 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 (Turkmenistan)* \$25 million by 1997

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 (Turkmenistan)* 25% by 1996, 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 (RO plant)* 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 (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

Section 3

Delivery Order Deliverables

As modified in September 1996, Article IV - Reports /Deliverables of Delivery Order No 2 specified the following deliverables

3 1 Potable Water Treatment and Packaging/Dispensing System

- Engineering design of a complete RO treatment system including analysis of water distribution methods related to container type(s) and /or truck hauling
- Procurement, delivery, and installation of the building controls, dispensing plant, brine lagoons, pre-treatment filters, chlorination facilities, package RO unit, and development of a workable construction schedule with local labor authorities
- Provision, planning, and arrangements for US based operation and maintenance training for 3 local RO unit operators and 3 members of the local administration staff
- Provision of on-site O&M training focused on care of the dispensing unit, disposal of brine, environmental impacts of improperly disposed brine, alternation of brine lagoons, etc
- Development of an RO O&M manual translated into Russian
- Development of a water pricing report

3 2 Other Supporting Activities in Environmental Sanitation

- Public health training of local SES officials and promulgation of appropriately defined public health messages through mass media
- Purchase and delivery of laboratory equipment and training of local SES laboratory staff in proper use of delivered laboratory equipment

3.3 Other Activities

- Provision of bi-weekly project status reports and one-page daily construction logs
- Transportation, vehicle procurement, and logistics arrangements related to the above activities

The status of deliverables produced under DO 2 is presented in Appendix A

Section 4

Delivery Order Accomplishments

4 1 Potable Water Treatment and Packaging/Dispensing System

The primary accomplishment of this delivery order was the successful completion of the RO water treatment plant. Construction of the plant was completed in August 1995. Major components of the completed plant are listed in Table 1. The plant was turned over to the Government of Turkmenistan in March 1996 after 8 months of startup assistance. EPT staff provided an additional 12 months of operational assistance and training until April 1997. Since then, the plant has been under the total operation and control of the Government of Turkmenistan.

Construction of this plant in one of the most remote locations of the former Soviet Union was more than a technical accomplishment. It was a social and diplomatic accomplishment. While the plant was conceived in the MOU as a means to improve public health in the area by providing safe drinking water, in a larger sense the plant represents tangible evidence of the goodwill of the American people toward the people of Turkmenistan.

The people and Government of Turkmenistan are extremely appreciative of the plant and the efforts expended by Americans in overcoming enormous logistical difficulties in constructing it in this remote part of their country. This was the first experience of the Turkmens in working with Americans. They were very skeptical and did not, at first, believe that the plant would ever be constructed. Other countries apparently had offered help earlier but no such help materialized, apparently under the belief that the living conditions at the site and the logistics would present insurmountable obstacles to the successful completion of the project.

It was not until completion of the metal buildings and the arrival of the RO process equipment in January 1995 that it became apparent to the Turkmens that the plant might actually be built. It was only then that they began to earnestly support its construction by committing adequate labor and equipment to the project. Their effort culminated in the installation of an impressive marble floor in the RO process building and a well-built brick security wall around the plant. The brick security wall is of similar design to the security wall surrounding the presidential palace in Ashgabat. These architectural features represented their best and esteemed workmanship and materials and was a way of demonstrating their pride in collaborating in the construction of the plant. In a proud and festive ceremony, the plant was dedicated by the president of Turkmenistan, Sapamurad Niazov, on August 20, 1996.

The extent to which the plant will offset childhood mortality resulting from contaminated drinking water will have to be assessed in time. As discussed in Section 5, observations made of sanitary conditions and practices indicate that although the plant should improve public health in the region by providing safe (potable) drinking water, other regional sanitary problems will need to be overcome before there is a significant reduction in childhood diseases.

Table 1
Major Components of the RO Plant

Component	Quantity	Rating (Capacity)	Manufacturer	Installation
Wells	6 EA	2 liters/sec (30 gpm)		GOT
Pumps, Submersible	6 EA	1 Liters/sec	Russian	GOT
Motor Starters	6 EA	30 hp	Allen Bradley	EPT
Raw Water Pipe	1,790 m	75 mm to 950 mm	Russian	EPT/GOT
Metal Buildings	2 EA	21 m by 10 5 m	Butler	EPT
Building Slabs	2 EA	21 m by 10 5 m		GOT
Finished Flooring				GOT
Treatment System				
Sand Sep Skids	3 EA		AES	EPT
Bag Filters Skids	3 EA		AES	EPT
Chemical Skids	5 EA	Sulfuric Acid, Chlorine, Antiscalant	AES	EPT
Cartridge Filters	3 EA		AES	EPT
Membrane Skids	3 EA	256 m3/day each	AES	EPT
Cleaning Skid	1 EA		AES	EPT
Power & Controls	LOT			EPT
Safety Equipment	LOT			EPT
Lab Equipment	LOT		Hach	EPT
Office Furniture	LOT			EPT
Extra Chemicals	LOT			EPT
Storage Reservoir	1 EA	400 m3 (100,000 gal)		GOT
Truck Load Pumps	2 EA	250 gpm, 5 hp	Crown	EPT
Truck Load Island	1 EA			EPT/GOT
Hydropneumatic	1 EA	Tank & Air Compres	Crown	EPT

Also, as discussed below, there exist a number of local administrative and financial problems that need to be resolved to ensure the plant's long term sustainability. Notwithstanding these potential problems, construction of the RO plant was a monumental accomplishment that will long reinforce goodwill between the people of the United States and the people of Turkmenistan.

The overall objectives of Component 1 were met through the completion of the following activities:

- Design and construction of the RO plant,
- U.S. and on-site training of plant operators,
- Provision of an O&M manual for the RO plant in English and Russian,
- Completing of a water pricing report projecting operation costs of the RO plant and proposing several methodologies for cost recovery,
- Completion of an analysis of water delivery options and provision of 3 water tanker trucks for water hauling.

4.2 Other Supporting Activities In Environmental Sanitation

A field visit was conducted in 1994 to assess the region's health problems, health improvement priorities, and needs related to water and sanitation. The report of this assessment recommended that further efforts be aimed at:

- involving representatives of various departments, ministries, and service providers responsible for public health, sanitation and environmental issues in an intersectoral planning activity, to be realized through a workshop,
- developing appropriate education methodologies in cooperation with the Tashauz Velayat (Oblast) Health Department,
- organizing an intensive skills development program for doctors and administrators responsible for public health education in the velayat,
- improving the capacity and effectiveness of sanitation education by supplying appropriate learning materials and equipment.

The assessment team also recommended an inter-agency planning seminar as the ideal means to assess water, sanitation, and related problems and to develop locally implemented solutions to these problems. This seminar was held in Tashauz in June 1995 for 65 representatives from local and regional agencies. Training provided during the seminar focused on increasing awareness of health issues by pointing to a linkage between the state of water and sanitation systems and the state of health of the local population. Eight health demonstration projects, aimed at increasing access to potable water and upgrading sanitary facilities in kindergartens and schools, hospitals,

farms, and factories in the velayat were outlined by seminar participants in collaboration with members of local communities

Work on the engineering design and specification of equipment for these projects was initiated during visits to the demonstration project sites in late 1995. These visits also afforded the opportunity for the EPT public health team to organize a health forum for children in grades 9-11 in cooperation with the Tashauz Health Center and the local administration. The forum was attended by approximately 500 students, 50 teachers, 50 doctors, and representatives of the local administration. Finally, during this visit the public health team held a two-day interagency planning meeting, attended by 23 residents of the Turkmenbashi Etrap, to discuss options for delivering water from the RO plant. A health action plan, including a comprehensive training program and support for health demonstration project implementation, was proposed for implementation under Delivery Order No. 12.

The overall objectives of Component 2 were met through the completion of the following activities:

- Assessment of the health situation in the area,
- Organization of an interagency planning seminar,
- Development of small health demonstration projects by local communities (for implementation under Delivery Order No. 12),
- Provision of laboratory equipment, including a spectrophotometer, to the SES and training in the use of the equipment.

Section 5 Delivery Order Lessons Learned

5.1 Objectives of the Delivery Order

As indicated earlier in Section 2, the key objectives of the delivery order were to provide safe drinking water to the approximately 100,000 people living in towns, villages, and collective farms of the Turkmenbashi Etrap by construction of a reverse osmosis water treatment plant and to provide supporting activities that promote environmental sanitation. All these objectives were met with the accomplishment of the tasks under Delivery Order No. 2, as detailed in Section 4.

Although the direct health benefit of the project to the population cannot be ascertained without a detailed study of the conditions which existed prior to and post project, at the completion of Delivery Order No. 2 the RO plant was providing safe drinking water to the Etrap's population, with each village receiving water roughly once a day. To prolong this benefit, plant operators were trained in the maintenance and repair of the equipment installed, and spare parts and treatment chemicals to last approximately two years were provided under the project. To sustain this benefit, the GOT must commit adequate amounts of financial resources. This issue was addressed by an EPT sustainability assessment team fielded to Turkmenistan in mid-1998 and are discussed further in Section 5.3.

The provision of safe water may not, by itself, result in the reduction of chronic intestinal illness, however. Assessments made by the USAID team in December 1993 concluded that most of these diseases were being transmitted by polluted drinking water. GOT officials also suggested that polluted drinking water was the primary cause of these diseases, thus justifying construction of an RO water treatment plant. While poor sanitary conditions were also cited by the assessment team as a likely cause of disease, the delivery order specified only limited sanitation efforts. Observations made by the EPT teams working and living in the Etrap over a twenty-month period suggest, however, that unsanitary conditions and poor hygiene practices may play as important a role in disease causation. Flies and roaches are endemic in the area, entering houses freely through unscreened windows, and moving freely from pit latrines to dining tables. People themselves unwittingly also spread disease, by handshaking, as there is no water near the pit privies with which to wash their hands. Future community-level efforts directed at the provision of non-potable water for hand washing near the vicinity of public pit privies, the improvement of pit privies, and the reduction of exposure to vectors through encouraging the use of inexpensive supplies and materials such as fly paper, roach traps, and window screens would certainly pay off in terms of improved sanitation and a reduced burden of disease.

5.2 Construction of the RO Plant

The original construction schedule of four months was unrealistic considering the logistic and labor difficulties encountered. The plant was ultimately constructed in twelve months and, given these difficulties, this was a realistic schedule for the project. The lack of locally available equipment and supplies was particularly problematic. All equipment and supplies had to be

shipped from the U S and retrieved from Asghabat, some 300 miles across the desert. Material shipped by air took at least 10 days to reach Asghabat.

5.3 Operator Training

The RO plant was operated by EPT-paid technicians for a period of twenty months, through April 1997. While, by the end of this period, a sufficient number of local personnel had been trained to ensure that the plant would be operated properly, this period of extended operation could have been shorter without the following problems:

- 1 RO plant training was provided in Tampa, Florida in November 1994 for 6 of the proposed Turkmen operators. None of these trainees was eventually assigned to operate the plant, necessitating the extension of on-site training.
- 2 Conflict between the GOT administrations as to who would retain operational control of the plant resulted in the training of several different groups of operators. Many trainees, who lived in distant collective farm villages and had to walk as much as 10 miles to the plant because of country-wide fuel shortages, had great difficulty in getting to the plant. Because of the long commute, their available training time was limited.

5.4 Sustainability

A project-conducted sustainability assessment of the RO plant made more than one year after its completion found the primary equipment units and systems installed under Delivery Order No. 2 (and Delivery Order No. 12) to be in place, functional and being operated. The assessment team also found that the Government of Turkmenistan has undertaken initiatives to sustain the project. Specific findings and recommendations of particular importance were:

- 1 The RO plant is operating at 60 percent of its installed capacity because the production capacity of the RO plant is higher than the capacity of the water distribution system, which consists of water trucks and stationary holding tanks.
- 2 In general the GOT is providing the necessary resources, including operator salaries, to keep the RO plant operating and the trucks delivering water.
- 3 The spare parts provided under the project were in safe custody at the plant and are being used judiciously.
- 4 Problems with currency exchange severely restrict the ability of the GOT to purchase supplies and equipment from companies outside the former Soviet Union. Spare parts and supplies of the U S -made water treatment and laboratory equipment are particularly difficult to obtain. The facility has not located sources for some supplies that will be needed soon, as those provided under the project are depleted.
- 5 In line with current water pricing policy in Turkmenistan, consumers are not charged for

the water service. Consequently, operation of the RO plant is fully financed by funds from the government budget. While Counterpart Consortium has been studying water pricing and the development of a Water Users Association, these efforts have not been well received by local officials in the face of the refusal of the GOT to give permission to form a Water Users Association. Previous 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.

6 The original operators trained under the project have been retained, and internal training for safety and operations is conducted periodically. However, operator training is less comprehensive than that provided under the project, and training needs to be improved. While the lack of a comprehensive training program does not appear to have affected the sustainability of the project to date, there could be a significant reduction in the quality of operations as EPT-trained operators retire from the system.

7 Laboratory operations have been impaired by the lack of a chemist on staff.

Upon completion of the RO plant in August 1995, there was much discussion and stated interest on the part of GOT officials to construct several more RO plants within the country - one in Kuna Urgench, one in Boldusaz, three in Tashauz, and one in Cardzev - all located in urban centers within walking distance of large populations. In 1994, Tashauz Oblast administration officials, particularly concerned with providing potable water and alleviating health problems in outlying areas of the oblast, expressed a strong preference for assistance in the Turkmenbashi area situated some 140 kilometers from the city of Tashauz. In hindsight, it seems that any of the urban sites currently under consideration would have been a better location to construct the first RO plant due to logistical and financial problems associated with hauling water to remote villages.

The answer to the question of whether or not to construct more RO plants rests with sustainability. The effectiveness of the systems for sustaining the existing plant is now entering a critical phase. Until now the plant has used the spare parts and chemicals provided under the EPT Project, and the previous ministry has provided salaries, fuel for trucks, and other operational expenses. This situation may well change over the next year or two, with a new ministry (the Committee for Providing Turkmenistan with Clean Water, responsible for sanitary and potable water issues, created in the spring of 1998), in charge and a pressing need for spare parts and supplies as those provided under the project are depleted.

Appendix A
Status of Deliverables

Task	Delivery Order Deliverables	Status of Deliverables
Reverse Osmosis Water Treatment and Packaging/Dispensing System		
1	Engineering design of a complete R O treatment system including analysis of water distribution methods related to container type and/or truck hauling	Completed Results reported in <i>Turkmenbashi R O Water Treatment Plant Record Drawings</i> July 1996
1	Procurement delivery and installation of the building controls dispensing plant brine lagoons pre treatment filters chlorination facilities package R O unit and development of a workable construction schedule with local labor authorities	Completed Results reported in <i>Initial Construction Completion Report for the Turkmenbashi Reverse Osmosis Water Treatment Plant</i> September 1995 <i>Turkmenbashi R O Water Treatment Plant Record Drawings</i> July 1996
1	Provision planning and arrangements for U S based operation and maintenance training for 3 local R O unit operators	Completed Two weeks of U S based training provided in November 1994
1	Provision of on site O&M training focused on care of dispensing unit disposal of brine environmental impacts of improperly disposed brine alternation of brine lagoons etc	Completed Two weeks of on site management training provided in October 1995 One year of on site technical assistance completed in April 1997
Supporting Activities in Environmental Sanitation		
2	Development of a water pricing report	Draft and final reports developed <i>Turkmenbashi Water Treatment Plant Draft Water Financing Report</i> November 1995 <i>Turkmenbashi Water Treatment Plant Water Financing Report Turkmenistan</i> June 1996
2	Public health training of local SES officials and promulgation of appropriately defined public health messages through mass media	Completed Results reported in <i>Assessment Report for Environmental and Health Education Program Dashovuz Velayat Turkmenistan</i> January 1995 <i>Draft Water and Sanitation Health Education Program Interagency Planning Seminar Dashovuz Velayat Turkmenistan</i> July 1995 Trip Report J Malvinsky and A Shafransky Turkmenistan September November 1995 <i>Water and Sanitation Health Education Program Health Program Summary Dashovuz Velayat Turkmenistan</i> December 1995 <i>Training in Health Education and Promotion Water and Sanitation Kazakhstan Turkmenistan, and Uzbekistan</i> June 1996
2	Purchase and delivery of laboratory equipment and training of local SES laboratory staff in proper use of delivered laboratory equipment	Completed Results reported in <i>Water Quality Assessment and Monitoring in the Tashauz Region of Turkmenistan</i> March 1995
2	Supervision of construction crews during installation of approximately 1000 pit privies in areas suggested by local authorities near the new R O dispensing unit installed under this project	Completed
2	Design of a simple AID approved pre fabricated latrine	Deleted by MOD 4
2	Development of R O O&M manual translated into Russian	Manuals developed <i>Draft Owners Manual for Installation Operation and Maintenance Reverse Osmosis Plant American Engineering Services Russian Translation</i> April 1995 <i>Operations and Maintenance Manual Turkmenbashi Reverse Osmosis Plant Turkmenistan Russian Translation</i> February 1996
2	Provision of bi weekly reports and one page daily construction logs	Completed
2	Procurement of local construction materials including all materials including all materials needed for pre fabricated latrines and other materials as necessary	Completed
2	Transportation vehicle procurement and logistics arrangements related to the above activities	Completed