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# PILOT HEATING PROJECT REPORT: SUNDUKYAN

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**This publication was produced for review by the United States Agency for International Development. It was prepared by the Residential Heating Project's team.**

Residential Heating Project  
USAID Contractor  
75 Hovsep Emin Street  
Yerevan Armenia  
(374)-10-268982 (tel.)  
(374)-10-210882 (fax)  
[www.heat.am](http://www.heat.am)

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## **DISCLAIMER**

The author's views expressed in this publication do not necessarily reflect the views of the United States Agency for International Development or the United States Government.

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## **PROJECT SUMMARY AND EXPECTED RESULTS**

To promote the development of the heat market in Armenia, the Residential Heating Project (RHP) sought to provide initial financial and technical assistance and advisory services to a boiler-house operator as a demonstration project to make the heat supply business attractive for private investors. RHP collaborated with Jerm-MAS Ltd. to re-commission an autonomous heating system with the expectation that the system could be expanded in the coming years as other buildings can be connected to the system given the consent and participation of the apartment owners.

The RHP originally developed the Sundukyan project to serve one building at Sundukyan 23, of which 45 of the 96 total apartments in the building were to be heated. With USAID's support to pursue an increased number of apartment buildings, RHP worked with the Sundukyan principal, Jerm-MAS Ltd, through its manager Armen Martoyan, to enhance the pilot project and expand service to heat 85 apartments out of 175 total apartments in three buildings.

Rapid progress achieved by Jerm-MAS Ltd. and Termoservice, the installation subcontractor, increased interest on behalf of residents and led to the addition of a fourth building to the pilot project, bringing the total targeted apartments to be heated to approximately 120, out of the 215 in the four buildings – over 55 percent participation.

The USAID-funded portion of the project includes the installation of external and internal building riser supply and return piping systems, heat metering to allow for individual building heat consumption measurement, and internal apartment heating systems, including piping and radiators.

## **PROJECT PARTNERS AND SUBCONTRACTING**

The project partner for long-term system operations is Jerm-MAS Ltd., which has leased several other formerly-operating boiler houses from the municipality of Yerevan. Jerm-MAS Ltd. is managed by Mr. Armen Martoyan, an active participant in a group of investors who have leased boiler houses in Yerevan and other municipalities in Armenia.

Subcontracting efforts began with the development and release of the Sundukyan construction/installation RFP in July 2006, resulting in two subcontractors submitting bids for the pilot project on August 10, 2006. During the week of August 14, 2006, bids were examined by the RHP technical review team, and the apparent lowest evaluated bidder was asked to meet with RHP representatives to subsequently clarify certain aspects of his proposal in an additional submission.

In order to provide maximum flexibility for a potential increase in the number of apartments subscribing to the project and ensure sufficient oversight and compliance with USAID procurement regulations, RHP developed a subcontract with USAID's concurrence in which RHP directly procured the majority of the piping, thereby preventing the subcontract from exceeding the \$100,000 simplified acquisition threshold. By the week of August 28, 2006 the subcontract was concluded with the apparent lowest bidder, and the subcontract and two draft pilot project MOUs were provided to Jerm-MAS Ltd. for review. On August 29, 2006, the subcontract was executed by RHP and Termoservice, and the RHP immediately began piping procurement activities.

Subsequent to the increased interest from residents in a fourth building and the securing of approval from USAID on October 6, 2006, the RHP prepared and subsequently secured signatures on October 26, 2006, on a subcontract modification with Termoservice, bringing the total targeted apartments to be heated to approximately 120.

## **PROJECT PLANNING AND EXECUTION**

As the RHP was scheduled to close by the end of 2006, the installation schedule would be critical for this pilot project. The RFP required the bidders to adhere to proposed start and end dates for various activities. After award, the subcontract was modified to add a fourth building, and a revised schedule was agreed to by RHP and the subcontractor, Termoservice.

The initial subcontract documents included a schedule for activities as follows:

<b>Task</b>	<b>Start date</b>	<b>End date</b>
Contract signed	29-Aug-2006	29-Aug-2006
Equipment and materials purchase for external and internal heating system for Sundukyan 21 and Kochar 20 buildings	31-Aug-2006	11-Sept-2006
Construction and insulation of external heat main	04-Sep-2006	20-Sept-2006
Construction and insulation of internal heat main for Sundukyan 21 building	11-Sept-2006	11-Oct-2006
Construction and insulation of internal heat main for Kochar 20 building	11-Sept-2006	11-Oct-2006
Equipment and materials purchase for internal heating system for Sundukyan 23	20-Sept-2006	20-Oct-2006
Construction and insulation of internal heat main for Sundukyan 23 building	15-Oct-2006	30-Oct-2005
Heat meter fitting in all 3 buildings	20-Oct-2006	30-Oct-2006
External heat systems connection to the boiler-houses	20-Oct-2006	30-Oct-2006
Hydraulic trial for all 3 buildings' heat systems	30-Oct-2006	06-Nov-2006
Defects detection, verification, regulation in the systems	30-Oct-2006	10-Nov-2006
Completion and acceptance	10-Nov-2006	10-Nov-2006

Subsequently, with the addition of the fourth building, the schedule was amended as follows:

<b>Task</b>	<b>Start date</b>	<b>End date</b>
Subcontract signed	29-Aug-2006	29-Aug-2006
Equipment and materials purchase for external and internal heating system for Sundukyan 21 and Kochar 20 buildings	31-Aug-2006	9-Sep-2006
Construction and insulation of external heat main	04-Sep-2006	25-Sep-2006
Construction and insulation of internal heat main for Sundukyan 21 building	11-Sept-2006	1-Nov-2006
Construction and insulation of internal heat main for Kochar 20 building	11-Sept-2006	1-Nov-2006
Equipment and materials purchase for internal heating system for Sundukyan 23	20-Sept-2006	10-Oct-2006
Construction and insulation of internal heat main for Sundukyan 23 building	15-Oct-2006	30-Oct-2006
Construction and insulation of internal heat main for Sundukyan 19 building	Upon sub-contract mod. execution	10-Nov-2006
Heat meter fitting in 3 original buildings (Sundukyan 21, Sundukyan 23, and Kochar 20)	20-Oct-2006	20-Oct-2006
External heat systems connection to the boiler-house	20-Oct-2006	30-Oct-2006
Hydraulic trial for original 3 buildings' heat systems	30-Oct-2006	06-Nov-2006
Hydraulic trial for the fourth building's (Sundukyan 19) heat system	30-Oct-2006	06-Nov-2006
Defects detection, verification, regulation in the systems	30-Oct-2006	10-Nov-2006
Completion and acceptance	10-Nov-2006	17-Nov-2006

Delays in securing timely delivery of metal-plastic pipe from the allowed 110 country code sources slightly affected the above schedule; however, the subcontractor and the boiler house operator worked closely to assure a rapid conclusion to the installation activities could be achieved once pipe became available.

Pipe for the final apartment-level heating systems was delivered on Friday, November 24, 2006, and by the end of the following week, Termoservice had essentially completed all apartment installations. Final testing and initial operation with hot water supplied from the refurbished boiler house was scheduled for the week of December 4, 2006.

On December 4, 2006, the boiler house began test-firing activities, and this initial operation resulted in the sustained delivery of heat to the participating apartments.

In addition to the virtually daily oversight of the subcontractor and partner activities by the RHP pilot project team over the course of installation and refurbishment activities, a series of site visits by senior project management and USAID representatives have become almost weekly occurrences. Oversight by the RHP pilot project team included taking photographs of project progress, engaging residents in discussions about the work on their apartments, and reviewing the subcontractor's work and the progress of the boiler house work by the operating partner. Further, the RHP team completed an Environmental Checklist in accordance with USAID regulations to assure the environmental compliance of facilities and equipment installed under the pilot project. The Site Visit reports are attached in Annex A, a tabulation of participating apartments is attached in Annex B, a summary of pilot project costs is attached in Annex C, and a copy of the draft Environmental Checklist documentation is attached in Annex D.

## **PROJECT RESULTS AND SUSTAINABILITY**

Communications initiatives by the RHP and Jerm-MAS Ltd., included the drafting and distribution of project information documents, such as fliers and posters, door-to-door informational visits, and project informational sessions that residents could sign up to attend. These initiatives increased the desired participation by apartment owners in the original three buildings and precipitated the RHP's seeking approval from USAID to add apartments in a fourth building at Sundukyan 19. A modification to the Termoservice subcontract was signed on October 26, 2006 adding this fourth building to the scope of work. The targeted participating apartments have now risen from the original 85 to approximately 120, representing some 55 percent of the total apartments in all four buildings. Even for the original three buildings, the participation level rose from the targeted 85 to 94, and the level of the participation in the newly added fourth building, some 25 or a total of 40 apartments, is over 60 percent.

Our discussions with residents indicate that four factors contributed to the expansion of participation in the project: (1) the quality and timeliness of the work by the subcontractor illustrated to the residents that the project was a serious effort to bring heat to the participating apartments; (2) the physical presence and active participation in the "community" by the operator, Jerm-MAS Ltd. and its owner Armen Martoyan, further gave confidence to the residents that a firm commitment was made by this operator to provide heat; and (3) the overall economics and safety of having heat provided by such hot water systems in lieu of individual electric or gas powered alternatives speaks highly of this alternative; and (4) the communications efforts of the RHP staff and the operator to assure the residents were aware of the first three factors.

The planning, execution, communication, and other activities that were successfully employed for the Sundukyan and Kochar pilot project should serve as practical examples to be followed for the continued installation and operation of other facilities supporting hundreds of Yerevan residents. The potential for this pilot project investment to serve as the nucleus of growing successes in providing residential heat to Armenians is great, as it is truly these additional

projects through which the USAID investment in the Sundukyan and Kochar pilot project will be substantially leveraged. In fact, by the end of November, 2006, Mr. Martoyan indicated he was going to install a third boiler soon in preparation for supplying a fifth building of 125 apartments next year.

## **RECOMMENDATIONS**

Recommendations, building on the successes of this project include:

- a. Assure sound technical feasibility of any project being attempted. Recalling some of the “hurdles” documented by the RHP, old abandoned systems are often not able to be evaluated properly; therefore, almost any refurbishment of heating supply should include a virtually total renewal of all risers, and in-apartment piping and radiators to assure quality and sustainable operation.
- b. Assure that financial resources are sufficient (from investors, donors, financial institutions, residents, etc.) to fund a quality project that will provide sustainable, quality heat to the participating apartments.
- c. Demonstrate a commitment to the project by quality workmanship, timely progress, active participation by the principals, and deliberately sought communications with and personal involvement of the residents – they, after all, are the ones who will ultimately “pay the bill” for the heat.
- d. Perform as promised: holding all participating organizations to their promises of performance.

# **ANNEX A: SITE VISIT REPORTS**

## **Site Visit Report**

**Project Name & Contract No.:** Armenia Residential Heating Project,  
Contract No. 111-C-00-05-00040-00

**Date of visit:** September 15, 2006

### **Overview**

By the USAID funded Residential Heating Program a pilot heating project was initiated in Yerevan Arabkir Community, in Kochar 20, Sundukyan 21 and 23 buildings jointly with “Jerm-MAS” CJSC, which has taken the responsibility to construct the boiler house, install all necessary equipment there and technically maintain the operation of local boiler house and heating systems installed in the apartments.

In the initial stage the Residential Heating project has conducted survey jointly with National Association for Condominium Owners. All interviewees were initially trained by the project team. The survey results demonstrated that 85 apartments were willing to get a heat from the boiler house. Tariff calculations demonstrated that for one-room apartment the heat will cost about AMD15.000, for two room apartment-AMD20.000 and for 3 room apartment-AMD25.000.

### **Purpose of Trip**

The purpose of the trip was to inspect the process of installation of external pipelines by the subcontractor, Termoservice, to make sure that all activities are being conducted according to the schedule and work plan.

### **Progress Made**

The following tasks outlined in the base contract with Termoservice CJSC, USAID Residential Heating Project subcontractor, and MOU with Jerm-Mas CJCS, USAID Residential Heating Project partner, were completed:

- Pipe stands had been fabricated and installed by the subcontractor so as to support the supply and return lines to the three buildings. These stands were well located and seem adequate for the purpose intended.
- External supply and return piping had been run from just inside the boiler house toward each building – two buildings had some internal work, the third was awaiting further construction for egress.
- Piping was welded in place, had been subsequently painted, and had the long runs of rock wool insulation and metal cladding in place. Most weld joint areas still needed the installation of the rock wool insulation and metal cladding.
- Care was being taken by subcontractor personnel.
- The boiler house activities consisted mainly of clearing out the old equipment and piping in preparation for installation of the needed equipment by Jerm-Mas, Ltd.

The project team is talking with residents about their formal documentation of participation in the project.

**Concerns**

No concerns expressed or noted.

**Next steps**

Continue scheduled and random site visits to review the progress.

**Attachment**

Selected photos indicting progress noted above.

**Sundukyan**  
**External network installation – 15Sep06**



Double pipe systems exit boiler house to  
Feed Sundukyan 21 and Kochar 20



Double pipe system exit boiler house to  
feed Sundukyan 21



Feed to Sundukyan 23



Feed to Sundukyan 21



Feed to Kochar 20

## Site Visit Report

**Project Name & Contract No.:** Armenia Residential Heating Project,  
Contract No. 111-C-00-05-00040-00

**Date of visit:** September 28, 2006

### Overview

By the USAID funded Residential Heating Program a pilot heating project was initiated in Yerevan Arabkir Community, in Kochar 20, Sundukyan 21 and 23 buildings jointly with “Jerm-MAS” CJSC, which has taken the responsibility to construct the boiler house, install all necessary equipment there and technically maintain the operation of local boiler house and heating systems installed in the apartments.

In the initial stage the Residential Heating project has conducted survey jointly with National Association for Condominium Owners. All interviewees were initially trained by the project team. The survey results demonstrated that 85 apartments were willing to get a heat from the boiler house. Tariff calculations demonstrated that for one-room apartment the heat will cost about AMD15.000, for two room apartment-AMD20.000 and for 3 room apartment-AMD25.000.

### Purpose of Trip

The purpose of the trip was to inspect the process of installation of heating systems in the apartments, which had signed the MOU with the Residential Heating Project, as well as support the project team, including the local communications, to make sure that all activities are being conducted according to the schedule and work plan.

### Progress Made

A subcontract was signed with “Termoservice” CJSC for a base number of 60 apartments, with firm price additional quotes for different sizes of apartments to be exercised should apartment owner participation levels be achieved.

The following tasks outlined in the base contract with “Termoservice” CJSC, USAID Residential Heating Project subcontractor, and MOU with Jerm-Mas CJCS, USAID Residential Heating Project partner, were completed:

- Radiators have been tested by “Termoservice” CJSC, the USAID/Residential Heating Project contractor, to install in apartments,
- Pipes for heating systems have been provided by the Residential Heating Project to “Termoservice” CJSC
- Heating systems, including vertical building risers, internal apartment pipes and radiators, have been installed in approximately 30% of the facilities at Sundukyan 23, Kochar 20 and Sundukyan 21.
- External piping, connecting the boiler house and Sundukyan 21, 23, and Kochar 20 building, is estimated to be 70% complete by “Termoservice” CJSC.
- External pipes were isolated and covered with protective metal cover.

- 2 boilers have been installed by the “Jerm-Mas” CJSC in the boiler house to feed the 3 buildings.

As result of local public communication activities, including direct awareness to residents, conducted by the Residential Heating Project team, the number of apartments, willing to participate in the pilot, has been increased and reached to 89. Messages to the residents (like “You can save energy and money with centralized heating,” “centralized heating is better than individualized because it’s more efficient,” “explosion is possible – it happens only one time”, “comfort starts with heating”etc.) had been designed depending on their existing level of awareness, willingness to participate, and informational needs. Based on them special information flyers have been prepared by the Residential Heating Project team and put on the walls, entrances to building, as well as distributed among apartment owners.

The project team has also distributed brochures informing citizen’s about their rights and responsibilities, regarding energy and gas consumption and heat precautions.

### **Concerns**

Jerm-Mas CJCS is behind of the schedule. Concerns were expressed to the head of the CJSC to hurry up with final installation and piping in the boiler house, as well as installation of chimney and gas distribution unit.

### **Next steps**

It was agreed that starting from October 23, each Monday USAID will try to schedule a site visit to review the progress.

### **Attachment**

Selected photos indicting progress noted above.

**Sundukyan**  
**Internal and external network installation – 28Sep06**



Two boilers installed in boiler house to Feed Sundukyan 21 and 23, and Kochar 20



Radiators tested and prepared for installation in apartment



Internal piping and radiator installation in Sundukyan 21 apartment



Riser and apartment piping in Sundukyan 23

## **Site Visit Report**

**Project Name & Contract No.:** Armenia Residential Heating Project,  
Contract No. 111-C-00-05-00040-00

**Date of visit:** October 23, 2006

### **Overview**

This USAID-funded pilot project was initiated in Yerevan Arabkir Community, in Kochar 20, Sundukyan 21 and 23 buildings jointly with "Jerm-Mas Ltd." CJSC, which has taken the responsibility to construct the boiler house, install all necessary equipment there and technically maintain the operation of local boiler house and heating systems installed in the apartments. Communications initiatives by the RHP and Jerm-Mas Ltd. have increased the desired participation by apartment owners in the original three buildings and precipitated the RHP's seeking approval from USAID to add apartments in a fourth building at Sundukyan 19. Negotiations with the subcontractor should be completed next week regarding the desired modification.

### **Purpose of Trip**

The purpose of this site visit was to review the progress of the preparations for pressure testing of the lines and equipment in the original three buildings, inspect the installations of building level heat metering equipment, and to assess the progress of the work being undertaken in the boiler house by Jerm-Mas Ltd.

### **Progress Made**

The following tasks outlined in the contract with Termoservice CJSC, USAID Residential Heating Project subcontractor, and MOU with Jerm-Mas Ltd. CJCS, USAID Residential Heating Project partner, were completed:

- Feeder lines running through basements and up risers in the original three buildings are essentially complete and insulated. In cases that warrant, additional protective metal cladding has been added over the insulation tubing.
- Termoservice reports that 74 apartments have been fully installed and 4 are currently under installation work.
- Circulating and feed pumps have been installed by Jerm-Mas Ltd. in the boiler house, and headers are in place for the attachment of the supply and return external lines serving the buildings.

### **Concerns**

Metal-plastic pipe is needed to support the overall completion of the first three buildings as subcontractor inventories are getting low. Some additional resources need to be applied to the boiler house work so as to assure its completion and readiness for operation when external and internal systems have been completed by the subcontractor.

**Next steps**

RHP staff will continue to monitor and encourage Jerm-Mas Ltd. to speed its work on the boiler house.

**Attachment**

Selected photos indicating progress noted above.

**Sundukyan**  
**Boiler house, supply networks and heat meter installation – 23Oct06**



Circulation and feed pumps installed in boiler house piping systems.



Feed and return lines to Sundukyan 23 basement with protective metal covering.



Heat meter and isolation valving installed in Sundukyan 21 basement.



Heat meter and isolation valving installed in Kochar 20 basement.

## Site Visit Report

**Project Name & Contract No.:** Armenia Residential Heating Project,  
Contract No. 111-C-00-05-00040-00

**Date of visit:** October 30, 2006

### Overview

This USAID-funded pilot project was initiated in Yerevan Arabkir Community, in Kochar 20, Sundukyan 21 and 23 buildings jointly with “Jerm-Mas Ltd.” CJSC, which has taken the responsibility to construct the boiler house, install all necessary equipment there and technically maintain the operation of local boiler house and heating systems installed in the apartments. Communications initiatives by the RHP and Jerm-Mas Ltd. have increased the desired participation by apartment owners in the original three buildings and precipitated the RHP’s getting approval from USAID to add apartments in a fourth building at Sundukyan 19. A modification to the Termoservice subcontract was signed on October 26, 2006 adding this fourth building to the scope of work.

### Purpose of Trip

The purpose of this site visit was to inspect the process of preparations for extension of feeder lines to Sundukyan 19, and to assess the progress of the work being undertaken in the boiler house by Jerm-Mas Ltd.

### Progress Made

The following tasks outlined in the contract with Termoservice CJSC, USAID Residential Heating Project subcontractor, and MOU with Jerm-Mas Ltd. CJCS, USAID Residential Heating Project partner, were completed:

- External feeder lines to Sundukyan 21 have been tapped by Termoservice to provide flow to Sundukyan 19.
- Insulation for risers and external apartment feed lines is virtually 100% installed. In certain situations, plugged or valved extra taps have been put in place in order to attach and serve future apartments not presently participating in the project.
- Feeder lines to buildings have been attached to the circulation headers in the boiler house.
- Natural gas supply have been run by Jerm-Mas Ltd. from the nearest ArmRusGasprom point of supply to the newly installed pressure reduction and metering station supporting the boiler house.

### Concerns

RHP-supplied metal-plastic pipe procurement facilitation is needed to support the overall completion of the first three buildings and the completion of the newly added fourth building.

**Next steps**

RHP must make a decision on the methodology of procuring metal-plastic pipe in a timely manner to support construction/installation.

**Attachment**

Selected photos indicting progress noted above.

**Sundukyan**  
**Boiler house and external network installation – 30Oct06**



Natural gas supply and metering/  
reduction installed to fuel boilers.



Feed and return lines to buildings  
attached to headers in boiler house



Tees and isolation valves installed in  
external pipes supplying Sundukyan 19



Riser pipes installed and ready for  
insulation in Sundukyan 23

## Site Visit Report

**Project Name & Contract No.:** Armenia Residential Heating Project,  
Contract No. 111-C-00-05-00040-00

**Date of visit:** November 9, 2006

### Overview

This USAID-funded pilot project was initiated in Yerevan Arabkir Community, in Kochar 20, Sundukyan 21 and 23 buildings jointly with "Jerm-Mas Ltd." CJSC, which has taken the responsibility to construct the boiler house, install all necessary equipment there and technically maintain the operation of local boiler house and heating systems installed in the apartments.

Subsequent to startup of installation operations, communications initiatives by the RHP and Jerm-Mas Ltd. have increased the desired participation by apartment owners in the original three buildings and precipitated the RHP's seeking and securing approval from USAID to add apartments in a fourth building at Sundukyan 19, bring the targeted participation level to approximately 120 of the total of 215 apartments in the four buildings

### Purpose of Trip

The purpose of this site visit was to inspect the process of installation of extension of feeder lines to Sundukyan 19, and to assess the progress of the work being undertaken in the boiler house by Jerm-Mas Ltd. as was contemplated at the last site visit.

### Progress Made

The following tasks outlined in the contract with Termoservice CJSC, USAID Residential Heating Project subcontractor, and MOU with Jerm-Mas Ltd. CJCS, USAID Residential Heating Project partner, were completed:

- External and internal pipes and radiators for heating systems continue pressure testing by Termoservice.
- External piping for Sundukyan 19 – the newly added building – have been hung, but only partially insulated at this time, and some preliminary work has begun using pipe sizes remaining from previous construction.
- The chimneys for the 2 boilers have been mounted on foundations and extended through the roof of the boiler house. Boiler exhausts have not been connected.
- One of the burners has now been installed in its boiler. Main gas headers are in place, but not connected to the burners.
- Tap lines for purging feeder lines and taking water samples have been installed.

### Concerns

Jerm-Mas Ltd. CJCS has a tight schedule remaining for boiler house make ready to support delivery of heat to residents prior to the 2006-2007 heating season.

**Next steps**

It was agreed that substantive work would be accomplished in the near term by Jerm-Mas Ltd. so as to regain some of its lost schedule for the boiler house activities.

**Attachment**

Selected photos indicting progress noted above.

**Sundukyan**  
**Boiler house and Sundukyan 19 external network installation – 09Nov06**



Chimney foundations in place behind each boiler, with external extensions completed.



Burner installed in boilers with natural gas supply prepared to connect.



Water sampling lines installed along with catch basin.



Supply and return lines from boiler house installed to reach Sundukyan 19.



Sundukyan 19 riser feeders run outside the building due to no basement.

## Site Visit Report

**Project Name & Contract No.:** Armenia Residential Heating Project,  
Contract No. 111-C-00-05-00040-00

**Date of visit:** November 15, 2006

### Overview

This USAID-funded pilot project was initiated in Yerevan Arabkir Community, in Kochar 20, Sundukyan 21 and 23 buildings jointly with “Jerm-Mas Ltd.” CJSC, which has taken the responsibility to construct the boiler house, install all necessary equipment there and technically maintain the operation of local boiler house and heating systems installed in the apartments.

Subsequent to startup of installation operations, communications initiatives by the RHP and Jerm-Mas Ltd. have increased the desired participation by apartment owners in the original three buildings and precipitated the RHP’s seeking and securing approval from USAID to add apartments in a fourth building at Sundukyan 19, bring the targeted participation level to approximately 120 of the total of 215 apartments in the four buildings

### Purpose of Trip

The purpose of this site visit was to inspect the process of installation of heating systems in the apartments (particularly in the newly added building at Sundukyan 19) and to assess the progress of the work being undertaken in the boiler house under the auspices of Jerm-Mas Ltd.

### Progress Made

The following tasks outlined in the contract with Termoservice CJSC, USAID Residential Heating Project subcontractor, and MOU with Jerm-Mas Ltd. CJCS, USAID Residential Heating Project partner, were completed:

- External and internal pipes and radiators for heating systems have been pressure tested by Termoservice.
- External piping and associated drain lines (as this building has no basement) have been installed and fully insulated for Sundukyan 19 – the newly added building.
- Termoservice reports that 12 apartments in Sundukyan 19 have had substantive work completed; however, Termoservice is awaiting the delivery of additional pipe being provided by RHP. In the first three buildings, 90 apartments have been completed, 2 are under way, and 1 is awaiting owner-assisted access.
- The exhausts of the 2 boilers have been connected to the chimneys, and one of the burners has now been connected to the gas header in the boiler house.
- The final boiler house flooring is approximately 40% installed, with the remainder awaiting the final installation of certain electrical conduits and drain lines.

### Concerns

The interior apartment installations, primarily in Sundukyan 19, are currently on hold pending delivery of metal-plastic pipe from a local supplier securing this pipe of Georgian manufacture.

It is expected that this pipe will arrive by the end of next week, and Termoservice states that it can complete the installations in 3-4 days.

Jerm-Mas Ltd. CJCS has a tight schedule remaining for boiler house make ready to support delivery of heat to the participating residents prior to the 2006-2007 heating season. Concerns were expressed to the boiler house operator, and assurances were secured regarding the completion of installation and test firing of the boilers and general clean-up and civil completions would be done prior to the end of the month.

### **Next steps**

It was agreed that a “ribbon-cutting” event would be planned for the first or second week on December. Jerm-Mas Ltd. would like to invite the Mayor of Yerevan (as this boiler house has been leased from the Municipality of Yerevan), and USAID will assess availabilities of the Mission Director and the Ambassador for possible attendance. It was noted that some degree of active resident participation in the event is desired.

### **Attachment**

Selected photos indicting progress noted above.

**Sundukyan**  
**Boiler house, Sundukyan 19 and 23 installations – 15Nov06**



Each boiler attached to its chimney for exhausting flue gases.



Systems in original three buildings shown holding pressure.



Sundukyan residents eager to replace current inadequate sources of heat so that the “whole family” can be more comfortable and enjoy the winter months ahead.



Lines from boiler house to Sundukyan 19 have purge drains installed.



Riser feeders made with provisions for connecting future apartments.

## Site Visit Report

**Project Name & Contract No.:** Armenia Residential Heating Project,  
Contract No. 111-C-00-05-00040-00

**Date of visit:** November 27, 2006

### Overview

This USAID-funded pilot project was initiated in Yerevan Arabkir Community, in Kochar 20, Sundukyan 21 and 23 buildings jointly with "Jerm-Mas Ltd." CJSC, which has taken the responsibility to construct the boiler house, install all necessary equipment there and technically maintain the operation of local boiler house and heating systems installed in the apartments.

Subsequent to startup of installation operations, communications initiatives by the RHP and Jerm-Mas Ltd. have increased the desired participation by apartment owners in the original three buildings and precipitated the RHP's seeking and securing approval from USAID to add apartments in a fourth building at Sundukyan 19, bring the targeted participation level to approximately 120 of the total of 215 apartments in the four buildings

### Purpose of Trip

The purpose of this site visit was to inspect the progress of work being undertaken in the boiler house under the auspices of Jerm-Mas Ltd., and to discuss planned apartment completion schedules with Termoservice for Sundukyan 19.

### Progress Made

The following tasks outlined in the contract with Termoservice CJSC, USAID Residential Heating Project subcontractor, and MOU with Jerm-Mas Ltd. CJCS, USAID Residential Heating Project partner, were completed:

- The sub-floor had been poured for the entire boiler house, with conduit for electrical routed appropriately.
- Inlet duct materials to provide combustion air were on site with installation scheduled for November 28, 2006.
- Electrical lines were installed, and the gas supply has been assured so as to support a test firing of the boiler as planned for November 29, 2006.
- The burner unit for the second boiler should be delivered to the site next week.
- Jerm-Mas Ltd. reports that it will be expanding the number of apartments to be serviced by this boiler house and has ordered a third boiler to be installed aside the first two.
- Termoservice reports that it plans to have 25 apartments completed in Sundukyan 19 by Thursday, November 30, 2006, with subsequent pressure testing of all Sundukyan 19 systems installed on Friday December 1, 2006.
- Preliminary system operations and testing is contemplated the week of December 4, 2006.

## **Concerns**

The installation of a planned third boiler will delay the installation of the final flooring in the boiler house; however, the private-sector expansion of this pilot project overshadows this minor inconvenience for the planned “ribbon-cutting” event in December.

## **Next steps**

It was agreed that a “ribbon-cutting” event could be fully supported by December 11, 2006, as all apartment installations and preliminary operations and testing of the boiler house equipment should be completed by December 4, 2006. Jerm-Mas Ltd. would like to invite the Mayor of Yerevan (as this boiler house has been leased from the Municipality of Yerevan), and USAID will assess availabilities of the Mission Director and the Ambassador for possible attendance. It was again noted that some degree of active resident participation in the event is desired.

## **Attachment**

Selected photos indicting progress noted above.

**Sundukyan**  
**Boiler house continues internal installations – 27Nov06**



Each boiler has electricity for fans and controls.



Inlet air duct for the boiler house to support combustion requirements of multiple boilers.



Gauges prepared for installation in supply, return and feed water headers.



Electrical power switches for feed and circulation pumps

## Site Visit Report

**Project Name & Contract No.:** Armenia Residential Heating Project,  
Contract No. 111-C-00-05-00040-00

**Date of visit:** December 11, 2006 (Final Site Visit Report)

### Overview

This USAID-funded pilot project was initiated in Yerevan Arabkir Community, in Kochar 20, Sundukyan 21 and 23 buildings jointly with “Jerm-Mas Ltd.” CJSC, which has taken the responsibility to construct the boiler house, install all necessary equipment there and technically maintain the operation of local boiler house and heating systems installed in the apartments.

Subsequent to startup of installation operations, communications initiatives by the RHP and Jerm-Mas Ltd. have increased the desired participation by apartment owners in the original three buildings and precipitated the RHP’s seeking and securing approval from USAID to add apartments in a fourth building at Sundukyan 19, bring the targeted participation level to approximately 120 of the total of 215 apartments in the four buildings

### Purpose of Trip

Participants for this site visit included USAID representatives from the contracting office and the CTO, the home office director of Chemonics International, senior staff of the RHP, representatives from Termoservice and Armen Martoyan, manager of Jerm-Mas Ltd. The purpose of this site visit was to verify completion of all work by subcontractor, Termoservice and assess the progress of work being undertaken in the boiler house under the auspices of Jerm-Mas Ltd.

### Progress Made

The following tasks outlined in the contract with Termoservice CJSC, USAID Residential Heating Project subcontractor, and MOU with Jerm-Mas Ltd. CJCS, USAID Residential Heating Project partner, were completed:

- Termoservice has completed installations of all external equipment and all internal equipment. The systems which Termoservice has installed have been in continuous operation since 4Dec, the initial firing of the boiler house. All systems are accepted, and final subcontract closeout documentation will be prepared and executed by RHP and Termoservice.
- The floor had been poured for the entire boiler house.
- Jerm-Mas Ltd. reiterated that it will be expanding the number of apartments to be serviced by this boiler house and has ordered a third boiler to be installed aside the first two.

### Concerns

The installation of the ceiling panels and remaining painting of walls and floor will further delay the contemplated “ribbon-cutting” event; however, the private-sector expansion of this pilot project overshadows this minor inconvenience for the planned “ribbon-cutting” event in

December. USAID expressed its desire for the “ribbon-cutting” event to occur so as to foster interest in the private sector by showcasing the success of this pilot project.

**Next steps**

Continued review of the construction progress of the boiler house will be monitored over the next several days so as to assess when/whether a proper “ribbon-cutting” event could be scheduled by USAID in the coming weeks.

Title Transfer Documents will be circulated to all parties receiving materials/equipment from RHP for signatures, so as to comply with USAID/Armenia regulations.

**Attachment**

Selected photos indicating progress noted above.

**Sundukyan**  
**Trial operation of Boiler K-2 and Completion of structure – 11Dec06**  
(photos taken 10Dec06)



Trial operation of Boiler K-1 (left above) began 4Dec, and trial operation of K-2 (right above) began 9Dec. Outside finishing touches to the boiler house tidy the appearance of the structure. Residents of participating apartments in Kochar 20, and Sundukyan 19, 21 and 23 have enjoyed a continuous supply of hot water for their heating systems since initial trial operation on 4Dec06.



Inside and outside of the boiler house structure are being finished and cleaned in preparation for painting. Operator Jerm-MAS Ltd. has noted that the boiler house floor will be tiled once the third boiler is installed in preparation for serving additional apartment buildings prior to the next heating season.

## ANNEX B: PARTICIPATING APARTMENTS

### 21 Sundukyan St. (by November 30)

Control #	Surname, Name	Number of Apt.	Number of rooms	Signed
1	Gasparyan Hayk	1	1	1
2	Azizyan Seyran	2	2	1
3	Amatunyan Ashot	3	3	1
4	Hovhannessyan Zakar	5	2	1
5	Baghdasaryan Samvel	6	3	1
6	Yedigaryan Marieta	8	2	1
7	Shigaryan Anush	10	1	1
8	Gharibyan Mariam	11	2	1
9	Papikyan Ludmila	15	3	1
10	Hakobyan Albert	17	3	1
11	Gasparyan Narine	25	3	1
12	Zohrabyan Ela	27	2	1
13	Baghdasaryan Seda	28	1	1
14	Khanoyan Robert	29	3	1
15	Mehrabyan Anahit	33	2	1
16	Mehrabyan Anahit	34	1	1
17	Titizyan Ghoghakat	35	3	1
18	Bilbojyan Lusine	36	2	1
19	Sargsyan Spartak	38	3	1
20	Mkrtchyan Lianna	39	2	1
	TOTAL			20

## **20 Kochar St. (by November 30)**

---

<b>Control #</b>	<b>Surname, Name</b>	<b>Number of Apt.</b>	<b>Number of rooms</b>	<b>Signed</b>
21	Baranjina Susanna	1	1	1
22	Khachikyan Andreas	2	2	1
23	Mkhitaryan Samvel	4	1	1
24	Alaverdyan Harut	5	2	1
25	Haroyan Susanna	7	1	1
26	Petrosyan Babken	9	3	1
27	Karapetyan Makich	10	1	1
28	Tigranyan Hmayak	13	1	1
29	Markosyan Samvel	17	4	1
30	Grigoryan Vrezh	18	3	1
31	Hovhannisyan Eghishe	24	3	1
32	Eloyan Suren	25	4	1
33	Bazikyan Stepan	31	1	1
34	Kojamanyan Hripsime	32	3	1
35	Nakhshkaryan Sveta	34	1	1
36	Ter-Hovhannisyan Naira	40	1	1
	<b>TOTAL</b>			<b>16</b>

**23 Sundukyan St. (by November 30)**

Control #	Surname, Name	Number of Apt.	Number of rooms	Signed
37	Zarbabyan Drastamat	3	2	1
38	Azatyany Karine	4	2	1
39	Mkhitaryan Nazik	6	3	1
40	Shakhranyan Hripsime	7	2	1
41	Yolchyan Anahit	8	2	1
42	Sargsyan Iskandar	9	3	1
43	Bakhshinyan Edik	10	3	1
44	Gozalyan Nazeli	11	2	1
45	Sahakyan Grigor	13	3	1
46	Yeghiazaryan Anna	18	3	1
47	Karapetyan Rima	23	2	1
48	Hakobyan Artashes	24	2	1
49	Hambartsumyan Roza	25	3	1
50	Shahinyan Varazdat	26	2	1
51	Shahbazyan Gayane	27	2	1
52	Stepanyan Levon	28	2	1
53	Hakobyan Onik	30	3	1
54	Ghaghachyan Susanna	32	2	1
55	Gevorgyan Arshaluys	34	3	1
56	Durinyan Tigran	38	3	1
57	Sargsyan Hrachik	39	2	1
58	Sargsyan Artur	40	2	1
59	Antonyan Arshak	41	3	1
60	Sahakyan Ruben	42	3	1
61	Fermanyan Ara	44	2	1
62	Harutyunyan Gevorg	45	3	1
63	Sahakyan Aramajis	46	3	1
64	Boyajyan Karine	47	2	1
65	Stepanyan Hekhush	48	2	1
66	Grigoryan Hrayr	50	2	1
67	Ghulyan Hamlet	51	3	1
68	Khachatryan Roza	53	2	1
69	Martirosyan Hrachuhi	54	2	1
70	Ohanjanyan Fao	55	3	1
71	Smbatyan Garnik	56	3	1
72	Simonyan Slavik	57	2	1
73	Khojoyan Armen	58	2	1
74	Baghdasaryan Ogush	59	3	1
75	Parsadanyan Suren	60	3	1
76	Nazaryan Elena	61	2	1
77	Avagyan Karlen	65	2	1
78	Hovhanisyan Ruzan	66	2	1
79	Gevorgyan Gagik	69	2	1
80	Sahakyan Samvel	70	2	1
81	Aghabekyan Armen	72	3	1
82	Egyan Rafael	75	3	1
83	Khachatryan Tsovinar	76	3	1
84	Sahakyan Eduard	78	3	1
85	Baghdasaryan Satenik	81	2	1
86	Avetisyan Janna	82	2	1
87	Movsesyan Tamara	86	2	1
88	Hayrapetyan Anna	89	2	1
89	Ghazaryan Laura	90	2	1
90	Margaryan Elionora	91	3	1
91	Hayrapetyan Amalia	92	3	1
92	Voskanyan Vaghinak	94	2	1
93	Arsenyan Martik	95	3	1
94	Hayrapetyan Kamo	96	3	1
	Total			58

## **19 Sundukyan St. (by November 30)**

<b>Control #</b>	<b>Surname, Name</b>	<b>Number of Apt.</b>	<b>Number of rooms</b>	<b>Signed</b>
95	Abrahamyan Vardan	1	1	1
96	Ghazaryan Boris	2	2	1
97	Petrosyan Amalia	3	3	1
98	Danielyan Emil	4	1	1
99	Hayrapetyan Arkadi	5	2	1
100	Hunanyan Zemfira	7	1	1
101	Babelyan Roman	8	2	1
102	Arakelyan Sahak	9	3	1
103	Agaloyan Melsik	10	1	1
104	Martoyan Armen	11	2	1
105	Mkrtchyan Julietta	12	3	1
106	Babelyan Hakob	13	1	1
107	Sahakyan Zhora	14	2	1
108	Hovhannisyan Karine	15	3	1
109	Hovhannisyan Levon	22	3	1
110	Alayan Tigran	23	4	1
111	Sahakyan Seda	24	3	1
112	Poghosyan Andranik	25	4	1
113	Mekhakyan Alfred	26	3	1
114	Stepanyan Susanna	29	3	1
115	Harutyunyan Sonik	30	2	1
116	Vardanyan Vardges	32	3	1
117	Atashyan Grigori	35	3	1
118	Khudaverdyan Armine	38	3	1
119	Gevorgyan Derenik	40	1	1
	Total			25

## ANNEX C: COST SUMMARY

### Sundukyan

Item	Actual	
	AMD	\$
Subcontract with Termoservice	52134146	137921
Insurance	1633200	4267
Pipe	12429800	32803
Alarms for boiler house	280000	741
Signage	64000	170
<b>Sub-Total</b>	<b>66541146</b>	<b>175902</b>

Number of apartments

119

Est. private sector investment

63,000

Sundukyan Total

238,902

▪

## **ANNEX D: ENVIRONMENTAL CHECKLIST (DRAFT)**

**Project Name:** RESIDENTIAL HEAT PROJECT  
**Project Number:** 111-C-00-05-00040-00

### **ENVIRONMENTAL REVIEW (ER) AND ASSESSMENT CHECKLIST**

**Location:** Yerevan, Sundukyan 21, 23, 19 and Kochar 20.

**Type of Activity:** Re-commissioning of the heating systems at Sundukyan 21, 23, 19 and Kochar 20

The USAID-funded Residential Heating Project, implemented by Chemonics International is project aimed at providing assistance to the Republic of Armenia in implementing the Government of Armenia (GOAM) heat strategy and in particular to demonstrate the full range of heat supply alternatives that will be required in addition to heating rehabilitation and modernization. The Project will focus on implementing various alternatives to promote the developing heat market in its ability to realize least cost solutions that enhance effective management and reduce environmental costs.

The Project will work closely with the Subcontractor to rehabilitate the residential heating systems supporting 115 apartments at Sundukyan 21, 23, 19 and Kochar 20 in Yerevan, Armenia.

Municipality efforts in re-commissioning of boiler houses given for lease are not intensive. Initial financial and technical assistance, as well as advisory services should be provided to boiler-house lessees to make the heat supply business attractive for private investors. Jerm-Mas LTD director, Armen Martoyan, has already leased several boiler houses in Yerevan and intends to extend his business in the heat supply sector. Recently Armen Martoyan met with representatives of the Residential Heating Project and proposed ways to collaborate in re-commissioning the autonomous heating system at Sundukyan 23 building. Upon review of suggested site, the Residential Heating Project recommends implementation of a joint project with "Jerm-Mas" LTD, for heating system re-commissioning activities covering four residential buildings: Sundukyan 21, Sundukyan 23, Sundukyan 19, and Kochar 20. The re-commissioning activities, which will provide heating for up to 130 apartments, are subcontracted to be implemented prior to the beginning of the 2006-2007 heating season. It is also anticipated that the system will be expanded during the forthcoming years and other apartments/buildings will be connected to the system given the consent and participation of the apartment owners.

The Subcontractor shall implement the required construction/installation work on the four buildings as follows:

1. External heating networks to be connected to existing BH
  - a. Construction of external heating network supplying the four buildings. Taking into consideration building typology, an over-ground external heating system with insulation is required.

- b. Installation of a heat metering unit in the basements.
- 2. Internal heating network of the buildings
  - a. Installation of vertical risers in building entrances/ steel pipes
  - b. Installation of cast-iron radiators in the apartments
  - c. Installation of metal-plastic pipes through the apartment walls and connection to the radiators, placing valves, fittings and air removal devices.
  - d. Connection of apartment systems to the risers.
- 3. Hydraulic tests upon completion of installation work to detect any existing defects, repair of detected defects, system final adjustment and tuning.

Cooperating partner - Jerm-Mas Ltd. (JM) will undertake all necessary activities to complete construction of BH, installation of 2 boilers with at least 300KW each as well as installation of all other necessary equipment. Jerm-Mas Ltd. will also be responsible for water, gas, power connections to the BH, as well as for all required official technical specifications and approvals.

**Name of reviewer:** Hovhannes Kantuni

**Date of Review:** September 19. 2006

**A. CHECKLIST FOR ENVIRONMENTAL CONSEQUENCES:** Check appropriate column as Yes (Y), Maybe (M), No (N) or Beneficial (B). Briefly explain Y, M and B checks in next Section, "Explanations". A "Y" response does not necessarily indicate a significant effect, but rather an issue that requires focused consideration.

Y. M. N or B

**1. Earth Resources**

- a. grading, trenching, or excavation > 1.0 hectare  
\_\_N
- b. geologic hazards (faults, landslides, liquefaction, unengineered fill, etc.)  
\_\_N
- c. contaminated soils or ground water on the site  
\_\_N
- d. offsite overburden/waste disposal or borrow pits required > 1.0 ton  
\_\_N
- e. loss of high-quality farmlands > 10 hectares  
\_\_N

**2. Agricultural and Agrochemical**

- a. impacts of inputs such as seeds and fertilizers  
\_\_N
- b. impact of production process on human health and environment  
\_\_N
- c. other adverse impacts  
\_\_N

**3. Industries**

- a. impacts of run-off and run-on water  
\_\_N
- b. impact of farming such as intensification or extensification  
\_\_N
- c. impact of other factors  
\_\_N

**4. Air Quality**

- a. substantial increase in onsite air pollutant emissions (construction/operation)  
\_\_B
- b. violation of applicable air pollutant emissions or ambient concentration standards  
\_\_N
- c. substantial increase in vehicle traffic during construction or operation  
\_\_N
- d. Demolition or blasting for construction  
\_\_N
- e. substantial increase in odor during construction or operation  
\_\_N
- f. substantial alteration of microclimate  
\_\_N

**5. Water Resources and Quality**

- a. river, stream or lake onsite or within 30 meters of construction  
\_\_N
- b. withdrawals from or discharges to surface or ground water  
\_\_N
- c. excavation or placing of fill, removing gravel from, a river, stream or lake  
\_\_N
- d. onsite storage of liquid fuels or hazardous materials in bulk quantities  
\_\_N

**6. Cultural Resources**

- a. prehistoric, historic, or paleontological resources within 30 meters of construction  
\_\_N
- b. site/facility with unique cultural or ethnic values  
\_\_N

**7. Biological Resources**

- a. vegetation removal or construction in wetlands or riparian areas > 1.0 hectare  
\_\_N
- b. use of pesticides/rodenticides, insecticides, or herbicides > 1.0 hectare  
\_\_N
- c. Construction in or adjacent to a designated wildlife refuge  
\_\_N

**8. Planning and Land Use**

- a. potential conflict with adjacent land uses  
\_\_N
- b. non-compliance with existing codes, plans, permits or design factors  
\_\_N
- c. construction in national park or designated recreational area  
\_\_N
- d. create substantially annoying source of light or glare  
\_\_N
- e. relocation of >10 individuals for +6 months  
\_\_N
- f. interrupt necessary utility or municipal service > 10 individuals for +6 months  
\_\_N
- g. substantial loss of inefficient use of mineral or non-renewable resources  
\_\_N
- h. increase existing noise levels >5 decibels for +3 months  
\_\_N

**9. Traffic, Transportation and Circulation**

- a. increase vehicle trips >20% or cause substantial congestion  
\_\_N
- b. design features cause or contribute to safety hazards  
\_\_N
- c. inadequate access or emergency access for anticipated volume of people or traffic  
\_\_N

**10. Hazards**

- a. substantially increase risk of fire, explosion, or hazardous chemical release  
\_\_M
- b. bulk quantities of hazardous materials or fuels stored on site +3 months  
\_\_N
- c. create or substantially contribute to human health hazard  
\_\_N

**11. Other Issues**

- a. Substantial adverse impact  
\_\_N
- b. Adverse impact  
\_\_N
- c. Minimal impact  
\_\_N

**B. EXPLANATION OF ENVIRONMENTAL CONSEQUENCES:** explain Y, M and B responses

4.a "B" Operation of installed gas- fire boilers will result in some onsite air pollutant emissions, not substantial, but on the other hand emissions reduction at the power plant will be approximately 3.5 times as much as emissions added at the site (due to fuel substitution from electricity to natural gas at the site).

(Efficiency of electricity production at TTP is 32%, loses at distribution line is 20%, efficiency of installed boilers are 90% and local distribution loses are 5%.  $(0.9 \times 0.95 / 0.8 \times 0.32 = 3.4)$ ).

10.a "M" Burning of natural gas always contains some potential risk of fire and explosion.

### **C. RECOMMENDED ACTION (Check Appropriate Action):**

1. The project has no potential for substantial adverse environmental effects. No further environmental review is required.
2. The project has little potential for substantial adverse environmental effects; however the recommended mitigation measures will be developed and incorporated in the project design. No further environmental review is required.
3. The project has substantial but mitigatable adverse environmental effects and required measures to mitigate environmental effects. Mitigation and Monitoring (M&M) Plan must be developed and approved by the BEO and/or REO prior to implementation. M&M Plan is to be attached to the Scope of Work.
4. The project has potentially substantial adverse environmental effects, but requires more analysis to form a conclusion. A Scoping Statement must be prepared and be submitted to the BEO for approval. Following BEO approval an Environmental Assessment (EA) will be conducted. Project may not be implemented until the BEO approves the final EA.
5. The project has potentially substantial adverse environmental effects, and revisions to the project design or location or the development of new alternatives is required.
6. The project has substantial and unmitigable adverse environmental effects. Mitigation is insufficient to eliminate these effects and alternatives are not feasible. The project is not recommended for funding.

### **D. IDENTIFIED SIGNIFIACNT ENVIRONMENTAL IMPACTS (including physical, biological and social), if any: (Use ER tools such as Leopold Matrix to identify significant environmental impacts)**

N/A

### **E. RECOMMENDED MITIGATION MEASURES:**

Given the above assessment, Chemonics International and its partners will monitor and ensure that the environmental procedures are implemented, potential impacts mitigated.

Standard and General Mitigation Measures:

- Comply with safety regulations, considering all workers employed on the site, including those employed by all partners, as well as general public;
- Installation of natural gas and CO gas leakage alarm sensors in boiler house to control gas leaks.
- Install boilers with automatic shut off valves to prevent gas leakage in the apartments.
- Use environmentally safe materials of the best quality consistent with the character of the works and specifications;

- Materials will be handled, stored, used and processes carried out, in strict accordance with manufacturer's instructions and recommendations;
- No explosives shall be used at the site;
- Comply in general with USAID, Armenian standards, and local regulations, and the best engineering practices.

**F. RECOMMENDED MONITORING MEASURES:**

Chemonics International and its partners (during the project's planning and design, construction, and operation and maintenance phases) will ensure that:

- Monitoring activities and environmental procedures are carried out as required;
- Recommended mitigation measures, if required, are considered and incorporated into the work;
- No asbestos-based materials is used or handled within the project's scope of work;

**G. LIST OF ATTACHEMENT:**

- Site Photos

**APPROVAL:**

Implementer Project Director/COP: \_\_\_\_\_ Date: \_\_\_\_\_

USAID/ Project CTO: \_\_\_\_\_ Date: \_\_\_\_\_

USAID Mission Environmental Officer: \_\_\_\_\_ Date: \_\_\_\_\_

## PROJECT SITE PHOTOS

### External network installation – 15Sep06



Double pipe systems exit boiler house to feed Sundukyan 21 and Kochar 20



Double pipe system exit boiler house to feed Sundukyan 21



Feed to Sundukyan 23



Feed to Sundukyan 21



Feed to Kochar 20



Cast iron radiators prepared for future installation in apartments.