SWISS AGENCY FOR DEVELOPMENT AND COOPERATION

FERGANA VALLEY
CANAL AUTOMATION PROJECT

REPORT OF THE FIFTH MISSION OF INTERNATIONAL EXPERTS

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EXECUTIVE SUMMARY

The team of international experts for the Fergana Valley Canal Automation project was invited by the Swiss Agency for Development and Cooperation (SDC) to travel to central Asia from October 5. to 16., 2009 to test the SCADA systems on the two canal automation pilot projects in Uzbekistan and Tajikistan (object of the present report), and to complete the Project Document for the Phase III of the SDC-supported Canal Automation Project. The mission was composed of Mr. Georges Favreau, SCADA system specialist and Mr. Jean-Francois Puigt, specialist in hydraulics and maintenance of automation systems.

The program of the mission was executed as scheduled.

Khoji-Bakirgan Canal:

Between October 6. and 8., the team of experts visited and tested the KBC structures. Except at DP 100 where no progress in gate repair occurred since May 2009, the SCADA system was installed by SIGMA at all sites. This includes the control rooms and the communication system which was fully operational on October 10.

At DP 100, it was decided, jointly with SDC, SIC and SIGMA that no equipment shall be installed, since the necessary repairs were not made on the gates. SIGMA will provide the already ordered equipment to KBCA to be used as spare parts for other structures.

Operation of the SCADA system required the computation of discharge at several key locations. KBCA will provide SIGMA with the missing conversion tables between level and discharge during the next vegetation period. SIGMA shall incorporate these tables into the SCADA system before the end of the next vegetation period. SIGMA will also perform the tuning of the regulation algorithms during the next vegetation period, and will complete training.

Some gates and associated equipment were repaired by KBCA, but some problems were observed during the mission. KBCA will repair all the mentioned problems on the gates, reducers and motors that can prevent their operation from the SCADA system. This should be done before the beginning of the next vegetation period.

The delay in completion of works by SIGMA is partly due to visa problems in Tajikistan. KBCA will facilitate visa procedures for SIGMA during the whole guarantee period.

SIC will keep track of all problems encountered during the guarantee period, and will inform SDC in their monthly report of the major ones.

The experts support SIGMA proposal for installation of solar panel systems at DP 13 and DP 228. All related works, if agreed by SDC, will have to be completed before the next vegetation period so as to get all the discharge data from these sites. KBCA will build fences around these structures.

SDC and SIC will write a letter to the Tajik authorities about the issues of visas, repairs in structures and installation of fences.

Considering the good progress of SIGMA work, the team of experts recommends to declare system commissioning at the date when the communication system was operational, i.e. October 10., 2009.

South Fergana Canal:

Between October 8. and 11., the mission visited the major SCADA sites along the South Fergana canal, and the control centers at Quva, Marhamat and Fergana.

The installation of the SCADA system (hardware and software) by SIGMA is completed (including communication system and solar panels). Inspection and testing of all the main sites was performed by the team of Experts during this mission.

SIGMA has performed a series of tests on each site before the mission (between August and October). Detailed tests document (called "protocols") were written by SIGMA and showed to the experts. These documents were written in Russian but could not be translated into English before mission.

Operation manuals have been prepared by SIGMA. They need to be completed with the parameters included in the test reports (limits in opening and closing of gates, limits in values for setpoints, time parameters for the regulation computation, etc). They will then be translated into Uzbek by SIGMA (initially not included in their contract).

Due to late installation of equipments and to vegetation period, it was not possible for SIGMA to test the system under a wide range of hydraulic conditions. The experts have tested the structures at the end of the vegetation period with limited discharge. Canal Management will have to test the system with more important discharge.

The system benefited of the good experience of SIGMA in canal automation. They provide standard solutions (hardware and software), which creates favorable conditions for Operation & Maintenance.

Since the last mission of the expert team, significant progress has been made by SIC in communicating of work progress by the means of monthly reports in English.

It is important that a real will to use the system in automatic mode exists at SFC. This must be shared at all levels, and even if problems occur. Operator's training must now be completed quickly and their hierarchy must ask them to use the system in automatic mode as much as possible.

The system includes many functions. To keep them available and ensure system sustainability, it is of paramount importance that SFC administration organizes appropriate framework for maintenance, to become effective immediately after the defect liability period.

The best solution seems a maintenance contract with SIGMA like the one for BWO structures.

Taking into account the degree of completion of installation and testing of the system, the team of experts recommends the commissioning of SIGMA works.

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1 PROGRAM OF THE MISSION

This is the report of the fifth mission of International Experts recruited by SDC to provide technical assistance for the Fergana Valley Canal Automation Project.

The team of SDC International Experts was composed of:

- Mr. Georges Favreau, expert in control equipment and hydraulic control,
- Mr. Jean-François Puigt, expert in hydraulics and maintenance of control systems.

The team arrived in Tashkent on October 6., 2009.

The team traveled in the Fergana Valley from May 6. to 12., 2009. The first system which was tested was the Khoji Bakirgan Canal (KBC) in Tajikistan, to check if SCADA system installation was suitable for commissioning. The mission moved then to Uzbekistan to visit the South Fergana Canal (SFC) and test the SCADA system, in view of its commissioning.

A debriefing meeting was held on October 11. in Fergana in the presence of SDC, SIC and SIGMA, and the SFC SCADA system was handed over to the SFC authorities on October 12 in a ceremony at Beshalish.

In complement to these activities linked to phase I of SDC project, the project document for phase III was discussed to improve its clarity. This report is presented separately.

The detailed itinerary is provided in Annex 1 and the list of persons met in Annex 2.

2 KHOJI-BAKIRGAN CANAL

2.1 BACKGROUND AND GENERAL OBSERVATIONS

The main objective of the October 2009 SDC mission of experts was to assess the progress of installation of the SCADA equipment by SIGMA contractor and check the performance of the SCADA system in view of its commissioning.

Five structures had automation equipment installed by SIGMA. All five structures were inspected by the team of Experts and the staff of the Khoji Bakirgan Canal Administration (KBCA) on October 6. and 7., 2009.

The inspected sites are the following (ordered from upstream to downstream):

- KBC head works on Khoji Bakirgan river,
- Hydropost at DP 13,
- Cross regulator at DP 24,
- Cross regulator at DP 33,
- Cross regulator at DP 61,
- Gorodskoy waterworks on Kostakoz canal,
- Hydropost at DP 228.

In addition to these sites, the Control Center at Chkalovsk was also inspected.

The cross regulator at DP 100 did not have any progress since May 2009 and was therefore not visited. It is located along the border with Kyrgyzstan in a disputed area, and the authorities of both countries did not reach an agreement for the construction of the control room near the structure. As a consequence, no equipment, even that for monitoring, was installed by SIGMA at this location.

The radio equipment was installed at all inspected sites, and the radio operating license was obtained from the national authorities. However, it was observed that only DP 24 and DP 33 could communicate with the control center at Chkalovsk at the time of the visit. SIGMA could terminate the installation of software for communication on October 10. and provided records of good communication between all sites and the Control Center at Chkalovsk.

2.2 INSPECTION OF THE CONTROL STRUCTURES AND SCADA SYSTEM

For each site is provided in this chapter:

- a brief description of the operating principles
- the observations on the hydraulic control system

- the results of test of the hydraulic control system comprising
  - local operation of gates
  - distance operation of gates

Gates are numbered according to the SCADA screen copies provided in annex.

2.2.1 CANAL CONTROL CENTER AT CHKALOVSK

The communication equipment was installed and is able to exchange data with all sites where SCADA system was installed.

The computer was installed and the supervisory software was tested. A global view of the system allows the display of levels and discharges at all sites where SCADA equipment was installed. Some values of discharge are not computed, because the conversion tables from level to discharge are still missing.

2.2.2 KBC HEAD WORKS ON KHOJI BAKIRGAN RIVER

a) Operating principle of the structure – hydraulic control

The head structure of the Gulyakandoz canal is located at the dam on the Khoji Bakirgan river. In normal operating conditions, the dam gates are closed and all discharge in the river is transferred to the Gulyakandoz canal (and a small outlet to the drinking water factory). In case of excess of water in the river, the gates of the dam can be opened to limit discharge in the Gulyakandoz canal.

b) Observations at the site for the SCADA and hydraulic system

The SCADA equipment was completely installed.

The level sensors provide measurements of water depth (relative to canal bottom), but no conversion to discharge is made (conversion table level, opening -> discharge to be provided by KBCA at the beginning of the next vegetation period).

Some cabling of end switches is not in good condition and may create problems in the future (cables not sufficiently protected).

c) Performed tests

The following tests were made:

- Test of opening and closing of gates 1 & 2 (left hand bank of KBC): the gates could be operated in local mode, but move very slowly. The mechanical system sometimes jumps.
- Test of opening and closing of gates 3 & 4 (right hand bank of KBC): the movement of the gates is faster than gates 1 & 2.
- These tests were repeated successfully from the operator workstation.

2.2.3 HYDROPOST AT DP 13

a) Operating principle of the structure – hydraulic control

This structure is an intermediate site for measurement of canal discharge between the head structure and DP 24.

b) Observations at the site for the SCADA and hydraulic system

The SCADA equipment was completely installed (data acquisition and communication equipment).

An ultrasonic level sensor was installed and a small electrical cabinet with UPS and radio. This cabinet is powered from the grid, but energy supply is not reliable.

SIGMA made a proposal for energy supply with a solar panel system. The conclusion is the same as for hydropost at DP 228 (see below). Protection fences will have to be installed by KBCA.

c) Performed tests

No local display is available. The operation of the site was checked from the Chkalovsk Control Center.

2.2.4 CROSS REGULATOR AT DP 24

a) Operating principle of the structure – hydraulic control

DP24 is a cross regulator structure between the Gulyakandoz canal and Kostakoz canal. Two minor outlets are also available on site: outlet to the Chkalovsk factory and outlet to release canal.

b) Observations at the site for the SCADA and hydraulic system

The SCADA equipment was completely installed.

The level sensors provide measurements of water depth (relative to canal bottom), but no conversion to discharge is made. At this place, discharge shall be computed according to water level and gate opening. Such a conversion mechanism is already implemented in the SCADA system and KBCA will provide the gate coefficients at the beginning of the next vegetation period.

The ultrasonic level sensor at the head of the Kostakoz canal seems too close to the gates, and is installed where water level is unsettled. It is recommended to move this sensor at least 10 m downstream.

c) Performed tests

All the gates, except the gate to release canal, were tested (opening/closing). The tests were made locally, then from the operator workstation. The tests were generally successful, with the following remarks:

- One of the two gates of escape to river (gate 6) is bent and leaking. KBCA declared they will replace it during winter. The other gate was not operated, as it should be used ony during emergency situations. To verify its operation, it will have to be tested in winter.
- The reducer for gate 2 has to be changed

- The reducer for gate 3 must be repaired, as it shows important oil leakage.
- The regulation of upstream level and discharge in the Kostakoz canal needs to be installed during the guarantee period by SIGMA

2.2.5 CROSS REGULATOR AT DP 33

a) Operating principle of the structure – hydraulic control

DP 33 is a cross regulator structure between the Gulyakandoz canal and Khitoyreza canal (4 m^3/s). A minor outlet to New Okaryk canal is also installed on site (0.05 m^3/s).

b) Observations at the site for the SCADA and hydraulic system

The SCADA equipment was completely installed.

The level sensors provide measurements of water depth (relative to canal bottom), and the conversion to discharge is made for the Khitoyreza canal.

The electrical cabling of motor on gate 1 must be protected (cover) for operator safety.

Opening end switch is not aligned on gate 5.

Connection of gate leaf to screw is weak on gate 7.

The leaf of gate 2 is severely bent, and its screw damaged the cable trays. The leaf was not reinforced at all, although recommended in the expert report of May 2009.

The radio tower may have to be reinforced (no fixation at bottom).

c) Performed tests

All the gates were tested (opening/closing). The tests were made locally, then from the operator workstation. The remarks on these are the following:

- Reducer of gate 4 is very noisy on gate opening. This reducer will have to be inspected and replaced if necessary.
- Motorized operation of gates 6 and 7 was not possible (problem in electrical cabinet).

2.2.6 CROSS REGULATOR AT DP 61

a) Operating principle of the structure – hydraulic control

At point 4, the following offtakes are found on the Gulyakandoz canal:

- the Navobod canal (4,5 m^3/s),
- the Kolkhozny canal (1 m^3/s).

b) Observations at the site for the SCADA and hydraulic system

The SCADA equipment was completely installed.

The level sensors provide measurements of water depth (relative to canal bottom), and the conversion to discharge is made for the Navobod canal canal. The table for the Kolkhozny canal is to be provided by KBCA.

Gate 1 was replaced. It leaf includes strengtheners, but does not have any gaskets (possible wear out of the gate). The reducer was re-welded, but welding is brittle and may break.

Gate 2 was reinforced.

The axis of gate 3 is made using several parts welded together; this assembly does not seem suitable for durable operation.

c) Performed tests

Gates 1-2 and 4-5 were tested (opening/closing). The tests were made locally, then from the operator workstation. No problem was observed, although gates 4 and 5 still allow some discharge even when totally closed.

The regulation of upstream level and discharge in the Navobod canal needs to be installed during the guarantee period by SIGMA

2.2.7 GORODSKOY WATERWORKS ON KOSTAKOZ CANAL

a) Operating principle of the structure – hydraulic control

At this structure, the Kostakoz branch divides into three sub-branches. The first is the Gorodskoy new canal (4 m^3/s), the second sub-branch divides into the Gorodskoy old canal (1.65 m^3/s) and the Iskandarov canal (0.35 m^3/s), the third sub-branch divides also in two: the Kostakoz feeder and the Kostakoz New canal (1.2 m^3/s).

b) Observations at the site for the SCADA and hydraulic system

The SCADA equipment was completely installed.

The level sensors provide measurements of water depth (relative to canal bottom), and all the tables for conversion to discharge were provided by KBCA and installed by SIGMA.

SIGMA incorporated into this site, and also others an interesting feature to take into account silting: the conversion table can be shifted by a user-definable offset between two campaigns of curve calibration.

c) Performed tests

The gates at the upstream structure were locally tested with the following remarks (numbering from left to right hand bank):

- Gate 1 could not be operated from the electrical motor.
- Reducer of gate 4 shows vibrations
- Gate 6 (right hand bank) is never totally closed.

All other gates were locally tested and from the operator workstation without any problem.

2.2.8 HYDROPOST AT DP 228

This structure is located at the downstream end of the Khoji Bakirgan canal. It is an isolated site for which reliable power supply is not possible from the grid. All the SCADA equipment was installed (level sensor, electrical cabinet + radio) but this site will be of no use without any energy.

A proposal for energy supply with a solar panel system was made by SIGMA (around 4000 USD for equipment supply and installation). This system would be similar to those installed on the south Fergana Canal (e.g. Hydropost n°8).

This could be a good solution, but KBCA will have to build a fence to protect access to the equipment. The pole will have to be high enough to prevent access and vandalism to the solar panels.

2.3 CONCLUSIONS

Except at DP 100, the SCADA system was installed by SIGMA at all sites. This includes the communication system which was fully operational on October 10.

At DP 100, it was decided, jointly with SDC, SIC and SIGMA that no equipment shall be installed, since the necessary repairs were not made on the gates. SIGMA will provide the already ordered equipment to KBCA to be used as spare parts for other structures.

KBCA will provide SIGMA with the missing conversion tables between level and discharge during the next vegetation period. SIGMA shall incorporate these tables into the SCADA system before the end of the next vegetation period. SIGMA will also perform the tuning of the regulation algorithms during the next vegetation period, and will complete training.

KBCA will repair all the mentioned problems on the gates, reducers and motors that can prevent their operation from the SCADA system. This should be done before the beginning of the next vegetation period.

The delay in completion of works by SIGMA is partly due to visa problems in Tajikistan. KBCA will facilitate visa procedures for SIGMA during the whole guarantee period.

SIC will keep track of all problems encountered during the guarantee period, and will inform SDC in their monthly report of the major ones.

The experts support SIGMA proposal for installation of solar panel systems at DP 13 and DP 228. All related works, if agreed by SDC, will have to be completed before the next vegetation period so as to get all the discharge data from these sites. KBCA will build fences around these structures.

SDC and SIC will write a letter to the Tajik authorities about the issues of visas, repairs in structures and installation of fences.

Considering the good progress of SIGMA work, the team of experts recommends to declare system commissioning at the date when the communication system was operational, i.e. October 10., 2009.

3 SOUTH FERGANA CANAL

3.1 BACKGROUND AND GENERAL OBSERVATIONS

The goal of the mission of the experts was to test the complete SCADA system installed by SIGMA which was partly possible in May 2009.

SIGMA has performed a series of tests on each site before the mission (between august and October). Detailed tests document (called "protocols") were written by SIGMA and showed to the experts. These documents were written in Russian but could not be translated in English before mission.

Due to late installation of equipments and to vegetation period, it was not possible for SIGMA to test the system under a wide range of hydraulic conditions. The experts have tested the structures at the end of the vegetation period with limited discharge. Canal Management will have to test the system with more important discharge.

The inspected sites are the following (presented from upstream to downstream):

1. Kampiravvat water works
2. Intake of SFC
3. Akbura water works at DP 36: crossing of Akbura River and K1 canal head structure
4. Hamza water works at DP 360: diversion of Karkidon Canal
5. Palvantash water works at DP 570
6. Tolmazor water works at DP 670
7. Beshalishsai water works (DP 950)
8. Margilansai water works (DP 1034)
9. Hydropost n°8

In addition to that, the following sites were inspected:

- Quva main control center
- Fergana Control center
- Marhamat Control center
- Fayzabad dispatching center

The sites which were not visited are:

- Aravan siphon: simple structure acting as security in case of high level in the canal.
- Andijan telecommunication tower: special authorization required and only communication equipments installed.
- Hydropost n°1: built like hydropost n°8 which was visited. Correct operation was checked from the control center.
- Karkidon reservoir: no modification to the SCADA system since last mission.

The communications in the South Fergana SCADA system are based on Wi-fi equipment, which was totally installed at the time of the visit.

Connection to the electrical grid is available at all visited sites except hydropost n°8. In addition to that, the following sites are equipped with solar panel systems (Quva, Tolmazor, Hydroposts n°1 and 8, and Fayzabad).

Gates are generally in good operating condition as well as gate engines and reducers. Gate position sensors were installed and calibrated.

In each control structure, a PC with supervisory software was installed. All these computers operate correctly.

The following site-specific observations have been made during the inspection and testing of SFC sites.

3.2 INSPECTION AND TEST OF THE CONTROL STRUCTURES AND SCADA SYSTEM

For each site is provided in this chapter:

- a brief description of the operating principles
- the observations on the hydraulic control system
- the results of test of the hydraulic control system comprising
  - local operation of gates
  - distance operation of gates
  - automatic control of gates

Gates are numbered according to the SCADA screen copies provided in annex.

3.2.1 KAMPIRAVVAT WATER WORKS

a) Operating principle of the structure – hydraulic control

The Andijan power plant is operated on the basis of irrigation requirements on a continuous basis. i.e. there is no production of peak energy. From the Kampiravvat waterworks, the following canals are issued:

- the Savaisai canal,
- the Shakhrikhansai canal, from which SFC will be issued,
- the Andijansai canal.

The purpose of automation is to control the discharges in the three irrigation canals through the SCADA system. The power plant management organization checks the releases to irrigation canals on a hydro-post located about one kilometer upstream from the dividing structure.

The controlled variables are :

- discharge in Savaisai canal,
- level upstream the control structure,

- discharge in Andijansai canal.

b) Observations at the site for the SCADA system

The system was completely and correctly installed.

c) Performed tests

All gates were successfully tested in local and distance mode (except gate 4 on Andijansai which showed mechanical problems).

All 3 controlled variables were successfully tested:

- discharge in Savaisai canal,
- level upstream the control structure,
- discharge in Andijansai canal.

Screenshots showing evolution of setpoints and controlled variables are provided in annex.

3.2.2 INTAKE OF SFC

a) Operating principle of the structure – hydraulic control

The intake of the SFC consists of a weir without any control gate. The Shakhrikhansai intake is equipped of three radial gates to be used for flow control.

The controlled variable is the level upstream the Shakhrikhansai intake. Discharges in the river and SFC are computed from level measurement in hydroposts located 1 km downstream.

b) Observations at the site for the SCADA system

The SCADA system was completely and correctly installed.

Mechanical and civil work problems were observed on the radial gates: gate 2 is bent, and gate 3 shows leakage.

c) Performed tests

All gates were successfully tested in local and distance mode (limited movements according to above mentioned problems).

Upstream level control was successfully tested.

Screenshot showing evolution of setpoint and controlled level is provided in annex.

3.2.3 AKBURA WATER WORKS AT DP 36: CROSSING OF AKBURA RIVER

a) Operating principle of the structure – hydraulic control

The two siphons under the river are not gated. The aqueduct over the river drains into a very short pool with two gates supplying a small irrigation canal (K1), controlled according to downstream water level, and two other gates connected with SFC, controlled on high level in the pool (discharge to SFC) or to supply K1 directly from SFC. One

motorized gate (gate 1) is located upstream the aqueduct and used to control level into the aqueduct and pool.

b) Observations at the site for the SCADA system

The SCADA system was completely and correctly installed.

Gate 1 has severe mechanical problem and can't be operated from the electrical motor. It will have to be repaired during the non-vegetation period.

c) Performed tests

All gates except gate 1 were successfully tested in local and distance mode.

The problems on gate 1 prevented SIGMA from testing and tuning the automatic control of level in the pool and upstream the K1 Canal. This will be done during the next vegetation period after repair of gate 1.

3.2.4 HAMZA WATER WORKS AT DP 360: DIVERSION TO KARKIDON CANAL

a) Operating principle of the structure – hydraulic control

This structure is the most important one of the SFC, as it controls the diversion of water to the Karkidon reservoir. The controlled variables are the following :

- flow to the SFC canal,
- level upstream structure.

b) Observations at the site for the SCADA system

The SCADA system was completely and correctly installed.

Gate 1 can not be completely closed. It has to be repaired during the non-vegetation period. The gates 3 and 4 show mechanical problems (broken casing and noisy reducer) which do not prevent gate operation today.

c) Performed tests

All gates were successfully tested in local and distance mode (with a limited movement for gate 1).

Simultaneous automatic control of upstream level and discharge in SFC canal will be possible after repair of gate 1. Complementary tests need to be performed during the next vegetation period.

3.2.5 PALVANTASH WATER WORKS AT DP 570

a) Operating principle of the structure – hydraulic control

That structure is located at a point where the SFC is divided into two branch canals before joining again into a single canal. The water level is controlled in the SFC by three gates on the right branch, and discharge is controlled in the Mayarik branch by three gates on the left bank.

b) Observations at the site for the SCADA system

The SCADA system was completely and correctly installed.

Gate 7 can not be operated due to mechanical problem.

c) Performed tests

All gates except gate 7 were successfully tested in local and distance mode.

Gates 6 to 8 can have only a limited impact on the water level therefore this regulation is not very useful.

Discharge control of the Mayarik Canal was successfully tested.

Screenshot showing evolution of setpoint and controlled discharge is provided in annex.

3.2.6 TOLMAZOR WATER WORKS AT DP 670

a) Operating principle of the structure – hydraulic control

This structure diverts water to the Quvasai canal through a radial gate. The regulator on the SFC consists of two bays, with only one equipped of a radial gate. This gate is used to control the level upstream the Quvasai gate.

b) Observations at the site for the SCADA system

The SCADA system was completely and correctly installed.

c) Performed tests

Gates 1 and 2 were successfully tested in local and distance mode.

Due to a low discharge in SFC Canal, control of upstream level was not tested. Hydraulic design of this structure makes this control inaccurate.

Discharge control of the Quvasai Canal was successfully tested.

Screenshot showing evolution of setpoint and controlled discharge is provided in annex.

3.2.7 BESHALISHSAI WATER WORKS (DP 950)

a) Operating principle of the structure – hydraulic control

That structure located at the crossing of the SFC with the Beshalishsai River is the most complicated one on the SFC. It makes possible to transfer water between SFC and the river and the opposite. A diversion structure of oval shape consisting of 8 flat gates is located 200 m downstream of the crossing with SFC to supply water to canals on both sides (Akhshak with 3 gates on left bank and Kora Tepa with 2 gates on right bank), and discharge excess water when needed to escape (Beshalishsai). All the 18 gates of this complex have been motorized.

Two gates (2 and 3) on the SFC will automatically control the level upstream of the diversion structure in the river section. Two other gates (4 and 5) will control the upstream level of SFC.

The following variables can be controlled at Beshalishsai site :

- discharge in Kora-Tepa canal,
- discharge in Akhshak canal,

- upstream level in SFC,
- upstream level of the diversion structure in Beshalishsai.

b) Observations at the site for the SCADA system

The SCADA system was completely and correctly installed.

c) Performed tests

Gates on Kora-Tepa and Akhshak were successfully tested in local and distance mode.

A global test was performed involving control of upstream level of diversion structure, of discharge in Kora-Tepa and Akhshak canals. Due to limited discharge in SFC canal, it was long and difficult to control the 3 variables but this could finally be achieved.

Screenshot showing evolution of setpoints and controlled variables is provided in annex.

The regulations of the 4 controlled variables are closely interrelated on hydraulic point of view and are performed with different response times. The values chosen for the setpoints will have to carefully take into account what the SFC can actually provide. This is the site on SFC where operators may meet the greatest difficulties to control the system.

3.2.8 MARGILANSAI WATER WORKS (DP 1034)

a) Operating principle of the structure – hydraulic control

That simple structure consists of

- the head structure of Magilansai equipped with one motorized gate
- a 3-bay regulator on SFC Canal composed of
  - one ungated bay,
  - 2 motorized gates used in emergency cases to limit discharge in SFC by using the right bank by-pass.

The controlled variable is the discharge in Margilansai.

b) Observations at the site for the SCADA system

The SCADA system was completely and correctly installed.

The two gates of the cross regulator are not in good operating conditions and apparently rarely operated (impossible to move gate 1 from electrical motor).

c) Performed tests

Gates 2 and 3 were successfully tested in local and distance mode.

Discharge control of the Margilansai canal was successfully tested.

Screenshot showing evolution of setpoint and controlled discharge is provided in annex.

3.2.9 OTHER SITES IN SFC

Quva

This site is the main control center of the SCADA system. All SCADA and communication equipment was installed. A solar panel system is installed. It was checked that this site communicates with all sites in the SCADA system.

Faizabad

The rehabilitation of control room was completed. A PC was installed for the software of water allocation management (in use since august). This site receives data from hydropost 8 and sends its data as well as water allocation data to the dispatching center. Satisfactory operation of the faizabad site was checked from the dispatching center. All this hardware is powered from a solar panel system of industrial quality (3 panels for 300 Watts Max. power).

Hydropost n° 8

This site comprises an ultrasonic level sensor, an electrical cabinet with PLC and communication equipment. All this hardware is powered from a solar panel system of industrial quality (2 panels for 200 Watts Max. power and 40 Watts of estimated consumption).

It was verified that this site transmits the level value to the dispatching center.

Akbarabad

This site is a balancing site, with no SCADA equipment foreseen. SIC indicates that the control room was prepared and communication equipment installed.

Repeater station at Andijan communication tower

It is not possible to visit this site without special authorization, and this site was not visited during the mission. The good operation of communication system shows that this site operates correctly.

3.3 VOICE AND DATA COMMUNICATION SYSTEM

3.3.1 DATA COMMUNICATION SYSTEM

The data communication system is based on the Wi-fi standard. Theoretical operating range of the equipment is 80 km. Due to problems of landscape and neighboring border, this operating range can not be reached which was solved by appropriate design of the communication system. A detailed design document was provided by SIGMA for the communication system.

This network is completely operated and owned by SFC management which received the required license by the Uzbek authorities.

The PLC installed at the Quva control center acquires data from the sites. The other control centers (Fergana, Marhamat) acquire data from the Quva control center

3.3.2 VOICE COMMUNICATION SYSTEM

The voice communication system is a standard radio system (ICOM equipment operating in the 170 MHz range).

Fixed radio systems were installed by SIGMA and mobile radio are available.

These equipments are already used by the staff.

3.4 TAKING OVER OF THE SYSTEM BY USERS

Currently, all structures are operated in local mode. The operators do not want to switch to automatic mode because installation was too recent and also because all training had not been organized.

It is important that the system is used in fully automatic mode. This must be agreed at all levels of management of SFC, from the top to operators.

A 3-day training session for operators was performed in Tashkent. In complement to this, on-the-job training must be performed at the structures.

User manuals in Russian have been prepared and distributed by SIGMA. Since all the operators are not fluent in Russian, SIGMA agreed to prepare a translation into Uzbek (not included in their contract).

3.5 CONCLUSIONS ON THE SOUTH FERGANA SCADA SYSTEM

<u>Installation and tests</u>

The installation of the SCADA system (hardware and software) by SIGMA is completed (including communication system and solar panels). Inspection and testing of all the main sites was performed by the team of Experts during this mission.

SIGMA has performed a series of tests on each site before the mission (between august and October). Detailed tests document (called “protocols”) were written by SIGMA and showed to the experts. These documents were written in Russian but could not be translated into English before mission.

Operation manuals have been prepared by SIGMA. They need to be completed with the parameters included in the test reports (limits in opening and closing of gates, limits in values for setpoints, time parameters for the regulation computation, etc). They will then be translated into Uzbek by SIGMA (initially not included in their contract).

Due to late installation of equipments and to vegetation period, it was not possible for SIGMA to test the system under a wide range of hydraulic conditions. The experts have tested the structures at the end of the vegetation period with limited discharge. Canal Management will have to test the system with more important discharge.

Taking into account the degree of completion of installation and testing of the system, the team of experts recommends the commissioning of SIGMA works.

Positive aspects:

The system benefited of the good experience of SIGMA in canal automation. They provide standard solutions (hardware and software), which creates favorable conditions for Operation & Maintenance.

Since the last mission of the expert team, significant progress has been made by SIC in communicating of work progress by the means of monthly reports in English.

Effective use of the system by SFC

It is important that a real will to use the system in automatic mode exists at SFC. This must be shared at all levels, and even if problems occur. Operator's training must now be completed quickly and their hierarchy must ask them to use the system in automatic mode as much as possible.

Maintenance

The system includes many functions. To keep them available and ensure system sustainability, it is of paramount importance that SFC administration organizes appropriate framework for maintenance, to become effective immediately after the defect liability period.

The best solution seems a maintenance contract with SIGMA like the one for BWO structures.

Points to be completed :

SFC Management :

- Clarify and correct the identified problems in gates opening/closing during the winter season
- Action towards operators for use of the structures in automatic mode.
- Prepare maintenance contract with SIGMA (starting after end of guarantee period).

SIC :

- Communicate to SDC progress and also possible problems during the defect liability period (monthly report)

SIGMA :

- Take into account possible updated limits in gates opening/closing after work by SFC management
- Tune parameters in regulators
- Write a short document in English describing the general regulation algorithms on SFC (PID, regulation loops, …)
- Complete, then translate user manuals into Uzbek language

4 ANNEX 1: MISSION SCHEDULE

October 5: **Departure of the team from Paris**

October 6: **Travel to Tajikistan**

Meeting with KBC Canal Management in Chkalovsk

Inspection of Chkalovsk control center, headworks at DP00, DP13 and DP24

Debriefing with SDC

October 7: **Inspection of DP24, DP33, DP61, Gorodskoy wtareworks and DP228 Hydropost**

Debriefing with SDC

October 8: **Travel to Uzbekistan**

Site visit of Hydropost 8 on SFC (Solar panel system)

Site visit of Fayzabad dispatching center (Solar panel system and Wi-fi communication system)

October 9: **Travel to Kampiravvat, visit of the structure**

Visit of the SFC structures down to Akbura siphon and K1 intake

October 10: **Visit of the SFC structures from Hamza down to Tolmazor, including the Marhamat control centre**

October 11: **Visit of the Fergana and Quva control centres**

Visit of the Margilan and Beshalish structures

Debriefing meeting on KBC and SFC with SDC, SIC and SIGMA

October 12: **Handover ceremony of the SFC control system in Beshalish**

Travel to Tashkent

October 13: **Meeting with SDC, BWO and SIC about project document for phase III**

Work on mission report and project document for phase III

October 14: **Work on mission report and project document for phase III**

October 15: **Day off.**

October 16: **Flight to Paris.**

5 ANNEX II: PERSONS MET DURING THE MISSION

SDC:

Hanspeter Maag:	Country Director for Kyrgyzstan and Uzbekistan
Omina Islamova:	Regional Water Sector Program Manager
Olivier Magnin:	Water Resources Management Advisor
Chris Morger:	Backstopper for IWRM Project

SIC-ICWC

Ismail Begimov:	Automation Expert

SIGMA

Michael Tolstunov:	Technical Director for Uzbekistan
Sergey Vasilenko:	Director, Kyrgyzstan, Tajikistan and Uzbekistan
Lev Annikov	Technical Director for Kyrgyzstan

BWO/Syr Darya

Alexander Laktionov:	Chief of Technical Division

South Fergana Canal Organization

Mirkhamid Maksudov:	Deputy head of Fergana Valley water management
Abduvakhob Elmurodov	Head of South Fergana canal

Khoji-Bakirgan Canal Organization

Zafar Maksudov:	Head of KBC Administration
Farkhad Kobilov	Chief Engineer

6 ANNEX III: PLANNING OF ACTIVITIES DURING GUARANTEE PERIOD FOR SCADA SYSTEMS ON KBC AND SFC

The following tables summarize the pending actions and necessary documents to complete installation and testing of the SCADA systems on the Khoji Bakirgan canal and on the South Fergana canal

SOUTH FERGANA CANAL

Activity	Performed by	End date
Clarify and correct the identified problems in gates opening/closing during the winter season	SFC	31/03/2010
Take into account possible updated limits in gates opening/closing after work by SFC management	SIGMA	30/04/2010
Terminate testing of regulators	SIGMA	31/08/2010
Complete, then translate user manuals into Uzbek language	SIGMA	30/04/2010
Provide Global Test Document	SIGMA	31/08/2010
Write a short document in English describing the general regulation algorithms on SFC (PID, regulation loops, …)	SIGMA	30/11/2009
Communicate to SDC progress and also possible problems during the defect liability period (report in English)	SIC	monthly
Prepare maintenance contract with SIGMA	SFC	30/09/2010
Action towards operators for use of the structures in automatic mode	SFC	30/04/2010

KHOJI BAKIRGAN CANAL

Activity	Performed by	End date
Deliver to KBCA all equipment planned for DP100, to be used as spare parts.	SIGMA	30/11/2009
Provide SIGMA with conversion tables level -> discharge and with gate coefficients	KBCA	30/06/2010
Integrate into system all conversion tables level -> discharge and with gate coefficients	SIGMA	31/07/2010
Perform tuning of automation algorithms	SIGMA	31/08/2010
Complete operator training	SIGMA	31/03/2010
Repair all mentioned problems on the gates, reducers and motors that can prevent their operation from the SCADA system	KBCA	31/03/2010
Facilitate visa procedures for SIGMA workers up to end of vegetation period	KBCA	28/02/2010
Keep track of all problems encountered during the guarantee period, and inform SDC of the major ones.	SIC	30/10/2010
Order to SIGMA the installation of solar panels at DP13 and DP228	SDC	30/11/2009
Install solar panels at DP13 and DP228	SIGMA	31/03/2010
Build fences around DP13 and DP228	KBCA	31/03/2010
Write letter to Tajik authorities about the issues of visas, repairs in structures and installation of fences	SDC + SIC	30/11/2009
Provide Global Test Document	SIGMA	31/08/2010
Provide Operation and Maintenance Document	SIGMA	31/03/2010
Translate Global Test Document and transmit it to team of Experts	SIC	15/09/2010
Provide to SDC progress report in English	SIC	monthly

7 ANNEX IV : SUPERVISION AND TESTED SITES AT KHOJI BAKIRGAN CANAL

8 ANNEX V : SUPERVISION AND TESTED SITES ON THE SOUTH FERGANA CANAL