資料4-1

TOHKEMY CORPORATION

Manufacturer of Filter Media and Dosing Pumps

1-12-11 Tagawakita, Yodogawa-ku, Osaka 532-0021, JAPAN, TEL: +81-6-6301-6460, FAX: +81-6-6308-3022

Packing List

Date : 21 APR. 2016
No. : TH/001627

Messrs. : LAPON COMPANY LIMITED
T4 Rd, B. Phonthan Tai, M.Saysettha,
Vientiane Capital, Lao P.D.R
Attention : Mr. Thongkham Phamavanh
Tel : +856-20-54375462
Commodity : EQUIPMENT & CONSUMABLES
FOR WATER TREATMENT
Shipped per : WAN HAI 313 V.S146
ETD : 11 MAY 2016
From : SHIMIZU,, JAPAN

<CASE MARK>
To Lao
No.1-41
TOHKEMY CORPORATION

<CASE MARK>

CT1~21,23~62,64~81

No.	DESCRIPTION	C/No.	PACKAGE TYPE	NET W/T	GROSS W/T	MEASUREMENT (M3)
	CONTAINER NO. WHLU5590657 / SEAL NO. WHL9357594					
2.	**(AF-1) Down-flow Actifiber filtration unit (Dwg. No. TSTC1434) (1 unit)**	-		-	-	-
2- 4.	(AF-1-4) Air-wash valve (×1)	1	SKID	1450 kg	1550 kg	12.287
2-14.	(AF-1-14) Air-wash check valve (×1)					
2-19.	(AF-1-19) Vessel (×1)					
15- 2.(3)	BU-201 ADS Silencer					
1.(2)	**(UA-2) Up-flow Actifiber filtration unit (Dwg. No. TSTC1433) (1 unit)**	-		-	-	-
1-16.(2)	(UA-2-16) Vessel(UA-2) (×1)	2	SKID	1400 kg	1500 kg	12.685
1- 4.(2)	(UA-2-4) Air-wash valve(AV124) (×1)					
1- 9.(2)	(UA-2-9) Air supply valve(V123) (×1)					
1-13.(2)	(UA-2-13) Air-wash check valve(CV121) (×1)					
1.	**(UA-1) Up-flow Actifiber filtration unit (Dwg. No. TSTC1433) (1 unit)**	-		-	-	-
1-16.	(UA-1-16) Vessel(UA-1) (×1)	3	SKID	2450 kg	2580 kg	19.051
1- 4.	(UA-1-4) Air-wash valve(AV114) (×1)					
1- 9.	(UA-1-9) Air supply valve(V113) (×1)					
1-13.	(UA-1-13) Air-wash check valve(CV111) (×1)					
5- 2.	UA SV panel (Dwg. No. TEWC1247B)					
33.	Filter media for Actifiber: AF-P1.45 x 744 + AF-P1.0 x 420	—		—	—	—
	CONTAINER NO. DFSU7753191 / SEAL NO. WHL9357592					
14.	**Volute pumps (1 unit)**	–		–	–	–
14- 1.	UA filter pump unit (Dwg. No. TSPC1791-1)	4	SKID	1550 kg	1690 kg	14.256
14- 2.	AF filter pump unit (Dwg. No. TSPC1791-2)	7	SKID	750 kg	810 kg	6.751
14- 3.	SF filter pump unit (Dwg. No. TSPC1791-3)	6	SKID	1900 kg	2000 kg	10.816
14- 4.	Conveying pump unit (Dwg. No. TSPC1791-4)	5	SKID	2000 kg	2140 kg	16.578
5.	**Control panels**	–		–	–	–
5-1.(1)	Water purification system control panel (Dwg. No. TEWC1247A)	8	CASE	600 kg	830 kg	5.354
	CONTAINER NO. WHLU5414766 / SEAL NO. WHL9357591					
-	**Chemical feeding pump unit (Dwg. No. TSPC1792)**	-		-	-	-
5- 4.	Chemical feeding facilities control panel (Dwg. No. TEWC1247D)	9	SKID	1700 kg	1900 kg	28.980
63.	(T-101) Aluminum sulfate storage tank (1 unit)					
64.	(T-201) Disinfectant storage tank (1 unit)					
8.	(T-301) Sodium hydroxide storage tank (1 unit)					
9.	(T-401) Acid chemical storage tank (1 unit)					
12.	(AG-301) Sodium hydroxide storage tank agitator (1 unit)					
13.	(AG-401) Acid chemical storage tank agitator (1 unit)					
16.	Aluminum sulfate dosing pumps (3/unit) w/ Braided soft PVC hose (1 unit)					
17.	Disinfectant dosing pumps (4/unit) w/ Braided soft PVC hose (1 unit)					
18.	Sodium hydroxide dosing pumps (3/unit) w/ PE hose (1 unit)					
19.	Acid chemical dosing pump (1/unit) w/ PE hose (1 unit)					
65.	(MP-100) Aluminum sulfate transfer pump (1 unit)					

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No.	DESCRIPTION	C/No.	PACKAGE TYPE	NET W/T	GROSS W/T	MEASUREMENT (M3)
66.	(MP-200) Disinfectant transfer pump (1 unit)	9	SKID	-	-	-
6.	(T-100) Aluminum sulfate dissolving tank (1 unit)	10	SKID	320 kg	360 kg	9.400
7.	(T-200) Disinfectant dissolving tank (1 unit)	11	SKID	120 kg	150 kg	4.343
11.	(AG-200) Disinfectant dissolving tank agitator (1 unit)					
15- 1.	(BU-101) UA Blower (×1)	13	SKID	180 kg	220 kg	0.669
15- 2.	(BU-201) AF Blower (×1)	12	SKID	500 kg	570 kg	1.386
1- 1.	(UA-1-1) Rinse water inlet valve(AV111) (×1)	19	CASE	350 kg	500 kg	4.219
1- 2.	(UA-1-2) Raw water valve(AV112) (×1)					
1- 5.	(UA-1-5) Waste water valve(AV115) (×1)					
1- 7.	(UA-1-7) Rinse flow control valve(V111) (×1)					
1- 8.	(UA-1-8) Filtration flow control valve(V112) (×1)					
1- 1.(2)	(UA-2-1) Rinse water inlet valve(AV121) (×1)	20	SKID	300 kg	350 kg	3.806
1- 2.(2)	(UA-2-2) Raw water valve(AV122) (×1)					
1- 5.(2)	(UA-2-5) Waste water valve(AV125) (×1)					
1- 7.(2)	(UA-2-7) Rinse flow control valve(V121) (×1)					
1- 8.(2)	(UA-2-8) Filtration flow control valve(V122) (×1)					
68.	Tray for measuring chemicals RX-240 (1 unit)					
4- 1.(15)	(Connection Piping) P-GC-12 (×1)	23	CASE	250 kg	300 kg	1.080

CONTAINER NO. WHSU5049519 / SEAL NO. WHL9357595

1- 3.	(UA-1-3) Filtration water valve(AV113) (×1)	14	CASE	750 kg	1060 kg	8.777
1- 6.	(UA-1-6) Rinse water outlet valve(AV116) (×1)					
1- 3.(2)	(UA-2-3) Filtration water valve(AV123) (×1)					
1- 6.(2)	(UA-2-6) Rinse water outlet valve(AV126) (×1)					
4-3.(13)	(Piping support) SP-RH-1(×2)					
4-3.(16)	(Piping support) SP-RH-4(×2)					
4-3.(17)	(Piping support) SP-RH-5(×1)					
4-3.(18)	(Piping support) SP-RH-6(×1)					
34.	**Electric work / wiring material (1 unit)**					
34- 1.	600V CV cables 2-8sq					
71-5.	Anchor bolt (Full thread bolt) (1set)					
3- 1.	(SF-1-1) Raw water valve(MV311) (×1)	15	CASE	460 kg	660 kg	5.316
3- 7.	(SF-1-7) Filtration flow control valve(V311) (×1)					
3- 4.	(SF-1-4) Waste water valve(MV314) (×1)					
4- 1.(78)	(Connection Piping) P-AFA-01 (×1)					
4- 1.(79)	(Connection Piping) P-SF-01 (×1)					
4- 1.(103)	(Connection Piping) P-SF-19 (×1)					
4- 1.(106)	(Connection Piping) P-SFW-01 (×1)					
4- 3.	**Piping support set (Dwg. No. TSAC2070-1～3)**	—		—	—	—
4-3.(1)	(Piping support) SP-UA-1(×1)	16	CASE	900 kg	1230 kg	8.018
4-3.(2)	(Piping support) SP-UA-2(×1)					
4-3.(3)	(Piping support) SP-UA-3(×1)					
4-3.(4)	(Piping support) SP-UA-4(×1)					
4-3.(6)	(Piping support) SP-UA-6(×1)					
34- 6.	Aluminum racks W=300-500, Separators					
4-3.(11)	**AF-1 Pipe unit 1(1set)**	17	SKID	890 kg	990 kg	7.700
2- 1.	(AF-1-1) Raw water valve(MV211) (×1)					
2- 2.	(AF-1-2) Filtration water valve(MV212) (×1)					
2- 3.	(AF-1-3) Backwash valve(MV213) (×1)					
2- 5.	(AF-1-5) Waste water valve(MV215) (×1)					
2- 6.	(AF-1-6) Rinse water valve(MV216) (×1)					
2- 7.	(AF-1-7) Filtration flow control valve(V211) (×1)					
2- 8.	(AF-1-8) Rinse flow control valve(V212) (×1)					
2- 9.	(AF-1-9) Backwash flow control valve(V213) (×1)					
2-11.	(AF-1-11) Drain valve(V215) (×1)					
5- 3.	AF/SF MV panel (Dwg. No. TEWC1247C)					

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No.	DESCRIPTION	C/No.	PACKAGE TYPE	NET W/T	GROSS W/T	MEASUREMENT (M3)
4- 1.(74)	(Connection Piping) P-AFB-01 (×1)	17	SKID	-	-	-
4- 1.(76)	(Connection Piping) P-AFW-01 (×1)					
4-3.(7)	(Piping support) SP-UA-7(×2)					
4-3.(12)	**AF-1 Pipe unit 2(1set)**	18	SKID	570 kg	670 kg	8.578
4- 1.(47)	(Connection Piping) P-AF-01 (×1)					
4- 1.(63)	(Connection Piping) P-AF-13 (×1)					
4- 1.(80)	(Connection Piping) P-SF-02 (×1)					
4- 1.(107)	(Connection Piping) P-SFW-02 (×1)					
3- 3.	(SF-1-3) Backwash valve(MV313) (×1)	24	SKID	150 kg	180 kg	1.642
3- 8.	(SF-1-8) Backwash flow control valve(V312) (×1)					
10.(2)	AG-100 Impeller (×1)	25	CRATE	70 kg	90 kg	1.134
11.(2)	AG-200 Impeller (×1)					
12.(2)	AG-301 Impeller (×1)					
13.(2)	AG-401 Impeller (×1)					
69-1.	Tools for electric work (1 unit)	CT61	CARTON	12 kg	13 kg	0.075
70.(1/3)	Tools for installation and piping work (1/3)	CT65	CARTON	22 kg	25 kg	0.180
70.(2/3)	Tools for installation and piping work (2/3)	CT66	CARTON	14 kg	15 kg	0.031
70.(3/3)	Tools for installation and piping work (3/3)	CT67	CARTON	22 kg	24 kg	0.100
71.	**Equipment of construction**	—		—	—	—
71-1.	Protective helmet(×10)	CT68	CARTON	14 kg	15 kg	0.157
71-2.	Blackboard(×2)					
72-15.	Tools for trial operation(1 units)	CT75	CARTON	8 kg	9 kg	0.068

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20.(acc.)	Use No.20 Pole(×1)	21	CASE	2600 kg	3080 kg	12.274
21.(acc.)	Use No.21 Pole(×1)					
22.(acc.)	Use No.22 Pole(×1)					
23.(acc.)	Use No.23 Pole(×1)					
24.(acc.)	Use No.24 Pole(×1)					
1.(acc.)	Pipe for PG112					
1.(acc.)	Pipe for V113					
1.(2)(acc.)	Pipe for PG122					
1.(2)(acc.)	Pipe for V123					
2-10.	(AF-1-10) Air supply valve(V214) (×1)					
2.(acc.)	Pipe for V214(×1)					
3-10.	(SF-1-10) Master valve for automatic relief valve(V314) (×1)					
3-14.	(SF-1-14) Automatic relief valve(AE311) (×1)					
3- 9.	(SF-1-9) Air supply valve(V313) (×1)					
3.(acc.)	Pipe for AE311,V313(1set)					
4- 1.	**Connection Piping (Dwg. No. TSLC0713-10～12)**					
4- 1.(1)	(Connection Piping) P-GC-01_1/4 (×1)					
4- 1.(2)	(Connection Piping) P-GC-01_2/4 (×1)					
4- 1.(3)	(Connection Piping) P-GC-01_3/4 (×1)					
4- 1.(4)	(Connection Piping) P-GC-01_4/4 (×1)					
4- 1.(5)	(Connection Piping) P-GC-02 (×1)					
4- 1.(6)	(Connection Piping) P-GC-03 (×1)					
4- 1.(20)	(Connection Piping) P-UA-05 (×1)					
4- 1.(21)	(Connection Piping) P-UA-06 (×1)					
4- 1.(22)	(Connection Piping) P-UA-07_1/4 (×1)					
4- 1.(23)	(Connection Piping) P-UA-07_2/4 (×1)					
4- 1.(24)	(Connection Piping) P-UA-07_3/4 (×1)					
4- 1.(25)	(Connection Piping) P-UA-07_4/4 (×1)					
4- 1.(26)	(Connection Piping) P-UA-08_1/4 (×1)					
4- 1.(27)	(Connection Piping) P-UA-08_2/4 (×1)					
4- 1.(28)	(Connection Piping) P-UA-08_3/4 (×1)					
4- 1.(29)	(Connection Piping) P-UA-08_4/4 (×1)					

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No.	DESCRIPTION	C/No.	PACKAGE TYPE	NET W/T	GROSS W/T	MEASUREMENT (M3)
4- 1.(30)	(Connection Piping) P-UA-09 (×1)	21	CASE	-	-	-
4- 1.(31)	(Connection Piping) P-UA-10 (×1)					
4- 1.(37)	(Connection Piping) P-UAW-02 (×1)					
4- 1.(38)	(Connection Piping) P-UAW-03 (×1)					
4- 1.(39)	(Connection Piping) P-UAB-01 (×1)					
4- 1.(40)	(Connection Piping) P-UAB-02 (×1)					
4- 1.(51)	(Connection Piping) P-AF-05 (×1)					
4- 1.(52)	(Connection Piping) P-AF-06 (×1)					
4- 1.(53)	(Connection Piping) P-AF-07 (×1)					
4- 1.(54)	(Connection Piping) P-AF-08 (×1)					
4- 1.(55)	(Connection Piping) P-AF-09_1/4 (×1)					
4- 1.(56)	(Connection Piping) P-AF-09_2/4 (×1)					
4- 1.(57)	(Connection Piping) P-AF-09_3/4 (×1)					
4- 1.(58)	(Connection Piping) P-AF-09_4/4 (×1)					
4- 1.(59)	(Connection Piping) P-AF-10 (×1)					
4- 1.(60)	(Connection Piping) P-AF-10A (×1)					
4- 1.(61)	(Connection Piping) P-AF-11 (×1)					
4- 1.(64)	(Connection Piping) P-AF-14_1/4 (×1)					
4- 1.(65)	(Connection Piping) P-AF-14_2/4 (×1)					
4- 1.(66)	(Connection Piping) P-AF-14_3/4 (×1)					
4- 1.(67)	(Connection Piping) P-AF-14_4/4 (×1)					
4- 1.(68)	(Connection Piping) P-AF-15 (×1)					
4- 1.(69)	(Connection Piping) P-AF-16 (×1)					
4- 1.(75)	(Connection Piping) P-AFB-02 (×1)					
4- 1.(77)	(Connection Piping) P-AFW-02 (×1)					
4- 1.(84)	(Connection Piping) P-SF-06 (×1)					
4- 1.(85)	(Connection Piping) P-SF-07 (×1)					
4- 1.(86)	(Connection Piping) P-SF-08 (×1)					
4- 1.(87)	(Connection Piping) P-SF-09 (×1)					
4- 1.(88)	(Connection Piping) P-SF-10 (×1)					
4- 1.(89)	(Connection Piping) P-SF-11 (×1)					
4- 1.(90)	(Connection Piping) P-SF-12_1/4 (×1)					
4- 1.(91)	(Connection Piping) P-SF-12_2/4 (×1)					
4- 1.(92)	(Connection Piping) P-SF-12_3/4 (×1)					
4- 1.(93)	(Connection Piping) P-SF-12_4/4 (×1)					
4- 1.(94)	(Connection Piping) P-SF-13_1/4 (×1)					
4- 1.(95)	(Connection Piping) P-SF-13_2/4 (×1)					
4- 1.(96)	(Connection Piping) P-SF-13_3/4 (×1)					
4- 1.(97)	(Connection Piping) P-SF-13_4/4 (×1)					
4- 1.(98)	(Connection Piping) P-SF-14 (×1)					
4- 1.(99)	(Connection Piping) P-SF-15 (×1)					
4- 1.(105)	(Connection Piping) P-SFB-01 (×1)					
4- 1.(111)	(Connection Piping) P-SFW-06 (×1)					
4- 1.(112)	(Connection Piping) P-SFW-07 (×1)					
4- 1.(113)	(Connection Piping) P-SFW-08_1/4 (×1)					
4- 1.(114)	(Connection Piping) P-SFW-08_2/4 (×1)					
4- 1.(115)	(Connection Piping) P-SFW-08_3/4 (×1)					
4- 1.(116)	(Connection Piping) P-SFW-08_4/4 (×1)					
4- 1.(117)	(Connection Piping) P-GC-13 (×1)					
4- 1.(118)	(Connection Piping) P-UA-15 (×1)					
4- 1.(119)	(Connection Piping) P-IA-01 (×1)					
4-3.(14)	(Piping support) SP-RH-2(×1)					
4-3.(15)	(Piping support) SP-RH-3(×1)					
4-3.(21)	(Piping support) SP-SF-1(×1)					
34- 4.	Unplasticized polyvinyl chloride conduits VE22-100					
34- 10.	Stepladder(×1)					

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No.	DESCRIPTION	C/No.	PACKAGE TYPE	NET W/T	GROSS W/T	MEASUREMENT (M3)
4- 1.(7)	(Connection Piping) P-GC-04 (×1)					
4- 1.(8)	(Connection Piping) P-GC-05 (×1)					
4- 1.(10)	(Connection Piping) P-GC-07 (×1)					
4- 1.(11)	(Connection Piping) P-GC-08 (×1)					
4- 1.(12)	(Connection Piping) P-GC-09 (×1)					
4- 1.(13)	(Connection Piping) P-GC-10 (×1)					
4- 1.(14)	(Connection Piping) P-GC-11 (×1)					
4- 1.(16)	(Connection Piping) P-UA-01 (×1)					
4- 1.(17)	(Connection Piping) P-UA-02 (×1)					
4- 1.(18)	(Connection Piping) P-UA-03 (×1)					
4- 1.(19)	(Connection Piping) P-UA-04 (×1)					
4- 1.(32)	(Connection Piping) P-UA-11 (×1)					
4- 1.(34)	(Connection Piping) P-UA-13 (×1)					
4- 1.(35)	(Connection Piping) P-UA-14 (×1)					
4- 1.(36)	(Connection Piping) P-UAW-01 (×1)					
4- 1.(41)	(Connection Piping) P-UAA-01 (×1)					
4- 1.(42)	(Connection Piping) P-UAA-02 (×1)					
4- 1.(43)	(Connection Piping) P-UAA-03 (×1)					
15- 1.(3)	BU-101 ADS Silencer (×1)					
4- 1.(44)	(Connection Piping) P-UAA-04 (×1)					
4- 1.(45)	(Connection Piping) P-UAA-05 (×1)					
4- 1.(46)	(Connection Piping) P-UAA-06 (×1)					
4- 1.(48)	(Connection Piping) P-AF-02 (×1)					
4- 1.(49)	(Connection Piping) P-AF-03 (×1)					
4- 1.(50)	(Connection Piping) P-AF-04 (×1)					
4- 1.(62)	(Connection Piping) P-AF-12 (×1)					
4- 1.(70)	(Connection Piping) P-AF-17 (×1)					
4- 1.(71)	(Connection Piping) P-AF-18 (×1)	22	CASE	2500 kg	2920 kg	12.274
4- 1.(72)	(Connection Piping) P-AF-19 (×1)					
4- 1.(73)	(Connection Piping) P-AF-20 (×1)					
4- 1.(81)	(Connection Piping) P-SF-03 (×1)					
4- 1.(82)	(Connection Piping) P-SF-04 (×1)					
4- 1.(83)	(Connection Piping) P-SF-05 (×1)					
4- 1.(100)	(Connection Piping) P-SF-16 (×1)					
4- 1.(101)	(Connection Piping) P-SF-17 (×1)					
4- 1.(102)	(Connection Piping) P-SF-18 (×1)					
4- 1.(104)	(Connection Piping) P-SF-20 (×1)					
4- 1.(108)	(Connection Piping) P-SFW-03 (×1)					
4- 1.(109)	(Connection Piping) P-SFW-04 (×1)					
4- 1.(110)	(Connection Piping) P-SFW-05 (×1)					
4-3.(5)	(Piping support) SP-UA-5(×2)					
4-3.(19)	(Piping support) SP-RH-7(×2)					
4-3.(20)	(Piping support) SP-RH-8(×1)					
4-3.(22)	(Piping support) SP-SF-2(×1)					
4-3.(23)	(Piping support) SP-SF-3(×1)					
4-3.(24)	(Piping support) SP-WW-1(×5)					
4-3.(25)	(Piping support) SP-WW-1S(×3)					
4-3.(26)	(Piping support) SP-WW-2(×1)					
4-3.(27)	(Piping support) SP-WW-3(×1)					
4-3.(28)	(Piping support) SP-B1-1(×2)					
4-3.(29)	(Piping support) SP-B2-1(×1)					
4-3.(30)	(Piping support) SP-EW-1(×2)					
4-3.(31)	(Piping support) SP-PU-1(×1)					
4-3.(32)	(Piping support) SP-PU-2(×1)					
4-3.(33)	(Piping support) SP-PU-3(×1)					
4-3.(34)	(Piping support) SP-PU-4(×1)					

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4-3.(35)	(Piping support) SP-PU-5(×1)	22	CASE	-	-	-
4-3.(36)	(Piping support) SP-PU-6(×2)					
4-3.(37)	(Piping support) SP-0-1(×3)					
4-3.(38)	(Piping support) SP-0-2(×2)					
4-3.(39)	(Piping support) SP-0-3(×2)					
4-3.(41)	(Piping support) SP-CF-1(×2)					
34- 5.	Thick steel conduit tubes G22-54					
34- 8.	Duct channel(1set)					
30-1	Filter media for SF-1: Anthracite 720L (30L/bag x 24 bags)	27	PALLET	505 kg	520 kg	1.016
30-2	Filter media for SF-1: Anthracite 720L (30L/bag x 24 bags)	28	PALLET	505 kg	520 kg	1.016
30-3	Filter media for SF-1: Anthracite 720L (30L/bag x 24 bags)	29	PALLET	505 kg	520 kg	1.016
30-4	Filter media for SF-1: Anthracite 480L (30L/bag x 16 bags)	30	PALLET	335 kg	350 kg	0.726
31-1	Filter media for SF-1: Sand 560L (20L/bag x 28 bags)	31	PALLET	845 kg	860 kg	0.956
31-2	Filter media for SF-1: Sand 560L (20L/bag x 28 bags)	32	PALLET	845 kg	860 kg	0.956
31-3	Filter media for SF-1: Sand 560L (20L/bag x 28 bags)	33	PALLET	845 kg	860 kg	0.956
31-4	Filter media for SF-1: Sand 440L (20L/bag x 22 bags)	34	PALLET	665 kg	680 kg	0.823
32-1	Filter media for SF-1: Gravel 540L (20L/bag x 27 bags)	35	PALLET	865 kg	880 kg	0.871
32-2	Filter media for SF-1: Gravel 540L (20L/bag x 27 bags)	36	PALLET	865 kg	880 kg	0.871
32-3	Filter media for SF-1: Gravel 540L (20L/bag x 27 bags)	37	PALLET	865 kg	880 kg	0.944
32-4	Filter media for SF-1: Gravel 480L (20L/bag x 24 bags)	38	PALLET	775 kg	790 kg	0.847
32-5	Filter media for SF-1: Gravel 480L (20L/bag x 24 bags)	39	PALLET	775 kg	790 kg	0.847
32-6	Filter media for SF-1: Gravel 480L (20L/bag x 24 bags)	40	PALLET	775 kg	790 kg	0.847
32-7	Filter media for SF-1: Gravel 300L (20L/bag x 15 bags) & Flexible container bag (10 pieces)	41	PALLET	485 kg	500 kg	1.004
4-23.	(FJ11) Flexible joint 250A (×1)	CT1	CARTON	31 kg	32 kg	0.090
4-24.	(FJ12) Flexible joint 125A (×1)	CT2	CARTON	12 kg	13 kg	0.039
4-25.	(FJ21) Flexible joint 125A (×1)	CT3	CARTON	25 kg	26 kg	0.073
4-26.	(FJ22) Flexible joint 125A (×1)					
4-27.	(FJ31) Flexible joint 200A (×1)	CT4	CARTON	21 kg	22 kg	0.210
4-28.	(FJ32) Flexible joint 100A (×1)	CT5	CARTON	17 kg	18 kg	0.058
4-29.	(FJ33) Flexible joint 100A (×1)					
4-30.	(FJ41) Flexible joint 250A (×1)	CT6	CARTON	31 kg	32 kg	0.099
4- 5.	(MV001) Valve 700Z-4I 125A (×1)	CT7	CARTON	19 kg	20 kg	0.100
4- 6.	(V-GC01) Valve 700Z-2F 150A (×1)	CT8	CARTON	5 kg	6 kg	0.032
4- 7.	(V-GC02) Valve 700Z-2F 250A (×1)	CT9	CARTON	15 kg	16 kg	0.058
4- 8.	(V-GC03) Valve 700Z-2F 150A (×1)	CT10	CARTON	5 kg	6 kg	0.032
4- 9.	(V-UAA1) Valve 700Z-1J 100A (×1)	CT11	CARTON	5 kg	6 kg	0.029
4-15.	(V-UA01) Valve 700Z-1J 125A (×1)					
4-16.	(V-UA02) Valve 700Z-2F 150A (×1)	CT12	CARTON	5 kg	6 kg	0.032
4-17.	(V-UA04) Valve 700Z-1J 125A (×1)	CT13	CARTON	6 kg	7 kg	0.028
4-38.	(V-GCVP) Valve 700Z-1J 125A (×1)					
4-18.	(V-AF01) Valve 700Z-2F 200A (×1)	CT14	CARTON	7 kg	8 kg	0.032
4-19.	(V-AF02) Valve 700Z-2F 150A (×1)	CT15	CARTON	5 kg	6 kg	0.032
4-21.	(V-SF01) Valve 700Z-2F 250A (×1)	CT16	CARTON	14 kg	15 kg	0.058
4-22.	(V-SF02) Valve 700Z-2F 150A (×1)	CT17	CARTON	5 kg	6 kg	0.032
27.	Level sensors (1 unit)	CT18	CARTON	10 kg	11 kg	0.030
27- 1.(1/2)	Raw water tank level sensor (×1)(1/2)					
27- 2.(1/2)	Up-flow Actifiber treated water tank level sensor (×1)(1/2)					
27- 3.(1/2)	Down-flow Actifiber treated water tank level sensor (×1)(1/2)					
27- 4.(1/2)	Sand filter treated water tank level sensor (×1)(1/2)					
28.	Pressure sensors (1 unit)					
28- 1.	Before the point of UA pressure sensor (×1)					
28- 2.	Before the point of AF pressure sensor (×1)					
28- 3.	Before the point of SF pressure sensor (×1)					
3-15.	(SF-1-15) Inlet pressure sensor connection (×1)					
2-15.	(AF-1-15) Inlet pressure sensor connection (×1)					

- TO BE CONTINUED -

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- TO CONTINUE -

No.	DESCRIPTION	C/No.	PACKAGE TYPE	NET W/T	GROSS W/T	MEASUREMENT (M3)
27- 1.(2/2)	Raw water tank level sensor (×1)(2/2)	CT19	CARTON	6 kg	7 kg	0.081
27- 2.(2/2)	Up-flow Actifiber treated water tank level sensor (×1)(2/2)					
27- 3.(2/2)	Down-flow Actifiber treated water tank level sensor (×1)(2/2)					
27- 4.(2/2)	Sand filter treated water tank level sensor (×1)(2/2)					
20.(1/2)	Raw Intake water turbidity meter (1 unit)(1/2)	CT20	CARTON	6 kg	7 kg	0.091
20.(2/2)	Raw Intake water turbidity meter (1 unit)(1/2)	CT21	CARTON	20 kg	21 kg	0.191
21.(1/2)	After the point of UA turbidity meter (Dwg. No. PSPC-0202) (1 unit)(1/2)	CT23	CARTON	7 kg	8 kg	0.062
22.(1/2)	After the point of SF turbidity meter (Dwg. No. PSPC-0202) (1 unit)(1/2)					
21.(2/2)	**After the point of UA turbidity meter (Dwg. No. PSPC-0202) (1 unit)(2/**	CT24	CARTON	15 kg	15 kg	0.096
22.(2/2)	After the point of SF turbidity meter (Dwg. No. PSPC-0202) (1 unit)(2/2)					
4-3.(9)	(Piping support) SP-UA-9(×1)					
4-3.(10)	(Piping support) SP-UA-10(×3)					
4-14.	(V-UAS1) Valve type 21 15A (×1)					
4-11.	(V-GCS1) Valve type 21 25A (×1)	CT25	CARTON	9 kg	10 kg	0.060
23.	Before the point of UA pH meter (Dwg. No. PSPC-0203) (1 unit)					
4-3.(8)	(Piping support) SP-UA-8(×1)					
24.	After the point of SF pH & Cl meter (Dwg. No. PSPC-0201) (1 unit)	CT26	CARTON	11 kg	12 kg	0.102
21.～24.(acc.)	No.21～24 Accessories	CT27	CARTON	9 kg	10 kg	0.068
25.	Raw Intake water flowmeter (1 unit)	CT28	CARTON	65 kg	67 kg	0.205
26.	Supply water flowmeter (1 unit)					
14- 1.(2)	(PU-101) Outlet Pressure gauge (×1)	CT29	CARTON	14 kg	15 kg	0.075
14- 1.(3)	(PU-102) Outlet Pressure gauge (×1)					
14- 1.(4)	(PU-103) Outlet Pressure gauge (×1)					
14- 1.(5)	(PU-104) Outlet Pressure gauge (×1)					
14- 2.(2)	(PU-201) Outlet Pressure gauge (×1)					
14- 2.(3)	(PU-202) Outlet Pressure gauge (×1)					
14- 3.(2)	(PU-221) Outlet Pressure gauge (×1)					
14- 3.(3)	(PU-301) Outlet Pressure gauge (×1)					
14- 3.(4)	(PU-302) Outlet Pressure gauge (×1)					
14- 4.(2)	(PU-321) Outlet Pressure gauge (×1)					
14- 4.(3)	(PU-401) Outlet Pressure gauge (×1)					
14- 4.(4)	(PU-402) Outlet Pressure gauge (×1)					
1-14.	(UA-1-14) Inlet pressure gauge (×1)					
1-14.(2)	(UA-2-14) Inlet pressure gauge (×1)					
1-15.	(UA-1-15) Outlet pressure gauge (×1)					
1-15.(2)	(UA-2-15) Outlet pressure gauge (×1)					
2-16.	(AF-1-16) Outlet pressure gauge (×1)					
3-16.	(SF-1-16) Outlet pressure gauge (×1)					
2-17.	(AF-1-17) Filtration flowmeter (×1)					
2-18.	(AF-1-18) Backwash flowmeter (×1)					
3-17.	(SF-1-17) Filtration flowmeter(FI311) (×1)					
3-18.	(SF-1-18) Backwash flowmeter(FI312) (×1)					
29.	Before the point of UA temperature sensor (1 unit)					
3- 6.	(SF-1-6) Filtration water sampling valve(MV316) (×1)	CT30	CARTON	13 kg	14 kg	0.070
4-20.	(V-SFS1/2) Valve type 21 15A (×2)					
4-31.	(V-CL01) Valve type 21 25A (×1)					
4-32.	(V-CL02) Valve type 21 25A (×1)					
4-33.	(V-AL01) Valve type 21 50A (×1)					
4-34.	(V-AL02) Valve type 21 40A (×1)					
4-35.	(S-CL01) Y-strainer 25A (×1)					
7.(2)	(T-200) Anchor plate (1 set)					
15- 1.(2)	BU-101 Suction Silencer	CT31	CARTON	120 kg	130 kg	0.585
15- 2.(2)	BU-201 Suction Silencer					
4- 1.(9)	(Connection Piping) P-GC-06					
4- 1.(33)	(Connection Piping) P-UA-12					
3.(acc.)	(SF-1/N9) Pipe					

- TO BE CONTINUED -

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- TO CONTINUE -

No.	DESCRIPTION	C/No.	PACKAGE TYPE	NET W/T	GROSS W/T	MEASUREMENT (M3)
10.	(AG-100) Aluminum sulfate dissolving tank agitator (1 unit)	CT31	CARTON	-	-	-
1-11.	(UA-1-11) Pressure gauge valve(V115) (×2)	CT32	CARTON	34 kg	36 kg	0.102
1-11.(1)	(UA-2-11) Pressure gauge valve(V125) (×2)					
1-12.	(UA-1-12) Sampling valve(V116) (×2)					
1-12.(2)	(UA-2-12) Sampling valve(V126) (×2)					
2-12.	(AF-1-12) Pressure gauge valve(V216) (×2)					
2-13.	(AF-1-13) Sampling valve(V217) (×2)					
3-12.	(SF-1-12) Pressure gauge valve(V316) (×2)					
3-13.	(SF-1-13) Sampling valve(V317) (×2)					
4-3.(40)	(SP-IA-1) Pipe Supports(×4)					
4-10.	(V-GC51/52) Valve TKW 15A (×2)					
4-12.	(V-GCS2) Valve TKW 25A (×1)					
4-36.	(S-AL01) Y-strainer 50A (×1)					
4-13.	(V-IA01) Valve TKW 15A (×1)					
1.、65.(acc.)	Pipe Supports(3) (UA-1×1,UA-2×1,MP-100×1)					
16.～19.(acc.)	No.16～19 Accessories(Hose) (1/3)	CT33	CARTON	23 kg	24 kg	0.131
16.～19.(acc.)	No.16～19 Accessories(Back pressure valve) (2/3)	CT34	CARTON	8 kg	9 kg	0.029
16.～19.(acc.)	No.16～19 Accessories(Spare parts) (3/3)	CT35	CARTON	7 kg	8 kg	0.035
35.	Turbidity meter (for laboratory use) (1 unit)	CT36	CARTON	20 kg	22 kg	0.266
36.	pH meter (for laboratory use) (1 unit)					
37.	pH electrode (reserve) (1 unit)					
38.	Chlorine concentration meter (for laboratory use) (1 unit)					
39.	Reagent for chlorine concentration meter (for free chlorine) (8 units)					
40.	Reagent for chlorine concentration meter (for total chlorine) (8 units)					
41.	Magnetic stirrer (analogue type) (2 units)					
42.	Magnetic stirrer rotor 30mm x 8mm dia. (2 units)					
43.	Magnetic stirrer rotor 60mm x 8mm dia. (2 units)					
44.	TPX Beaker 200ml (2 units)					
45.	TPX Beaker 500ml (2 units)					
46.	TPX Beaker 1000ml (2 units)					
47.	TPX Graduated cylinder 500ml (2 units)					
48.	TPX Graduated cylinder 1000ml (2 units)					
49.	TPX Graduated cylinder 2000ml (2 units)					
50.	Filter paper No. 2 (185mm dia.) (2 units)					
51.	Filter paper No. 2 (150mm dia.) (2 units)					
52.	Filter paper No. 5C (185mm dia.) (2 units)					
53.	Filter paper No. 5C (150mm dia.) (2 units)					
54.	TPX Hi-speed funnel (75mm dia.) (2 units)					
55.	TPX Hi-speed funnel (120mm dia.) (2 units)					
56.	Komagome type pipette (2ml) (2 units)					
57.	Komagome type pipette (5ml) (2 units)					
58.	Komagome type pipette (20ml) (2 units)					
59.	Silicon dropping pipette (2ml) (2 units)					
60.	Silicon dropping pipette (5ml) (2 units)					
61.	Silicon dropping pipette (20ml) (2 units)					
62.	Satin spoon (3 pcs/set) (2 units)					
5-1.(2)	UPS(control panel accessory)	CT37	CARTON	45 kg	48 kg	0.132
4- 2.(1/20)	Bolts, Nuts and Packing for connection piping (1/20)	CT38	CARTON	7 kg	8 kg	0.014
4- 2.(2/20)	Bolts, Nuts and Packing for connection piping (2/20)	CT39	CARTON	7 kg	8 kg	0.012
4- 2.(3/20)	Bolts, Nuts and Packing for connection piping (3/20)	CT40	CARTON	10 kg	11 kg	0.022
4- 2.(4/20)	Bolts, Nuts and Packing for connection piping (4/20)	CT41	CARTON	8 kg	9 kg	0.014
4- 2.(5/20)	Bolts, Nuts and Packing for connection piping (5/20)	CT42	CARTON	18 kg	19 kg	0.020
4- 2.(6/20)	Bolts, Nuts and Packing for connection piping (6/20)	CT43	CARTON	16 kg	17 kg	0.011
4- 2.(7/20)	Bolts, Nuts and Packing for connection piping (7/20)	CT44	CARTON	24 kg	25 kg	0.014
4- 2.(8/20)	Bolts, Nuts and Packing for connection piping (8/20)	CT45	CARTON	6 kg	7 kg	0.007
4- 2.(9/20)	Bolts, Nuts and Packing for connection piping (9/20)	CT46	CARTON	19 kg	20 kg	0.025

- TO BE CONTINUED -

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- TO CONTINUE -

No.	DESCRIPTION	C/No.	PACKAGE TYPE	NET W/T	GROSS W/T	MEASUREMENT
4- 2.(10/20)	Bolts, Nuts and Packing for connection piping (10/20)	CT47	CARTON	29 kg	30 kg	0.012
4- 2.(11/20)	Bolts, Nuts and Packing for connection piping (11/20)	CT48	CARTON	12 kg	13 kg	0.013
4- 2.(12/20)	Bolts, Nuts and Packing for connection piping (12/20)	CT49	CARTON	29 kg	30 kg	0.012
4- 2.(13/20)	Bolts, Nuts and Packing for connection piping (13/20)	CT50	CARTON	17 kg	18 kg	0.011
4- 2.(14/20)	Bolts, Nuts and Packing for connection piping (14/20)	CT51	CARTON	15 kg	16 kg	0.011
4- 2.(15/20)	Bolts, Nuts and Packing for connection piping (15/20)	CT52	CARTON	20 kg	21 kg	0.012
4- 2.(16/20)	Bolts, Nuts and Packing for connection piping (16/20)	CT53	CARTON	27 kg	28 kg	0.011
4- 4.(1/2)	Bolts and Nuts for piping support set(1/2)	CT54	CARTON	13 kg	14 kg	0.009
4- 4.(2/2)	Bolts and Nuts for piping support set(2/2)	CT55	CARTON	5 kg	6 kg	0.005
15- 1.(4)	BU-101 Flexible Joint	CT56	CARTON	45 kg	47 kg	0.088
15- 2.(4)	BU-201 Flexible Joint					
1-10.	(UA-1-10) Drain valve(V114) (×1)					
1-10.(2)	(UA-2-10) Drain valve(V124) (×1)					
34- 2.	CVV cables 1.25sq	CT57	CARTON	40 kg	41 kg	0.153
34- 3.	CC link cables					
34- 7.	Waterproof pull boxes (100-300mm sq) 7 pcs	CT58	CARTON	15 kg	16 kg	0.070
34- 9.(1/2)	Parts of electric work(1/2)	CT59	CARTON	20 kg	21 kg	0.049
34- 9.(2/2)	Parts of electric work(2/2)	CT60	CARTON	26 kg	27 kg	0.072
69-2.	High-speed cutting machine (1 unit)	CT62	CARTON	29 kg	30 kg	0.151
69-3.	Hammer drill (1 unit)					
67.	Elevated water tank level sensor (1 unit)	CT64	CARTON	9 kg	10 kg	0.030
71-3.	Adjusting liner(1set)	CT69	CARTON	50 kg	51 kg	0.014
71-4.	Anchor bolt (Hole-in anchor) (1set)	CT70	CARTON	16 kg	17 kg	0.014
72.	**Equipment of trial operation**	—		—	—	—
72-1.	Handy pump（HP-601）(1 units)	CT71	CARTON	3 kg	4 kg	0.027
72-2.(1/2)	Purified water 20L（W-20）(×1)	CT72	CARTON	20 kg	22 kg	0.031
72-2.(2/2)	Purified water 20L（W-20）(×1)	CT73	CARTON	20 kg	22 kg	0.031
72-3.	Curing tape（Y09-GR）(10 units)	CT74	CARTON	8 kg	10 kg	0.113
72-4.	Curing tape（No.395N）(3 units)					
72-5.	Cock for Purified water (2 units)					
72-6.	Washing bottle（Type BS）(2 units)					
72-7.	Filter paper No. 4 (185mm dia.) (2 units)					
72-8.	Filter paper No. 1 (185mm dia.) (2 units)					
72-9.	Beaker with handle 2L (2 units)					
72-10.	Beaker with handle 3L (2 units)					
72-11.	Magnet sheet（200×300） (5 units)					
72-12.	Plastic bucket 10L(1 units)					
72-13.	Plastic bucket 15L(1 units)					
72-14.	Plastic bucket 25L(1 units)					
4- 2.(17/20)	Bolts, Nuts and Packing for connection piping (17/20)	CT76	CARTON	14 kg	15 kg	0.030
4- 2.(18/20)	Bolts, Nuts and Packing for connection piping (18/20)	CT77	CARTON	9 kg	10 kg	0.016
4- 2.(19/20)	Bolts, Nuts and Packing for connection piping (19/20)	CT78	CARTON	9 kg	10 kg	0.006
4-37.(1/2)	Piping material	CT79	CARTON	6 kg	7 kg	0.025
4-37.(2/2)	Piping material	CT80	CARTON	8 kg	9 kg	0.053
4- 2.(20/20)	Bolts, Nuts and Packing for connection piping (20/20)	CT81	CARTON	16 kg	18 kg	0.016

CONTAINER NO. WHLU1205217 / SEAL NO. WHL9357596

3.	**(SF-1) Sand filtration unit (Dwg. No. TSTC1435) (1 unit)**	–		–	–	–
3-19.	(SF-1-19) Vessel(SF-1)(×1)	26	CASE	3000 kg	4200 kg	36.580
3-11.	(SF-1-11) Drain valve(V315) (×1)					
3- 2.	(SF-1-2) Filtration water valve(MV312) (×1)					
3- 5.	(SF-1-5) Rinse water valve(MV315) (×1)					

TOTAL: **16 SKIDS** **39,572.00 KGS** **44,717.00 KGS** **272.930 M3**
1 CRATE
9 CASES
15 PALLETS
79 CARTONS
120 PACKAGES

資料4-2

平成26年度普及実証事業

浄水装置　梱包積 写真

撮影:2016/5/11

	至　大村総業 (梱包会社) 下向流 ｱｸﾃｨﾌｧｲﾊﾞｰ		至　大村総業 (梱包会社) 砂ろ過 装置
	至　大村総業 (梱包会社) 上向流 ｱｸﾃｨﾌｧｲﾊﾞｰ		至　大村総業 (梱包会社) ポンプ ユニット
	至　大村総業 (梱包会社) 電機操作盤		至　大村総業 (梱包会社) 薬注 ユニット
	至　大村総業 (梱包会社) 配管類		至　大村総業 (梱包会社) ろ過材

資料4-3

平成26年度普及実証事業

装置　運搬･搬入 写真

撮影:2016/5/30

	運搬 メコン河渡船		運搬 メコン河 ラオス側 接岸
	運搬 40フィート コンテナ		運搬 20フィート ｵｰﾌﾟﾝﾄｯﾌﾟ コンテナ
	設置現場付近 トラック 待機場所		設置現場 トラック 搬入状況
	設置現場 重機 搬入		設置現場 下向ｱｸﾃｨﾌｧｲﾊﾞｰ 荷卸し

資料5-1 現地施工写真

浄水場建設現場

朝礼風景
安全作業注意

撮影日
2016年6月7日

浄水場建設現場

コンテナ・重機
搬入

撮影日
2016年5月30日

浄水場建設現場

コンテナ

貨物積み下ろし

撮影日
2016年5月30日

浄水場建設現場

装置設置箇所
位置決め墨だし

撮影日
2016年6月1日

浄水場建設現場

ろ過装置搬入作業

撮影日
2016年6月1日

浄水場建設現場

積荷数量確認

撮影日
2016年6月1日

浄水場建設現場

機材搬入・据付

撮影日
2016年6月2日

浄水場建設現場

大型装置据付完了

撮影日
2016年6月2日

浄水場建設現場

配管接続作業

撮影日
2016年6月13日

浄水場建設現場

配管溶接・接続作業

撮影日
2016年6月10日

浄水場建設現場

レベル計設置作業

撮影日
2016年6月17日

浄水場建設現場

電気配線作業

撮影日
2016年6月8日

浄水場建設現場

ｹﾐｶﾙｱﾝｶｰ打設

撮影日
2016年6月3日

浄水場建設現場

電気配線作業

撮影日
2016年6月15日

浄水場建設現場

浄水装置設置完了

撮影日
2016年6月15日

浄水場建設現場

浄水装置設置完了

撮影日
2016年6月15日

資料5-2　現地試運転写真

浄水場建設現場

電機操作盤
受電確認

撮影日
2016年6月20日

浄水場建設現場

原動機
回転方向確認

撮影日
2016年6月20日

浄水場建設現場

薬注ポンプ

薬注量の計量

撮影日
2016年7月4日

浄水場建設現場

砂ろ過装置

自動弁単位操作確認

撮影日
2016年6月21日

浄水場建設現場

電機操作盤

制御機能確認

撮影日
2016年7月4日

浄水場建設現場

水質測定

撮影日
2016年6月20日

浄水場建設現場

水槽

左:原水槽

右:砂ろ過
処理水槽

撮影日
2016年7月4日

浄水場建設現場

下向流ｱｸﾃｨﾌｧｲﾊﾞｰ

洗浄排水ドレイン

撮影日
2016年7月4日

資料5-3

平成26年度普及実証事業

パクサン市浄水装置
試運転完了時装置状況

浄水場建設現場

制御盤

撮影日
2016年9月30日

浄水場建設現場

ポンプユニット

撮影日
2016年9月30日

浄水場建設現場

上向流
アクティファイバーろ過装置

UA-1,2

撮影日
2016年9月30日

浄水場建設現場

下向流
アクティファイバーろ過装置

AF-1

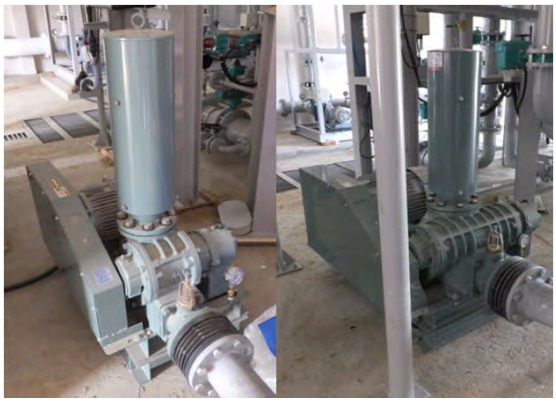
撮影日
2016年9月30日

浄水場建設現場

砂ろ過装置

SF-1

撮影日
2016年9月30日



浄水場建設現場

ブロワ
左:BU-101
右:BU-201

撮影日
2016年9月30日

浄水場建設現場

溶解タンク
左:硫酸バンド用
右:殺菌剤用

撮影日
2016年9月30日

浄水場建設現場

薬液注入ポンプ
貯留タンク

撮影日
2016年9月30日

ラオス人民民主共和国　スモール･タウン水道事業
高濁度原水対応型浄水装置

資料6-1

指導内容記録リスト

①	②	③	④
⑤			

※当月実施分は太枠にて表示

① 技術指導年月
② 認定（Joi Xaybuonmy）
③ 認定（Phouthong Vongphachan）
④ 認定（Airnoy Panyanouvong）
⑤ 内容

指導期間		指導概要
2016年10月度	9月29日～10月7日	自動運転の方法、薬品の補充要領（溶解、移送）、各モニタリング項目記録方法、停電後の復帰方法
2016年11月度	11月15日～11月17日	P&ID理解、タッチパネル操作方法、各測定値記録要領再確認
2016年12月度	12月19日～12月23日	電流値･絶縁抵抗値の測定方法、分析機器の校正方法の確認
2017年1月度	1月24日～1月27日	電動機過負荷時のリセット操作、ろ過装置各工程の機器動作、各計器設置場所･指示値読取方法
2017年2月度	2月20日～2月24日	pH計（DCCa、DACa、ラボ用測定器）の校正および点検方法の確認
2017年3月度	3月20日～3月24日	各工程の適正流量理解および流量調整方法、薬注ポンプ手動操作および検量方法
2017年4月度	4月24日～4月28日	警報（計装空気圧力低下）発生理由と対処方法、沈砂槽水抜きおよび清掃方法
2017年5月度	5月22日～5月26日	水質（処理水濁度）異常時の対処方法、各水位設定点での機器動作
2017年6月度	6月22日～6月28日	警報（電動弁異常）発生理由と対処方法、凝集試験方法、貯槽内塩素濃度確認方法
2017年7月度	7月23日～7月28日	水位･水質異常時の対処方法、タッチパネルによる薬注率変更方法、圧力計ゼロ点確認
2017年8月度	8月23日～8月28日	計測機器のメンテナンス･校正方法の確認および説明、異常時の動作確認および指導
2017年9月度	9月22日～9月28日	年次点検項目説明、マニュアル引き渡しと概要説明、タッチパネル故障時の対処方法説明

A 装置全体

技　能　内　容　（認定欄には、A:完全に出来る、B:一部可能　とし、出来ない項目には何も記入しない）

	装置全体	電気関係	制御盤①	制御盤②	タッチパネル①	タッチパネル②	タッチパネル③	ペーパーレスレコーダ	警報対処	
1	16.10 A A A 処理フロー（取水から送水までの流れ）を理解している	16.10 A A A 電力量計の指示値が読み取れる	16.10 A A A 盤面の電圧計で電源電圧の確認ができる	16.10 A A A 各電動機の定格電流値をサーマルリレーにセットできる	16.10 A A A FLOW画面にて、各機器の動作状態および各測定値が確認できる	16.11 A A A SETTING画面にてテストモードによる測定値模擬入力ができる	16.10 A A A ALARM画面にて警報の確認とリセット操作ができる	16.10 A A A 各画面の表示内容を理解している	17.7 B B B 水位異常時の対処方法を理解している	
2	16.11 A A A P&IDを理解している（機番により該当機器を特定できる）	17.1 A A A テスタを用いて各所の電圧を測定できる	16.10 B B B 盤内機器の概要を把握している	17.1 A A A サーマルリレーのリセット操作ができる	16.10 A A A OPERATION画面にて各機器の手動運転操作ができる	16.11 A A A SETTING画面にて各設定項目の設定変更ができる （値はトーケミ指示）	16.10 A A A ALARM HISTORY画面にて警報の履歴を確認できる	16.10 A A A 過去の時刻のデータが読み出せる	17.5 A A A 水質異常時の対処方法を理解している (検量・注入率変更)	
3	17.5 A B A 各水位での機器動作を理解している	17.02 A A A クランプメータを用いて電流値を測定できる	17.7 B B B 電源系統を把握している（主回路図にて）		16.10 A A A OPERATION画面にて各自動弁の手動開閉操作ができる	16.11 A A A CHEMICAL SETTING画面にて各設定項目の設定変更ができる （値はトーケミ指示）	16.10 A A A RUNNING HISTORY画面にて各装置の工程履歴を確認できる	16.10 A A A 記録データをUSBメモリにバックアップできる	17.04 B B B 機器異常時の対処方法を理解している	
4	17.5 B B B 各水位での警報動作を理解している	16.12 B 絶縁抵抗計を用いて、各電動機の絶縁抵抗を測定できる	16.10 A A 各ブレーカ・UPS操作により電源ONできる。		16.10 A A A OPERATION画面にて各機器の自動運転操作ができる	17.7 B B B SETTING画面にて各設定項目を理解し、状況に応じ設定変更できる	16.10 A A A MOTOR RUNNING TIME画面にて各機器の運転積算時間が確認できる	16.10 A A A 記録データをPCの所定の場所に保存できる	16.10 A A A 停電時の対処方法を理解している	
5	17.7 B B B 各警報の内容を理解している		16.10 A A 各ブレーカ・UPS操作により電源OFFできる。		16.10 A A A PROCESS画面にて各装置の自動運転操作ができる	17.04 A A A CHEMICAL SETTING画面にて各設定項目を理解し、水質に応じ設定変更できる	16.11 A A A 指定したタッチパネル画面を撮影し、メールにて送信できる			
6	17.1 A A 長期停止操作ができる。（槽の水抜き等）		16.10 A A 各機器を自動にし、装置の自動運転ON/OFFができる		16.11 A A A PROCESS画面にて各装置の強制洗浄操作ができる					

B 各機器

技　能　内　容　（認定欄には、A:完全に出来る、B:一部可能　とし、出来ない項目には何も記入しない）

	UA	AF	SF	渦巻ポンプ	ブロワ	薬注ポンプ	撹拌機	手動弁	自動弁	コンプレッサ
1	17.1 A A A	17.1 A A A	17.1 A A A	16.10 A A A	17.1 A A A	17.3 A A A	16.10 A A A	16.10 A A A	17.9 A A A	16.10 A A A
	装置の概要を理解している（各工程の機器動作）	装置の概要を理解している（各工程の機器動作）	装置の概要を理解している（各工程の機器動作）	空運転不可を理解している	点検項目を理解し点検できる	ポンプ本体の設定変更ができる(Analog⇔Manual)	空転不可を理解している	各手動弁について開操作、閉操作ができる	手動運転操作により開閉動作の確認ができる	タンクの水抜き作業ができる
2	17.3 A A A	17.3 A A A	17.3 A A A	16.10 A A A		17.3 A A A	17.8 A A A			17.8 A A A
	各工程での適正な流量を理解している（-0～+5%）	各工程での適正な流量を理解している（-0～+5%）	各工程での適正な流量を理解している（-0～+5%）	呼び水（エア抜き）方法	消耗品の交換ができる	ポンプ本体の手動操作ができる（MANUAL MODE）	点検項目を理解し点検できる			点検項目を理解し点検できる
3	17.3 A A A	17.3 A A A	17.3 A A A	17.1 A A A		17.3 A A A				
	各工程での流量を調整できる	各工程での流量を調整できる	各工程での流量を調整できる	グランドパッキンからの適正漏れ量を理解し調整できる		検量できる（QUICK PRIMINGによる）				
4	17.9 B B B	17.9 B B B	17.9 B B B	17.8 A A A		17.5 A A A				
	点検項目を理解し点検できる	点検項目を理解し点検できる	点検項目を理解し点検できる	点検項目を理解し点検できる		メンテ時の液抜き作業ができる				
5						17.9 A A A				
				消耗品の交換ができる		消耗品の交換ができる				
6						17.9 A A A				
						分解清掃ができる				

C 計装品

技　能　内　容　（認定欄には、A:完全に出来る、B:一部可能　とし、出来ない項目には何も記入しない）

	原水濁度計				その他濁度計（プロミネント製）				pH計（DCCa）				pH計（DACa）				残留塩素計（DACa）				電磁流量計（原水・処理水）				レベルセンサ（キーエンス製）				圧力センサ				オリフィス式流量計				圧力計			
1	16.10	A	A	A	16.10	A	A	A	16.10	A	A	A	16.10	A	A	A	16.10	A	A	A	17.3	A	A	A	17.1	A	A	A	17.1	A	A	A	16.10	A	A	A	16.10	A	A	A
	本体にて現在値が読み取れる				本体にて現在値が読み取れる				本体にて現在値が読み取れる				本体にて現在値が読み取れる				本体にて現在値が読み取れる				本体にて現在値が読み取れる				本体にて現在値が読み取れる				現在値が読み取れる				現在値が読み取れる				現在値が読み取れる			
2	17.8	B	B	B	17.8	B	B	B	17.06	A	A	B	17.06	B	A	B	17.04	B	A	B	17.08	B	B	B	17.1	A	A	A					17.02	A	A	A	16.12	A	A	A
	校正ができる				校正ができる				校正ができる				校正ができる				校正ができる				設定変更ができる				スタビリティを確認できる								エア抜きができる				ゼロ点確認ができる			
3	17.8	B	B	B	17.8	B	B	B	17.06	A	A	B	17.02	B	B	B	17.8	B	B	B													17.02	A	A	A				
	点検ができる				点検ができる				点検ができる				点検ができる				点検ができる																清掃ができる							
4	17.08	B	B	B	17.04	B	B	B	17.06	B	B	B	17.08	B	B	B	17.08	B	B	B																				
	消耗品の交換ができる				消耗品の交換ができる				消耗品の交換ができる				消耗品の交換ができる				消耗品の交換ができる																							
5	17.08	B	B	B	17.08	B	B	B	17.08	B	B	B	17.08	B	B	B	17.08	B	B	B																				
	設定変更ができる				設定変更ができる				設定変更ができる				設定変更ができる				設定変更ができる																							
6																																								

D 水質測定･維持管理

技　能　内　容　（認定欄には、A:完全に出来る、B:一部可能　とし、出来ない項目には何も記入しない）

	分析（ラボ用測定器にて）	薬品溶解	日々のデータ取り	日常の点検項目	月次点検項目	年次点検項目	沈砂槽排泥（水槽水抜き）	ろ過材交換方法（UA）	ろ過材交換方法（AF）	ろ過材交換方法（SF）
1	16.10 A A A 濁度を測定できる	16.10 A A A 使用薬品について理解している（性状、危険性等）	16.10 A A A リストにより点検項目を理解している	16.10 A A A リストにより記録項目を理解している	16.11 A A A リストにより点検項目を理解している	17.9 B B B リストにより点検項目を理解している	17.04 B A A 沈砂槽の清掃方法を理解している	（トーケミ立会）	（トーケミ立会）	（トーケミ立会）
2	16.10 A A A pH値を測定できる	16.10 A A A 薬品取扱い時の注意点を理解している（保護具着用等）	16.10 A A A 記録用紙に各データを記録できる	17.1 A A A 点検内容を記録できる	17.5 A A A 点検内容を記録できる	17.9 B B B 点検内容を記録できる	16.10 A A A 各水槽の水抜き方法を理解している			
3	16.10 A A A 残留塩素濃度を測定できる	16.10 A A A 薬品溶解方法を理解している（薬品量、希釈水量）	16.10 A A A 各データをPC（エクセル）に記録できる				17.1 A A A 水抜き後の復旧方法を理解している			
4	16.12 B 濁度計の校正ができる	16.10 A A A 溶解した薬品の移送方法を理解している								
5	17.02 A A pH計の校正ができる	16.10 A A A 薬注設備操作盤について理解している（操作方法）								
6	17.06 B B B 殺菌剤貯槽内の塩素濃度を測定できる	16.11 A A A Y形ストレーナの清掃方法を理解している								

平成26年度普及実証事業(ラオス)

事業活動終了3ヵ月後のフォローアップ

資料6-2

撮影日:2017/12/05～12/07

	日常点検時 の様子		日常点検時 の様子
	日常点検内容の 確認の様子		薬注ポンプ部品 交換方法指導の様子
	設備の風景		設備内の風景

資料7-1

LAO PEOPLE'S DEMOCRATIC REPUBLIC

Peace Independence Democracy Unity Prosperity

To JICA

TOHKEMY Corporation

This is the announcement to inform you that we have started to provide clear water to Paksan citizen. It's appreciated to have your continue corporation.

Project name

Verification Survey with the Private Sector for Disseminating Japanese Technologies of Water Purification System for Highly Turbid Water for Use in Small Town Water Supply

Product setting place

Thong Village, Paksan District, Bolikhamxay province, Lao PRD

Quantity

1,000 m3 per day

Date of start providing

October 3rd 2016

Bolikhamxay, October 7th 2016

Mr.Vilaykhone Phimmasone

Managing Director NamPapa State -ownedEnterprises (NPSE)-Bolikhamxay

資料7-2

初期試験のモニタリングデータ

2016.10.20

日付	天候	浄水設備運転時間 (h)	原水取水量 (UA通水量) (m^3)	浄水送水量		送水ポンプ運転時間※3 (h)	取水原水濁度 (NTU)			前処理 (UA処理水) 濁度 (NTU)			浄水 (SF-1処理水) 濁度 (NTU)			原水取水 (UA原水) 水温 (℃)			UA原水pH			浄水 (SF-1処理水) pH			浄水 (SF-1処理水) 遊離残留塩素濃度 (mg/L)		
				実送水量※1 (m^3)	送水能力※2 (m^3/日)		最大値	最小値	平均値	最大値	最小値	平均値	最大値	最小値	平均値	最大値	最小値	平均値	最大値	最小値	平均値	最大値	最小値	平均値	最大値	最小値	平均値
2016/10/3	晴れ	14.0	780.7	587.0	1223.6	11.0	550.0	190.0	324.8	495.0	3.0	35.3	2.60	<0.1	<0.1	26.7	26.1	26.4	7.13	6.68	6.79	7.08	6.54	7.00	1.92	0.04	0.67
2016/10/4	晴れ	24.0	1038.8	902.3	1222.0	17.0	371.0	141.0	226.2	235.0	2.0	55.7	2.80	<0.1	0.32	26.8	25.6	26.2	7.45	6.76	7.06	7.31	7.04	7.16	2.00	0.17	0.68
2016/10/5	晴れ	24.0	1022.6	740.3	1213.3	14.0	410.0	113.0	211.3	258.0	19.0	73.5	2.60	<0.1	0.14	27.0	26.2	26.7	7.47	7.09	7.22	7.44	7.08	7.29	2.00	0.13	0.63
2016/10/6	晴れ	24.0	1111.5	877.0	1226.2	16.5	369.0	120.0	245.2	303.0	17.0	59.0	2.90	<0.1	0.51	27.0	26.2	26.7	7.50	6.99	7.19	7.46	7.19	7.32	1.92	0.52	0.67
2016/10/7	晴れ	24.0	1106.6	842.3	1224.8	15.8	422.0	126.0	260.6	250.0	5.0	62.3	2.80	<0.1	<0.1	26.9	26.0	26.5	7.21	7.10	7.16	7.38	7.05	7.17	1.96	0.20	0.62

【注記】

※1 浄水送水量の実送水量は、高架水槽へ送水された浄水の総量を表す。

※2 浄水送水量の送水能力は、実送水量と送水ポンプ運転時間から算出した値。SF-1（砂ろ過）の逆洗時間を除いた23時間/日で送水ポンプが送水可能な最大送水量の推定量を表す。

※3 送水ポンプ運転時間は、送水ポンプが運転し、高架水槽へ浄水を送水した時間を表す。

1

WORKING REPORT

Date		Mon Tue Wed Thu Fri Sat Sun	Name	
Weather		Temperature ℃ (time)		

Analysis of the quality of the water (Sampling)

※T.P.＝Touch panel

No.	Water intake point	Filtration time (T.P.)	Sampling time	Turbidity (NTU)		pH (temp.)			Chlorine (mg/L)		Remarks
				Analysis	Indicator	Analysis		Indicator	Analysis	Indicator	
1	Raw Water						℃				
2	UA raw water						℃				
3	UA treated water						℃				
4	AF raw water						℃				
5	AF treated water						℃				
6	SF inlet water						℃				
7	SF treated water						℃				
8	Treated water						℃				
9	Water to supply						℃				

Washing Count (Touch panel／PROCESS)

									Time	
1	UA-1		2	UA-2		3	AF		4	SF	

Check of the Equipment

No.	Item	Judgment	Comment (Remarks)
1	Control panel		
2	Pumps		
3	Chemical pumps		
4	Chemical tanks		
5	Water leak		
6	Others		
7			
8			
9			
10			

Comment

資料7-3

2.1 ELECTRIC POWER METER／INDICATOR

Date	ELECTRIC POWER METER		SUPPLY VOLTAGE				INDICATOR／Touch panel															
							Time	TUIRA	TUICRA	TUIRA	TUIRA	FIQRA 101		FIQRA 401		PHICRA	PHICRA	CLICRA	THIR	PIRA	PIRA	PIRA
	Time	kWh	Time	R-S	S-T	R-T		101	102	201	301					101	301	301	101	101	211	311
				V	V	V		NTU	NTU	NTU	NTU	m^3/h	m^3	m^3/h	m^3	-	-	mg /L	℃	MPa	MPa	MPa

2.2 MOTOR RUNNING

Date	【CUMULATIVE (hour) 】MOTOR RUNNING／Touch panel																												
	Time	PU001	PU002	PU101	PU102	PU103	PU104	PU201	PU202	PU221	PU301	PU302	PU321	PU401	PU402	BU101	BU201	C101	DP101	DP102	DP103	DP201	DP202	DP203	DP204	DP301	DP302	DP303	DP401

資料7-3

2.3 INDICATOR／Local

Date	INDICATOR／Local											CHEMICAL TANK LEVEL						
	Time	PG 111	PG 112	PG 121	PG 122	PG 212	PG 312	FI 211	FI 212	FI 311	FI 312	Time	T 100	T 101	T 200	T 201	T 301	T 401
		MPa	MPa	MPa	MPa	MPa	MPa	m^3/h	m^3/h	m^3/h	m^3/h		L	L	L	L	L	L

資料7-3

5 DISSOLUTION and TRANSPORTATON of the ALUMINUM SULFATE

T-100 ALUMINUM SULFATE DISSOLVING TANK						Transport	T-101 ALUMINUM SULFATE STORAGE TANK					T-100
DATE	TIME	Before A（L）	ALUMINUM SULFATE B（kg）	TIME	After C（L）	T-100 ↓ T-101	DATE	TIME	Before D（L）	TIME	After E（L）	After F（L）
						⇒						
						⇒						
						⇒						
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						⇒						

資料7-3

6 DISSOLUTION and TRANSPORTATON of the DISINFECTAT (Chlorine)

T-200 DISINFECTAT DISSOLVING TANK						Transport	T-201 DISINFECTAT STORAGE TANK					T-200
DATE	TIME	Before A (L)	DISINFECTAT B (kg)	TIME	After C (L)	T-200 ↓ T-201	DATE	TIME	Before D (L)	TIME	After E (L)	After F (L)
						⇒						
						⇒						
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平成26年度普及実証事業

資料7-4

パクサン市浄水装置
現地適合性検証モニタリング

浄水場建設現場

装置運転状況確認

撮影日
2016年10月5日

浄水場建設現場

薬注量検定

撮影日
2016年10月5日

浄水場建設現場

水質分析

撮影日
2016年10月3日

浄水場建設現場

薬品溶解

撮影日
2016年10月5日

浄水場建設現場

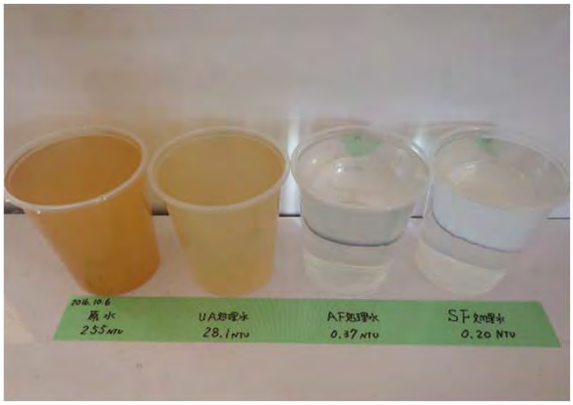
高架水槽出口水
サンプリング

撮影日
2016年10月3日

浄水場建設現場

高架水槽出口濁度

撮影日
2016年10月3日



浄水場建設現場

左より
原水
UA処理水
AF処理水
砂ろ過処理水

撮影日
2016年10月6日

浄水場建設現場

記録データの
抜き取り

撮影日
2016年10月7日

平成26年度普及実証事業

資料8-1

京都水道展製品展示状況写真

2016/11/9-11

<table>
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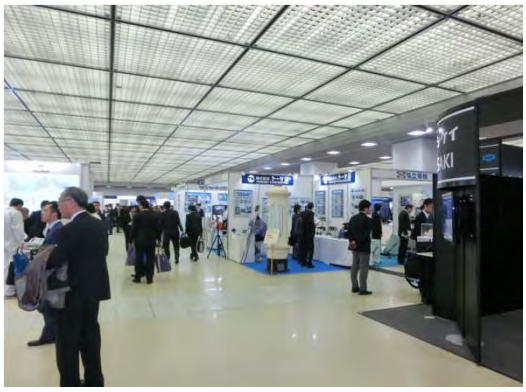
<td>京都水道展会場

京都みやこめっせ

撮影日
2016年11月9日</td>
<td>  </td>
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撮影日
2016年11月9日</td>
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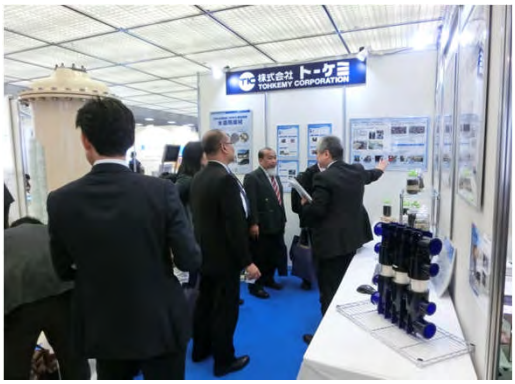
トーケミ　ブース
製品･事業説明状況

撮影日
2016年11月9日</td>
<td> 
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トーケミ　ブース
製品･事業説明状況

撮影日
2016年11月9日</td>
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資料8-2

平成26年度普及実証事業

第4回JICA技術プロジェクトMaWaSu国際セミナーパネル展示状況写真

2016年11月16-18日

	会場 撮影日 2016年11月17日		セミナー開会式 撮影日 2016年11月16日
	パネル展示場所① 撮影日 2016年11月16日		パネル展示場所② 撮影日 2016年11月16日
	パネル展示場所③ 撮影日 2016年11月16日		パネル展示　説明状況 撮影日 2016年11月16日

平成26年度普及実証事業

資料8-3

パクサン市浄水装置設置　オープニングセレモニー・現地説明会　写真

2017年1月

	オープニング セレモニー テープカット 撮影日 2017年1月31日		オープニング セレモニー 儀式 撮影日 2017年1月31日
	オープニング セレモニー 感謝状贈呈 撮影日 2017年1月31日		オープニング セレモニー (スピーカー) 在ラオス日本大使館 引原大使 撮影日 2017年1月31日
	オープニング セレモニー 装置見学・説明会 撮影日 2017年1月31日		オープニング セレモニー 装置見学・説明会 撮影日 2017年1月31日
	オープニング セレモニー 装置見学・説明会 右：ポリカムサイ県知事 中央：引原大使 撮影日 2017年1月31日		オープニング セレモニー 装置見学・説明会 撮影日 2017年1月31日

資料 8-4

Water supply yet to reach remote districts

Khonesavanh Latsaphao

Many districts around the country don't yet have access to municipal water supplies, an official has said, adding that it is only the smaller and more remote districts that have yet to receive water supplies.

Director General of the Water Department, Mr Phomma Veolavanh, told *Vientiane Times* on Wednesday that there are about 20 of these smaller district out of 147 districts across the Country.

Most of these do not have access to clean water supplies and are in Luang Prabang, Vientiane, Savannakhet and Champassak provinces.

The government set a target during the 10th Party Congress last year for 80 percent of households to have access to clean water by 2020, and 90 percent by 2030.

"The water access that we are targeting is clean water from municipal water supplies, known as Nampapa," he said.

Currently, clean water from the Nampapa system is available to about 68 percent of households nationwide.

A plan drawn up by the Ministry Health called for at least

CONTINUED PAGE 2

Water supply yet... FROM PAGE 1

85 percent of households to have access to clean water supplies in 2015, and more than 95 percent by 2030. Mr Phomma said the Ministry of Health includes household water sources such as artesian wells and well water but noted that well water may not necessarily be clean.

The Water Department was established a year ago under the Ministry of Public Works and Transport, following the 10th Party Congress resolution adopted last year that required the government to ensure that 80 percent of households throughout the country would have access to the Nampapa system by 2020.

Water supply operators are working hard to provide access to clean water for many households in these 20 small districts, and it is anticipated that this will reach most homes by 2020.

It is estimated that in 2016 some 300,000 cubic metres of water was available for residents in Vientiane each day.

At the end of last year, the Prime Minister's Office ordered a freeze on water charge increases in Vientiane and put the matter forward for further consideration.

The impending 4 percent price rise that was set to take place earlier this year was suspended.

This followed Nampapa Nakhoneluang proclaiming a new fee structure for household water usage on December 8, which was to have come into effect in Vientiane last month.

The Vientiane Water Supply Company (Nampapa Nakhoneluang) said the Prime Minister's Office had ordered a suspension of water fee increases in the capital.

VTE Times 2017 年 2 月 2 日

ເປີດໃຊ້ໂຮງງານຜະລິດນ້ຳປະປາ ທີ່ບ້ານຄຳໄຊ

ລາວເງິນຕາຕ່າງປະເທດ ມາດຕາທີ 49 ມາດຕະການປ່ຽນໃໝ

ໃຫ້ມູນເງິນຕາ ຫຼື ສະກຸນທີ່ບໍ່ມີການຫ້ຽວຍ້ອງທີ່ບໍ່ຖືກຕ້ອງຕາມລະບຽບການ ຈະຖືກປ່ຽນໃໝ ຫ້າລ້ານ (5.000.000) ກີບຕໍ່ຄັ້ງ

Distribute through out the country

Socio-Economic Newspaper 2017 年 2 月 3 日

ເປີດນຳໃຊ້ໂຮງງານຜະລິດນ້ຳປະປາຢູ່ບ້ານທົ່ງ ຢ່າງເປັນທາງການ

ລາວ: ສີເອດ

ມີພິທີເປີດນຳໃຊ້ໂຄງການກໍ່ສ້າງໂຮງງານນ້ຳປະປາ ຢູ່ບ້ານທົ່ງ ເມືອງປາກຊັນ ແຂວງບໍ່ລິຄຳໄຊ. ໄດ້ຈັດຂຶ້ນໃນວັນທີ 31 ມີງກອນຜ່ານມານີ້, ໂດຍໃຫ້ກຽດເຂົ້າຮ່ວມຂອງ ທ່ານ ປອ ກອງແກ້ວ ໄຊສົງຄາມ ເຈົ້າແຂວງບໍ່ລິຄຳໄຊ, ທ່ານ ວຽງສະໝັດ ມີພັນດອນ ຮອງລັດຖະມົນຕີກະຊວງໂຍທາທິການ ແລະ ຂົນສົ່ງ, ທ່ານ ຄຳໃຈ ສາທານີ ເອກອັກຄະລັດຖະທູດຜູ້ຢຸ່ນ ປະຈຳ ສປປ ລາວ, ມີພັນດາຫົວໜ້າ, ຮອງຫົວໜ້າກົມ ຈາກກະຊວງໂຍທາທິການ ແລະ ຂົນສົ່ງ, ບໍລິສັດ, ພະແນກການ, ຫ້ອງການ, ເມືອງ ແລະ ແຂວງ ອ້ອມຂ້າງເຂົ້າຮ່ວມ.

ອ້ານຕໍ່ໜ້າ 6

ボリカムサイ新聞　2017 年 2 月 6 日

The new water treatment plant in Thong village, Pakxan district, Borikhamxay province.

New water treatment plant opens in Borikhamxay

Times Reporters

Borikhamxay provincial authority last week opened a new water treatment plant in Thong village, Pakxan district.

The plant supplies 1,000m3 of drinking water per day, equivalent to the needs of 6,600 people, with the water sourced from the Nam Ngiep River.

The plant was built as one of the Japanese Economic Assistance projects of the Japan International Cooperation Agency (JICA) under a proposal by Team Tohkemy (consisting of Tohkemy Corporation as a representative, Pacific Consultants Co., Ltd. as a consultant, and Lapon Company Limited as a local partner). It purifies highly turbid local river water to a level that meets the Japanese Drinking Water Standard.

The project was initiated by an agreement in May 2015 between the Department of Housing and Urban Planning, the Ministry of Public Works and Transport, and JICA.

The Lao side built the plant, water tanks and pipes, while the Japanese side designed and manufactured water treatment apparatus. Lao and Japanese collaboration enabled the project to successfully supply drinking water in a very short period of time.

The government has set a goal to supply piped water to 80 percent of urban communities nationwide by 2020. In 2014, only 67 percent of households had access to piped water. This is required to support economic growth, urbanisation and population increases as well as the reduction of regional disparities.

Given the reduced quality of underground water resources in urban areas, it has become a challenge to produce a stable drinking water supply at a reasonable cost by purifying surface water such as that from the Mekong River with high turbidity in the rainy season.

Team Tohkemy expressed their willingness to help boost the supply of drinking water by focusing on medium and small-sized drinking water supplies for small towns and suburban areas.

The introduction of the new plant in Pakxan district has increased the drinking water supply ratio from 69 percent to 89 percent.

The Ambassador of Japan to Laos Mr Takeshi Hikihara said "Japan is supporting the supply of safe water together with the Lao government. It is pleasing that Japanese technology is effectively used for the people of Laos and that Japan's Official Development Assistance is playing a very important role in the social and economic development of Laos."

The water treatment facility is scheduled to be donated by JICA to Borikhamxay province upon the transfer of operational know-how to the Borikhamxay Waterworks Bureau through a joint one year operation by Team Tohkemy and the Bureau.

VTE Times 2017 年 2 月 6 日

ວັນທີ 30/03/2017

ໜ້າ ๑๐

ໜັກໃນໂຮຊິກຫປັບປຸງປ໋ະອາກອງບໍລິສັດ ໂທເກມີ (Tohkemy) ຈາກປະເທດຍີ່ປຸ່ນ

Clean water tech among solutions as Japan's Small and Medium Enterprises join Lao partners in inclusive development drive

The water treatment system implemented by Tokenny.

Clean water's ability to dissolve development barriers and release untold potential has made its management and supply a keystone in the development of prosperous and healthy urban communities worldwide. Now progress is flowing freely in the form of regular supplies of fresh, clean water to quench the growing thirst of the population of a rapidly expanding urban growth area of Paksan in the Southeast Asian nation of Laos.

This is being achieved together with the technology and expertise of Japanese small and medium enterprise (SME) Tokkenny, one of several from Japan busy working with local partners in meeting the challenges and opportunities presented by the fast-developing country. They have been assisted to do so with the support of the government and people of Japan and the Japan International Cooperation Agency (JICA) via the Verification Survey for Highly Turbid Water for use in Small Town Water Supply.

In the case of Tokkenny, expertise in water treatment systems and technologies developed over more than five decades has seen it make the separation of clean and sufficient tap water supplies a reality for the rapidly expanding urban area in Borikhamxay province some 150 kilometres from the national capital. Traversed by numerous rivers that rise along its mountainous spine before running varying degrees south and westward to meet the Mekong, Laos is a country blessed with ample water resources when compared to many. Yet these resources are unevenly distributed and seasonally-affected in terms of quality and quantity. As elsewhere, communities in the countryside have generally sprung up close in proximity to nearby rivers, sources of much from sustenance to transport to a venue for bathing and the household laundry. Meanwhile, topography renders some land with seasonal abundance to the point of being flood prone, while others located at higher elevations or less favourable geology usually the first to feel the effects of shortages and drought. The varying conditions mean water from rivers and reservoirs range widely in terms of suspended matter, in many cases making treatment and supply a challenging business. Such river water resources are further supplemented by natural groundwater wells and springs, some that also experience high turbidity.

Located in Paksan district, the neighbourhood of Thong Ngoi and surrounds is no exception. In the past decade the extant water treatment capacity has become increasingly inadequate to provide for an expanding population. On too many days precious little water flowed from taps with a pre-existing treatment plant not designed to responding to rising demand in what has been identified as a key urban growth area. The problem peaked during periods of high usage such as the annual dry season months, with temperatures sending demand spiking as seasonal flows of river water slow. That in turn has led to a necessity of over-reliance upon groundwater wells that for much of the year produces cloudy, highly turbid water ill-fitted for household purposes such as cleaning and washing (much less drinking). Yet thanks to expertise, its local partnerships and support from Japan, Tokkenny has been able to provide a full and working model facility with an output of 1000 cubic metres of clean water to supply households and businesses daily. In doing so it is seeking to ease the supply of water to reduce the burden on both household and business, and particularly on the women-folk upon whom responsibility for household chores remains heaviest.

Meanwhile, clean tap water on demand makes washing and household chores easier and frees up time and effort now being put to better use in pursuit of more profitable activities in support of lives and livelihoods. This is made possible by the filtration systems installed by Tokkenny, developed over more than five decades since the company's establishment. The company produces filter equipment and media in systems as well as liquid devices such as pumps as well as various water treatment units. Tokkenny Senior Managing Director Takuya Hosotani said the company's systems were being used by a multitude of clients in Japan from manufacturers and corporate clients. The company's systems typically help clients save money and local environment by filtering and cleaning wastewater to reduce pollution and water usage in compliance with all local laws and regulations. With a little technical tweaking and innovative thinking, this same technology is now more than ready to be used to make cloudy surface water suitable for daily use in small towns in Laos, Mr Hosotani said. The company is hoping more small towns across rapidly urbanizing country will see the benefits of systems, increasing the global market for their technology while contributing to socio-economic development.

Among the biggest beneficiaries of the project that will see enhanced security for the area's water fresh supply secured for years to come is the local community of Thong Ngoi headed by Madame Khamman Phanyanouvong. Chief of the village which plays host to the new model facility as well as a mother to six and grandmother to five, Khamman warmly welcomes the arrival of the enhanced water supply and what it represents to daily life in the area. Speaking through an interpreter at the ceremony to hand over the system local authorities, she expressed appreciation for its installation that will see her own descendants spared much of the extraordinary time and effort hauling water as endured by herself and her ancestors over so many years.

"This village is located uphill, and it has been considered an area afflicted by drought," she says. "Whenever we made a well, we had to dig very deep and break through a layer of rock. In the driest and hottest months from February to May particularly we have had to spend a long time to collect enough water. The water we got from the water wells was not so clean and appeared milky. Now since construction of this facility villagers have been very happy because they have enough clean water for daily consumption and assist in cooking, it is very convenient. And when it comes to improving hygiene, it's much easier now to run a bath for my grandsons, for example. Before it took almost half a day to collect enough water for everything but now we can spare more time for more agricultural production or other activities."

"So on behalf of the village and local authority, we want to express sincere thanks to all especially the government and people of Japan for their continued support."

Lao and Japanese officials Governor of Borikhamxay Dr Kongsak Keysengkham (second from right) release balloons to celebrate the opening of the water treatment system.

VTE Times 2017 年 3 月 30 日

平成26年度普及実証事業

資料8-5

スモール・タウン水道事業向け高濁度対応型浄水装置の普及・実証事業

株式会社トーケミ

普及事業写真(2017年7月11-13日撮影)

会場

ラオ・プラザホテル

撮影日
2017年7月11日

受付

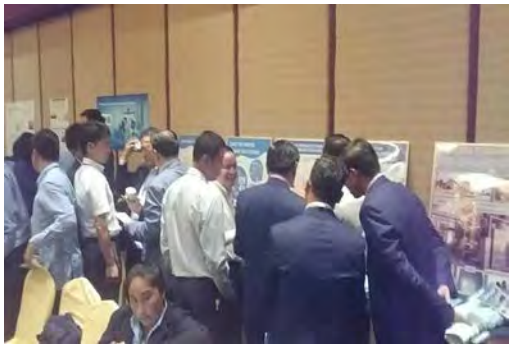
撮影日
2017年7月11日

会場風景

撮影日
2017年7月11日

会場風景

撮影日
2017年7月11日



会場

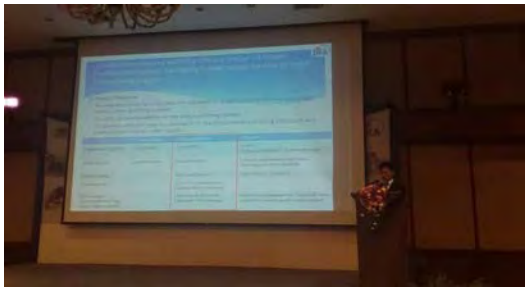
製品展示

撮影日
2017年7月12日

会場

製品展示

撮影日
2017年7月12日



会場

プレゼンテーション
トーケミ

撮影日
2017年7月13日

会場

プレゼンテーション
ｶｳﾝﾀｰﾊﾟｰﾄ

撮影日
2017年7月13日

平成26年度普及実証事業（ラオス）

県内水道関係者ワークショップ写真

資料8-6

撮影日：2017/09/27

ワークショップ風景

ワークショップ風景

ワークショップ風景

ヴィライコン局長からの挨拶

運転マニュアル引渡し

記念撮影

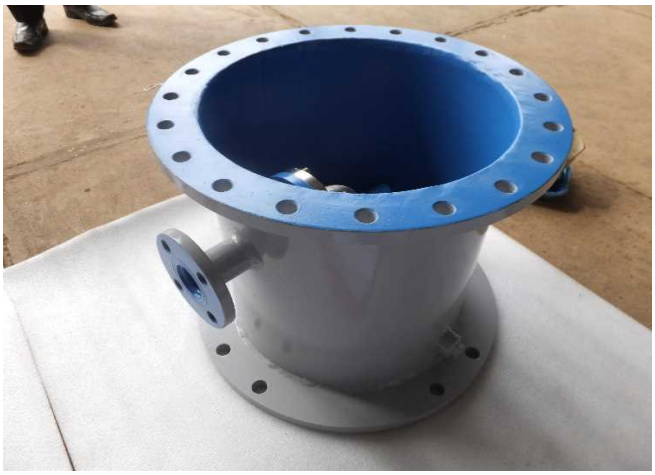
資料9-1

ラオス人民民主主義共和国

サワナケット県ホイムーン村向け ろ過塔 完成検査写真

撮影日:2017/03/27

完成品状況



塔下部

塔上部

構造確認

散水管/製作途中(ボルト穴振り分け具合悪い)

講評

資料9-2

ラオス人民民主主義共和国

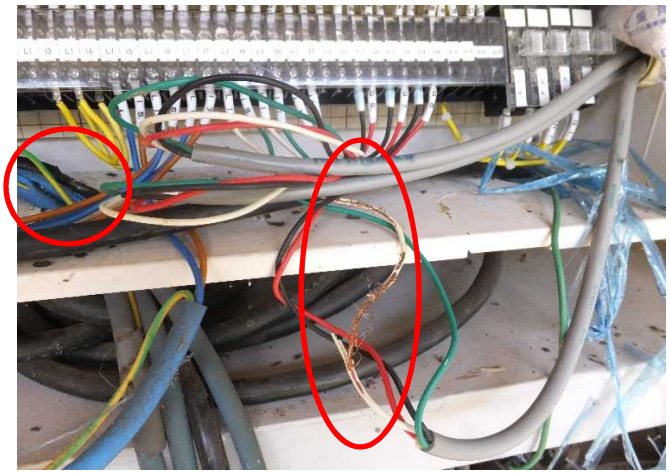
サワナケット県ホイムーン村 浄水設備 視察写真

撮影日：2017/03/25

装置保管状況

装置外観

装置各機器動作確認



電気配線被覆欠損状況

浄水設備施工状況①

浄水設備施工状況②（右下青いパイプが井戸）

資料10-1

ລາຍງານໂຄງການທົດລອງຕົວຈິງຂອງລະບົບກັນຕອງນ້ຳທີ່ສາມາດບຳບັດນ້ຳທີ່ມີຄວາມຂຸ່ນສູງ ສຳລັບຕົວເມືອງນ້ອຍຢູ່ ສປປລາວ

TOHKMEY CORPORATION

1 ໂຄງການສາທິດແລະສົ່ງເສີມ (JICA)

* ຈຸດປະສົງ
  * ສົ່ງເສີມໃຫ້ບໍລິສັດນ້ອຍແລະກາງ ນຳສະເໜີ ຜະລິດຕະພັນ ແລະ ເຕັກໂນໂລຊີ, ຍົກລະດັບເຕັກນິກ ໃຫ້ເໝາະສົມກັບບັນດາປະເທດທີ່ກຳລັງພັດທະນາ ເພື່ອໃຫ້ມີການນຳໃຊ້ຢ່າງກ້ວາງຂວາງ.
  * ອີງໃສ່ໂຄງການດັ່ງກ່າວ ບັນດາໂຄງການຂອງລັດຖະບານ ແລະໂຄງການຊ່ວຍເຫຼືອຕ່າງໆ ສາມາດນຳໃຊ້ ຜະລິດຕະພັນ ແລະ ເຕັກໂນໂລຊີ ຫລາຍຂຶ້ນ, ໂດຍການແຜ່ກະຈ່າຍ ຜະລິດຕະພັນ ແລະ ເຕັກໂນໂລຊີດັ່ງກ່າວ ຄຽງຄູ່ກັບການອອກສູ່ຕະຫຼາດສາກົນຂອງ ບໍລິສັດນ້ອຍ ແລະ ກາງ ສາມາດຊ່ວຍພັດທະນາເສດຖະກິດໃນເຂດພາກພື້ນນັ້ນໆ.

2 ໂຄງການສຳຫຼວດແລະສົ່ງເສີມລະບົບກັ່ນຕອງນ້ຳທີ່ມີຄວາມຂຸ່ນສູງ ສຳລັບທຸລະກິດນ້ຳປະປາຕົວເມືອງນ້ອຍ

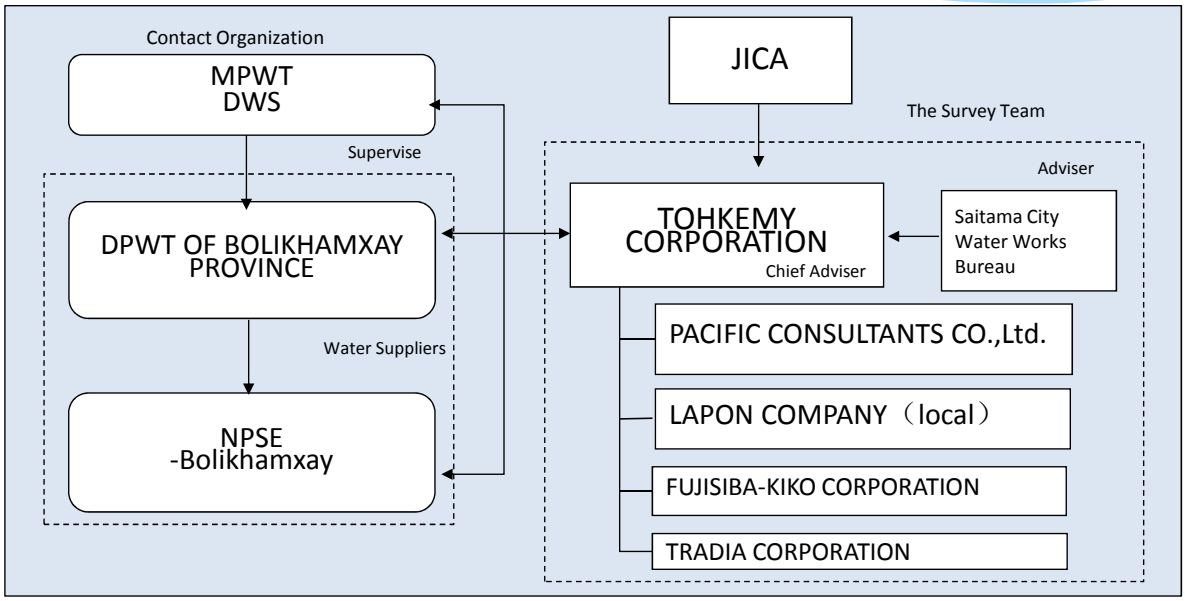
1)ຈຸດປະສົງຂອງໂຄງການ

* ນຳໃຊ້ລະບົບກັ່ນຕອງນ້ຳທີ່ມີຄວາມຂຸ່ນສູງເພື່ອປັບປຸງເຂົ້າເຖິງນ້ຳທີ່ປອດໄພຂອງປະຊາຊົນໃນເຂດສາມາດໃຫ້ດີຂຶ້ນ
* ການຍັ້ງຍືນລະບົບທີ່ເໝາະສົມກັບສະພາບຕົວຈິງ
* ກຳນົດແຜນຂະຫຍາຍ ເພື່ອປະກອບສ່ວນໃນວຽກງານການສະໜອງນ້ຳປະປາ

	ປະຈຸບັນ	ເປົ້າໝາຍປະສິດທິຜົນ	ເພີ່ມເຕີມ
ປະຊາກອນບໍລິການ	13,905ຄົນ (69%)	17,778ຄົນ (88%)	20,101ຄົນ ກ່າຍ80%ຂອງເປົ້າໝາຍລັດຖະບານ (ປີ2020)
ແຫຼ່ງນ້ຳ	ນ້ຳບາດານ	ແມ່ໜ້າດິນ	ບັນຫາເລື່ອງທາດຫີນປູນ ປະລິມານນ້ຳບໍ່ພຽງພໍ
ຄຸນນະພາບນ້ຳ		ຕ່ຳກ່ວາ 3NTU	ແຫລ່ງນ້ຳ ～3000NTU
ຕົ້ນທຶນການຜະລິດ		1/3ຂອງແບບທົ່ວໄປ	
ຍົກລະດັບພະນັກງານນ້ຳປະປາ		ຮຽນເຕັກນິກໃໝ່	ລະບົບແຫ່ກວາມຂຸ່ນອັດຕະໂນມັດ, ໃຊ້ພະນັກງານໃນການຄຸ້ມຄອງໜ້ອຍ

2 ໂຄງການສຳຫຼວດແລະສົ່ງເສີມລະບົບກັ່ນຕອງນ້ຳທີ່ມີຄວາມຂຸ່ນສູງ ສຳລັບທຸລະກິດນ້ຳປະປາຕົວເມືອງນ້ອຍ

2)ໂຄງຮ່າງການຈັດຕັ້ງການປະຕິບັດໂຄງການ



2 ໂຄງການສາທິດແລະສົ່ງເສີມລະບົບກັ່ນຕອງນ້ຳທີ່ມີຄວາມຂຸ່ນສູງ ສຳລັບທຸລະກິດນ້ຳປະປາຕົວເມືອງນ້ອຍ

3) ຂໍ້ມູນລວມຂອງລະບົບ

- ນຳໃຊ້ເຕັກໂນໂລຊີເສັ້ນໃຍ(FIBER)ຕອງນ້ຳຂຸ່ນສູງ ກັ່ນຕອງສິ່ງທີ່ເຮັດໃຫ້ນ້ຳຂຸ່ນ, ສາມາດກັ່ນຕອງນ້ຳທີ່ມີຄວາມຂຸ່ນຂົ້ນສູງໄດ້

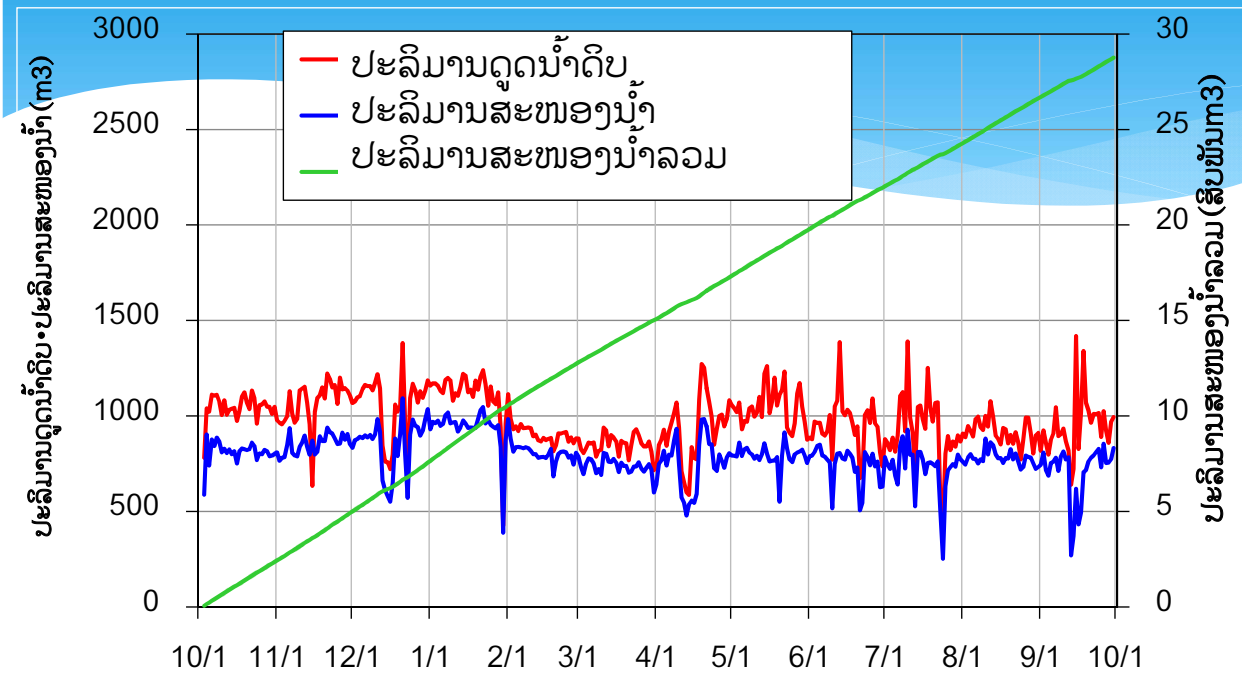
ລະບົບກັ່ນຕອງ	ເສັ້ນໃຍຕອງຄວາມຂຸ່ນສູງ＋ເສັ້ນໃຍຕອງຄວາມຂຸ່ນຕ່ຳ+ຕອງຊາຍ【ລະບົບຖັງຕອງ3ຂັ້ນ】
ຄຸ້ມຄອງຄຸນນະພາບນ້ຳ	pH ຄໍລິນ ຄວາມຂຸ່ນ
ນຳໃຊ້ຢາເຄມີ	ຫີນສົ້ມ, ຄໍລິນຝຸ່ນ

3. ປະຫວັດ(ແຕ່ການເຊັນສັນຍາ ເຖິງການກໍ່ສ້າງ)

- ເຊັນ MOU: 15 May 2015
- ເລີ່ມຜະລິດ: 20 Oct 2015
- ນຳເຂົ້າສະໜາມ : 30 May 2016
- ເລີ່ມສະໜອງນ້ຳ : 3 Oct 2016

MOU - ຕິດຕັ້ງ:1 ປີ
ໃຊ້ເວລາຕິດຕັ້ງ :1 ເດືອນ

4. ຜົນການທົດລອງ(ປະລິມານສະໜອງນ້ຳ)



-ສະໜອງນ້ຳ1000m^3 ໃຫ້ປະຊາຊົນປະມານ 6,600ຄົນ ຈາກນ້ຳງຽບ
-ຊ່ວຍໃຫ້ອັດຕາການເຂົ້າເຖິງນ້ຳປະປາຢູ່ເຂດເທດສະບານເມືອງປາກຊັນ ຈາກ 69% ເປັນ 89%

5. ຜົນການທົດລອງ(ຄຸນະພາບການສະໜອງນ້ຳ)

1) ຄວາມຂຸ່ນຂອງນ້ຳດິບ ແລະ ນ້ຳທີ່ບຳບັດແລ້ວ

非公開

5. ຜົນການທົດລອງ(ຄຸນະພາບການສະໜອງນ້ຳ)

2)ໄລຍະຄວາມຊຸ່ນສູງຂອງແຫຼງນ້ຳ ແລະ ນ້ຳທີ່ບຳບັດແລ້ວ (ເດືອນ ກັນຍາ 2017)

非公開

5. ຜົນການທົດລອງ(ຄຸນະພາບການສະໜອງນ້ຳ)

3) ຕໍ່ກັບຄວາມຊຸ່ນທີ່ມີການປ່ຽນແປງໄວ

非公開

5. ຜົນການທົດລອງ(ຄຸນະພາບການສະໜອງນ້ຳ)

4) ມາດຕະຖານນ້ຳປະປາ 23 ຫົວໜ່ວຍ

- ໄດ້ເອົານ້ຳທີ່ບຳບັດແລ້ວໄປວັດແທກຄຸນພາບນ້ຳຕາມມາດຕະຖານປະເທດລາວ 23 ຫົວໜ່ວຍ ຢູປະເທດຍີ່ປຸ່ນ
- ໄດ້ຍັ້ງຢືນຄຸນະພາບຢູ່ໃນຂອບເຂດມາດຕະຖານ (06 ຕຸລາ 2016)
- ເຫັນໄດ້ວ່າລະບົບດັ່ງກ່າວແມ່ນແທດເໝາະກັບພື້ນທີ່ນີ້ດີ.

水 質 検 査 結 果 書
(Result of Water Quality Testing)

6. ຜົນການທົດລອງ(ຕົ້ນທຶນ)

5) ຕົ້ນທຶນໃນການຜະລິດນ້ຳ (ສານເຄມີແລະໄຟຟ້າ ຕໍ່ m^3)

非公開

6. ຜົນການທົດລອງ(ຕົ້ນທຶນ)

6) ຕາມການຄິດໄລ ເມື່ອປຽບທຽບກັບລະບົບທໍ່ໄປ (ຕໍ່ m^3)

非公開

7. ຄວາມເປັນໄປໄດ້ໃນຕໍ່ໜ້າ

1) ການດຳເນີນງານແລະການບຳລຸງຮັກສາ

ການດຳເນີນງານ ແລະ ບຳລຸງຮັກສາໂດຍພະນັກງານນ້ຳປະປາ, ຍົກລະດັບຄວາມສາມາດ ໃຫ້ພະນັກງານ ສາມາດສະໜອງນ້ຳປະປາທີ່ປອດໄພ ແລະ ມີຄວາມສະຖຽນລະພາບ.








7. ຄວາມເປັນໄປໄດ້ໃນຕໍ່ໜ້າ

2) ການຜະລິດໃນທ້ອງຖິ່ນ

ການຜະລິດອຸປະກອນໃນທ້ອງຖິ່ນຈະປະກອບສ່ວນໃຫ້ແກ່ການພັດທະນາອຸດສະຫະກຳພາຍໃນ ໃນສປປລາວ.

ເຕັກໂນໂລຊີ່ຍີ່ປຸ່ນ
ຜະລິດຢູ່ລາວ

8. ບົດຮຽນທີ່ໄດ້ຮຽນຮູ້

① ຄວາມຮັບຮູ້ຕໍ່ຄວາມປອດໄພຂອງພະນັກງານ
② ລະດັບຄວາມຮູ້ຂອງພະນັກງານທີ່ແຕກໂຕນ
③ ຄຸນະພາບທາງເຄມີ ແລະ ການຈັດການ
④ ອຸປະກອນວັດແທກ ເພຍ້ອນຟ້າຝ
⑤ ພາຍໃນມື້ດຽວ ມີກໍລະນີການປ່ຽນແປງຂອງຄວາມຂຸ່ນຂອງແຫຼ່ງນ້ຳ ເກີນ 1000NTU

9. Line up

Lapon Co.,Ltd.

* ເປົ້າໝາຍ : ຕົວເມືອງນ້ອຍ ແລະ ໝູ່ບ້ານ
* ແຫຼ່ງນ້ຳ : ແມ່ນ້ຳ / ບຶງ / ນ້ຳບາດານ
* ຜະລິດຕະພັນ

ປະລິມານ	100 m^3/ມື້	300 m^3/ມື້	500 m^3/ມື້	800 m^3/ມື້	1000 m^3/ມື້
ຈຳນວນຄົນ	660	2,000	3,300	5,300	6,600
ຈຳນວນຄອບຄົວ	100	300	500	800	1,000
ພື້ນທີ່ສຳລັບເຄື່ອງຈັກ	5mx12m	6mx14m	7mx17m	9mx19m	9mx20m
ຂະໜາດອ່າງຕອງ	3mx12m	5mX16m	7mX20m	9mX23 m	9mx26m





ຂໍຂອບໃຈ


Department of Public Works and Transport of

Bolikhamxay Province,NPSE-Bolikhamxay

Department of Water Supply

/ Ministry of Public Works and Transport

Summary Report

Lao People's Democratic Republic

Verification Survey with the Private Sector for Disseminating Japanese Technologies of Water Purification System for Highly Turbid Water for Use in Small Town Water Supply

April, 2018

Japan International Cooperation Agency

TOHKEMY CORPORATION

CONTENTS

ATTACHMENTS:

1. BACKGROUND

The government of the Lao PDR has set a national goal of 80% coverage of piped water supply in urban communities by 2020: the coverage ratio as of 2014 remains at 67%. The securing of a “stable supply of safe water” is a critical issue for the promotion of economic growth, urbanization and population increase, as well as for the reduction of regional disparities. One of the policies adopted by the government, the “Small Town Water Supply Service Investment Plan” (Revised Investment Plan for Water Supply Service) has been implemented in Lao PDR since 2013, aiming at the development of an urban water supply in small scattered villages (close to urban areas). However, there is a shortage of good-quality groundwater sources especially in urban areas, so there is a need to purify surface water economically, even though the surface water, such as the Mekong River, is extremely turbid following rainy weather.

Meanwhile, in FY2013 the Joint Study Team (consisting of TOHKEMY Corporation and Pacific Consultants Co., Ltd.) carried out a “Study on the Project Formulation for a Small Town Water Supply System” in Lao PDR, as part of a “Project Formulation Survey” under the Governmental Commission on the Projects for ODA Overseas Economic Cooperation. As a result, it was confirmed that the system and technologies of the Joint Study Team, namely a purification system for very turbid water, might be applicable to the water supply projects listed in the above-mentioned investment plan. At the present time the “Project Formulation Survey”, which had been agreed on in a MOU (Memorandum of Understanding) dated 27th December 2013 between the Department of Housing and Urban Planning, the Ministry of Public Works and Transport of Lao PDR and the Joint Study Team, has been adopted as one of the Verification Surveys with the Private Sector for Disseminating Japanese Technologies, targeting Paksan, Bolikhamxay, a small town in Lao PDR.

Subsequently, MM（Minutes of Meeting）dated 15th May 2015, concerning the Verification Survey with the Private Sector for Disseminating Japanese Technologies of Water Purification System for Highly Turbid Water for Use in Small Town Water Supply (referred to below as "the survey") were signed among the Japan International Cooperation Agency (JICA), TOHKEMY Corporation and the Department of Public Works and Transport (referred to below as the DPWT) of Bolikhamxay Province; and the survey has now been completed.

2. OUTLINE OF THE SURVEY

(1) Purpose

1) Objective

The Survey will improve access to safe water for residents in target areas by introducing a high-turbidity water purifying system in Paksan area of Bolikhamxay, and will contribute to the improvement of living standards and the widespread of the urban water supply. At the same time, the Survey will verify regional adaptability of the water purifying system, and develop a plan to diffuse the system through Lao PDR.

2) Expected Results

Result 1: The adaptability of the water purifying system will be verified and access to safe water will be improved.

Result 2: A plan to diffuse the water purifying system will be formulated.

(2) Activities

Activities related to Result 1:

1-1 Discuss with the local organization concerned and survey the site

1-2 Examine the design and construction plan

1-3 Plan and implement the local procurement

1-4 Manufacture water purification system in Japan

1-5 Transport the water purification system and equipment (Transportation by sea and land)

1-6 Confirm the progress and completion of the part to be implemented by C/P

1-7 Construct the system on-site (installation and test run)

1-8 Prepare the manual of operation and maintenance for “the water purification system”.

1-9 Transfer the technology of operation and maintenance of “the water purification system” to staff of NPSE-Bolikhamxay

1-10 Operate/maintain and monitor the system to verify compatibility (water quality measurement etc.).

Activities related to Result 2:

2-1 Coordinate and negotiate with the local organizations concerned

2-2 PR activities (Workshop, Session etc.)

2-3 Collect Information and interviews with key-persons concerned for the

dissemination

2-4 Formulate a dissemination plan after the completion of this Survey

(3) Information of Product/ Technology to be Provided

1) Water Purification System:

This is a small-scale high-turbidity water purifying system, consisting of fiber filtration equipment for high and medium turbidity, and rapid sand filtration. The system is capable of treating 1,000m^3/day high-turbidity surface water (1,000 to 3,000 NTU) under rainy conditions.

2) Principal equipment and specifications:

Treated water capacity: 1,000m^3/day

- Up-flow Actifiber filtration unit (AFU1215)φ1200 ㎜×H3500 ㎜ 2 vessels
- Down-flow Actifiber filtration unit (AFU1615)φ1600 ㎜×H3900 ㎜ 1vessel
- Sand filtration unit 2600 ㎜×H4500 ㎜ 1 vessel
- Control panel for water purification system
- Pump (UA、AF、SF、conveying water unit)
- Air blower
- Piping
- Chemical dosing unit (Al2(SO4), Chlorine ,Caustic sodium) 4units
- Water analyzer

(4) Counterpart Organization

Japanese Side: TOHKEMY CORPORATION

Lao Side : Department of Public Works and Transport (DPWT) of Bolikhamxay Province
NPSE-Bolikhamxay
(NPSE：Nam Papa State-owned Enterprises (Provincial public water suppliers))

<Contact Organizations>

(Until December 2015)

Department of Housing and Urban Planning/Ministry of Public Works and Transport

(After January 2016)

Department of Water Supply/ Ministry of Public Works and Transport

(5) Target Area and Beneficiaries

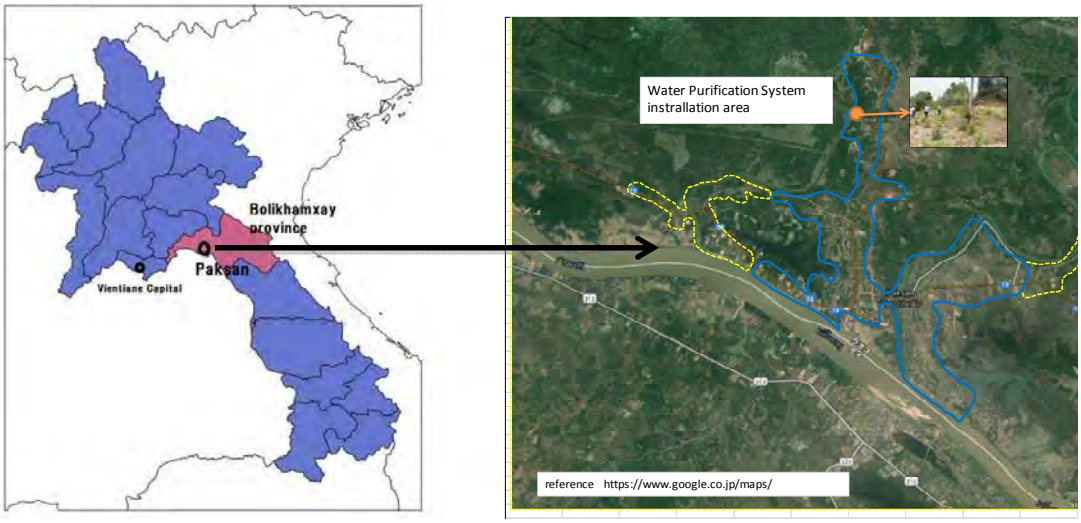


Figure: Site MAP

Target Area (Location of Installation):

Thong Village, Paksan District, Bolikhamxay Province, Lao PDR.

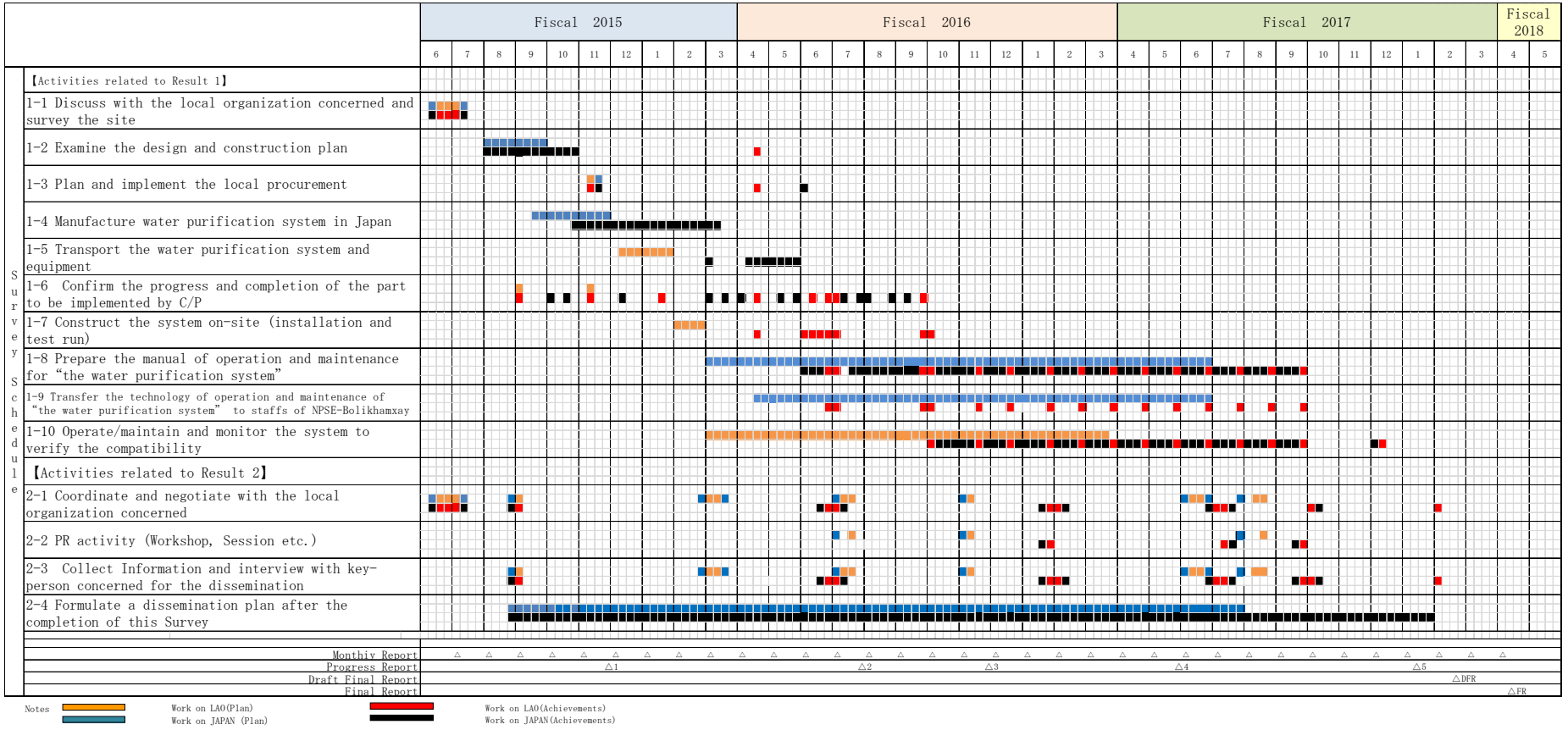
Beneficiaries:

Water supply users: local residents, stores, public facilities in the district served by the water supply system.

(6) Duration

From June, 2015 to May, 2018 (3 years)

(7) Progress Schedule



(8) Manning Schedule

① Manning Schedule（Plan）

Work Assignment	Name	Company Name	Fiscal 2015 Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Fiscal 2016 Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Fiscal 2017 Apr	May	Jun	Jul	Aug	Sep	Total LAO	JAPAN
Project Maneger	Takuya HOSOTANI	TOHKEMY CORPORATION			6									6				6				6							6		10		1.33	
Engineering	Kensaku KOBAYASHI	TOHKEMY CORPORATION			6				5				24																				1.17	
Engineering	Jun HASHIGUCHI	TOHKEMY CORPORATION											14		6				10			6			6					6				1.60	
Engineering	Tsutomu OHGAI	TOHKEMY CORPORATION														6				6				6		6								0.80	
Engineering	Hideaki TAN	TOHKEMY CORPORATION															6				6				6		6							0.80	
Chief Adviser	Tatsuo MORIMOTO	PACIFIC CONSULTANTS CO.,LTD			15 5	3		5 3					10 3	2				10 5					5 5						10 5	1	10	5	5	2.17	2.35
																																TOHKEMY (M・M) =	5.70	
																																PCKK (M・M) =	2.17	2.35
																																Total (M・M) =	7.87	2.35

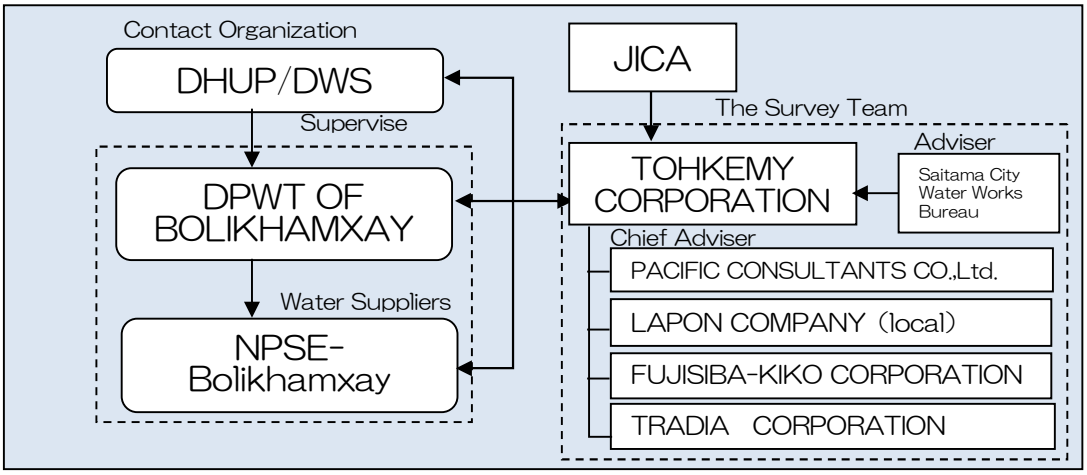
Notes
Work on LAO
Work on JAPAN

② Manning Schedule（Achievements）

Work Assignment	Name	Company Name	Fiscal 2015 Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Fiscal 2016 Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Fiscal 2017 Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Fiscal 2018 Aug	Sep	Total LAO	JAPAN
Project Maneger	Takuya HOSOTANI	TOHKEMY CORPORATION			6 1	1							1		1 1	1	2	7 1	2	3	1	1	3	1	3	1	3	2	1	8 1			1				7			1.20	1.95
Engineering	Kensaku KOBAYASHI	TOHKEMY CORPORATION			6 1	1		5	2	5 1	4		1	2	3	6	24 3		1		3	15 3	7 2			3	11	2	12	3	8 2	1	8			2	10 1	1				3.53	2.75
Engineering	Jun HASHIGUCHI	TOHKEMY CORPORATION													1	2	19 4		1		3	15 3			8 3	1	9 2		7	1	10 3		2	9	1	1	7 1	1				2.80	1.65
Engineering	Tsutomu OHTANI	TOHKEMY CORPORATION																																							0.00	0.00
Engineering	Hideaki TAN	TOHKEMY CORPORATION																																							0.00	0.00
Chief Adviser	Tatsuo MORIMOTO	PACIFIC CONSULTANTS CO.,LTD			15 5	3		5 3			1		1		1		10 3	4	1		1	3	1		8 3	1	10 3	5	4	1	10 1			8 1			1	7				2.17	2.35
																																								TOHKEMY (M・M) =	7.53	6.35
																																								PCKK (M・M) =	2.17	2.35
																																									Total (M・M) =	9.70	8.70

Notes
Work on LAO
Work on JAPAN

(9) Implementation System



Roles of each organization

Organization	Roles
DPWT OF BOLIKHAMXAY	- Secure the budget for civil and building construction to install the water purification system - Support for procedures to install the water purification system - Coordinate the handover of the system from Japanese side to NPSE.
NPSE-Bolikhamxay	- Implement the civil and building construction to install the Water Purification system - Support for procedures to install the water purification system - Support for data collection (in regard to water supply utility) - Provide the office space during the survey - Support for measuring and recording data during the survey - Train the engineers to operate the system continuously after the survey - Provide opportunities to present the verification survey and any supports
DHUP and DWS /Ministry of Public Works and Transport	- Contact institution of this survey (foreign assistance) - Support for procedures to transport the system and equipment (custom) - Support for data collection (national level) - Supervise the staff members of Lao side
The Survey Team/ TOHKEMY CORPORATION/ Pacific Consultants Co.,LTD. etc	- Interview with related organization and site reconnaissance - Design and plan the construction - Plan and implement the procurement in Laos - Manufacture the water purification system in Japan - Transfer the system from Japan to Laos - Confirm the completion of facilities to be installed by Laos side - Construction works (Installation and commissioning of the system) - Provide operation and maintenance manuals - Transfer the technology to maintain and operate the system (to NPSE) - Operation management and water quality monitoring - Formulate a dissemination plan after the “Survey” - Support the implementation of the survey - Coordinate and negotiate with Lao side agencies - Collect information to develop a business roll out and interview with the parties concerned - PR activities (Work shop and seminar) - Support to formulate a plan for dissemination of the system (including market analyze and profitability)

3. ACHIEVEMENT OF THE SURVEY

(1) Achievement of activities related to Result 1:

1-1 Discuss with the local organization concerned and survey the site

- An understanding of the variation in river water quality was gained through interviews with the staff of NPSE-Bolikhamxay.
- Cooperation in a daily inspection of river water quality was arranged.
- A study of the chemical injection rate, etc.,was made based on the raw water (river water) turbidity data and the results of water flow testing.

1-2 Examine the design and construction plan

- A design coordination meeting was held with the local NPSE-Bolikhamxay and local construction companies in June, September and November 2015, at which details of construction matters requiring attention were confirmed, adjusted and reviewed.

1-3 Plan and implement the local procurement

- The local materials and equipment were procured in timely manner.

1-4 Manufacture water purification system in Japan

- An order for the materials and equipment to manufacture the water purification system in Japan was placed dated 20th October 2015, after the progress of the local construction plan/work and the completion of the access road to the construction site were confirmed.
- The water purification system and equipment were manufactured in Japan and made a trial run, and checked the operation and performance of each section of the equipment.

1-5 Transport the water purification system and equipment (Transportation by sea and land)

- A meeting was held with the transport company with respect to packing involving checking of the actual items on 3rd March 2016.
- From 11th April of the same year, the water purification system and equipment were sequentially sent to the packing company, and were shipped from Shimizu Port on May 11.
- The equipment was then transported overland from Laem Chabang Port in Thailand, passed through Laos import clearance procedures, and arrived on site 30th May, and installation work was then begun.

1-6 Confirm the progress and completion of the part to be implemented by C/P

- The Survey Team visually checked the progress of the construction work at the site, and.kept up with the state of progress by means of photographs of the construction

site taken monthly.

- The water tank, construction of which was reported to be delayed, was completed on 8th September 2016.

1-7 Construct the system on-site (installation and test run)

- Unloading of the equipment began on-site on 3rd August 2016 and completed the next day.
- Equipment installation, piping assembly and electrical work were carried out from the next day, and construction was completed on 17th June 2016 save for the installation of some measuring equipment.
- Japanese experts were dispatched to check the plumbing and electric wiring with the support of local hired workers.
- A test run was carried out starting 20th June 2016 and completed 5th July 2016 with the exception of tests relating to the elevated water tank.
- As for the elevated water tank, installation of the instrumentation device was completed 26th September 2016 and the comprehensive trial run was completed at the end of September.
- A trial run of the system confirmed that the treated water met the water quality standards of Laos.

1-8 Prepare the manual of operation and maintenance for “the water purification system”.

- Confirmation of year-round operation of the system and preparation of an operating and maintenance manual in English to enable the NPSE-Bolikhamxay to use the system properly.

1-9 Transfer the technology of operation and maintenance of “the water purification system” to staff of NPSE-Bolikhamxay

- The technology for operation and maintenance of the system was transferred to three staff members of NPSE-Bolikhamxay, with the prepared manuals.
- Training sessions were provided basically six days per month during the first year monitoring period (from the end of September 2016), and after this period the staff of NPSE-Bolikhamxay started to operate the system by themselves with tele-support by Tohkemy via the Internet and by phone.
- Maintenance service was provided through the cooperation of Lapon Co. Ltd., who is a local partner of TOHKEMY Corporation.

1-10 Operate/maintain and monitor the system to verify compatibility (water quality measurement etc.).

The compatibility was examined by the following steps in order to adapt the water

purification system to the condition of the site.

i.Commissioning & Coordination: Confirmed that the system operated properly and sequentially.

ii.Primary test: Checked the performance of all the water purification system including the up-flow filter for high turbidity using measuring equipment and water analyzer.

iii.Stable operation [Dry season]: Operated the down-flow filter for medium turbidity and the sand filter for low turbidity, and conducted the water purification

iv.System adjustment [Rainy season]: Operated the up-flow filter for high turbidity purification in order to adapt properly to the condition of rainy season.

v.Stable operation [Rainy season]: Confirmed that the series of operation is stable by checking the measured data of turbidity.

(2) Achievement of activities related to Result 2:

2-1 Coordinate and negotiate with the local organizations concerned

・The Survey Team held interviews with the C/P (DHUP, NPSE-Bolikhamxay), other related Lao governors and agencies, JICA Laos office and the Japanese Embassy in Lao, to explain the outline and purpose of the survey and coordinate with them for its implementation.

2-2 PR activities (Workshop, Session etc.)

The following events were held to disseminate the water purification system with the consent of the counterparts.

- Presentation and Ceremony to celebrate the completion of the Water Treatment Plant in Paksan.
  - ・The presentation was held 31st January 2017 together with a ceremony to mark the completion of the water purification system.
  - ・Approximately, 40 persons attended the Presentation and 110 persons attended the ceremony. During the Q&A session about the equipment, some specific questions were raised, such as questions on the scheme for this survey, product cost, running cost, number of days required for production, and number of administrators. In addition, many local residents who participated in the session expressed their gratitude on being able to use a piped water supply service.
- Presentation at JICA Technical Cooperation Project Seminar.
  - ・The survey results of the water purification system were presented, and PR was

carried out at the MaWaSu seminar (venue: Vientiane) from 11th to 13th July 2017.(MaWaSu: JICA technical cooperation project)

- The number of participants was approximately 250 .
- Providing an overview of the survey enabled the participants to gain a greater understanding.
- The panel display produced expressions of interest and opinions from water supply utilities.
- People looked forward to the provision of facilities not only in Bolikhamxay province but also in other provinces.
- The participants learned the name of TOHKEMY.

- Work shop for NPSE-Bolikhamxay and Presentation of the results of verification activities.
  - The aim of this workshop was to deepen NPSE-Bolikhamxay staff's understanding of the technical and maintenance aspects of the water purification equipment and to exchange views on what improvements can be made to water purification equipment. It was held in the Conference Room of NPSE-Bolikhamxay on 27th September 2017.
  - The participants were 20 members of staff of NPSE-Bolikhamxay.
  - The Survey Team reported the verification results of site compatibility over 12 months.
  - Through the exchange of views and the workshop, the participants gained a deeper understanding of the technical and maintenance aspects of the water purification system.
- Other effective PR activities
  - A panel exhibition describing the survey implementation status was held at the Project MaWaSu 4th International Seminar held in Savannakhet from 16th to 17th November 2016.A total of some 100 persons participated in the Seminar, including water service officials from each of the provinces of Laos and participants from Japan. The Survey Team were asked a lot of questions about the equipment.

2-3 Collect Information and interviews with key-persons concerned for the dissemination

For full-scale expansion, the following studies and interviews were conducted.

- Verification of means of maintaining production quality in Laos
- Examination of business model for dissemination (including risk management)

・Cost benefit analysis
・Suggestions to other organizations such as international and bilateral donors

2-4 Formulate a dissemination plan after the completion of this Survey

・Business possibility was examined in terms of municipal water supply plant for small town in other area and private water supply plant in industrial park and developing zone, and the dissemination plan after the completion of this project was formulated.

【Phase 1: Continuous accumulation of achievements and experiences, and establishment of local structures (2018 - 2020)】

Establishment of a local affiliate as a base for equipment manufacture, sales and maintenance service in Lao PDR. Creation of business alliances with local affiliate and local manufacturing companies. Start and expansion of water purification equipment sales activities. Promotion of the equipment not only in small towns but also in rural areas, to contribute to the achievement of the national goals of Lao PDR.

【Phase 2: Wider dissemination through contracting to long-term comprehensive projects (2021 to 2023)】

In addition to the manufacture and sale of equipment, the affiliate will establish a system with engineering and maintenance functions. The affiliate will contract into long-term projects from NPSEs (Provincial public water suppliers) integrating sales and maintenance of water purification equipment. At this time, the technology for the operation and maintenance of the water purification system will be transferred to NPSE staff.

【Phase 3: Business expansion including pipeline provision (From 2024)】

The affiliate will turn functions other than water purification system necessary for waterworks, such as maintenance and management of the pipe network, meter reading and tariff collection, water leakage control, etc., into a value chain through tie-ups with other companies, M&A, etc., and will also enter into concession-type water supply projects. The affiliate will consider participation in third-country ODA projects and private-sector water supply projects. In addition, it will also expand into neighboring countries such as Cambodia and Vietnam.

Looking to the future, TOHKEMY Corporation also aim to re-enter the market for small water supply projects in Japan (There are about 7,000 projects).

(3) Outputs and Outcomes of the Survey

- The equipment supplies 1,000m^3 of drinkable water per day, enough to supply 6600 people, using raw water sourced from the Nam Ngiep River.
- The installation of the equipment has increased the piped water supply coverage of Paksan District from 69% to 89% , reaching the national goal of 80%.
- The equipment was installed as a Verification Survey of JICA under a proposal by TEAM TOHKEMY (consisting of TOHKEMY Corporation (representative), PACIFIC CONSULTANTS CO., LTD. (consultant) and LAPON Company Limited (local partner) and purifies high-turbidity river water in Lao PDR to meet the Lao PDR water quality standards (5 NTU or less).
- At the same time, in this survey three staff members of NPSE-Bolikhamxay received instruction in the technology for operation and maintenance of this water purification system .
- The results of monitoring over a period of 12 months from October 2016 to September 2017 showed that the annual average turbidity of the raw water was 167 NTU, and daily maximum turbidity was in excess of 4,000 NTU.
- Even with turbidity of 4,000 NTU, the quality of the purified water satisfied the Lao PDR water quality standards (5 NTU or less) , and it was possible to verify that the water purification system was well suited to local conditions.
- The running cost in terms of the cost of electricity and chemicals per unit of water was an average of 689 Kip / m^3 over the year, which was about one quarter of the calculated estimate of 2,833 Kip m^3 for the previous water purification method (flocculation + sand filtration). This was less than one-third of the initial estimated cost, confirming the cost advantage of this water purification system.

(4) Self-reliant and Continual Activities to be Conducted by Counterpart Organization

After the implementation of this survey, NPSE-Bolikhamxay will be responsible for the operation and maintenance of the equipment according to the technology transfer and the manual created during this survey period as one of its own waterworks.

The water purification plant will be operated 24 hours a day under a water purification plant manager and several members of staff. The cost of operating and maintaining the equipment will be covered by the water tariff.

4. FUTURE PROSPECTS

(1) Impact and Effect on the Relevant Development Issues through Business Development of the Product/ Technology in the Surveyed Country

- The more widespread installation of the equipment in Lao PDR is, the greater the contribution to the improvement of the piped water supply coverage.
- The expansion to other provinces of technology transfer for the operation and maintenance of this water purification system will lead to skill development of the staff of other provincial water authorities in Lao PDR, and will improve the level for ensuring a stable supply of safe water.
- Furthermore, if it becomes possible for a local manufacturing company to manufacture part of the equipment, this will contribute to local industrial development in Lao PDR.

(2) Lessons Learned and Recommendation through the Survey

（Lessons Learned）

- As safety awareness is low, it is important to take into consideration the loan of protective equipment when work is carried out by local workers.
- Even though drawings were submitted, the work was not always carried out according to the specified dimensions/correlations. Therefore, it is necessary to check and verify important parts after construction is completed.
- Since construction rarely progresses according to the work schedule, it is necessary for there to be plenty of leeway in the schedule and also for the state of progress to be checked at each stage.
- Since the foundation on which the equipment is to be installed is very uneven, it is necessary to take measures such as the preparation of a jig that provides ease of level adjustment (In this survey, leveling was facilitated through the installation of leveling bolts on each piece of equipment.)
- Though chemicals such as germicides and flocculating agents are available in liquid form in Japan, in Lao PDR chemicals in solid form need to be dissolved before use. Since undissolved matter can clog the injection pumps, leading to deterioration of the quality of the treated water, it is necessary to work out a means of separating out any undissolved matter.
- A level sensor was damaged by lightning during the Survey. Though the control panel was protected by a lighting arrester, damage to the main body could not be avoided. In areas where lightning strikes are frequent, sufficient measures need to be taken in the use of precision equipment, and as far as possible equipment that is available locally should be used. (Even items that are readily available in Japan are often difficult to obtain in Lao PDR.)
- When water intake for the equipment is from river water, the fluctuation in

turbidity can exceed 1,000NTU a day, so that manual adjustment of the amount of chemicals to be injected is considered difficult. In order to achieve stable water quality from raw river water, it is considered essential that the turbidity of the raw water be measured continuously and chemical injection controlled automatically. If such measures cannot be taken, measures such as restricting the raw water intake are necessary.

- Since there is little awareness of the need for cleanliness and tidiness within the facility, it is necessary to make workers aware of the need for daily tidying and cleaning in and around the facility, as a part of operation management.
- Since it often happened that malfunctions and problems were dealt with only after they occurred, operators need to learn to try to prevent such malfunctions and problems before they occur, through daily checks and inspections.
- Though the equipment is installed indoors, during the rainy season the measuring instruments and control panel were invaded by large numbers of ants. Since there seems little that can be done to prevent this in terms of hardware, daily checks by staff are necessary.
- Due to the lack of basic knowledge and experience of water treatment and equipment, difficulties were felt in explaining operational procedures. Some means of encouraging mastery of the basics is required.
- The Survey Team is especially grateful for all the support provided in import and customs duty procedures, including the issue by the counterpart organization of a letter of support, which enabled customs clearance to proceed smoothly.

（Recommendations）

- The survey supports the overseas expansion of SME (small medium-size enterprises).

  The survey became a local showcase undertaking; it was very beneficial in gaining recognition of the equipment among people involved in the water supply in Lao PDR and helped to promote its branding to some extent.

  Though it provides a foothold for the expansion and spread of business locally, there are concerns regarding local funding. In a water supply project, expenses are recovered from the water tariff over a long period spanning several decades. However funding for the initial investment is far from easy, leading to a vicious cycle: the construction of facilities does not make headway → income from water tariffs does not increase → maintenance costs increase due to the aging of the facilities → waterworks fall into financial difficulties..

For these reasons, it is strongly recommended that consideration be given to the establishment of small-lot loan schemes suited to initial investment to support the introduction and development of small-sized water purification facilities, the establishment of a financial support framework specializing in water facility development, and support for subsidy programs for water supply projects in Lao PDR.

- Difference in recognition of the usefulness of the equipment in comparison with Japan (Turbidity above 100NTU is usual in Lao PDR, unusual in Japan)

  As was shown in the results of the water quality monitoring, the turbidity of the river water (surface water used as the water source) in the area of the Mekong River rises to an average of around 200NTU during the rainy season, with daily peaks of around 1,000NTU; this can rise to over 4,000NTU in extreme circumstances, such as an upstream dam break. In Japan, 200NTU is considered a level that might be recorded for short periods of time as a result of torrential rain, and is not normal. Thus, what is considered water treatment under extreme circumstances in Japan is normal during the rainy season in Lao PDR.

  Therefore, it is extremely difficult to apply Japanese experience and performance to the evaluation of performance and economic efficiency in Lao PDR. This point should be recognized and understood when the usefulness of this equipment is compared with experience and performance achieved with other equipment.

- Awareness building of the survey scheme (burden sharing)

  The survey was carried out and the flow of treated water accomplished thanks to the civil engineering and construction works implemented by the Lao PDR side and the installation of the equipment on the Japanese side. Having the Lao side bear some of the burden significantly raised their commitment and interest in the survey.

  By paying their own expenses, they exhibited excellent leadership, had a greater sense of mission and responsibility, and were able to execute the survey successfully. We expect that this survey will be recognized as a successful example for both Lao PDR and Japan and will help in the adaptation of other cases as well as improving water supply coverage.

LAO PDR

Verification Survey with the Private Sector for Disseminating Japanese technologies of Water Purification System for Highly Turbid Water for Use in Small Town Water Supply

TOHKEMY CORPORATION, Osaka, Japan

Concerned Development Issues in LAO

- There are some problems such as Regional disparities in water service and Stable supply of safe water.
- It is required to purify surface water with cost savings and supply stably, even though the surface water is remarkably high turbid under rainy weather, under the conditions of good-quality groundwater sources are going to be in short.

Implemented Activities in the Survey

- By introducing a high-turbid water purifying system in Paksan area, Bolikhamxay,the JICA Survey Team will verify local adaptability of it's system.
- Transfer the technology of the operation and maintenance of the "The water purifying system" to staff of NPSE-Bolikhamxay.
- Formulate a dissemination plan after the "Survey".

Proposed Products/Technologies

Water Purification System for Highiy Turbid Water =Fiber filters (Actifiber) and Sand filtration System.
-Technology of Fiber filters (patent)
-Utility cost can be reduced by around a one-third in comparison with coagulation-sedimentation system .
-Construction period and space can be shortened and smaller.

Survey Overview

Name of Counterpart:
Department of Public Works and Transport of Bolikhamxay Province/ NPSE-Bolikhamxay
Survey duration:From June, 2015 to May, 2018 (3 years)
Survey Area:Paksan District, Bolikhamxay Province in LAO

Impact on the Concerned Development Issues in LAO

- Established stable purification system for highly turbid water.
- The population served by water supply will increase.
- Running cost decreases in comparison with a conventional method.

Outputs and Outcomes of the Survey

- The installed equipment supplies 1,000m^3 of drinkable water per day.
- Even with turbidity of 4,000 NTU, the quality of the purified water satisfied the Lao PDR water quality standards (5 NTU or less) ,and it was possible to verify that the water purification system was well suited to local conditions.
- After the Survey, challenge to the public water supply project, private urban development business and industrial water business in Lao.

ລາຍງານໂຄງການທົດລອງຕົວຈິງຂອງລະບົບກັນຕອງນ້ຳທີ່ສາມາດບຳບັດນ້ຳທີ່ມີຄວາມຂຸ່ນສູງ ສຳລັບຕົວເມືອງນ້ອຍຢູ່ ສປປລາວ

TOHKMEY CORPORATION

1 ໂຄງການສາທິດແລະສົ່ງເສີມ (JICA)

* ຈຸດປະສົງ
  * ສົ່ງເສີມໃຫ້ບໍລິສັດນ້ອຍແລະກາງ ນຳສະເໜີ ຜະລິດຕະພັນ ແລະ ເຕັກໂນໂລຊີ, ຍົກລະດັບເຕັກນິກ ໃຫ້ເໝາະສົມກັບບັນດາປະເທດທີ່ກຳລັງພັດທະນາ ເພື່ອໃຫ້ມີການນຳໃຊ້ຢ່າງກ້ວາງຂວາງ.
  * ອີງໃສ່ໂຄງການດັ່ງກ່າວ ບັນດາໂຄງການຂອງລັດຖະບານ ແລະໂຄງການຊ່ວຍເຫຼືອຕ່າງໆ ສາມາດນຳໃຊ້ ຜະລິດຕະພັນ ແລະ ເຕັກໂນໂລຊີ ຫລາຍຂຶ້ນ, ໂດຍການແຜ່ກະຈ່າຍ ຜະລິດຕະພັນ ແລະ ເຕັກໂນໂລຊີດັ່ງກ່າວ ຄຽງຄູ່ກັບການອອກສູ່ຕະຫຼາດສາກົນຂອງ ບໍລິສັດນ້ອຍ ແລະ ກາງ ສາມາດຊ່ວຍພັດທະນາເສດຖະກິດໃນເຂດພາກພື້ນນັ້ນໆ.

2 ໂຄງການສຳຫຼວດແລະສົ່ງເສີມລະບົບກັ່ນຕອງນ້ຳທີ່ມີຄວາມຂຸ່ນສູງ ສຳລັບທຸລະກິດນ້ຳປະປາຕົວເມືອງນ້ອຍ

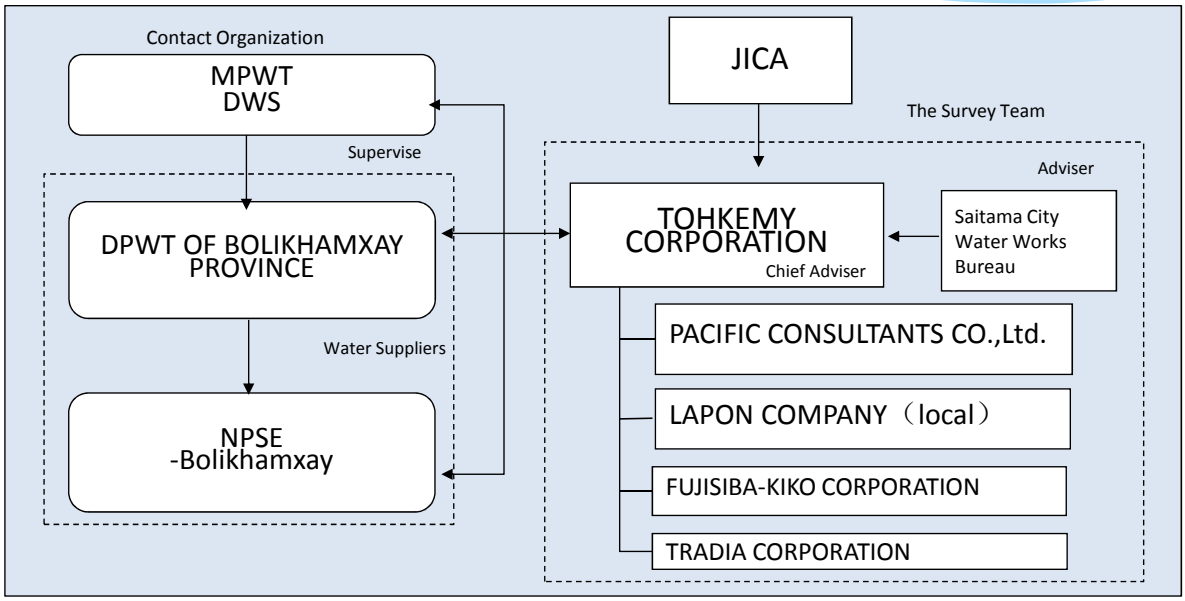
1)ຈຸດປະສົງຂອງໂຄງການ

* ນຳໃຊ້ລະບົບກັ່ນຕອງນ້ຳທີ່ມີຄວາມຂຸ່ນສູງເພື່ອປັບປຸງເຂົ້າເຖິງນ້ຳທີ່ປອດໄພຂອງປະຊາຊົນໃນເຂດສາມາດໃຫ້ດີຂຶ້ນ
* ການຍັ້ງຍືນລະບົບທີ່ເໝາະສົມກັບສະພາບຕົວຈິງ
* ກຳນົດແຜນຂະຫຍາຍ ເພື່ອປະກອບສ່ວນໃນວຽກງານການສະໜອງນ້ຳປະປາ

	ປະຈຸບັນ	ເປົ້າໝາຍປະສິດທິຜົນ	ເພີ່ມເຕີມ
ປະຊາກອນບໍລິການ	13,905ຄົນ (69%)	17,778ຄົນ (88%)	20,101ຄົນ ກ່າຍ80%ຂອງເປົ້າໝາຍລັດຖະບານ (ປີ2020)
ແຫຼ່ງນ້ຳ	ນ້ຳບາດານ	ແມ່ໜ້າດິນ	ບັນຫາເລື່ອງທາດຫີນປູນ ປະລິມານນ້ຳບໍ່ພຽງພໍ
ຄຸນນະພາບນ້ຳ		ຕ່ຳກ່ວາ 3NTU	ແຫລ່ງນ້ຳ ～3000NTU
ຕົ້ນທຶນການຜະລິດ		1/3ຂອງແບບທົ່ວໄປ	
ຍົກລະດັບພະນັກງານນ້ຳປະປາ		ຮຽນເຕັກນິກໃໝ່	ລະບົບແຫ່ກວາມຂຸ່ນອັດຕະໂນມັດ, ໃຊ້ພະນັກງານໃນການຄຸ້ມຄອງໜ້ອຍ

2 ໂຄງການສຳຫຼວດແລະສົ່ງເສີມລະບົບກັ່ນຕອງນ້ຳທີ່ມີຄວາມຂຸ່ນສູງ ສຳລັບທຸລະກິດນ້ຳປະປາຕົວເມືອງນ້ອຍ

2)ໂຄງຮ່າງການຈັດຕັ້ງການປະຕິບັດໂຄງການ



2 ໂຄງການສາທິດແລະສົ່ງເສີມລະບົບກັ່ນຕອງນ້ຳທີ່ມີຄວາມຂຸ່ນສູງ ສຳລັບທຸລະກິດນ້ຳປະປາຕົວເມືອງນ້ອຍ

3) ຂໍ້ມູນລວມຂອງລະບົບ

- ນຳໃຊ້ເຕັກໂນໂລຊີເສັ້ນໃຍ(FIBER)ຕອງນ້ຳຂຸ່ນສູງ ກັ່ນຕອງສິ່ງທີ່ເຮັດໃຫ້ນ້ຳຂຸ່ນ, ສາມາດກັ່ນຕອງນ້ຳທີ່ມີຄວາມຂຸ່ນຂົ້ນສູງໄດ້

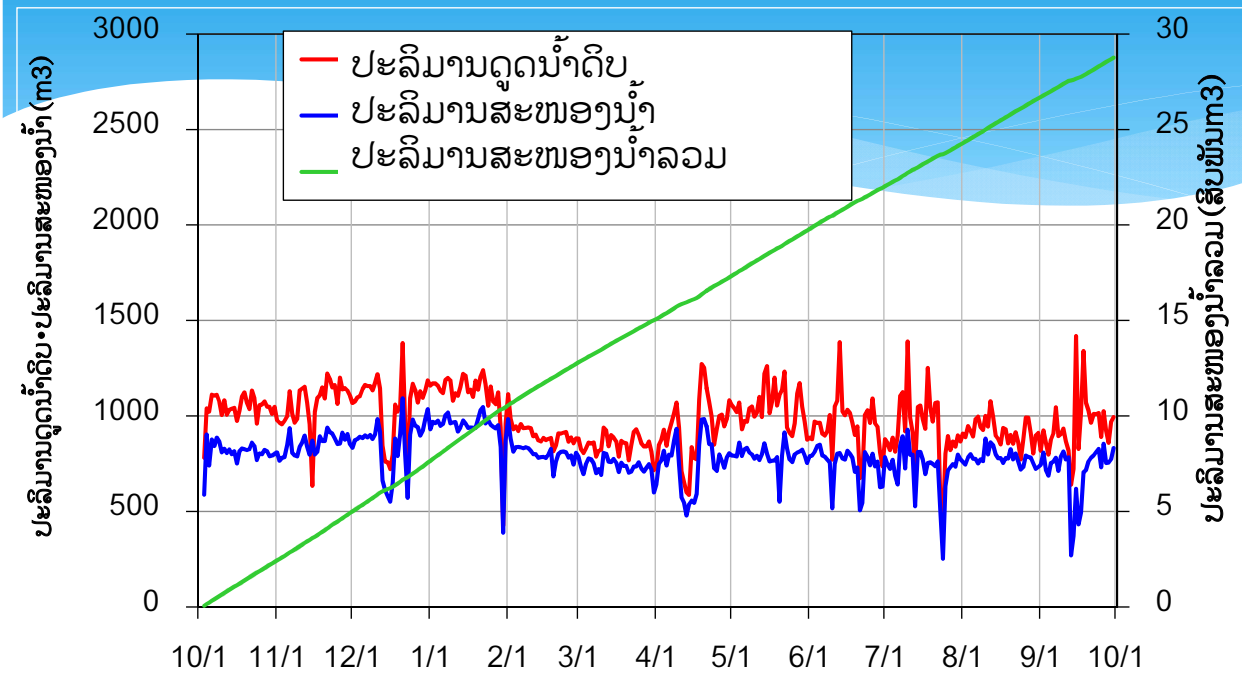
ລະບົບກັ່ນຕອງ	ເສັ້ນໃຍຕອງຄວາມຂຸ່ນສູງ＋ເສັ້ນໃຍຕອງຄວາມຂຸ່ນຕ່ຳ+ຕອງຊາຍ【ລະບົບຖັງຕອງ3ຂັ້ນ】
ຄຸ້ມຄອງຄຸນນະພາບນ້ຳ	pH ຄໍລິນ ຄວາມຂຸ່ນ
ນຳໃຊ້ຢາເຄມີ	ຫີນສົ້ມ, ຄໍລິນຝຸ່ນ

3. ປະຫວັດ(ແຕ່ການເຊັນສັນຍາ ເຖິງການກໍ່ສ້າງ)

- ເຊັນ MOU: 15 May 2015
- ເລີ່ມຜະລິດ: 20 Oct 2015
- ນຳເຂົ້າສະໜາມ : 30 May 2016
- ເລີ່ມສະໜອງນ້ຳ : 3 Oct 2016

MOU - ຕິດຕັ້ງ:1 ປີ
ໃຊ້ເວລາຕິດຕັ້ງ :1 ເດືອນ

4. ຜົນການທົດລອງ(ປະລິມານສະໜອງນ້ຳ)



-ສະໜອງນ້ຳ1000m^3 ໃຫ້ປະຊາຊົນປະມານ 6,600ຄົນ ຈາກນ້ຳງຽບ
-ຊ່ວຍໃຫ້ອັດຕາການເຂົ້າເຖິງນ້ຳປະປາຢູ່ເຂດເທດສະບານເມືອງປາກຊັນ ຈາກ 69% ເປັນ 89%

5. ຜົນການທົດລອງ(ຄຸນະພາບການສະໜອງນ້ຳ)

1) ຄວາມຂຸ່ນຂອງນ້ຳດິບ ແລະ ນ້ຳທີ່ບຳບັດແລ້ວ

非公開

5. ຜົນການທົດລອງ(ຄຸນະພາບການສະໜອງນ້ຳ)

2)ໄລຍະຄວາມຊຸ່ນສູງຂອງແຫຼງນ້ຳ ແລະ ນ້ຳທີ່ບຳບັດແລ້ວ (ເດືອນ ກັນຍາ 2017)

非公開

5. ຜົນການທົດລອງ(ຄຸນະພາບການສະໜອງນ້ຳ)

3) ຕໍ່ກັບຄວາມຊຸ່ນທີ່ມີການປ່ຽນແປງໄວ

非公開

5. ຜົນການທົດລອງ(ຄຸນະພາບການສະໜອງນ້ຳ)

4) ມາດຕະຖານນ້ຳປະປາ 23 ຫົວໜ່ວຍ

- ໄດ້ເອົານ້ຳທີ່ບຳບັດແລ້ວໄປວັດແທກຄຸນພາບນ້ຳຕາມມາດຕະຖານປະເທດລາວ 23 ຫົວໜ່ວຍ ຢູປະເທດຍີ່ປຸ່ນ
- ໄດ້ຍັ້ງຢືນຄຸນະພາບຢູ່ໃນຂອບເຂດມາດຕະຖານ (06 ຕຸລາ 2016)
- ເຫັນໄດ້ວ່າລະບົບດັ່ງກ່າວແມ່ນແທດເໝາະກັບພື້ນທີ່ນີ້ດີ.

水 質 検 査 結 果 書
(Result of Water Quality Testing)

6. ຜົນການທົດລອງ(ຕົ້ນທຶນ)

5) ຕົ້ນທຶນໃນການຜະລິດນ້ຳ (ສານເຄມີແລະໄຟຟ້າ ຕໍ່ m^3)

非公開

6. ຜົນການທົດລອງ(ຕົ້ນທຶນ)

6) ຕາມການຄິດໄລ ເມື່ອປຽບທຽບກັບລະບົບທໍ່ໄປ (ຕໍ່ m^3)

非公開

7. ຄວາມເປັນໄປໄດ້ໃນຕໍ່ໜ້າ

1) ການດຳເນີນງານແລະການບຳລຸງຮັກສາ

ການດຳເນີນງານ ແລະ ບຳລຸງຮັກສາໂດຍພະນັກງານນ້ຳປະປາ, ຍົກລະດັບຄວາມສາມາດ ໃຫ້ພະນັກງານ ສາມາດສະໜອງນ້ຳປະປາທີ່ປອດໄພ ແລະ ມີຄວາມສະຖຽນລະພາບ.








7. ຄວາມເປັນໄປໄດ້ໃນຕໍ່ໜ້າ

2) ການຜະລິດໃນທ້ອງຖິ່ນ

ການຜະລິດອຸປະກອນໃນທ້ອງຖິ່ນຈະປະກອບສ່ວນໃຫ້ແກ່ການພັດທະນາອຸດສະຫະກຳພາຍໃນ ໃນສປປລາວ.

ເຕັກໂນໂລຊີ່ຍີ່ປຸ່ນ
ຜະລິດຢູ່ລາວ

8. ບົດຮຽນທີ່ໄດ້ຮຽນຮູ້

① ຄວາມຮັບຮູ້ຕໍ່ຄວາມປອດໄພຂອງພະນັກງານ
② ລະດັບຄວາມຮູ້ຂອງພະນັກງານທີ່ແຕກໂຕນ
③ ຄຸນະພາບທາງເຄມີ ແລະ ການຈັດການ
④ ອຸປະກອນວັດແທກ ເພຍ້ອນຟ້າຝ
⑤ ພາຍໃນມື້ດຽວ ມີກໍລະນີການປ່ຽນແປງຂອງຄວາມຂຸ່ນຂອງແຫຼ່ງນ້ຳ ເກີນ 1000NTU

9. Line up

Lapon Co.,Ltd.

* ເປົ້າໝາຍ : ຕົວເມືອງນ້ອຍ ແລະ ໝູ່ບ້ານ
* ແຫຼ່ງນ້ຳ : ແມ່ນ້ຳ / ບຶງ / ນ້ຳບາດານ
* ຜະລິດຕະພັນ

ປະລິມານ	100 m^3/ມື້	300 m^3/ມື້	500 m^3/ມື້	800 m^3/ມື້	1000 m^3/ມື້
ຈຳນວນຄົນ	660	2,000	3,300	5,300	6,600
ຈຳນວນຄອບຄົວ	100	300	500	800	1,000
ພື້ນທີ່ສຳລັບເຄື່ອງຈັກ	5mx12m	6mx14m	7mx17m	9mx19m	9mx20m
ຂະໜາດອ່າງຕອງ	3mx12m	5mX16m	7mX20m	9mX23 m	9mx26m





ຂໍຂອບໃຈ


Department of Public Works and Transport of

Bolikhamxay Province,NPSE-Bolikhamxay

Department of Water Supply

/ Ministry of Public Works and Transport

Summary Report

Lao People's Democratic Republic

Verification Survey with the Private Sector for Disseminating Japanese Technologies of Water Purification System for Highly Turbid Water for Use in Small Town Water Supply

April, 2018

Japan International Cooperation Agency

TOHKEMY CORPORATION

CONTENTS

ATTACHMENTS:

1. BACKGROUND

The government of the Lao PDR has set a national goal of 80% coverage of piped water supply in urban communities by 2020: the coverage ratio as of 2014 remains at 67%. The securing of a “stable supply of safe water” is a critical issue for the promotion of economic growth, urbanization and population increase, as well as for the reduction of regional disparities. One of the policies adopted by the government, the “Small Town Water Supply Service Investment Plan” (Revised Investment Plan for Water Supply Service) has been implemented in Lao PDR since 2013, aiming at the development of an urban water supply in small scattered villages (close to urban areas). However, there is a shortage of good-quality groundwater sources especially in urban areas, so there is a need to purify surface water economically, even though the surface water, such as the Mekong River, is extremely turbid following rainy weather.

Meanwhile, in FY2013 the Joint Study Team (consisting of TOHKEMY Corporation and Pacific Consultants Co., Ltd.) carried out a “Study on the Project Formulation for a Small Town Water Supply System” in Lao PDR, as part of a “Project Formulation Survey” under the Governmental Commission on the Projects for ODA Overseas Economic Cooperation. As a result, it was confirmed that the system and technologies of the Joint Study Team, namely a purification system for very turbid water, might be applicable to the water supply projects listed in the above-mentioned investment plan. At the present time the “Project Formulation Survey”, which had been agreed on in a MOU (Memorandum of Understanding) dated 27th December 2013 between the Department of Housing and Urban Planning, the Ministry of Public Works and Transport of Lao PDR and the Joint Study Team, has been adopted as one of the Verification Surveys with the Private Sector for Disseminating Japanese Technologies, targeting Paksan, Bolikhamxay, a small town in Lao PDR.

Subsequently, MM（Minutes of Meeting）dated 15th May 2015, concerning the Verification Survey with the Private Sector for Disseminating Japanese Technologies of Water Purification System for Highly Turbid Water for Use in Small Town Water Supply (referred to below as "the survey") were signed among the Japan International Cooperation Agency (JICA), TOHKEMY Corporation and the Department of Public Works and Transport (referred to below as the DPWT) of Bolikhamxay Province; and the survey has now been completed.

2. OUTLINE OF THE SURVEY

(1) Purpose

1) Objective

The Survey will improve access to safe water for residents in target areas by introducing a high-turbidity water purifying system in Paksan area of Bolikhamxay, and will contribute to the improvement of living standards and the widespread of the urban water supply. At the same time, the Survey will verify regional adaptability of the water purifying system, and develop a plan to diffuse the system through Lao PDR.

2) Expected Results

Result 1: The adaptability of the water purifying system will be verified and access to safe water will be improved.

Result 2: A plan to diffuse the water purifying system will be formulated.

(2) Activities

Activities related to Result 1:

1-1 Discuss with the local organization concerned and survey the site

1-2 Examine the design and construction plan

1-3 Plan and implement the local procurement

1-4 Manufacture water purification system in Japan

1-5 Transport the water purification system and equipment (Transportation by sea and land)

1-6 Confirm the progress and completion of the part to be implemented by C/P

1-7 Construct the system on-site (installation and test run)

1-8 Prepare the manual of operation and maintenance for “the water purification system”.

1-9 Transfer the technology of operation and maintenance of “the water purification system” to staff of NPSE-Bolikhamxay

1-10 Operate/maintain and monitor the system to verify compatibility (water quality measurement etc.).

Activities related to Result 2:

2-1 Coordinate and negotiate with the local organizations concerned

2-2 PR activities (Workshop, Session etc.)

2-3 Collect Information and interviews with key-persons concerned for the

dissemination

2-4 Formulate a dissemination plan after the completion of this Survey

(3) Information of Product/ Technology to be Provided

1) Water Purification System:

This is a small-scale high-turbidity water purifying system, consisting of fiber filtration equipment for high and medium turbidity, and rapid sand filtration. The system is capable of treating 1,000m^3/day high-turbidity surface water (1,000 to 3,000 NTU) under rainy conditions.

2) Principal equipment and specifications:

Treated water capacity: 1,000m^3/day

- Up-flow Actifiber filtration unit (AFU1215)φ1200 ㎜×H3500 ㎜ 2 vessels
- Down-flow Actifiber filtration unit (AFU1615)φ1600 ㎜×H3900 ㎜ 1vessel
- Sand filtration unit 2600 ㎜×H4500 ㎜ 1 vessel
- Control panel for water purification system
- Pump (UA、AF、SF、conveying water unit)
- Air blower
- Piping
- Chemical dosing unit (Al2(SO4), Chlorine ,Caustic sodium) 4units
- Water analyzer

(4) Counterpart Organization

Japanese Side: TOHKEMY CORPORATION

Lao Side : Department of Public Works and Transport (DPWT) of Bolikhamxay Province
NPSE-Bolikhamxay
(NPSE：Nam Papa State-owned Enterprises (Provincial public water suppliers))

<Contact Organizations>

(Until December 2015)

Department of Housing and Urban Planning/Ministry of Public Works and Transport

(After January 2016)

Department of Water Supply/ Ministry of Public Works and Transport

(5) Target Area and Beneficiaries

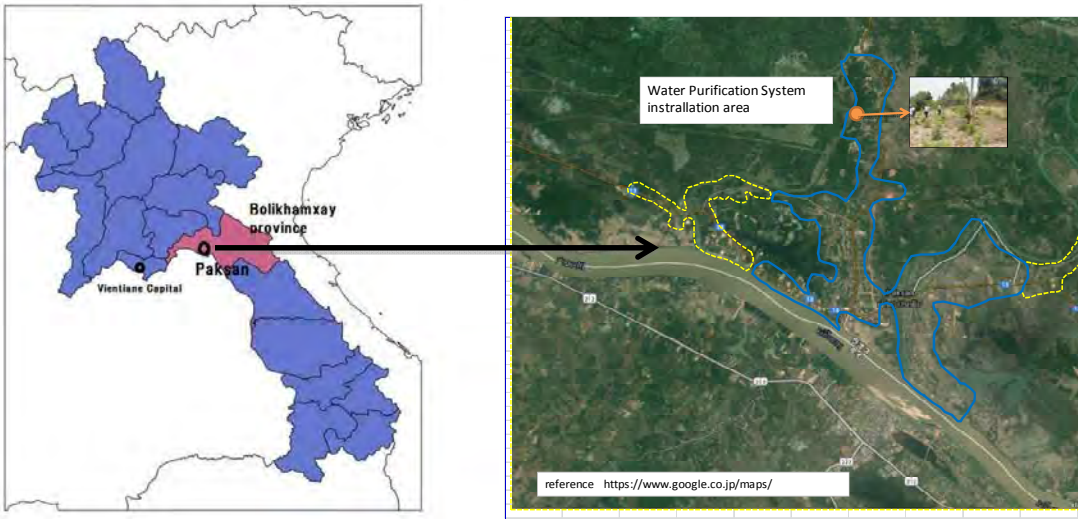


Figure: Site MAP

Target Area (Location of Installation):

Thong Village, Paksan District, Bolikhamxay Province, Lao PDR.

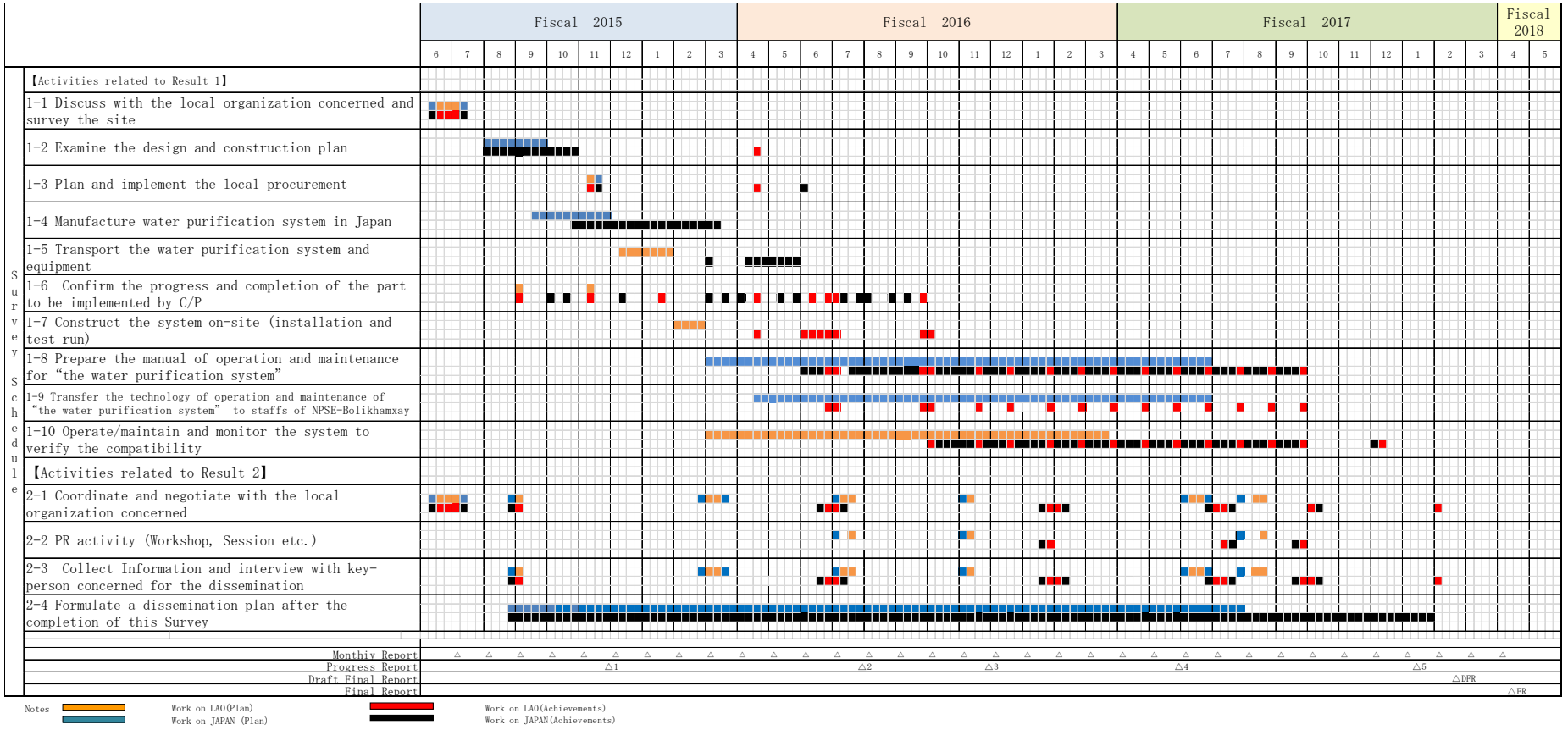
Beneficiaries:

Water supply users: local residents, stores, public facilities in the district served by the water supply system.

(6) Duration

From June, 2015 to May, 2018 (3 years)

(7) Progress Schedule



(8) Manning Schedule

① Manning Schedule（Plan）

Work Assignment	Name	Company Name	Fiscal 2015 Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Fiscal 2016 Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Fiscal 2017 Apr	May	Jun	Jul	Aug	Sep	Total LAO	JAPAN
Project Maneger	Takuya HOSOTANI	TOHKEMY CORPORATION			6									6				6				6							6		10		1.33	
Engineering	Kensaku KOBAYASHI	TOHKEMY CORPORATION			6				5				24																				1.17	
Engineering	Jun HASHIGUCHI	TOHKEMY CORPORATION											14		6				10			6			6					6				1.60	
Engineering	Tsutomu OHGAI	TOHKEMY CORPORATION														6				6				6		6								0.80	
Engineering	Hideaki TAN	TOHKEMY CORPORATION															6				6				6		6							0.80	
Chief Adviser	Tatsuo MORIMOTO	PACIFIC CONSULTANTS CO.,LTD			15 5	3		5 3					10 3	2				10 5					5 5						10 5	1	10	5	5	2.17	2.35
																																TOHKEMY (M・M) =	5.70	
																																PCKK (M・M) =	2.17	2.35
																																Total (M・M) =	7.87	2.35

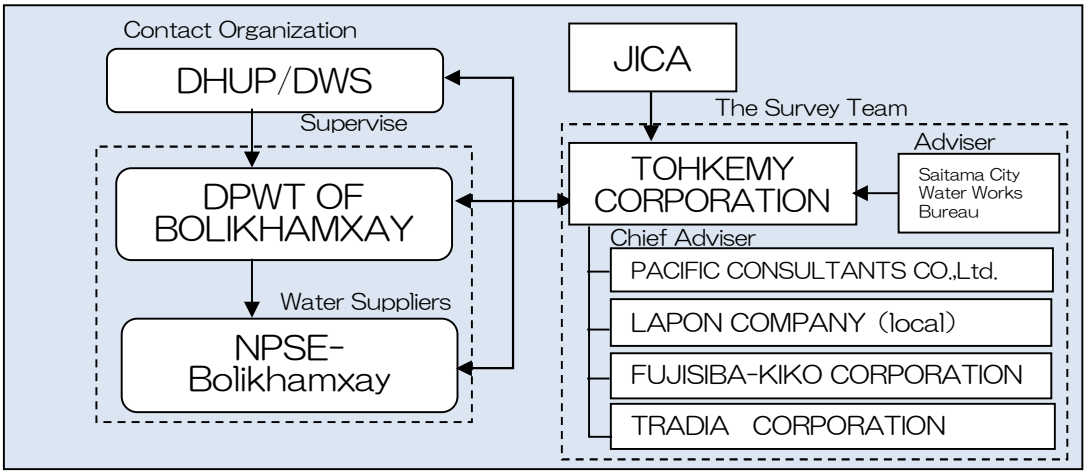
Notes
Work on LAO
Work on JAPAN

② Manning Schedule（Achievements）

Work Assignment	Name	Company Name	Fiscal 2015 Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Fiscal 2016 Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Fiscal 2017 Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Fiscal 2018 Aug	Sep	Total LAO	JAPAN
Project Maneger	Takuya HOSOTANI	TOHKEMY CORPORATION			6 1	1							1		1 1	1	2	7 1	2	3	1	1	3	1	3	1	3	2	1	8 1			1				7			1.20	1.95
Engineering	Kensaku KOBAYASHI	TOHKEMY CORPORATION			6 1	1		5	2	5 1	4		1	2	3	6	24 3		1		3	15 3	7 2			3	11	2	12	3	8 2	1	8			2	10 1	1				3.53	2.75
Engineering	Jun HASHIGUCHI	TOHKEMY CORPORATION													1	2	19 4		1		3	15 3			8 3	1	9 2		7	1	10 3		2	9	1	1	7 1	1				2.80	1.65
Engineering	Tsutomu OHTANI	TOHKEMY CORPORATION																																							0.00	0.00
Engineering	Hideaki TAN	TOHKEMY CORPORATION																																							0.00	0.00
Chief Adviser	Tatsuo MORIMOTO	PACIFIC CONSULTANTS CO.,LTD			15 5	3		5 3			1		1		1		10 3	4	1		1	3	1		8 3	1	10 3	5	4	1	10 1			8 1			1	7				2.17	2.35
																																								TOHKEMY (M・M) =	7.53	6.35
																																								PCKK (M・M) =	2.17	2.35
																																									Total (M・M) =	9.70	8.70

Notes
Work on LAO
Work on JAPAN

(9) Implementation System



Roles of each organization

Organization	Roles
DPWT OF BOLIKHAMXAY	- Secure the budget for civil and building construction to install the water purification system - Support for procedures to install the water purification system - Coordinate the handover of the system from Japanese side to NPSE.
NPSE-Bolikhamxay	- Implement the civil and building construction to install the Water Purification system - Support for procedures to install the water purification system - Support for data collection (in regard to water supply utility) - Provide the office space during the survey - Support for measuring and recording data during the survey - Train the engineers to operate the system continuously after the survey - Provide opportunities to present the verification survey and any supports
DHUP and DWS /Ministry of Public Works and Transport	- Contact institution of this survey (foreign assistance) - Support for procedures to transport the system and equipment (custom) - Support for data collection (national level) - Supervise the staff members of Lao side
The Survey Team/ TOHKEMY CORPORATION/ Pacific Consultants Co.,LTD. etc	- Interview with related organization and site reconnaissance - Design and plan the construction - Plan and implement the procurement in Laos - Manufacture the water purification system in Japan - Transfer the system from Japan to Laos - Confirm the completion of facilities to be installed by Laos side - Construction works (Installation and commissioning of the system) - Provide operation and maintenance manuals - Transfer the technology to maintain and operate the system (to NPSE) - Operation management and water quality monitoring - Formulate a dissemination plan after the “Survey” - Support the implementation of the survey - Coordinate and negotiate with Lao side agencies - Collect information to develop a business roll out and interview with the parties concerned - PR activities (Work shop and seminar) - Support to formulate a plan for dissemination of the system (including market analyze and profitability)

3. ACHIEVEMENT OF THE SURVEY

(1) Achievement of activities related to Result 1:

1-1 Discuss with the local organization concerned and survey the site

- An understanding of the variation in river water quality was gained through interviews with the staff of NPSE-Bolikhamxay.
- Cooperation in a daily inspection of river water quality was arranged.
- A study of the chemical injection rate, etc.,was made based on the raw water (river water) turbidity data and the results of water flow testing.

1-2 Examine the design and construction plan

- A design coordination meeting was held with the local NPSE-Bolikhamxay and local construction companies in June, September and November 2015, at which details of construction matters requiring attention were confirmed, adjusted and reviewed.

1-3 Plan and implement the local procurement

- The local materials and equipment were procured in timely manner.

1-4 Manufacture water purification system in Japan

- An order for the materials and equipment to manufacture the water purification system in Japan was placed dated 20th October 2015, after the progress of the local construction plan/work and the completion of the access road to the construction site were confirmed.
- The water purification system and equipment were manufactured in Japan and made a trial run, and checked the operation and performance of each section of the equipment.

1-5 Transport the water purification system and equipment (Transportation by sea and land)

- A meeting was held with the transport company with respect to packing involving checking of the actual items on 3rd March 2016.
- From 11th April of the same year, the water purification system and equipment were sequentially sent to the packing company, and were shipped from Shimizu Port on May 11.
- The equipment was then transported overland from Laem Chabang Port in Thailand, passed through Laos import clearance procedures, and arrived on site 30th May, and installation work was then begun.

1-6 Confirm the progress and completion of the part to be implemented by C/P

- The Survey Team visually checked the progress of the construction work at the site, and.kept up with the state of progress by means of photographs of the construction

site taken monthly.

- The water tank, construction of which was reported to be delayed, was completed on 8th September 2016.

1-7 Construct the system on-site (installation and test run)

- Unloading of the equipment began on-site on 3rd August 2016 and completed the next day.
- Equipment installation, piping assembly and electrical work were carried out from the next day, and construction was completed on 17th June 2016 save for the installation of some measuring equipment.
- Japanese experts were dispatched to check the plumbing and electric wiring with the support of local hired workers.
- A test run was carried out starting 20th June 2016 and completed 5th July 2016 with the exception of tests relating to the elevated water tank.
- As for the elevated water tank, installation of the instrumentation device was completed 26th September 2016 and the comprehensive trial run was completed at the end of September.
- A trial run of the system confirmed that the treated water met the water quality standards of Laos.

1-8 Prepare the manual of operation and maintenance for “the water purification system”.

- Confirmation of year-round operation of the system and preparation of an operating and maintenance manual in English to enable the NPSE-Bolikhamxay to use the system properly.

1-9 Transfer the technology of operation and maintenance of “the water purification system” to staff of NPSE-Bolikhamxay

- The technology for operation and maintenance of the system was transferred to three staff members of NPSE-Bolikhamxay, with the prepared manuals.
- Training sessions were provided basically six days per month during the first year monitoring period (from the end of September 2016), and after this period the staff of NPSE-Bolikhamxay started to operate the system by themselves with tele-support by Tohkemy via the Internet and by phone.
- Maintenance service was provided through the cooperation of Lapon Co. Ltd., who is a local partner of TOHKEMY Corporation.

1-10 Operate/maintain and monitor the system to verify compatibility (water quality measurement etc.).

The compatibility was examined by the following steps in order to adapt the water

purification system to the condition of the site.

i.Commissioning & Coordination: Confirmed that the system operated properly and sequentially.

ii.Primary test: Checked the performance of all the water purification system including the up-flow filter for high turbidity using measuring equipment and water analyzer.

iii.Stable operation [Dry season]: Operated the down-flow filter for medium turbidity and the sand filter for low turbidity, and conducted the water purification

iv.System adjustment [Rainy season]: Operated the up-flow filter for high turbidity purification in order to adapt properly to the condition of rainy season.

v.Stable operation [Rainy season]: Confirmed that the series of operation is stable by checking the measured data of turbidity.

(2) Achievement of activities related to Result 2:

2-1 Coordinate and negotiate with the local organizations concerned

・The Survey Team held interviews with the C/P (DHUP, NPSE-Bolikhamxay), other related Lao governors and agencies, JICA Laos office and the Japanese Embassy in Lao, to explain the outline and purpose of the survey and coordinate with them for its implementation.

2-2 PR activities (Workshop, Session etc.)

The following events were held to disseminate the water purification system with the consent of the counterparts.

- Presentation and Ceremony to celebrate the completion of the Water Treatment Plant in Paksan.
  - ・The presentation was held 31st January 2017 together with a ceremony to mark the completion of the water purification system.
  - ・Approximately, 40 persons attended the Presentation and 110 persons attended the ceremony. During the Q&A session about the equipment, some specific questions were raised, such as questions on the scheme for this survey, product cost, running cost, number of days required for production, and number of administrators. In addition, many local residents who participated in the session expressed their gratitude on being able to use a piped water supply service.
- Presentation at JICA Technical Cooperation Project Seminar.
  - ・The survey results of the water purification system were presented, and PR was

carried out at the MaWaSu seminar (venue: Vientiane) from 11th to 13th July 2017.(MaWaSu: JICA technical cooperation project)

- The number of participants was approximately 250 .
- Providing an overview of the survey enabled the participants to gain a greater understanding.
- The panel display produced expressions of interest and opinions from water supply utilities.
- People looked forward to the provision of facilities not only in Bolikhamxay province but also in other provinces.
- The participants learned the name of TOHKEMY.

- Work shop for NPSE-Bolikhamxay and Presentation of the results of verification activities.
  - The aim of this workshop was to deepen NPSE-Bolikhamxay staff's understanding of the technical and maintenance aspects of the water purification equipment and to exchange views on what improvements can be made to water purification equipment. It was held in the Conference Room of NPSE-Bolikhamxay on 27th September 2017.
  - The participants were 20 members of staff of NPSE-Bolikhamxay.
  - The Survey Team reported the verification results of site compatibility over 12 months.
  - Through the exchange of views and the workshop, the participants gained a deeper understanding of the technical and maintenance aspects of the water purification system.
- Other effective PR activities
  - A panel exhibition describing the survey implementation status was held at the Project MaWaSu 4th International Seminar held in Savannakhet from 16th to 17th November 2016.A total of some 100 persons participated in the Seminar, including water service officials from each of the provinces of Laos and participants from Japan. The Survey Team were asked a lot of questions about the equipment.

2-3 Collect Information and interviews with key-persons concerned for the dissemination

For full-scale expansion, the following studies and interviews were conducted.

- Verification of means of maintaining production quality in Laos
- Examination of business model for dissemination (including risk management)

・Cost benefit analysis
・Suggestions to other organizations such as international and bilateral donors

2-4 Formulate a dissemination plan after the completion of this Survey

・Business possibility was examined in terms of municipal water supply plant for small town in other area and private water supply plant in industrial park and developing zone, and the dissemination plan after the completion of this project was formulated.

【Phase 1: Continuous accumulation of achievements and experiences, and establishment of local structures (2018 - 2020)】

Establishment of a local affiliate as a base for equipment manufacture, sales and maintenance service in Lao PDR. Creation of business alliances with local affiliate and local manufacturing companies. Start and expansion of water purification equipment sales activities. Promotion of the equipment not only in small towns but also in rural areas, to contribute to the achievement of the national goals of Lao PDR.

【Phase 2: Wider dissemination through contracting to long-term comprehensive projects (2021 to 2023)】

In addition to the manufacture and sale of equipment, the affiliate will establish a system with engineering and maintenance functions. The affiliate will contract into long-term projects from NPSEs (Provincial public water suppliers) integrating sales and maintenance of water purification equipment. At this time, the technology for the operation and maintenance of the water purification system will be transferred to NPSE staff.

【Phase 3: Business expansion including pipeline provision (From 2024)】

The affiliate will turn functions other than water purification system necessary for waterworks, such as maintenance and management of the pipe network, meter reading and tariff collection, water leakage control, etc., into a value chain through tie-ups with other companies, M&A, etc., and will also enter into concession-type water supply projects. The affiliate will consider participation in third-country ODA projects and private-sector water supply projects. In addition, it will also expand into neighboring countries such as Cambodia and Vietnam.

Looking to the future, TOHKEMY Corporation also aim to re-enter the market for small water supply projects in Japan (There are about 7,000 projects).

(3) Outputs and Outcomes of the Survey

- The equipment supplies 1,000m^3 of drinkable water per day, enough to supply 6600 people, using raw water sourced from the Nam Ngiep River.
- The installation of the equipment has increased the piped water supply coverage of Paksan District from 69% to 89% , reaching the national goal of 80%.
- The equipment was installed as a Verification Survey of JICA under a proposal by TEAM TOHKEMY (consisting of TOHKEMY Corporation (representative), PACIFIC CONSULTANTS CO., LTD. (consultant) and LAPON Company Limited (local partner) and purifies high-turbidity river water in Lao PDR to meet the Lao PDR water quality standards (5 NTU or less).
- At the same time, in this survey three staff members of NPSE-Bolikhamxay received instruction in the technology for operation and maintenance of this water purification system .
- The results of monitoring over a period of 12 months from October 2016 to September 2017 showed that the annual average turbidity of the raw water was 167 NTU, and daily maximum turbidity was in excess of 4,000 NTU.
- Even with turbidity of 4,000 NTU, the quality of the purified water satisfied the Lao PDR water quality standards (5 NTU or less) , and it was possible to verify that the water purification system was well suited to local conditions.
- The running cost in terms of the cost of electricity and chemicals per unit of water was an average of 689 Kip / m^3 over the year, which was about one quarter of the calculated estimate of 2,833 Kip m^3 for the previous water purification method (flocculation + sand filtration). This was less than one-third of the initial estimated cost, confirming the cost advantage of this water purification system.

(4) Self-reliant and Continual Activities to be Conducted by Counterpart Organization

After the implementation of this survey, NPSE-Bolikhamxay will be responsible for the operation and maintenance of the equipment according to the technology transfer and the manual created during this survey period as one of its own waterworks.

The water purification plant will be operated 24 hours a day under a water purification plant manager and several members of staff. The cost of operating and maintaining the equipment will be covered by the water tariff.

4. FUTURE PROSPECTS

(1) Impact and Effect on the Relevant Development Issues through Business Development of the Product/ Technology in the Surveyed Country

- The more widespread installation of the equipment in Lao PDR is, the greater the contribution to the improvement of the piped water supply coverage.
- The expansion to other provinces of technology transfer for the operation and maintenance of this water purification system will lead to skill development of the staff of other provincial water authorities in Lao PDR, and will improve the level for ensuring a stable supply of safe water.
- Furthermore, if it becomes possible for a local manufacturing company to manufacture part of the equipment, this will contribute to local industrial development in Lao PDR.

(2) Lessons Learned and Recommendation through the Survey

（Lessons Learned）

- As safety awareness is low, it is important to take into consideration the loan of protective equipment when work is carried out by local workers.
- Even though drawings were submitted, the work was not always carried out according to the specified dimensions/correlations. Therefore, it is necessary to check and verify important parts after construction is completed.
- Since construction rarely progresses according to the work schedule, it is necessary for there to be plenty of leeway in the schedule and also for the state of progress to be checked at each stage.
- Since the foundation on which the equipment is to be installed is very uneven, it is necessary to take measures such as the preparation of a jig that provides ease of level adjustment (In this survey, leveling was facilitated through the installation of leveling bolts on each piece of equipment.)
- Though chemicals such as germicides and flocculating agents are available in liquid form in Japan, in Lao PDR chemicals in solid form need to be dissolved before use. Since undissolved matter can clog the injection pumps, leading to deterioration of the quality of the treated water, it is necessary to work out a means of separating out any undissolved matter.
- A level sensor was damaged by lightning during the Survey. Though the control panel was protected by a lighting arrester, damage to the main body could not be avoided. In areas where lightning strikes are frequent, sufficient measures need to be taken in the use of precision equipment, and as far as possible equipment that is available locally should be used. (Even items that are readily available in Japan are often difficult to obtain in Lao PDR.)
- When water intake for the equipment is from river water, the fluctuation in

turbidity can exceed 1,000NTU a day, so that manual adjustment of the amount of chemicals to be injected is considered difficult. In order to achieve stable water quality from raw river water, it is considered essential that the turbidity of the raw water be measured continuously and chemical injection controlled automatically. If such measures cannot be taken, measures such as restricting the raw water intake are necessary.

- Since there is little awareness of the need for cleanliness and tidiness within the facility, it is necessary to make workers aware of the need for daily tidying and cleaning in and around the facility, as a part of operation management.
- Since it often happened that malfunctions and problems were dealt with only after they occurred, operators need to learn to try to prevent such malfunctions and problems before they occur, through daily checks and inspections.
- Though the equipment is installed indoors, during the rainy season the measuring instruments and control panel were invaded by large numbers of ants. Since there seems little that can be done to prevent this in terms of hardware, daily checks by staff are necessary.
- Due to the lack of basic knowledge and experience of water treatment and equipment, difficulties were felt in explaining operational procedures. Some means of encouraging mastery of the basics is required.
- The Survey Team is especially grateful for all the support provided in import and customs duty procedures, including the issue by the counterpart organization of a letter of support, which enabled customs clearance to proceed smoothly.

（Recommendations）

- The survey supports the overseas expansion of SME (small medium-size enterprises).

  The survey became a local showcase undertaking; it was very beneficial in gaining recognition of the equipment among people involved in the water supply in Lao PDR and helped to promote its branding to some extent.

  Though it provides a foothold for the expansion and spread of business locally, there are concerns regarding local funding. In a water supply project, expenses are recovered from the water tariff over a long period spanning several decades. However funding for the initial investment is far from easy, leading to a vicious cycle: the construction of facilities does not make headway → income from water tariffs does not increase → maintenance costs increase due to the aging of the facilities → waterworks fall into financial difficulties..

For these reasons, it is strongly recommended that consideration be given to the establishment of small-lot loan schemes suited to initial investment to support the introduction and development of small-sized water purification facilities, the establishment of a financial support framework specializing in water facility development, and support for subsidy programs for water supply projects in Lao PDR.

- Difference in recognition of the usefulness of the equipment in comparison with Japan (Turbidity above 100NTU is usual in Lao PDR, unusual in Japan)

  As was shown in the results of the water quality monitoring, the turbidity of the river water (surface water used as the water source) in the area of the Mekong River rises to an average of around 200NTU during the rainy season, with daily peaks of around 1,000NTU; this can rise to over 4,000NTU in extreme circumstances, such as an upstream dam break. In Japan, 200NTU is considered a level that might be recorded for short periods of time as a result of torrential rain, and is not normal. Thus, what is considered water treatment under extreme circumstances in Japan is normal during the rainy season in Lao PDR.

  Therefore, it is extremely difficult to apply Japanese experience and performance to the evaluation of performance and economic efficiency in Lao PDR. This point should be recognized and understood when the usefulness of this equipment is compared with experience and performance achieved with other equipment.

- Awareness building of the survey scheme (burden sharing)

  The survey was carried out and the flow of treated water accomplished thanks to the civil engineering and construction works implemented by the Lao PDR side and the installation of the equipment on the Japanese side. Having the Lao side bear some of the burden significantly raised their commitment and interest in the survey.

  By paying their own expenses, they exhibited excellent leadership, had a greater sense of mission and responsibility, and were able to execute the survey successfully. We expect that this survey will be recognized as a successful example for both Lao PDR and Japan and will help in the adaptation of other cases as well as improving water supply coverage.

LAO PDR

Verification Survey with the Private Sector for Disseminating Japanese technologies of Water Purification System for Highly Turbid Water for Use in Small Town Water Supply

TOHKEMY CORPORATION, Osaka, Japan

Concerned Development Issues in LAO

- There are some problems such as Regional disparities in water service and Stable supply of safe water.
- It is required to purify surface water with cost savings and supply stably, even though the surface water is remarkably high turbid under rainy weather, under the conditions of good-quality groundwater sources are going to be in short.

Implemented Activities in the Survey

- By introducing a high-turbid water purifying system in Paksan area, Bolikhamxay,the JICA Survey Team will verify local adaptability of it's system.
- Transfer the technology of the operation and maintenance of the "The water purifying system" to staff of NPSE-Bolikhamxay.
- Formulate a dissemination plan after the "Survey".

Proposed Products/Technologies

Water Purification System for Highiy Turbid Water =Fiber filters (Actifiber) and Sand filtration System.
-Technology of Fiber filters (patent)
-Utility cost can be reduced by around a one-third in comparison with coagulation-sedimentation system .
-Construction period and space can be shortened and smaller.

Survey Overview

Name of Counterpart:
Department of Public Works and Transport of Bolikhamxay Province/ NPSE-Bolikhamxay
Survey duration:From June, 2015 to May, 2018 (3 years)
Survey Area:Paksan District, Bolikhamxay Province in LAO

Impact on the Concerned Development Issues in LAO

- Established stable purification system for highly turbid water.
- The population served by water supply will increase.
- Running cost decreases in comparison with a conventional method.

Outputs and Outcomes of the Survey

- The installed equipment supplies 1,000m^3 of drinkable water per day.
- Even with turbidity of 4,000 NTU, the quality of the purified water satisfied the Lao PDR water quality standards (5 NTU or less) ,and it was possible to verify that the water purification system was well suited to local conditions.
- After the Survey, challenge to the public water supply project, private urban development business and industrial water business in Lao.

ລາຍງານໂຄງການທົດລອງຕົວຈິງຂອງລະບົບກັນຕອງນ້ຳທີ່ສາມາດບຳບັດນ້ຳທີ່ມີຄວາມຂຸ່ນສູງ ສຳລັບຕົວເມືອງນ້ອຍຢູ່ ສປປລາວ

TOHKMEY CORPORATION

1 ໂຄງການສາທິດແລະສົ່ງເສີມ (JICA)

* ຈຸດປະສົງ
  * ສົ່ງເສີມໃຫ້ບໍລິສັດນ້ອຍແລະກາງ ນຳສະເໜີ ຜະລິດຕະພັນ ແລະ ເຕັກໂນໂລຊີ, ຍົກລະດັບເຕັກນິກ ໃຫ້ເໝາະສົມກັບບັນດາປະເທດທີ່ກຳລັງພັດທະນາ ເພື່ອໃຫ້ມີການນຳໃຊ້ຢ່າງກ້ວາງຂວາງ.
  * ອີງໃສ່ໂຄງການດັ່ງກ່າວ ບັນດາໂຄງການຂອງລັດຖະບານ ແລະໂຄງການຊ່ວຍເຫຼືອຕ່າງໆ ສາມາດນຳໃຊ້ ຜະລິດຕະພັນ ແລະ ເຕັກໂນໂລຊີ ຫລາຍຂຶ້ນ, ໂດຍການແຜ່ກະຈ່າຍ ຜະລິດຕະພັນ ແລະ ເຕັກໂນໂລຊີດັ່ງກ່າວ ຄຽງຄູ່ກັບການອອກສູ່ຕະຫຼາດສາກົນຂອງ ບໍລິສັດນ້ອຍ ແລະ ກາງ ສາມາດຊ່ວຍພັດທະນາເສດຖະກິດໃນເຂດພາກພື້ນນັ້ນໆ.

2 ໂຄງການສຳຫຼວດແລະສົ່ງເສີມລະບົບກັ່ນຕອງນ້ຳທີ່ມີຄວາມຂຸ່ນສູງ ສຳລັບທຸລະກິດນ້ຳປະປາຕົວເມືອງນ້ອຍ

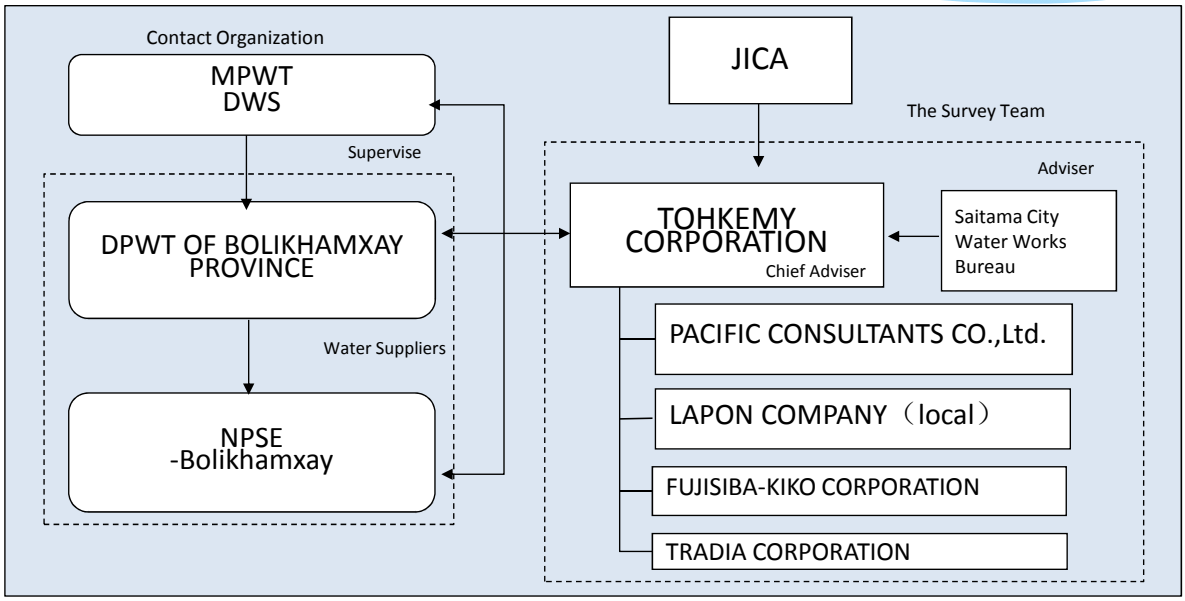
1)ຈຸດປະສົງຂອງໂຄງການ

* ນຳໃຊ້ລະບົບກັ່ນຕອງນ້ຳທີ່ມີຄວາມຂຸ່ນສູງເພື່ອປັບປຸງເຂົ້າເຖິງນ້ຳທີ່ປອດໄພຂອງປະຊາຊົນໃນເຂດສາມາດໃຫ້ດີຂຶ້ນ
* ການຍັ້ງຍືນລະບົບທີ່ເໝາະສົມກັບສະພາບຕົວຈິງ
* ກຳນົດແຜນຂະຫຍາຍ ເພື່ອປະກອບສ່ວນໃນວຽກງານການສະໜອງນ້ຳປະປາ

	ປະຈຸບັນ	ເປົ້າໝາຍປະສິດທິຜົນ	ເພີ່ມເຕີມ
ປະຊາກອນບໍລິການ	13,905ຄົນ (69%)	17,778ຄົນ (88%)	20,101ຄົນ ກ່າຍ80%ຂອງເປົ້າໝາຍລັດຖະບານ (ປີ2020)
ແຫຼ່ງນ້ຳ	ນ້ຳບາດານ	ແມ່ໜ້າດິນ	ບັນຫາເລື່ອງທາດຫີນປູນ ປະລິມານນ້ຳບໍ່ພຽງພໍ
ຄຸນນະພາບນ້ຳ		ຕ່ຳກ່ວາ 3NTU	ແຫລ່ງນ້ຳ ～3000NTU
ຕົ້ນທຶນການຜະລິດ		1/3ຂອງແບບທົ່ວໄປ	
ຍົກລະດັບພະນັກງານນ້ຳປະປາ		ຮຽນເຕັກນິກໃໝ່	ລະບົບແຫ່ກວາມຂຸ່ນອັດຕະໂນມັດ, ໃຊ້ພະນັກງານໃນການຄຸ້ມຄອງໜ້ອຍ

2 ໂຄງການສຳຫຼວດແລະສົ່ງເສີມລະບົບກັ່ນຕອງນ້ຳທີ່ມີຄວາມຂຸ່ນສູງ ສຳລັບທຸລະກິດນ້ຳປະປາຕົວເມືອງນ້ອຍ

2)ໂຄງຮ່າງການຈັດຕັ້ງການປະຕິບັດໂຄງການ



2 ໂຄງການສາທິດແລະສົ່ງເສີມລະບົບກັ່ນຕອງນ້ຳທີ່ມີຄວາມຂຸ່ນສູງ ສຳລັບທຸລະກິດນ້ຳປະປາຕົວເມືອງນ້ອຍ

3) ຂໍ້ມູນລວມຂອງລະບົບ

- ນຳໃຊ້ເຕັກໂນໂລຊີເສັ້ນໃຍ(FIBER)ຕອງນ້ຳຂຸ່ນສູງ ກັ່ນຕອງສິ່ງທີ່ເຮັດໃຫ້ນ້ຳຂຸ່ນ, ສາມາດກັ່ນຕອງນ້ຳທີ່ມີຄວາມຂຸ່ນຂົ້ນສູງໄດ້

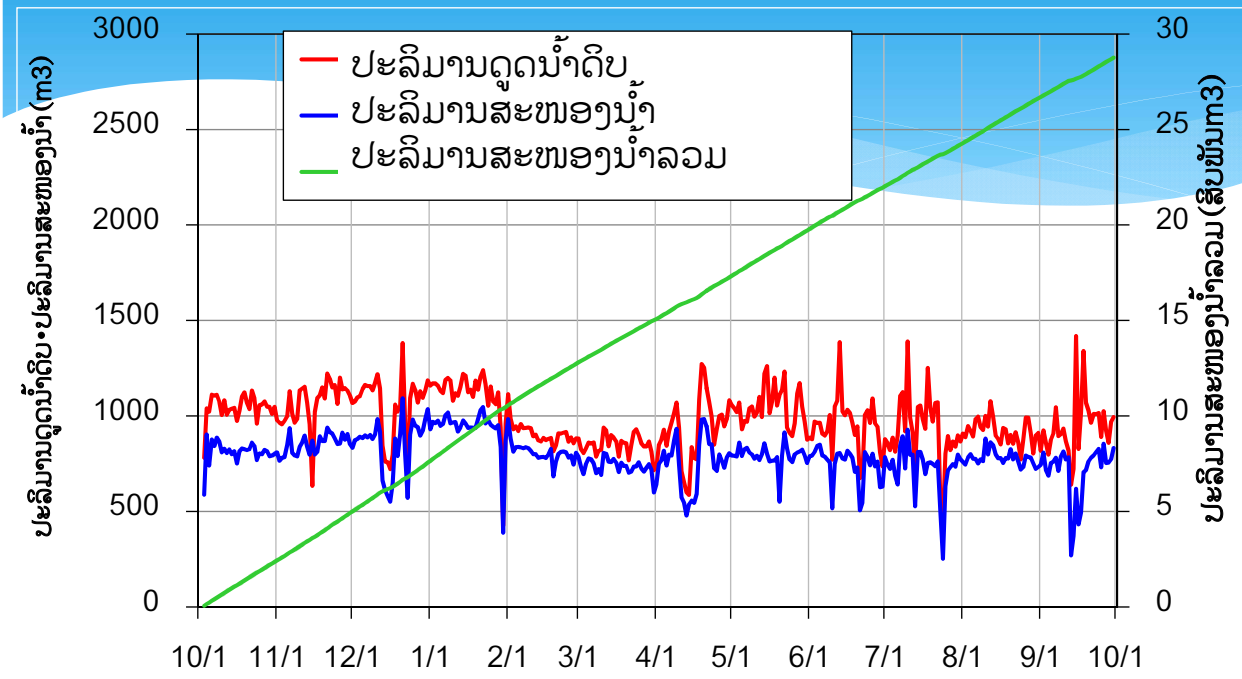
ລະບົບກັ່ນຕອງ	ເສັ້ນໃຍຕອງຄວາມຂຸ່ນສູງ＋ເສັ້ນໃຍຕອງຄວາມຂຸ່ນຕ່ຳ+ຕອງຊາຍ【ລະບົບຖັງຕອງ3ຂັ້ນ】
ຄຸ້ມຄອງຄຸນນະພາບນ້ຳ	pH ຄໍລິນ ຄວາມຂຸ່ນ
ນຳໃຊ້ຢາເຄມີ	ຫີນສົ້ມ, ຄໍລິນຝຸ່ນ

3. ປະຫວັດ(ແຕ່ການເຊັນສັນຍາ ເຖິງການກໍ່ສ້າງ)

- ເຊັນ MOU: 15 May 2015
- ເລີ່ມຜະລິດ: 20 Oct 2015
- ນຳເຂົ້າສະໜາມ : 30 May 2016
- ເລີ່ມສະໜອງນ້ຳ : 3 Oct 2016

MOU - ຕິດຕັ້ງ:1 ປີ
ໃຊ້ເວລາຕິດຕັ້ງ :1 ເດືອນ

4. ຜົນການທົດລອງ(ປະລິມານສະໜອງນ້ຳ)



-ສະໜອງນ້ຳ1000m^3 ໃຫ້ປະຊາຊົນປະມານ 6,600ຄົນ ຈາກນ້ຳງຽບ
-ຊ່ວຍໃຫ້ອັດຕາການເຂົ້າເຖິງນ້ຳປະປາຢູ່ເຂດເທດສະບານເມືອງປາກຊັນ ຈາກ 69% ເປັນ 89%

5. ຜົນການທົດລອງ(ຄຸນະພາບການສະໜອງນ້ຳ)

1) ຄວາມຂຸ່ນຂອງນ້ຳດິບ ແລະ ນ້ຳທີ່ບຳບັດແລ້ວ

非公開

5. ຜົນການທົດລອງ(ຄຸນະພາບການສະໜອງນ້ຳ)

2)ໄລຍະຄວາມຊຸ່ນສູງຂອງແຫຼງນ້ຳ ແລະ ນ້ຳທີ່ບຳບັດແລ້ວ (ເດືອນ ກັນຍາ 2017)

非公開

5. ຜົນການທົດລອງ(ຄຸນະພາບການສະໜອງນ້ຳ)

3) ຕໍ່ກັບຄວາມຊຸ່ນທີ່ມີການປ່ຽນແປງໄວ

非公開

5. ຜົນການທົດລອງ(ຄຸນະພາບການສະໜອງນ້ຳ)

4) ມາດຕະຖານນ້ຳປະປາ 23 ຫົວໜ່ວຍ

- ໄດ້ເອົານ້ຳທີ່ບຳບັດແລ້ວໄປວັດແທກຄຸນພາບນ້ຳຕາມມາດຕະຖານປະເທດລາວ 23 ຫົວໜ່ວຍ ຢູປະເທດຍີ່ປຸ່ນ
- ໄດ້ຍັ້ງຢືນຄຸນະພາບຢູ່ໃນຂອບເຂດມາດຕະຖານ (06 ຕຸລາ 2016)
- ເຫັນໄດ້ວ່າລະບົບດັ່ງກ່າວແມ່ນແທດເໝາະກັບພື້ນທີ່ນີ້ດີ.

水 質 検 査 結 果 書
(Result of Water Quality Testing)

6. ຜົນການທົດລອງ(ຕົ້ນທຶນ)

5) ຕົ້ນທຶນໃນການຜະລິດນ້ຳ (ສານເຄມີແລະໄຟຟ້າ ຕໍ່ m^3)

非公開

6. ຜົນການທົດລອງ(ຕົ້ນທຶນ)

6) ຕາມການຄິດໄລ ເມື່ອປຽບທຽບກັບລະບົບທໍ່ໄປ (ຕໍ່ m^3)

非公開

7. ຄວາມເປັນໄປໄດ້ໃນຕໍ່ໜ້າ

1) ການດຳເນີນງານແລະການບຳລຸງຮັກສາ

ການດຳເນີນງານ ແລະ ບຳລຸງຮັກສາໂດຍພະນັກງານນ້ຳປະປາ, ຍົກລະດັບຄວາມສາມາດ ໃຫ້ພະນັກງານ ສາມາດສະໜອງນ້ຳປະປາທີ່ປອດໄພ ແລະ ມີຄວາມສະຖຽນລະພາບ.








7. ຄວາມເປັນໄປໄດ້ໃນຕໍ່ໜ້າ

2) ການຜະລິດໃນທ້ອງຖິ່ນ

ການຜະລິດອຸປະກອນໃນທ້ອງຖິ່ນຈະປະກອບສ່ວນໃຫ້ແກ່ການພັດທະນາອຸດສະຫະກຳພາຍໃນ ໃນສປປລາວ.

ເຕັກໂນໂລຊີ່ຍີ່ປຸ່ນ
ຜະລິດຢູ່ລາວ

8. ບົດຮຽນທີ່ໄດ້ຮຽນຮູ້

① ຄວາມຮັບຮູ້ຕໍ່ຄວາມປອດໄພຂອງພະນັກງານ
② ລະດັບຄວາມຮູ້ຂອງພະນັກງານທີ່ແຕກໂຕນ
③ ຄຸນະພາບທາງເຄມີ ແລະ ການຈັດການ
④ ອຸປະກອນວັດແທກ ເພຍ້ອນຟ້າຝ
⑤ ພາຍໃນມື້ດຽວ ມີກໍລະນີການປ່ຽນແປງຂອງຄວາມຂຸ່ນຂອງແຫຼ່ງນ້ຳ ເກີນ 1000NTU

9. Line up

Lapon Co.,Ltd.

* ເປົ້າໝາຍ : ຕົວເມືອງນ້ອຍ ແລະ ໝູ່ບ້ານ
* ແຫຼ່ງນ້ຳ : ແມ່ນ້ຳ / ບຶງ / ນ້ຳບາດານ
* ຜະລິດຕະພັນ

ປະລິມານ	100 m^3/ມື້	300 m^3/ມື້	500 m^3/ມື້	800 m^3/ມື້	1000 m^3/ມື້
ຈຳນວນຄົນ	660	2,000	3,300	5,300	6,600
ຈຳນວນຄອບຄົວ	100	300	500	800	1,000
ພື້ນທີ່ສຳລັບເຄື່ອງຈັກ	5mx12m	6mx14m	7mx17m	9mx19m	9mx20m
ຂະໜາດອ່າງຕອງ	3mx12m	5mX16m	7mX20m	9mX23 m	9mx26m





ຂໍຂອບໃຈ