Monitoring Report
“Evaporation System Modernization at OJSC “Ilim Group” Branch in Koryazhma”

Version 2.1
17 May 2010

Monitoring period: 01.01.2008 – 31.12.2009

Executed by CCGS LLC

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SECTION A. General Project activity information

A.1 Title of the project activity:

"Evaporation System Modernization at OJSC "Ilim Group" Branch in Koryazhma**".**

A.2 Short description of the project activity:

This project envisages construction of a new high-technology evaporator plant manufactured by "Andritz" with the evaporating capacity of 600 tonnes per hour and decommissioning of the two old "Ramen" evaporator plants with the design capacity of 140 tonnes per hour, each.

The new evaporator plant is a single-line six-stage plant consisting of seven evaporating units operating as per a six-stage scheme and on the principle of falling film formed across heat exchange surfaces manufactured from "lamellar" packages. There is no barometric condenser. Highly contaminated condensates are treated in a stripping column. Design concentration of dry residue after the evaporator plant is 53%, further evaporation to 65% is achieved in the existing "Ahlstrom" concentrators. Evaporating capacity of the evaporator plant is 600t/h and it can be freely regulated within the range of 20÷100%. Quick start and shutdown of the units is ensured by presence of small quantities of liquor in the units.

The project is aimed at modernization of the Mill's evaporation system, which is intended to reduce power consumption of the pulp production process, stabilize operation of the process equipment, mitigate negative environmental impacts and reduce greenhouse gases (GHG) emissions.

A.3 Monitoring period:

- Monitoring period starting date: 01.01.2008;
- Monitoring period closing date: 31.12.2009.

A.4. Methodology applied to the project activity (incl. version number)

A.4.1. Baseline methodology:

The developer proposes his own approach [R1] to the baseline setting and GHG emission reductions calculation and does not agree it with any methodologies for the clean development mechanism (CDM), but he certainly makes his approach consistent with the requirements of *Decision 9/CMP.1, Appendix B* [R2].

A.4.2. Monitoring methodology:

The monitoring plan was developed following our own approach [R1] in accordance with the project specifics and requirements of *Decision 9/CMP.1, Appendix B* [R2] without using any approved CDM methodologies.

A.5. Status of implementation including time table for major project parts:

Activity	Date
Signing of contract for procurement of main equipment	January 2005
Commencement of construction and assembly works	March 2005
Commissioning of equipment	December 2007

A.6. Intended deviations or revisions to the registered PDD:

Deviations affected the monitoring plan only.

A.7. Intended deviations or revisions to the registered monitoring plan:

A.7.1. The monitoring plan given in the PDD provides that heat savings from the use of condensate and warm water generated at the new "Andritz" evaporator plant are determined by readings of respective instruments (flow meters and temperature sensors). And such savings are to be metered on an hourly basis. However, all necessary instruments were put into operation stage by stage only in mid-2009. Therefore while the instruments were still missing, the monitoring of GHG emission reductions in 2008 and partially in 2009 had to use design, statistical and calculated monthly data on flows and temperatures of these heat carriers with strictly complying of the principle of conservatism. As the instruments were gradually put into operation, the calculations began to use monthly average (for temperature sensors) and monthly (for flow meters) readings.

Monthly volumes of warm water produced at "Andritz" evaporator plant and then used in production process were determined by flow meter readings over the entire monitoring period from January 2008 till December 2009.

Water temperature at the inlet to the new "Andritz" evaporator plant for the period January 2008 – April 2009 was assumed equal to the highest value (which is a conservative solution in terms of GHG emission reductions) within a range of values that includes design data and monthly average readings recorded by instruments in May – December 2009. Starting in May 2009 this temperature has been measured by an instrument and average monthly readings of this instrument have been used in calculations (See Table B.2.4).

Water temperature at the outlet from the new "Andritz" evaporator plant for the period January 2008 – March 2009 was assumed equal to the lowest value (which is a conservative solution in terms of GHG emission reductions) within a range of values that includes design data and monthly average readings recorded by instruments in April – December 2009. Starting in April 2009 this temperature has been measured by an instrument and monthly average readings of this instrument have been used in calculations (See Table B.2.4).

Monthly volumes of relatively clean condensate produced at the new "Andritz" evaporator plant and then used in production process were calculated for the entire monitoring period from January 2008 till August 2009 using liquor evaporation data. The calculations used monthly-minimum values of evaporated water quantity which are recorded every week. This, in its turn, resulted in a minimum value of condensate production, and therefore also in a minimum GHG emission reduction effect from using condensate (the method for calculation of relatively clean condensate is described in more details in Section D.2). Beginning from September 2009 volumes of reused relatively clean condensate have been measured by a flow meter and monthly readings of this flow meter have been used in calculations.

When estimated and actual volumes of relatively clean condensate supplied to production during the flow meter operation period (September – December 2009) were compared, it was found that estimated values are lower by 6.7-15.9 %. Therefore it is fair to say that the decision to calculate relatively clean condensate volumes using liquor evaporation data and the methodology described in Section D.2. is justified and conservative.

Monthly volumes of treated condensate produced at the new "Andritz" evaporator plant and then used in production process from January 2008 till August 2009 were initially calculated using a methodology similar to the one used for calculation of relatively clean condensate. However after installation of a flow meter it turned out that not all of the produced treated condensate is supplied to production process. Between 45 490 and 111 450 m^3 of treated condensate are utilized per month, which accounts for between 31.3 % and 56.5 % of the produced quantity. Following the principle of conservatism, the lowest value, t.e. 45 490 m^3 per month, was finally assumed for the period January 2008 – August 2009 in our calculations. Starting in September 2009 the volumes of reused treated condensate have been measured by a flow meter and monthly readings of this meter have been used in calculations.

Temperature of relatively clean condensate for the period January 2008 – July 2009 was assumed equal to the lowest value (which is a conservative solution in terms of GHG emission reductions) within a range of values that includes design data and monthly average readings recorded by instruments in August – December 2009.

Starting in August 2009 this temperature has been measured by an instrument and the monthly average readings of this instrument have been used in calculations (See Table B.2.4).

Temperature of treated condensate for the period January 2008 – April 2009 was assumed equal to the lowest value (which is a conservative solution in terms of GHG emission reductions) within a range of values that includes design data and monthly average readings recorded by instruments in May – December 2009. Starting in May 2009 this temperature has been measured by an instrument and monthly average readings of this instrument have been used in calculations (See Table B.2.4).

These deviations from the approved monitoring plan are described in Section D.2 and are taken into account in the calculation model.

Heat savings from use of warm water and condensates will be monitored on an hourly basis, as it was planned in the PDD, starting in 2010.

A.7.2. During the monitoring period from January 1, 2008 till January 10, 2009 red liquor was evaporated at the new "Andritz" evaporator plant, but beginning from January 11, 2009 red liquor began to be evaporated at the old "UkrNIIHimMash" evaporator plant as it had been the case before the project. This was due to the technological complexities of co-evaporation of black and red liquors at "Andritz" evaporator plant. Attempts were made to solve the problem by using various evaporation modes and chemicals. However the Mill's specialists came to a conclusion that co-evaporation of black and red liquors at the new evaporator plant is not possible, because this leads to clogging up of distribution grates and, as a consequence, to clogging up of heating surfaces (lamellas) of the evaporator units and to increase of fresh steam consumption. The plant had to be shut down in order to clean up the evaporator units.

Considering that from January 11, 2009 red liquor has been supplied to "UkrNIIHimMash" evaporator plant, just like it was under the baseline scenario, hereafter the project and the baseline scenarios merge together, and the effects from red liquor evaporation at the new evaporator plant are lost. In the future, if the same practice of red liquor evaporation at the "UkrNIIHimMash" evaporator plant is carried on, it will be no longer necessary to monitor red liquor parameters.

Thus, the effects from red liquor evaporation at the new and more efficient "Andritz" evaporator plant (lower heat consumption for liquid evaporation and higher output content of dry matter in liquors) can be taken into account only for the period 01.01.2009 – 10.01.2009, which has been done.

The GHG emission reduction calculation method didn't have to be modified in any way. The effect of shifting red liquor evaporation to the old "UkrNIIHimMash" evaporator plant was taken into account by assuming that from the moment of this shift (from January 11, 2009) red liquor flow to the new "Andritz" evaporator plant is zero.

This deviation from the monitoring plan was taken into account in the calculation model.

A.8. Changes since last verification:

There are no changes as this is the first monitoring verification.

A.9. Name of responsible person(s)/entity(ies):

The person (s) responsible for the preparation and submission of the monitoring report are:

OJSC "Ilim Group" Branch in Koryazhma"
• Pavel Kushmylev, Chief of Technical Development Department

CCGS LLC
• Vladimir Dyachkov, Director of Project Implementation Department
• Evgeniy Zhuravskiy, Specialist of Project Implementation Department

SECTION B. Key monitoring activities according to the monitoring plan for the monitoring period stated in A.3.

B.1. Monitoring equipment types:

The measuring devices are provided in accordance with the official rules "Electricity Metering Rules", "Heat Metering Rules" etc. The devices have to undergo regular inspection and supervision under the Federal Law "On Uniformity of Measurements". Table B.1.1. shows metrological performance of the measuring devices used for monitoring.

Table B.1.1. Data on metering devices for GHG emission reduction monitoring

Metered parameter	Mark and type of meter	Serial number	Set number	Measurement range	Unit	Error, accuracy class	Calibration interval (month)	Last calibration data	Organisation which performs calibration
Volume of pulp produced in SAS-1 cooking workshop after blowdown:	1.Flow meter: AXFA200G,200	S5HA03069839	D-341	0-360	m^3/h	1.0	60	23.10.2009	OJSC "Ilim Group" Branch in Koryazhma
	2.Concentration meter: MEK-2300	256337/1/3	D-504	2-5	%	1.0	Adjusted on a weekly basis as per laboratory analysis		OJSC "Ilim Group" Branch in Koryazhma
Volumetric consumption of natural gas by utilizing boiler	3.Natural gas flow meter: PROWIRL 72,25 PROWIRL F,25	8103AF02000	Ch-322	0-400	m^3/h	1.0	60	20.06.2007	OJSC "Ilim Group" Branch in Koryazhma
Volumetric consumption of natural gas by flare	4.Natural gas flow meter: PROWIRL F,40	8103B002000	Ch-320	0-650	m^3/h	1.0	60	20.06.2007	OJSC "Ilim Group" Branch in Koryazhma
Calorific value of natural gas	5.Calorimetric bomb: V-08-MA	1857	TEC	15000	J/kg	0.10%	12	03.12.2009	Arkhangelsk Centre for Standardisation and Metrology (ACSM)
	6.Weights: VLKT-500	136	S-002	0-500	g	Class 4	12	28.07.2009	Arkhangelsk Centre for Standardization and Metrology
	7.Set of weights: G-2-210	288	T-002	1-100	g	Class 2	12	17.02.2010	
Calorific value of liquor	8.Calorimetric bomb: V-08-M	1085	TEC	15000	J/kg	0.10%	12	03.12.2009	Arkhangelsk Centre for Standardization and Metrology
	9.Weights: VLKT-500	10	S-001	0-500	g	Class 4	12	23.07.2009	OJSC "Ilim Group" Branch in Koryazhma

	10.Set of weights: G-2-210	392	T-003	1-100	g	Class 2	12	17.02.2010	Arkhangelsk Centre for Standardization and Metrology
Heat consumption for CHP-3 evaporator plant	11.Flow meter: HD4SD27SHO	u/n	T-365	0-63	t/h	0.5	12	11.01.2010	OJSC "Ilim Group" Branch in Koryazhma
	12.Temperature meter: Sh4500, THK	2034746	T-152	0-300	^{0}C	1.5	24	09.02.2010	OJSC "Ilim Group" Branch in Koryazhma
	13.Pressure meter: HT6S122SHO	44659434	T-256	0-60	bar	0.5	12	03.04.2010	OJSC "Ilim Group" Branch in Koryazhma
Heat consumption for CHP-3 concentrators	14.Flow meter: DIFF-EL	5829	T-396	0.47; 0-40	kgf/cm^2; t/h	0.5	12	15.08.2009	OJSC "Ilim Group" Branch in Koryazhma
	15.Temperature meter: TSP-Pt100	u/n	T-162	0-200	^{0}C	0.3 grade of C	12	14.01.2010	Arkhangelsk Centre for Standardization and Metrology
	16.Pressure meter: PRESS-EL	3447	T-202	0-13	bar	0.5	12	27.08.2009	OJSC "Ilim Group" Branch in Koryazhma
Heat consumption for CHP-2 evaporator plant	17.Flow meter: PMD-75	81007E0109D	Ch-300	0-0.075	bar	0.5	12	01.09.2009	OJSC "Ilim Group" Branch in Koryazhma
	18.Temperature meter: TR88-AA4	u/n	Ch-100	0-250	^{0}C	Class C	60	23.06.2008	OJSC "Ilim Group" Branch in Koryazhma
	19.Pressure meter: PMP-71	8100790109C	Ch-201	0-5	bar	0.5	12	02.06.2009	OJSC "Ilim Group" Branch in Koryazhma
Heat consumption for CHP-2 concentrators	20.Pressure meter: PRESS-EL	110664	S-228	0-10	bar	0,5	12	26.08.2009	OJSC "Ilim Group" Branch in Koryazhma
	21.Flow meter: DIFF EL	250668	S-343	0-588.4	mbar	0.5	12	20.10.2009	OJSC "Ilim Group" Branch in Koryazhma
	22.Flow meter: DIFF EL	250667	S-381	0-588,4	mbar	0,5	12	23.12.2009	OJSC "Ilim Group" Branch in Koryazhma
	23.Temperature meter: S-550	u/n	S-100	0-200	^{0}C	Class C	60	23.06.2008	OJSC "Ilim Group" Branch in Koryazhma
	24.Temperature meter: S-550	u/n	S-102	0-200	^{0}C	Class C	60	23.06.2008	OJSC "Ilim Group" Branch in Koryazhma
Heat production by utilizing boiler	25.Flow meter: Deltabar S, PMD75 type	81009A0109D	Ch-316	0.230; 0-2.8	bar; kg/s	0.5	12	26.08.2009	OJSC "Ilim Group" Branch in Koryazhma
	26.Temperature meter: TR88-AA4B1D2R3000	810061	Ch-143	0-220	^{0}C	Class C	60	26.06.2008	OJSC "Ilim Group" Branch in Koryazhma
	27.Pressure meter: Cerabar S, PMP71 type	81008F0109C	Ch-222	0-20	bar	0.5	12	26.08.2009	OJSC "Ilim Group" Branch in Koryazhma

Quantity of red liquor fed to CHP-2 evaporator plant	28.Flow meter: OPTI FLUX4000F,150	A0732427	Ch-333	0-250	m^3/h	1.0	60	28.10.2008	OJSC “Ilim Group” Branch in Koryazhma
	29.Temperature meter:	556	____	0-150	^0C	1 grade of C	48	23.01.2010	OJSC “Ilim Group” Branch in Koryazhma
	30.Density meter:	BY LABORATORY METHOD							OJSC “Ilim Group” Branch in Koryazhma
Quantity of black liquor from CPP fed to CHP-2 evaporator plant	31.Flow meter: 50XM12,50; SM,50	2X1003/A6; 2X1003/C6	D-913	0-20	m^3/h	1.0	60	04.09.2008	OJSC “Ilim Group” Branch in Koryazhma
	32.Temperature meter:	555	____	0-150	^0C	1 grade of C	48	23.01.2010	OJSC “Ilim Group” Branch in Koryazhma
	33.Density meter:	BY LABORATORY METHOD							OJSC “Ilim Group” Branch in Koryazhma
Quantity of black liquor from SBPP fed to CHP-2 evaporator plant	34.Flow meter: IFS400F,250; IFC080,250	150A0732429; 93401408	B-391	0 – 450	m^3/h	1,0	60	31.08.2009	OJSC “Ilim Group” Branch in Koryazhma
	35.Temperature meter: 13TD73	7528	B-112	0-100	^0C	1.5	12	15.10.2009	OJSC “Ilim Group” Branch in Koryazhma
	36.Density meter:	BY LABORATORY METHOD							OJSC “Ilim Group” Branch in Koryazhma
Quantity of black liquor from SBPP fed to CHP-3 evaporator plant	37.Flow meter: DMPK100	07932	T-370	6300; 0-500	kgf/m^2; t/m^3	1.5	12	01.06.2009	OJSC “Ilim Group” Branch in Koryazhma
	38.Temperature meter:	125	____	0-150	^0C	1 grade of C	48	23.01.2010	OJSC “Ilim Group” Branch in Koryazhma
	39.Density meter: DIFF AIR	7997	T-017	0-300; 1-1,1	kgf/m^2; t/m^3	1.0	12	27.08.2009	OJSC “Ilim Group” Branch in Koryazhma
Volume of warm water after condenser of CHP-2 evaporator plant fed for production needs	40.Flow meter: OPTI FLUX5000F,600	A0693092	Ch-328	0-5000	m^3/h	1.0	60	15.10.2007	OJSC “Ilim Group” Branch in Koryazhma
Temperature of warm water after the condenser of CHP-2 evaporator plant fed for production needs	41.Temperature meter: TR15 1xPT100/A/4	u/n	Ch -151	0-120	^0C	Class C	60	17.08.2007	OJSC “Ilim Group” Branch in Koryazhma
Volume of condensate after CHP-2 evaporator plant, fed for production needs from condensate accumulation tank	42.Flow meter: Deltabar S PMD72 type	81007F0109D	Ch-301	0-42	l/s	0.5	12	08.06.2009	OJSC “Ilim Group” Branch in Koryazhma

Condensate temperature after evaporator plant of CHP-2 that is fed for process needs from condensate surge tank (Condensate A)	43.Temperature sensor 1XPt100/dl	00449900	D-127	0-200	^{0}C	Class B	60	26.10.2009	OJSC "Ilim Group" Branch in Koryazhma
Flow rate of relatively clean condensate B	44.Flow meter AXF200G,200 AXF146,200	S5FC04180651; S5FC 04186	D-334	0-180	m3/h	1,0	60	14.06.07	OJSC "Ilim Group" Branch in Koryazhma
Temperature of relatively clean condensate B	45.Temperature sensor 1XPt100/dl	00449012	D-126	0-200	^{0}C	Class B	60	26.10.2009	OJSC "Ilim Group" Branch in Koryazhma
Electricity consumption by CHP-2 evaporator plant	46.Electricity meter: ELCTIEA	1138305	—	10000	kW/h	0.5	96	2nd quarter of 2006	OJSC "Ilim Group" Branch in Koryazhma
Electricity consumption by CHP-3 evaporator plant	47.Electricity meter: ELCTIEA	1138304	—	10000	kW/h	0.5	96	2nd quarter of 2006	OJSC "Ilim Group" Branch in Koryazhma

B.2. Monitored data:

The data were monitored in accordance with the schemes shown in Fig. B.2.1, B.2.2.

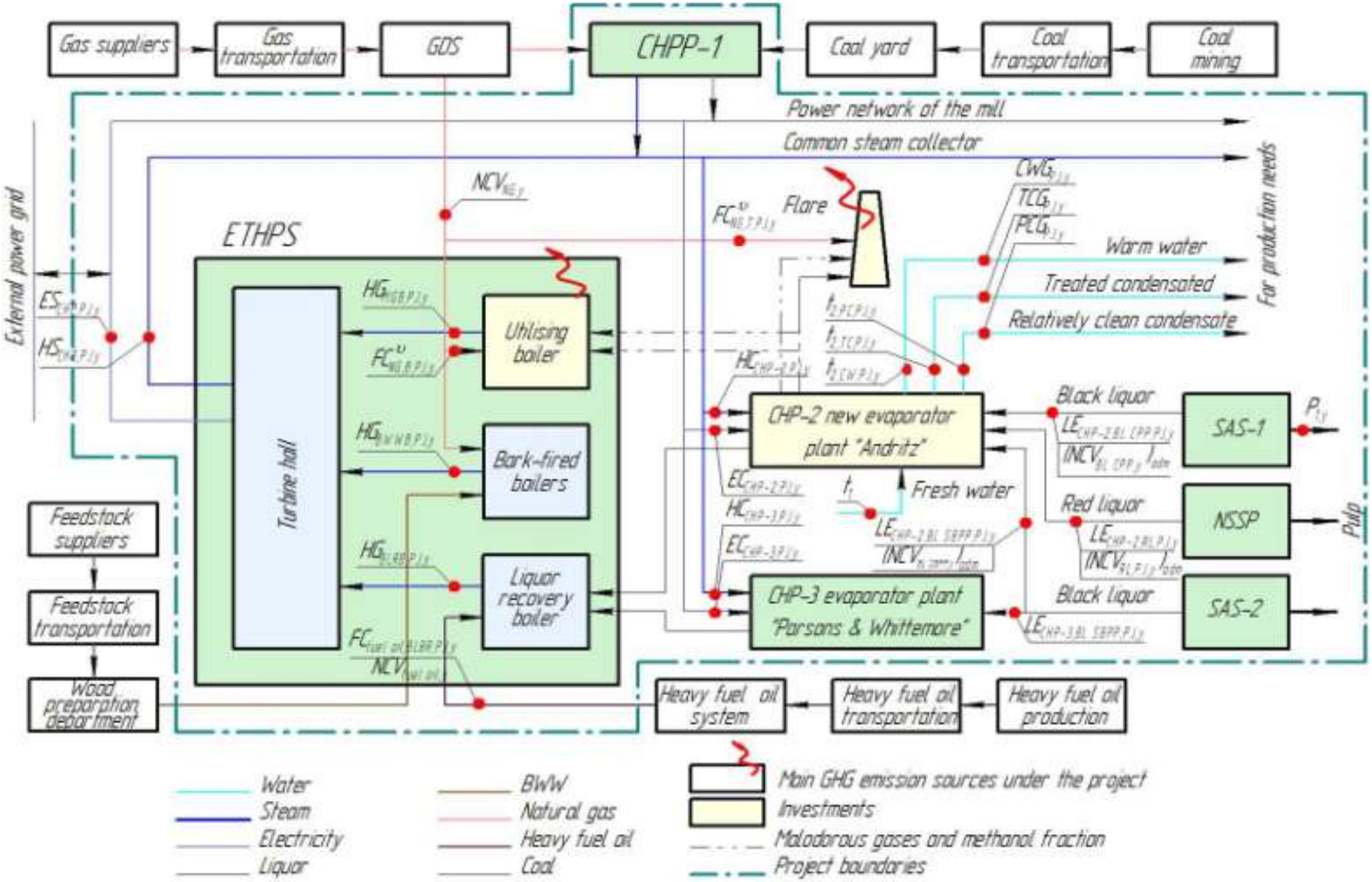

Fig. B.2.1. Location of the monitoring points for the time period from 01.01.2008 till 10.01.2009

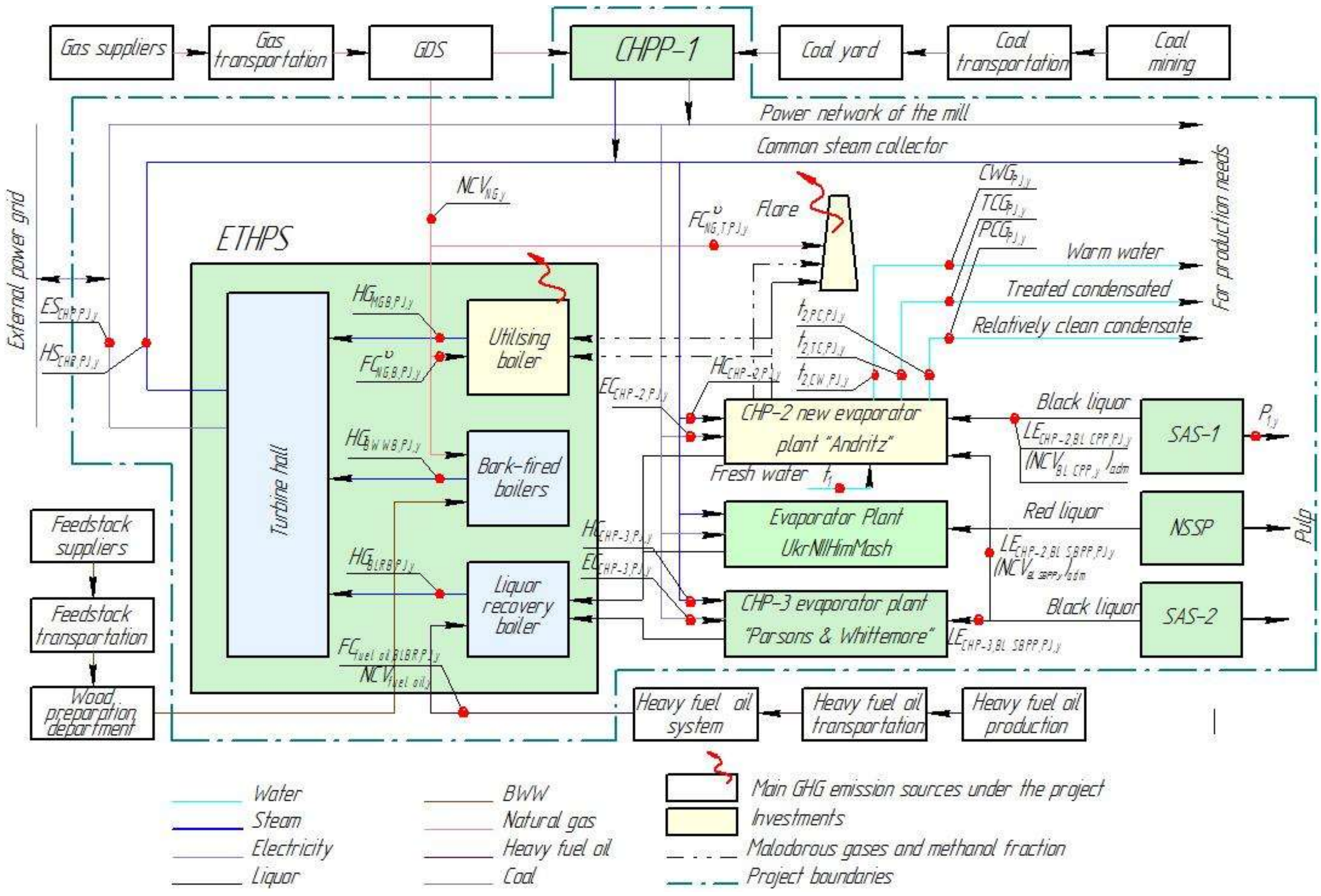

Fig. B.2.2. Location of the monitoring points for the time period from 11.01.2009 till 31.12.2009

According to the emissions reduction monitoring plan, the following twenty nine parameters should be controlled (see Tables B.2.1, B.2.2, B.2.3, B.2.4). These tables also contain parameter values for the year 2008 and 2009.

Table B.2.1. Data to be collected in order to monitor emissions from the project, and how these data will be archived:

ID number	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Numerical value	
								2008	2009
1. $FC^{v}_{NG,B,y}$	Volumetric consumption of natural gas by the utilizing boiler	The Mill's Energy Service	Thousand m^3	m	Continuously	100 %	Electronic and paper	2 738.60	2429.27
2. $FC^{v}_{NG,T,y}$	Volumetric consumption of natural gas by the flare	The Mill's Energy Service	Thousand m^3	m	Continuously	100 %	Electronic and paper	419.40	550.77
3. $NCV_{NG,y}$	Weighted average net calorific value of natural gas	Production laboratory, the Mill's Energy Service	GJ/ thousand m^3	m	Once per week	100 %	Electronic and paper	33.46	33.58

Table B.2.2. Data to be collected in order to monitor emissions from the baseline, and how these data will be archived:

ID number	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Numerical value	
								2008	2009
4. $P_{1,y}$	Volume of pulp produced in the pulp cooking workshop SAS-1	The Mill's commercial Department, SAS-1 cooking workshop	t a.d.p.	m	Continuously	100 %	Electronic and paper	364 637	343 367
5. $FC_{fuel\ oil,BLRB,y}$	Heavy fuel oil consumption by liquor recovery boilers under the project	The Mill's Energy Service	t	m	Continuously	100 %	Electronic and paper	3 073	3 183

6. $\left(NCV_{RL,PJ,y}\right)_{adm}$	Weighted average net calorific value of red liquor referred to absolutely dry mass under the project	Production laboratory, the Mill's Energy Service	GJ/t a.d.m.	m	Once per week	100 %	Electronic and paper	10.03	9.14
7. $\left(NCV_{BL\ CPP,y}\right)_{adm}$	Weighted average net calorific value of BL CPP referred to absolutely dry mass	Production laboratory, the Mill's Energy Service	GJ/t a.d.m.	m	Once per week	100 %	Electronic and paper	9.97	10.40
8. $\left(NCV_{BL\ SBPP,y}\right)_{adm}$	Weighted average net calorific value of BL SBPP referred to absolutely dry mass	Production laboratory, the Mill's Energy Service	GJ/t a.d.m.	m	Once per week	100 %	Electronic and paper	9.77	9.83
9. $NCV_{fuel\ oil,y}$	Weighted average net calorific value of heavy fuel oil	Fuel certificate	GJ/t a.d.m.	m	For each supplied batch of heavy fuel oil	100 %	Electronic and paper	40.61	40.61
10. $HC_{CHP-3,PJ,y}$	Heat consumption at the evaporator plant of CHP-3 under the project	The Mill's Energy Service	GJ	m, c	Continuously	100 %	Electronic and paper	1 629 639	1 348 185
11. $HC_{CHP-2,PJ,y}$	Heat consumption at the evaporator plant of CHP-2 under the project	The Mill's Energy Service	GJ	m, c	Continuously	100 %	Electronic and paper	2 848 131	2 598 239
12. $HG_{MGB,y}$	Heat production by the utilizing boiler	The Mill's Energy Service	GJ	m, c	Continuously	100 %	Electronic and paper	131 685	140 315
13. $HG_{BLRB,PJ,y}$	Total heat produced by liquor recovery boilers under the project	The Mill's Energy Service	GJ	m, c	Continuously	100 %	Electronic and paper	9 451 405	8 807 844
14. $HG_{BWWB,PJ,y}$	Total heat produced by BWW-fired boilers under the project	The Mill's Energy Service	GJ	m, c	Continuously	100 %	Electronic and paper	4 009 386	3 585 990
15. $HS_{CHP,PJ,y}$	Heat supply from ETHPS under the project	The Mill's Energy Service	GJ	m, c	Continuously	100 %	Electronic and paper	11 459 547	10 175 126
16. $LE_{CHP-2,RL,PJ,y}$	Quantity of red liquor fed to the evaporator plant of CHP-2 under the project	The Mill's Energy Service	t a.d.m.	m	Continuously	100 %	Electronic and paper	27 841	745

17. $LE_{CHP-2,BL\ CPP,PJ,y}$	Quantity of BL CPP fed to the evaporator plant of CHP-2 under the project	The Mill's Energy Service	t a.d.m.	m	Continuously	100 %	Electronic and paper	458 000	446 377
18. $LE_{CHP-2,BL\ SBPP,PJ,y}$	Quantity of BL SBPP fed to the evaporator plant of CHP-2 under the project	The Mill's Energy Service	t a.d.m.	m	Continuously	100 %	Electronic and paper	106 738	169 897
19. $LE_{CHP-3,BL\ SBPP,PJ,y}$	Quantity of BL SBPP fed to the evaporator plant of CHP-3 under the project	The Mill's Energy Service	t a.d.m.	m	Continuously	100 %	Electronic and paper	426 943	360 061
20. $CWG_{PJ,i,y}$	Volume of warm water returned for reuse under the project	The Mill's Energy Service	m^3	m	Continuously	100 %	Electronic and paper	23 873 555	22 844 850
21. $PCG_{PJ,i,y}$	Volume of relatively clean condensate returned for reuse under the project	The Mill's Energy Service	m^3	c/m	Continuously	100 %	Electronic and paper	959 523	1 095 909
22. $TCG_{PJ,i,y}$	Volume of treated condensate returned for reuse under the project	The Mill's Energy Service	m^3	c/m	Continuously	100 %	Electronic and paper	545 880	696 420
23. $t_{1,i,y}$	Water temperature at the inlet to the new evaporator plant	The Mill's Energy Service	^oC	e/m	Continuously	100 %	Electronic and paper	24.0	See table B.2.4.
24. $t_{2,CW,PJ,i,y}$	Temperature of warm water stream at the outlet from the new evaporator plant	The Mill's Energy Service	^oC	e/m	Continuously	100 %	Electronic and paper	39.5	See table B.2.4.
25. $t_{2,PC,PJ,i,y}$	Temperature of relatively clean condensate stream at the outlet from the new evaporator plant	The Mill's Energy Service	^oC	e/m	Continuously	100 %	Electronic and paper	50.2	See table B.2.4.
26. $t_{2,TC,PJ,i,y}$	Temperature of treated condensate stream at the outlet from the new evaporator plant	The Mill's Energy Service	^oC	e/m	Continuously	100 %	Electronic and paper	67.0	See table B.2.4.

Table B.2.3. Data to be collected in order to monitor the leakage, and how these data will be archived:

ID number	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Numerical value	
								2008	2009
27. $EC_{CHP-2,PJ,y}$	Electricity consumption by evaporator plant of CHP-2 under the project	The Mill's Energy Service	MWh	m	Continuously	100 %	Electronic and paper	22 532	18 466
28. $EC_{CHP-3,PJ,y}$	Electricity consumption by evaporator plant of CHP-3 under the project	The Mill's Energy Service	MWh	m	Continuously	100 %	Electronic and paper	8 431	8 907
29. $ES_{CHP,PJ,y}$	Electricity supply from ETHPS under the project	The Mill's Energy Service	MWh	m	Continuously	100 %	Electronic and paper	205 545	188 960

Table B.2.4. Temperatures of water and condensates:

Data variable	Symbol	Unit	Value under the project	Indications of devices 2009									Values of temperatures accepted to calculation for the period of absence of devices since 01.01.2008
				April	May	June	July	August	September	October	November	December	
Water temperature at the inlet to the new evaporator plant	$t_{1,i,y}$	°C	**24**	-	22.7	23.76	23.21	23.45	23.49	19.82	20.02	17.27	**24.0**
Temperature of warm water stream at the outlet from the new evaporator plant	$t_{2,CW,PJ,i,y}$	°C	45	44.05	44.92	47.85	45.99	43.66	39.97	39.74	**39.50**	40.51	**39.5**
Temperature of relatively clean condensate stream at the outlet from the new evaporator plant	$t_{2,PC,PJ,i,y}$	°C	55	-	-	-	-	**50.20**	54.02	54.47	57.01	55.63	**50.2**
Temperature of treated condensate stream at the outlet from the new evaporator plant	$t_{2,TC,PJ,i,y}$	°C	**67**	-	77.08	77.37	74.05	71.70	69.78	73.88	72.68	75.83	**67.0**

B.3. The environmental service

The Environmental Service, accountable to the Deputy Technical Manager for Environmental Protection, is responsible for industrial environmental monitoring at the enterprise. The Service consists of:

- Environmental Protection Department (EPD), comprising a production laboratory;
- Biological Treatment Facility for Industrial Effluents (BTFIE), comprising a production laboratory.

The industrial environmental monitoring covers the following:

- Analytical control of compliance with the prescribed pollutant emission standards in accordance with the laboratory control charts;
- Monitoring of the impact of waste disposal sites on underground and surface waters, atmospheric air and soil;
- Control of pollution content in the atmospheric air on the border of the sanitary protection zone, etc.

The data retrieved by the analytical laboratory are processed and summarized in monthly and annual reports, which contain all required detailed data, including data by sections and streams covered by this project.

The enterprise has the following reporting obligations as per official annual statistic forms:

- 2-tp (air) Data on Atmospheric Air containing information on the quantities of trapped and destroyed air pollutants, detailed emissions of specific pollutants, number of emission sources, emission reduction actions and emissions from separate groups of pollutant sources;
- 2-tp (water) Data on Water Use, containing information on water consumption from natural sources, discharges of effluents and their pollutant content, capacity of wastewater treatment facilities, etc.;
- 2-tp (wastes) Data on generation, utilization, destruction, transportation and disposal of production and consumption residues, containing an annual balance of wastes flows by their types and hazard classes.

In compliance with the Russian legislation, the enterprise annually develops and implements environmental protection measures.

Quality, environment and industrial safety management systems at Koryazhma Branch comply with the international standards ISO 9001, ISO 14001 and OHSAS 18001. The enterprise manufactures products certified for compliance with the requirements of the Forest Stewardship Council (FSC).

B.4. Data processing and archiving (incl. software used):

All data will be stored in the Mill's archive in electronic and paper form for at least 2 years after the end of the crediting period or the last issue of ERUs.

SECTION C. Quality assurance and quality control measures

C.1. Quality control (QC) and quality assurance (QA) procedures undertaken for data monitored

Table C.1.1. Quality control (QC) and quality assurance (QA) procedures undertaken for data monitored:

Data *(Indicate table and ID number)*	Uncertainty level of data (high/medium/low)	Explain QA/QC procedures planned for these data
Table B.2.1. ID 1,2	Low	Flow meters are used to measure consumption of natural gas in the flare and in the utilizing boiler. Measurement error is 1.0 %. Calibration interval: 5 years. Output signals from the flow meters transmitters enters the Automated Process Control System (APCS).
Table B.2.2. ID 4	Low	The volume of pulp produced in SAS-1 cooking workshop is measures with the help of the following: 1. Flow meter. Measurement error 1.0 %. Calibration interval: five years. 2. Concentration meter. Measurement error 1.0 %. The concentration meter is adjusted on a weekly basis according to the laboratory analysis. The instruments are installed after the digesters of SAS-1. Data from the instruments are sent to the APCS. In addition, pulp cooking volumes are cross checked by two methods: The first method is by measuring the rotation speed of the special dosing tray with known holding capacity which is used to feed chips to the digesters. Then using the pulp yield standards approved at the enterprise the volume of cooked pulp is determined. The second method is based on weighing of each type of finished marketable product and determining the quantity of pulp consumed for manufacturing of these products using special consumption coefficients approved at the enterprise. These coefficients are approved individually for each paper and cardboard making machine.
Table B.2.2. ID 5	Low	Flow meters are used for measuring heavy fuel oil consumption by liquor recovery boilers. Flow meters are installed at each liquor recovery boiler. Measurement error is 1.0 %. Calibration interval: five years. Output signals from the flow meters transmitters are sent to the APCS.

Table B.2.1. ID 3 Table B.2.2. ID 6-8	Low	The calorific values of natural gas and liquors are measured in the Mill's production laboratory on a weekly basis. Instruments for measurement of calorific value of liquors and natural gas are: 1. Calorimetric bomb. Measurement error is 0.10%. Calibration interval: 1 year. 2. Weights. Accuracy class: 4. Calibration interval: 1 year. 3. Set of weights. Accuracy class: 2. Calibration interval: 1 year.
Table B.2.2. ID 9	Low	Calorific value of heavy fuel oil. Data of the fuel suppliers' certified laboratories are used. At the year-end weighted average value is determined.
Table B.2.2. ID 10-15	Low	For metering of output, supply and consumption of heat the following is used: 1. Steam flow meters. Measurement error 0.5 %. Calibration interval: 1 year; 2. Temperature meter. Accuracy class C. Calibration interval: five years; 3. Pressure meter. Measurement error 0.5 %. Calibration interval: 1 year. Signals from the instruments are sent to the APCS.
Table B.2.2. ID 16-19	Low	Liquor consumption is measured by the following: 1. Flow meters. Measurement error 1.0%. Calibration interval: five years. 2. Temperature meter. Measurement error 1 ^{o}C. Calibration interval: four years. 3. Density meter. Liquor density is measured by laboratory method on a daily basis. Mass flow rate of liquors is calculated in tonnes of a.d.m. based on the volume flow rate, temperature and density.
Table B.2.2. ID 20-22	Low	Consumption of warm water and condensate streams are measured by electromagnetic flow meters. Measurement error 1.0%. Calibration interval: five years. Output signals from flow meters are sent to the APCS.
Table B.2.2. ID 23-26	Low	Temperature converters are used for measurement of warm water and condensate streams after CHP-2 evaporator plant. Accuracy class C. Calibration interval: five years. Output signals from the converters are sent to the APCS.
Table B.2.3. ID 27-29	Low	Electricity consumption at evaporator plants and electricity supply from ETHPS are measured by electricity meters. Measurement error 0.5 %. Calibration interval: eight years.

Internal check-out

The responsibility for timely and full collection of primary data, organization of primary data check-out and transfer to the Central office and for dealing with other organizational issues related to monitoring lies with the Head of the Technical Development Department, Pavel Kushmylev.

The responsibility for collection, check-out and transfer of primary data for monitoring lies with the following persons:

- The Head of Planning and Economics Department Production Line "Energetika" Maxim Balakshin (consumption of fuel and energy resources, technical data);
- The Lead Economist of ETHPP Tatyana Kraeva (consumption of fuel and energy resources, technical data);
- The Head of the Budgeting Department Elena Popova (pulping volumes and production output levels);
- The Chief Ecologist Nikolay Ryabov (environmental impact of the project).

The responsibility of these persons is specified in Order No. FU/512-A of 04.12.2007.

The internal check-out of GHG emission reduction calculation at "Ilim Group" Branch in Koryazhma was carried out by the Head of the THPP Evaporator Department, Michael Vorontsov.

The powers of the Head of the THPP Evaporator Department, Michael Vorontsov, to check out GHG emission reduction calculation results are officially confirmed by the order No.FK/1381 of 03.12.2009.

Cross-check

Check of the monitoring report is carried out by the Director of the Project Implementation Department of CCGS LLC, or, on his instructions, by other Specialist of the Project Implementation Department who was not directly involved in preparation of this project monitoring report.

Additional cross check is carried out by the director of the Project Development Department of CCGS LLC, or, on his instructions, by other specialist of the Project Development Department.

At CCGS LLC the procedure for verification of the monitoring reports are laid down in "The provisions for quality control procedure in relation to preparation of project design documents and monitoring reports for greenhouse gas emission reduction projects at CCGS LLC" (see Annex 2).

C.2 Operational and administrative structure

C.2.1. Monitoring procedures:

Procedure for registration, monitoring, record and storage of data

Collection and record of data required for calculation of GHG emission reductions will be carried out in accordance with the metering points scheme shown in Fig B.2.1., B.2.2.

Original request for primary GHG emission reductions monitoring data is made by the Director of the Project Implementation Department of CCGS LLC to the Central Office of ”Ilim Group” in St.-Petersburg, namely to the Director for Labour Protection, Fire Safety and Environment, who in his turn gives instructions to a certain enterprise to collect the requested data. Each enterprise that is implementing projects within the framework of the Kyoto Protocol has specific persons (a working group) that responsible for collection, control and transfer of monitoring data. The responsibility of these persons is specified in corresponding orders. At “Ilim” Group Branch in Koryazhma the responsibility of such persons are set forth in Order No. FU/512-A of 04 .12. 2007.

The information collected at the enterprise is transferred to the Central Office, namely to the Director for Labour Protection, Fire Safety and Environment, who in his turn transfers it to the Director of the Project Implementation Department of CCGS LLC. All information is transferred by e-mail.

On the basis of the received data the Department of Project Implementation of CCGS LLC prepares a GHG emission reduction monitoring report and submits it for additional cross-check to the Project Development Department of CCGS LLC. As soon as all comments made by the Project Development Department are incorporated or resolved the monitoring report is submitted for verification to the enterprise where the project is implemented. At CCGS LLC the procedure for verification of the monitoring reports are laid down in “The provisions for quality control procedure in relation to preparation of project design documents and monitoring reports for greenhouse gas emission reduction projects” (see Annex 2).

At “Ilim Group” Branch in Koryazhma responsibility of the person for the control of results calculation GHG emission reduction is set forth in Order No. FU/1381A of 03 .12. 2009.

After the report is verified and amended as necessary, the Director of the Project Implementation Department of CCGS LLC informs the Director for Labour Protection, Fire Safety and Environment of “Ilim” Group’s Central Office in St.-Petersburg about preliminary monitoring results and, if there are no comments on his part, the General Director of CCGS LLC takes the final decision to submit the monitoring report for verification to an independent expert organization.

The procedure for collection and record of data required for calculation of GHG emission reductions is described in Table C.2.1.

Table C.2.1. Monitoring procedures	
Monitored parameter	**Procedure for registration, monitoring, record and storage of data (including everyday monitoring)**
Pulp cooking volume	1. The volume of pulp produced in the pulp cooking workshop SAS-1 is continuously measured by flow meters and concentration sensor installed after the digesters. In addition, pulp cooking volumes are cross checked by two methods: The first method is by measuring the rotation speed of the special dosing tray with known holding capacity which is used to feed chips to the digesters. Then the volume of cooked pulp is determined using pulp production standards approved at the enterprise. The second method is based on weighing of each type of finished marketable products and determining the quantity of pulp consumed for manufacturing of these products using special consumption coefficients approved at the enterprise. These coefficients are approved individually for each paper and cardboard making machine. 2. Data from the instruments are sent to APCS and recorded in the Mill's automated dispatch control system (ADCS), printed in hard copy at the Mill's commercial department and stored in the computer memory for not less than one year, then the computer data are handed over to the Mill's archives. 3. The data are recorded by an operator on a daily basis in daily reports on pulp cooking workshop performance, and also handed over to the commercial department of the enterprise. Daily reports are then summarized in monthly and annual reports. 4. Pulp cooking data will be stored in the Mill's archives in electronic and paper form for at least 2 years after the end of the crediting period or the last issue of ERUs.
Natural gas consumption in the utilizing boiler and in the flare	1. The consumed quantity of natural gas is continuously measured by flow meters. 2. Flow meter readings are recorded in the APCS and are shown on the displays of all computers with the required software installed. The data are printed in hard copy and stored in the computer memory for at least one year, and then sent to the Mill's electronic archive. 3. The data are recorded by CHP-2 operators on a daily basis in daily reports, which are then summarized in monthly and annual reports. 4. Natural gas consumption data will be stored in the Mill's archive in electronic and paper form for at least 2 years after the end of the crediting period or the last issue of ERUs.

Consumption of heavy fuel oil by liquor recovery boilers	1. The consumed quantity of heavy fuel oil is continuously measured by flow meters. 2. Flow meter readings are recorded in the APCS and are shown on the displays of all computers with the required software installed. The data are printed in hard copy and are stored in the computer memory for at least one year, and then sent to the Mill's electronic archive. 3. The data are recorded by operators on a daily basis in daily reports, which are then summarized in monthly and annual reports. 4. Heavy fuel oil consumption data will be stored in the Mill's archive in electronic and paper form for at least 2 years after the end of the crediting period or the last issue of ERUs.
Calorific value of heavy fuel oil	1. The calorific value of heavy fuel oil is determined by the fuel supplier, and the fuel certificate is provided by the fuel supplier for each batch of heavy fuel oil supplied to the Mill. 2. The calorific value data are recorded in the logs and then transferred to the APCS where they are stored for at least one year, and then the data are sent to the Mill's electronic archive. The data are shown on the displays of all computers with the required software installed. 3. Calorific values data will be stored in the Mill's archive in electronic and paper form for at least 2 years after the end of the crediting period or the last issue of ERUs.
Calorific values of natural gas and liquors	1. Calorific values of natural gas and liquors are determined experimentally on a weekly basis in the production laboratory of OJSC "Ilim Group" Branch in Koryazhma. 2. The test results are recorded by laboratory assistants in the logs and then transferred to the APCS where they are stored for at least one year, and then the data are sent to the Mill's electronic archive. The data are shown on the displays of all computers with the required software installed. 3. Calorific values data will be stored in the Mill's archive in electronic and paper form for at least 2 years after the end of the crediting period or the last issue of ERUs.
Inlet and outlet dryness of liquors	1. Inlet and outlet dryness of liquors are determined experimentally on a weekly basis in the production laboratory of OJSC "Ilim Group" Branch in Koryazhma. 2. The test results are recorded by laboratory assistants in the logs and fixed in the computer of the lead economist of ETHPS. 3. Inlet and outlet dryness of liquors data will be stored in the Mill's archive in electronic and paper form for at least 2 years after the end of the crediting period or the last issue of ERUs.

Liquor supply to evaporator plants	1. For measurement of the quantity of liquors fed to evaporator plants, flow meters and concentration meters are used. The parameters are measured continuously. 2. The meter readings are recorded in the APCS and are shown on the displays of all computers with the required software installed. The data are printed in hard copy and are stored in the computer memory for at least one year, and then sent to the Mill's electronic archive. 3. The data are recorded by operators on a daily basis in daily reports, which are then summarized in monthly and annual reports. 4. Data on the quantity of liquors supplied to evaporator plants will be stored in the Mill's archive in electronic and paper form for at least 2 years after the end of the crediting period or the last issue of ERUs.
Production, supply and consumption of heat	1. For monitoring of heat production, supply and consumption sensors and transmitters are used, which continuously measure flow rate, temperature and pressure of steam. 2. The meter readings are recorded in the APCS and are shown on the displays of all computers with the required software installed. The data are printed in hard copy and are stored in the computer memory for at least one year, and then sent to the Mill's electronic archive. 3. The data are recorded by operators on a daily basis in daily reports, which are then summarized in monthly and annual reports. 4. Data will be stored in the Mill's archive in electronic and paper form for at least 2 years after the end of the crediting period or the last issue of ERUs.
Quantity of warm water and condensate streams fed for reuse	1. Flow meters are used for monitoring of the quantity of warm water and condensate streams supplied for production needs. The parameters are measured continuously. 2. The meter readings are recorded in the APCS and are shown on the displays of all computers with the required software installed. The data are printed in hard copy and are stored in the computer memory for at least one year, and then sent to the Mill's electronic archive. 3. The data are recorded by operators on a daily basis in daily reports, which are then summarized in monthly and annual reports. 4. Data on the quantity of reused warm water and condensate will be stored in the Mill's archive in electronic and paper form for at least 2 years after the end of the crediting period or the last issue of ERUs.

Temperatures of warm water and condensates	1. Temperature sensors are used for monitoring of warm water and condensates temperatures. The parameters are measured continuously. 2. The meter readings are recorded in the APCS and are shown on the displays of all computers with the required software installed. The data are printed in hard copy and are stored in the computer memory for at least one year, and then sent to the Mill's electronic archive. 3. The data are recorded by operators on a daily basis in daily reports, which are then summarized in monthly and annual reports. 4. Data on the warm water and condensates temperatures will be stored in the Mill's archive in electronic and paper form for at least 2 years after the end of the crediting period or the last issue of ERUs.
Electricity consumption metering	1. Electricity consumption at the evaporator plants and the electricity supply from ETHPS are continuously measured by electricity meters. 2. The meter readings are recorded in the APCS and are shown on the displays of all computers with the required software installed. The data are printed in hard copy and are stored in the computer memory for at least one year, and then sent to the Mill's electronic archive. 3. The data are recorded by operators on a daily basis in daily reports, which are then summarized in monthly and annual reports. 4. Data on electricity consumption by evaporator plants and electricity supply from ETHPS will be stored in the Mill's archive in electronic and paper form for at least 2 years after the end of the crediting period or the last issue of ERUs.

Procedures for management of monitoring and measuring devices.

The GHG monitoring procedures use procedures applied under ISO 9001, ISO 14001, OHSAS 18001 standards.

Specifically, the Plant Standard "Management of monitoring and measuring devices" [R11] is in effect at the enterprise and specifies the following:

- procedures for procurement of measuring devices;
- stock record procedure;
- operation;
- repair;
- identification;
- operational procedure in case of identification of non-compliance of the measuring devices;
- persons responsible for measuring devices operation and monitoring of compliance with the Plant Standard.

The Plant Standard was developed in accordance with the requirements of:

- ISO 9001:2008 "Quality Management Systems. Requirements" (item 7.6);
- ISO 14001:2004 "Environmental Management Systems. Requirements and Guidance (item 4.5.1);
- OHSAS 18001:2007 "Occupational Safety and Health Management Systems. Specification" (item. 4.5.1).

The enterprise's compliance with the three above mentioned standards has been officially certified.

According to procedures of these standards, if any non-compliance of the measuring processes with the standards specified in design documentation is identified, the situation is analyzed, alternative monitoring and measuring procedures are developed for the period of non-compliance as well as corrective actions are taken that allow to remedy any identified non-compliance.

Alternative monitoring and measuring procedures as applied to this JI project

If any instrument fails, the parameters shall be monitored for not more than 15 days in one year based on calculation of an average value of this instrument's readings taken over a 3-days period prior to the failure.

If the equipment is operated without instrument-based monitoring of any parameter for more than 15 days, then the calculations shall be made using estimates or the most conservative (in terms of GHG emission reductions) value including design data and readings recorded by instruments from the start of the project monitoring.

C.2.2. Roles and responsibility:

The management of “Ilim” Group’s Central Office in Saint-Petersburg is responsible for monitoring plan observance at the enterprise (director for labour protection, fire safety and environment).

The management of OJSC “Ilim Group” Branch in Koryazhma is responsible for:

- normal operation of the equipment;
- timely calibration and proper maintenance of instrumentation (chief metrologist);
- collection of all data required for calculation of GHG emission reductions under the project (chief of technical development department);
- arranging and holding training sessions for the Mill’s personnel regarding collection of data required for the GHG emissions monitoring under the project (chief of technical development department).

The management of CCGS LLC is responsible for:

- arranging and holding training sessions for the Mill’s personnel regarding collection of data required for the GHG emissions monitoring under the project (director of project implementation department);
- drawing up of the monitoring report (director of project implementation department);
- check of correctness of the primary data and calculations GHG emissions reductions (director of project development department);
- interaction with the independent expert organization concerning verification of GHG emissions reductions (director of project implementation department).

The roles and responsibilities of technicians and engineers of OJSC “Ilim Group” Branch in Koryazhma related to collection, check-out and transfer of GHG emission reduction monitoring data are shown in Fig. C.2.1. and Table C.2.2. The authorities of the responsible persons are recorded in the order FU/512-A of 04 .12. 2007.

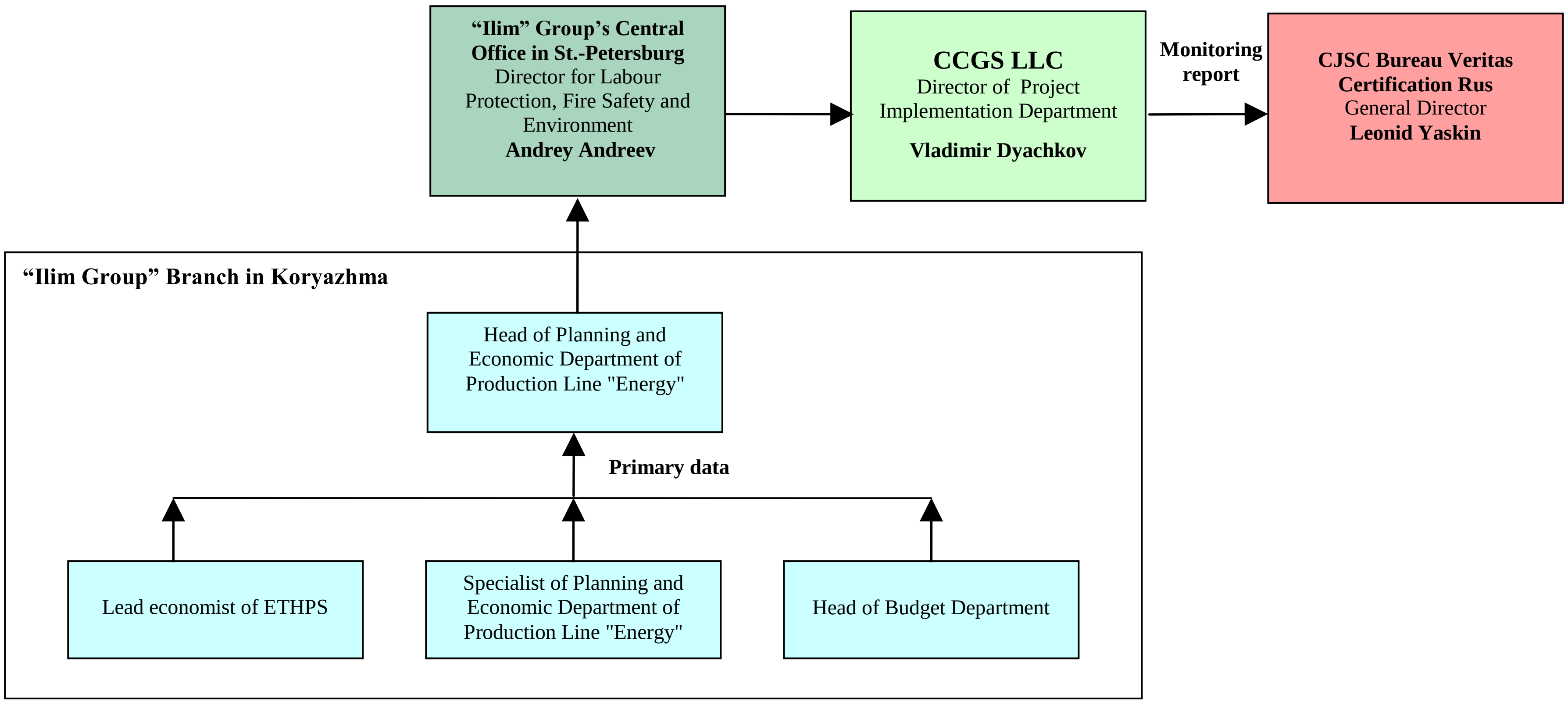

Fig. C.2.1. Data transfer scheme (from primary data to monitoring report).

Table C.2.2. Personal responsibilities of primary data collection and storage		
Primary data	Person responsible for monitoring of the parameter	Document where the parameter is recorded
Consumption of heavy fuel oil by LRBs	Lead economist of ETHPS	“ETHPS Performance”
Net calorific value of red liquor adjusted to absolutely dry matter		
Net calorific value of BL CPP adjusted to absolutely dry matter		
Net calorific value of BL SBPP adjusted to absolutely dry matter		
Net calorific value of heavy fuel oil		
Net calorific value of natural gas		
Heat production by the utilizing boiler firing malodorous gases and methanol fraction (used to determine the overall heat production at ETHPS)		
Overall heat quantity produced by liquor recovery boilers (used to determine the overall heat production at ETHPS)		
Overall heat quantity produced by BWW-fired boilers (used to determine the overall heat production at ETHPS)		
Quantity of red liquor fed to the evaporator plant of CHP-2		
Quantity of BL CPP fed to the evaporator plant of CHP-2		
Quantity of BL SBPP fed to the evaporator plant of CHP-2		
Quantity of BL SBPP fed to the evaporator plant of CHP-3		
Electricity supply from ETHPS		
Inlet and outlet dryness of liquors	Lead economist of ETHPS	“Inlet and outlet dryness of liquors”
Volumetric consumption of natural gas by utilizing boiler	Lead economist of ETHPS	“Evaporator Plant Performance Parameters”
Volumetric consumption of natural gas by flare		
Volume of reused warm water		
Volume of treated condensate fed for reuse (condensate A)		
Volume of relatively clean condensate fed for reuse (condensate B)		
Water temperature at the inlet to the new evaporator plant		

Warm water flow temperature at the outlet from the new evaporator plant		
Temperature of relatively clean condensate stream at the outlet from the new evaporator plant (condensate B)		
Temperature of treated condensate stream at the outlet from the new evaporator plant (condensate A)		
Electricity consumption at the evaporator plant of CHP-2	Specialist of Planning and Economic Department of Production Line "Energy"	"Monthly Electricity Balance"
Electricity consumption at the evaporator plant of CHP -3		
Heat consumption at the evaporator plant of CHP-3	Specialist of Planning and Economic Department of Production Line "Energy"	"Monthly Heat Balance"
Heat consumption at the evaporator plant of CHP-2		
Heat supply from ETHPS		
Volume of pulp produced in the cooking department of SAS-1	Chief of budgetary department	"Production Output"

C.2.3. Trainings:

All personnel of the evaporation plant have undergone certification in accordance with the requirements of Rostechnadzor.

Furthermore, in connection with the commissioning of the evaporator plant, the personnel underwent training within the framework of the contract with the equipment supplier, "ANDRITZ OY", in accordance with the personnel's job content.

At least once per year CCGS LLC together with the management of OJSC "Ilim Group" Branch in Koryazhma shall arrange and hold training sessions for the Mill's personnel regarding collection of data required for the GHG emissions monitoring under the project.

Check-out of the equipment required for primary monitoring data collection and personnel training were carried out on September 17-19, 2008; October 29-30, 2008; January 19-22, 2009 and October 6-8, 2009.

C.2.4. Involvement of Third Parties:

The Arkhangelsk Centre for Standardization and Metrology is the Third Party involved.

C.3. Influence estimation on environment:

The Mill is located in the industrial zone of Koryazhma, 1 km from the residential area. The modernized production is a part of the functioning pulp and paper mill and has no sanitary protection zone of its own.

Under the project the old run-down equipment is replaced by the new modern equipment purchased from "Andritz" (Finland), which provides for more complete and efficient evaporation of liquors.

Commissioning of the new evaporator plant makes it possible to completely avoid emissions of harmful substances in the process of liquor evaporation. Stabilization of operation of other evaporator plants by redistribution of liquor streams and load reduction will help to minimize overall emissions from all evaporator plants operated by the Mill.

The environmental monitoring shows that in 2008 and 2009 the pollutant emissions reduced against the pre-investment level (Table C.3.1. - C.3.6.).

Reduction of pollutant emissions from the evaporator plants amounted to 418 tonnes in 2008 and 420 tonnes in 2009.

Table C.3.1. Pollutant emissions from all evaporator plants in 2008, t/year

Name	Before project implementation	Actual in 2008	Increase(+)/Reduction(-)
Hydrogen sulfide	2.9	2.3	-0.6
Methanol	220.7	0.0	-220.7
Methyl disulphide	40.9	0.0	-40.9
Dimethyl sulfide	59.1	0.0	-59.1
Methylmercaptan	2.3	1.2	-1.1
Turpentine	95.7	0.0	-95.7
Total:	**421.6**	**3.5**	**-418.1**

Table C.3.2. Overall pollutant emissions from the Mill in 2008, t/year

Name	Before project implementation	Actual in 2008	Increase(+)/Reduction(-)
Sulfur dioxide (SO_2)	3820.76	1180.70	-2640.06
Nitrogen oxide (NO_2)	3966.29	4497.37	+531.08
Carbon oxide (CO)	6475.41	2379.76	-4095.65
Hydrogen sulfide	1052.98	91.70	-961.28
Methanol	487.32	150.08	-337.24
Methyl disulphide	246.65	189.92	-56.73
Dimethyl sulfide	217.83	79.48	-138.35
Methylmercaptan	127.75	21.48	-106.27
Turpentine	242.75	62.65	-180.11
Total:	**16 637.74**	**8653.12**	**-7984.62**

Table C.3.3. The amount of pollutants contained in the Mill’s overall effluents at the inlet and outlet of the Mill’s wastewater treatment facilities for 2008, t/year

Ingredient	Before project implementation		Actual in 2008		Increase(+)/Reduction(-)	
	Input	Output	Input	Output	Input	Output
BOD 20	67 496.04	10 594.67	23 736.37	3 725.83	-43 759.67	-6 868.84
COD	214 063.70	88 455.56	164 374.67	66 680.35	-49 689.03	-21 775.21
Lignin sulfonates	50 217.73	37 241.98	21 167.64	15 712.66	-29 050.09	-21 529.32
Suspended solids	37 237.73	11 028.75	37 237.73	3 229.56	0	-7 799.19
Methanol	8 766.82	1 519.29	925.73	160.43	-7841.09	-1358.86
Phenol	158.95	3.73	60.20	1.39	-98.75	-2.34
Total:	**377 940.97**	**148 843.98**	**247 502.34**	**89 510.22**	**-130 438.63**	**-59 333.76**

Table C.3.4. Pollutant emissions from all evaporator plants in 2009, t/year

Name	Before project implementation	Actual in 2009	Increase(+)/Reduction(-)
Hydrogen sulfide	2.9	1.3	-1.6
Methanol	220.7	0.0	-220.7
Methyl disulphide	40.9	0.0	-40.9
Dimethyl sulfide	59.1	0.0	-59.1
Methylmercaptan	2.3	0.2	-2.1
Turpentine	95.7	0.0	-95.7
Total:	**421.6**	**1.5**	**-420.1**

Table C.3.5. Overall pollutant emissions from the Mill in 2009, t/year

Name	Before project implementation	Actual in 2009	Increase(+)/Reduction(-)
Sulfur dioxide (SO_2)	3820.76	898.86	-2921.90
Nitrogen oxide (NO_2)	3966.29	3708.33	-257.96
Carbon oxide (CO)	6475.41	2016.52	-4458.89
Hydrogen sulfide	1052.98	70.34	-982.64
Methanol	487.32	68.56	-418.76
Methyl disulphide	246.65	101.88	-144.77
Dimethyl sulfide	217.83	43.05	-174.78
Methylmercaptan	127.75	15.01	-112.74
Turpentine	242.75	36.75	-206.00
Total:	**16 637.74**	**6959.31**	**-9678.43**

Table C.3.6. The amount of pollutants contained in the Mill’s overall effluents at the inlet and outlet of the Mill’s wastewater treatment facilities for 2009, t/year

Ingredient	Before project implementation		Actual in 2009		Increase(+)/Reduction(-)	
	Input	Output	Input	Output	Input	Output
BOD 20	67 496.04	10 594.67	20 068.00	1 137.73	-47 428.04	-9 456.94
COD	214 063.70	88 455.56	89 663.40	12 503.19	-124 400.30	-75 952.37
Lignin sulfonates	50 217.73	37 241.98	10 874.30	1 863.92	-39 343.43	-35 378.06
Suspended solids	37 237.73	11 028.75	30 995.10	1 468.10	-6 242.63	-9 560.65
Methanol	8 766.82	1 519.29	460.50	81.64	-8 306.32	-1 437.65
Phenol	158.95	3.73	31.20	0.60	-127.75	-3.13
Total:	**377 940.97**	**148 843.98**	**152 092.50**	**17 055.18**	**-225 848.47**	**-131 788.80**

SECTION D. Calculation of GHG emission reductions

D.1 Calculation of the project GHG emission

The project GHG emissions during the year *y*, t CO_2e:

$$PE_y = PE_{NG,y},$$

where $PE_{NG,y}$ is the project emissions of CO_2 from natural gas combustion in the utilizing boiler and in the flare during the year *y*, t CO_2e:

$$PE_{NG,y} = FC_{NG,B+T,y} \times EF_{CO2,NG},$$

where $EF_{CO2,NG}$ is the emission factor for natural gas, t CO_2/GJ. According to IPCC [R3], and with an allowance for the oxidized carbon fraction of 0.995, this factor is assumed constant and equal to $EF_{CO2,NG}$ =0.0561×0.995=0.05582 t CO_2/GJ;

$FC_{NG,B+T,y}$ is the natural gas consumption by the utilizing boiler and the flare during the year *y*, GJ.

$$FC_{NG,B+T,y} = FC_{NG,B,y} + FC_{NG,T,y},$$

where $FC_{NG,B,y}$ is the natural gas consumption by the utilizing boiler during the year *y*, GJ;

$FC_{NG,T,y}$ is the natural gas consumption by the flare during the year *y*, GJ.

$$FC_{NG,B,y} = FC^{v}_{NG,B,y} \times NCV_{NG,y},$$

where $FC^{v}_{NG,B,y}$ is the volumetric consumption of natural gas by the utilizing boiler during the year *y*, thousand m^3;

$NCV_{NG,y}$ is the weighted average net calorific value of natural gas during the year *y*, GJ/ thousand m^3.

$$FC_{NG,T,y} = FC^{v}_{NG,T,y} \times NCV_{NG,y},$$

where $FC^{v}_{NG,T,y}$ is the volumetric consumption of natural gas by the flare under the project during the year *y*, thousand m^3.

D.2 Calculation of the baseline GHG emission

The baseline GHG emissions during the year *y*, t CO_2e:

$$BE_y = BE_{NG,y},$$

where $BE_{NG,y}$ is the baseline emissions of CO_2 from natural gas combustion during the year *y*, t CO_2.

$$BE_{NG,y} = \Delta FC_{NG,CHPP-1,y} \times EF_{CO2,NG},$$

where $\Delta FC_{NG,CHPP-1,y}$ is the reduction of natural gas consumption at CHPP-1 due to the project during the year *y*, GJ.

$$\Delta FC_{NG,CHPP-1,y} = \frac{\Delta HG_{CHPP-1,y}}{\eta_{B,CHPP-1}},$$

where $\eta_{B,CHPP-1}$ is the efficiency of gas-fired boilers of CHPP-1. This efficiency is assumed constant over years and equal to $\eta_{B,CHPP-1}$ = 0.93 [R6, page 14];

$\Delta HG_{CHPP-1,y}$ is the reduction of heat production by CHPP-1 boilers due to the project during the year *y*, GJ.

$$\Delta HG_{CHPP-1,y} = \frac{1.2485 \times \Delta HC_{PJ,y}}{(1-\omega_{HN}) \times (1-q_{CHPP-1}) \times \omega_{TF}},$$

where ω_{HN} is the relative losses in the Mill's steam network. This value is assumed constant over years and equal to ω_{HN} = 0.02 [R6, page 22];

ω_{TF} is the heat flow factor. This value is assumed constant over years and equal to ω_{TF} = 0.98 [R7, page 135, fig. 10.2].

q_{CHPP-1} is the relative heat consumption for auxiliary needs of CHPP-1. This value is assumed constant over years and equal to q_{CHPP-1} = 0.02 [R8, table 4].

1.2485 is the factor which describes the relation between variation of fresh steam flow to turbines and variation of heat supply from production steam extraction of turbines (see Annex 3);

$\Delta HC_{PJ,y}$ is the total heat savings in the pulp production cycle due to the project during the year *y*, GJ.

$$\Delta HC_{PJ,y} = \Delta HC_{CHP,PJ,y} + \Delta HS_{CHP,PJ,y} + \Delta HC_{W,PJ,y} + \Delta HS_{MGB,y},$$

where $\Delta HC_{CHP,PJ,y}$ is the savings of heat consumed for liquor evaporation due to the project during the year *y*, GJ;

$\Delta HS_{CHP,PJ,y}$ is the additional heat supply from ETHPS due to increased heat production by liquor recovery boilers during the year *y*, GJ;

$\Delta HC_{W,PJ,y}$ is the total heat savings due to reuse of warm water and condensates from the new evaporator plant during the year *y*, GJ;

$\Delta HS_{MGB,y}$ is the additional heat supply due to operation of the utilizing boiler during the year *y*, GJ.

$$\Delta HC_{CHP,PJ,y} = HC_{CHP,BL,y} - HC_{CHP,PJ,y},$$

where $HC_{CHP,PJ,y}$ is the total project heat consumption for liquor evaporation during the year y, GJ;

$HC_{CHP,BL,y}$ is the total baseline heat consumption for liquor evaporation during the year y, GJ.

$$HC_{CHP,PJ,y} = HC_{CHP-3,PJ,y} + HC_{CHP-2,PJ,y},$$

where $HC_{CHP-3,PJ,y}$ is the heat consumption by evaporator plant of CHP-3 under the project during the year *y*, GJ;

$HC_{CHP-2,PJ,y}$ is the heat consumption by evaporator plant of CHP-2 under the project during the year *y*, GJ.

$$HC_{CHP,BL,y} = HC_{CHP-2,BL,y} + HC_{CHP-3,BL,y} + HC_{UkrNIIHimMash,BL,y},$$

where $HC_{CHP-2,BL,y}$ is the heat consumption by evaporator plants of CHP-2 under the baseline during the year *y*, GJ;

$HC_{CHP-3,BL,y}$ is the heat consumption by evaporator plant of CHP-3 under the baseline during the year *y*, GJ;

$HC_{UkrNIIHimMash,BL,y}$ is the heat consumption by evaporator plant "UkrNIIHimMash" under the baseline during the year *y*, GJ.

$$HC_{CHP-2,BL,y} = \beta_{HC,CHP-2,BL} \times LE_{CHP-2,BL,y},$$

where $\beta_{HC,CHP-2,BL}$ is the specific heat consumption by evaporator plant of CHP-2 under the baseline, GJ/t a.d.m. It is assumed constant over years and equal to $\beta_{HC,CHP-2,BL}$ = 6.811 GJ/t a.d.m.[R1, section B.1];

$LE_{CHP-2,BL,y}$ is the total quantity of liquors fed to evaporator plants of CHP-2 under the baseline during the year *y*, t a.d.m.

$$LE_{CHP-2,BL,y} = LE_{CHP-2,BL\ CPP,BL,y},$$

where $LE_{CHP-2,BL\ CPP,BL,y}$ is the quantity of BL CPP fed to evaporator plants of CHP-2 under the baseline during the year y, t a.d.m.

$$LE_{CHP-2,BL\ CPP,BL,y} = LG_{BL\ CPP,BL,y},$$

where $LG_{BL\ CPP,BL,y}$ is the quantity of BL CPP fed for evaporation under the baseline during the year y, t a.d.m.

$$LG_{BL\ CPP,BL,y} = \alpha_{BL\ CPP,BL} \times P_{1,y},$$

where $\alpha_{BL\ CPP,BL}$ is the specific yield of BL CPP under the baseline, t a.d.m./ t a.d.p. This value is assumed constant over years and equal to $\alpha_{BL\ CPP,BL}$ = 1.202 t a.d.m./t a.d.p. [R1, section B.1],

$P_{1,y}$ is the quantity of pulp produced in the cooking workshop SAS-1 during the year y, t a.d.p.

$$HC_{CHP-3,BL,y} = \beta_{HC,CHP-3,BL} \times LE_{CHP-3,BL,y},$$

where $\beta_{HC,CHP-3,BL}$ is the specific heat consumption by evaporator plant of CHP-3 under the baseline, GJ/t a.d.m. This value is assumed constant over years and equal to $\beta_{HC,CHP-3,BL}$ = 3.244 GJ/t a.d.m. [R1, section B.1];

$LE_{CHP-3,BL,y}$ is the total quantity of liquors fed to evaporator plant of CHP-3 under the baseline during the year y, t a.d.m.

$$LE_{CHP-3,BL,y} = LE_{CHP-3,BL\ SBPP,BL,y}$$

where $LE_{CHP-3,BL\ SBPP,BL,y}$ is the quantity of BL SBPP fed to evaporator plant of CHP-3 under the baseline during the year y, t a.d.m.

$$LE_{CHP-3,BL\ SBPP,BL,y} = LE_{CHP-2,BL\ SBPP,PJ,y} + LE_{CHP-3,BL\ SBPP,PJ,y},$$

where $LE_{CHP-2,BL\ SBPP,PJ,y}$ is the quantity of BL SBPP fed to evaporator plant of CHP-2 under the project during the year y, t a.d.m;

$LE_{CHP-3,BL\ SBPP,PJ,y}$ is the quantity of BL SBPP fed to evaporator plant of CHP-3 under the project during the year *y*, t a.d.m.

$$HC_{UkrNIIHimMash,BL,y} = \beta_{HC,UkrNIIHimMash,BL} \times LE_{UkrNIIHimMash,BL,y},$$

where $\beta_{HC,UkrNIIHimMash,BL}$ is the specific heat consumption by “UkrNIIHimMash” evaporator plant under the baseline, GJ/t a.d.m. It is assumed constant over years and equal to $\beta_{HC,UkrNIIHimMash,BL}$ = 18.260 GJ/t a.d.m. [R1, section B.1];

$LE_{UkrNIIHimMash,BL,y}$ is the total quantity of liquors fed to “UkrNIIHimMash” evaporator plant under the baseline during the year *y*, t a.d.m.

$$LE_{UkrNIIHimMash,BL,y} = LE_{UkrNIIHimMash,RL,BL,y},$$

where $LE_{UkrNIIHimMash,RL,BL,y}$ is the quantity of red liquor fed to “UkrNIIHimMash” evaporator plant under the baseline during the year *y*, t a.d.m.

$$LE_{UkrNIIHimMash,RL,BL,y} = LE_{CHP-2,RL,PJ,y},$$

where $LE_{CHP-2,RL,PJ,y}$ is the quantity of red liquor fed to evaporator plant of CHP-2 under the project during the year *y*, t a.d.m.

$$\Delta HS_{CHP,PJ,y} = \varphi_{HS,CHP,y} \times \Delta HG_{BLRB,PJ,y},$$

where $\varphi_{HS,CHP,y}$ is the factor of specific heat supply from ETHPS during the year *y*, GJ/GJ;

$\Delta HG_{BLRB,PJ,y}$ is the total additional heat production by liquor recovery boilers under the project during the year *y*, GJ.

$$\varphi_{HS,CHP,y} = \frac{HS_{CHP,PJ,y}}{HG_{CHP,PJ,y}},$$

where $HG_{CHP,PJ,y}$ is the total heat production by ETHPS boilers under the project during the year *y*, GJ;

$HS_{CHP,PJ,y}$ is the heat supply from ETHPS under the project during the year *y*, GJ.

$$HG_{CHP,PJ,y} = HG_{MGB,y} + HG_{BLRB,PJ,y} + HG_{BWWB,PJ,y},$$

where $HG_{MGB,y}$ is the heat production by the utilizing boiler during the year *y*, GJ;

$HG_{BLRB,PJ,y}$ is the total heat produced by liquor recovery boilers under the project during the year *y*, GJ;

$HG_{BWWB,PJ,y}$ is the total heat produced by BWW-fired boilers under the project during the year *y*, GJ.

$$\Delta HG_{BLRB,PJ,y} = \Delta HG_{BLRB,RL,PJ,y} + \Delta HG_{BLRB,BL\ CPP,PJ,y},$$

where $\Delta HG_{BLRB,RL,PJ,y}$ is the additional heat production by liquor recovery boilers under the project due to combustion of red liquor with a higher calorific value during the year *y*, GJ;

$\Delta HG_{BLRB,BL\ CPP,PJ,y}$ is the additional heat production by liquor recovery boilers under the project due to combustion of more BL CPP during the year *y*, GJ.

$$\Delta HG_{BLRB,RL,PJ,y} = HG_{BLRB,RL,PJ,y} - HG_{BLRB,RL,BL,y},$$

where $HG_{BLRB,RL,PJ,y}$ is the heat production by liquor recovery boilers under the project due to combustion of red liquor during the year *y*, GJ;

$HG_{BLRB,RL,BL,y}$ is the heat production by liquor recovery boilers under the baseline due to combustion of red liquor during the year *y*, GJ.

$$HG_{BLRB,RL,PJ,y} = LE_{CHP-2,RL,PJ,y} \times \left(NCV_{RL,PJ,y}\right)_{adm} \times \eta_{BLRB,y},$$

where $LE_{CHP-2,RL,PJ,y}$ is the quantity of red liquor fed to evaporator plant of CHP-2 under the project during the year *y*, t a.d.m.;

$\left(NCV_{RL,PJ,y}\right)_{adm}$ is the weighted average net calorific value of red liquor referred to absolutely dry mass under the project in the year *y*, GJ/t a.d.m;

$\eta_{BLRB,y}$ is the average efficiency of liquor recovery boilers in the year *y*.

$$\eta_{BLRB,y} = \frac{HG_{BLRB,PJ,y}}{LE_{CHP-2,RL,PJ,y} \times (NCV_{RL,PJ,y})_{adm} + LE_{CHP-2,BL\ CPP,PJ,y} \times (NCV_{BL\ CPP,y})_{adm} + LE_{CHP-2,BL\ SBPP,PJ,y} + LE_{CHP-3,BL\ SBPP,PJ,y}) \times (NCV_{BL\ SBPP,y})_{adm} + FC_{fuel\ oil,BLRB,PJ,y} \times NCV_{fuel\ oil,y}},$$

where $\left(NCV_{BL\ CPP,y}\right)_{adm}$ is the weighted average net calorific value of BL CPP referred to absolutely dry mass in the year *y*, GJ/t a.d.m.;

$\left(NCV_{BL\ SBPP,y}\right)_{adm}$ is the weighted average net calorific value of BL SBPP referred to absolutely dry mass in the year *y*, GJ/t a.d.m.;

$NCV_{fuel\ oil,y}$ is the weighted average net calorific value of heavy fuel oil in the year *y*, GJ/t;

$FC_{fuel\ oil,BLRB,PJ,y}$ is the total heavy fuel oil consumption by liquor recovery boilers under the project during the year *y*, t;

$LE_{CHP-2,BL\ CPP,PJ,y}$ is the quantity of BL CPP fed to evaporator plant of CHP-2 under the project during the year *y*, t a.d.m.

$$HG_{BLRB,RL,BL,y} = LE_{UkrNIIHimMash,RL,BL,y} \times \left(NCV_{RL,BL,y}\right)_{adm} \times \eta_{BLRB,y},$$

where $\left(NCV_{RL,BL,y}\right)_{adm}$ is the weighted average net calorific value of red liquor referred to absolutely dry mass under the baseline scenario during the year *y*, GJ/t a.d.m. It is assumed constant over years and equal to $\left(NCV_{RL,BL,y}\right)_{adm}$ = 8.845 GJ/t a.d.m. [R1, section B.1].

$$\Delta HG_{BLRB,BL\ CPP,PJ,y} = \left(LE_{CHP-2,BL\ CPP,PJ,y} - LE_{CHP-2,BL\ CPP,BL,y}\right) \times \left(NCV_{BL\ CPP,y}\right)_{adm} \times \eta_{BLRB,y}.$$

$$\Delta HS_{MGB,y} = HG_{MGB,y} \times \left(1 - k_B\right),$$

where $HG_{MGB,y}$ is the heat output by the utilizing boiler firing malodorous gases and methanol fraction under the project during the year *y*, GJ;

k_B is the factor of heat consumption for auxiliary needs of the utilizing boiler. It is assumed constant over years and equal to k_B = 0.05. The value of relative heat consumption for auxiliary needs of the utilizing boiler in accordance with the order [R8, table 4] could have been assumed equal to 0.02. But for conservative reasons the value of k_B was fixed at the level of 0.05.

$$\Delta HC_{W,PJ,y} = HC_{CW,BL,y} + HC_{PC,BL,y} + HC_{TC,BL,y},$$

where $HC_{CW,BL,y}$ is the heat consumption for water heating to meet the process needs under the baseline scenario during the year *y*, which under the project will be substituted by reuse of warm water from the new evaporator plant, GJ;

$HC_{PC,BL,y}$ is the heat consumption for water heating to meet the process needs under the baseline scenario during the year *y*, which under the project will be substituted by reuse of relatively clean condensate from the new evaporator plant, GJ;

$HC_{TC,BL,y}$ is the heat consumption for water heating to meet the process needs under the baseline scenario during the year *y*, which under the project will be substituted by reuse of treated condensate from the new evaporator plant, GJ.

The formulae for calculation of heat savings from the use of warm water and condensates are given with allowance for the deviation from the approved monitoring plan. The nature of this deviation is as follows: these formulae use monthly parameters (flows and temperatures) and not hourly ones. This deviation is partly caused by the lack of instruments and partly by the lack of a readings archivation system. All necessary instruments and archivation systems were put into operation stage by stage in mid-2009. Therefore in GHG emission reduction monitoring for 2008 and partially for 2009 (when the instruments were missing) design and statistical data on temperatures of water and condensates and calculated monthly condensate flow data had to be used. The most conservative values in terms of GHG emission reductions were used in calculations. As the instruments were gradually installed the calculations began to use average monthly (for temperature sensors) and monthly (for flow meters) readings.

Heat savings from the use of warm water and condensates will be monitored on an hourly basis, as it was planned in the PDD, beginning from 2010.

Heat consumption for water heating to meet the process needs under the baseline scenario during the year *y*, which under the project will be substituted by reuse of warm water from the new evaporator plant, GJ:

$$HC_{CW,BL,y} = \sum \frac{\rho_w \times c_w \times CWG_{PJ,j,y} \times (t_{2,CW,PJ,j,y} - t_{1,j,y})}{10^6},$$

where $CWG_{PJ,j,y}$ is the volume of warm water produced under the project during month *j* of year *y*, m^3; over the entire monitoring period January 2008 – December 2009 it is determined by flow meter readings.

$t_{2,CW,PJ,j,y}$ is the average project temperature of warm water at the outlet from the new evaporator plant during month *j* of year *y*, ^oC; for the period January 2008 – March 2009 it was assumed equal to the lowest value (which is a conservative solution in terms of GHG emission reductions) within a range of values that includes design data and monthly average readings recorded by instruments in April – December 2009. Starting in April 2009 the value of this temperature has been measured by an instrument and monthly average readings of this instrument have been used in calculations (See Table B.2.4);

$t_{1,j,y}$ is the average water temperature at the inlet to the new evaporator plant during month *j* of year *y*, °C; for the period January 2008 – April 2009 it was assumed equal to the highest value (which is a conservative solution in terms of GHG emission reductions) within a range of values that includes design data and monthly average readings recorded by instruments in May – December 2009. Starting in May 2009 this temperature has been measured by an instrument and monthly average readings of this instrument have been used in calculations (See Table B.2.4);

ρ_w is the water density, kg/m^3. The water density is assumed constant: $\rho_w = 1000$ kg/m^3;

c_w is the specific thermal capacity of water, $\frac{kJ}{kg \times {}^oC}$. The specific thermal capacity of water is assumed constant: $c_w = 4.187 \frac{kJ}{kg \times {}^oC}$.

Heat consumption for water heating to meet the process needs under the baseline scenario during the year y, which under the project will be substituted by reuse of relatively clean condensate from the new evaporator plant, GJ;

$$HC_{PC,BL,y} = \sum \frac{\rho_w \times c_w \times PCG_{PJ,j,y} \times (t_{2,PC,PJ,j,y} - t_{1,j,y})}{10^6},$$

where $PCG_{PJ,j,y}$ is the volume of relatively clean condensate produced under the project during month *j* of year *y*, m^3;

$t_{2,PC,PJ,j,y}$ is the average project temperature of relatively clean condensate at the outlet from the evaporator plant of CHP-2 during month *j* of year *y*, °C; for the period January 2008 – July 2009 was assumed equal to the lowest value (which is a conservative solution in terms of GHG emission reductions) within a range of values that includes design data and monthly average readings recorded by instruments in August – December 2009. Starting in August 2009 this temperature has been measured by an instrument and monthly average readings of this instrument have been used in calculations (See Table B.2.4).

Heat consumption for water heating for process needs under the baseline scenario during the year *y*, which under the project will be offset by reuse of treated condensate from the new evaporator plant, GJ:

$$HC_{TC,BL,y} = \sum \frac{\rho_w \times c_w \times TCG_{PJ,j,y} \times (t_{2,TC,PJ,j,y} - t_{1,j,y})}{10^6},$$

where $TCG_{PJ,j,y}$ is the volume of treated condensate produced under the project during month *j* of year *y*, m^3;

$t_{2,TC,PJ,j,y}$ is the average project temperature of treated condensate at the outlet from the new evaporator plant of CHP-2 during month *j* of year *y*, ^{o}C; for the period January 2008 – April 2009 it was assumed equal to the lowest value (which is a conservative solution in terms of GHG emission reductions) within a range of values that includes design data and monthly average readings recorded by instruments in May – December 2009. Starting in May 2009 this temperature has been measured by an instrument and monthly average readings of this instrument have been used in calculations (See Table B.2.4).

Monthly volumes of relatively clean condensate produced at the new "Andritz" evaporator plant and thereafter utilized in production process for the period January 2008 – August 2009 were calculated using liquor evaporation data. The calculations used the minimum values of evaporated water volumes which are recorded every week. This, in its turn, resulted in a minimum value of condensate production, and therefore in the minimum effect of GHG emission reduction from the use of condensate.

Volume of relatively clean condensate produced under the project at the new "Andritz" evaporator plant during month *j* of year *y*, m^3:

$$PCG_{PJ,j,y} = EWQ_{PJ,j,y} \cdot \chi ;$$

where $EWQ_{PJ,j,y}$ is the volume of water evaporated at the new evaporator plant during month *j* of year *y*, m^3;

$\chi = 0.3098$ is the mass fraction of relatively clean condensation in the total volume of evaporated water calculated using design technical specification of the evaporator plant (see Annex 1).

$$EWQ_{PJ,j,y} = EWQ_{RL,PJ,j,y} + EWQ_{BL,CPP,PJ,j,y} + EWQ_{BL,SBPP,PJ,j,y} ,$$

where $EWQ_{RL,PJ,j,y}$ is the volume of water evaporated from red liquor during month *j* of year *y*, m^3;

$EWQ_{BL,CPP,PJ,j,y}$ is the volume of water evaporated from BL CPP during month *j* of year *y*, m^3;

$EWQ_{BL,SBPP,PJ,j,y}$ is the volume of water evaporated from BL SBPP during month *j* of year *y*, m^3;

$$EWQ_{RL,PJ,j,y} = \alpha^{EWQ}_{RL,PJ,j,y} \cdot LE_{RL,PJ,j,y} ;$$

where $\alpha^{EWQ}_{RL,PJ,j,y}$ is the evaporated water volume per 1 t a.d.m. of red liquor under the project during month *j* of year *y*, m^3/t a.d.m.; minimum weekly value over month *j* of year *y*;

$LE_{RL,PJ,j,y}$ is the quantity of red liquor supplied to the evaporator plant of CHP-2 under the project during month *j* of year *y*, t a.d.m.

$$\alpha^{EWQ}_{RL,PJ,j,y} = MIN\left[\frac{(100-\varphi_{RL,in,l,j,y})}{\varphi_{RL,in,l,j,y}} - \frac{(100-\varphi_{RL,out,l,j,y})}{\varphi_{RL,out,l,j,y}}\right];$$

where $\varphi_{RL,in,l,j,y}$ is the inlet dryness factor of red liquor supplied to the evaporator plant of CHP-2 recorded over week l in month j of year y, % a.d.m.;

$\varphi_{RL,out,l,j,y}$ is the outlet dryness factor of red liquor supplied to the evaporator plant of CHP-2 recorded over week l in month j of year y, % a.d.m.

$$EWQ_{BL,CPP,PJ,j,y} = \alpha^{EWQ}_{BL,CPP,PJ,j,y} \cdot LE_{BL,CPP,PJ,j,y};$$

where $\alpha^{EWQ}_{BL,CPP,PJ,j,y}$ is the evaporator water quantity per 1 t a.d.m. of BL CPP under the project during month j of year y, m^3/a.d.m.; the minimum weekly value over month j of year y is assumed.

$LE_{BL,CPP,PJ,j,y}$ the quantity of BL CPP supplied to the evaporator plant of CHP-2 under the project over month j of year y, t a.d.m.;

$$\alpha^{EWQ}_{BL,CPP,PJ,j,y} = MIN\left[\frac{(100-\varphi_{BL,CPP,in,l,j,y})}{\varphi_{BL,CPP,in,l,j,y}} - \frac{(100-\varphi_{BL,CPP,out,l,j,y})}{\varphi_{BL,CPP,out,l,j,y}}\right],$$

where $\varphi_{BL,CPP,in,l,j,y}$ is the inlet dryness factor of BL CPP supplied to the evaporator plant of CHP-2 recorded over week l of month j of year y, % a.d.m.;

$\varphi_{BL,CPP,out,l,j,y}$ is the outlet dryness factor of BL CPP supplied to the evaporator plant of CHP-2 recorded over week l of month j of year y, % a.d.m.

$$EWQ_{BL,SBPP,PJ,j,y} = \alpha^{EWQ}_{BL,SBPP,PJ,j,y} \cdot LE_{BL,SBPP,PJ,j,y};$$

where $\alpha^{EWQ}_{BL,SBPP,PJ,j,y}$ is the evaporator water quantity per 1 t a.d.m. of BL SBPP under the project during month j of year y, m^3/a.d.m.; the minimum weekly value over month j of year y is assumed;

$LE_{BL,SBPP,PJ,j,y}$ is the quantity of BL SBPP supplied to the evaporator plant of CHP-2 under the project over month j of year y, t a.d.m.;

$$\alpha^{EWQ}_{BL,SBPP,PJ,j,y} = MIN\left[\frac{(100-\varphi_{BL,SBPP,in,l,j,y})}{\varphi_{BL,SBPP,in,l,j,y}} - \frac{(100-\varphi_{BL,SBPP,out,l,j,y})}{\varphi_{BL,SBPP,out,l,j,y}}\right],$$

where $\varphi_{BL,SBPP,in,l,j,y}$ is the inlet dryness factor of BL SBPP supplied to the evaporator plant of CHP-2 recorded over week *l* of month *j* of year *y*, % a.d.m.;

$\varphi_{BL,SBPP,out,l,j,y}$ is the outlet dryness factor of BL SBPP supplied to the evaporator plant of CHP-2 recorded over week *l* of month *j* of year *y*, % a.d.m.

The conservatism of parameters $\alpha^{EWQ}_{RL,PJ,j,y}$ $\alpha^{EWQ}_{BL,CPP,PJ,j,y}$ and $\alpha^{EWQ}_{BL,SBPP,PJ,j,y}$ is demonstrated by the fact that they are calculated using monthly-minimum evaporated water quantity values that are recorded every week. This in its turn gave minimum quantity of generated condensate and therefore minimum GHG emission reduction effect.

Starting in 2009 the volumes of reused relatively clean condensate have been measured by a flow meter and monthly average readings of this flow meter have been used in calculations.

When calculated and actual volumes of relatively clean condensate supplied for reuse during the flow meter operation period (September – December 2009) were compared, it turned out that the estimated values are lower by 6.7 – 15.9 % (See Table D.2.1). Therefore it is fair to say that the method proposed for determining relatively clean condensate volumes is adequate and conservative.

At the first stage, monthly volumes of treated condensate generated at the new “Andritz” evaporator plant and thereafter utilized in production process for the period from January 2008 till August 2009 were calculated by the formula:

$$TCG_{PJ,j,y} = EWQ_{PJ,j,y} - PCG_{PJ,j,y}.$$

However after installation of flow meters in 2009 it turned out that not all generated treated condensate is supplied to production process. Utilized are only between 45 490 and 111 450 m^3 of treated condensate per month which is between 31.3% and 56.5 % of the total volume generated (see Table D.2.1). Following the principle of conservatism, for the period from January 2008 till August 2009 the lowest value of 45 490 m^3 per month was assumed in final calculations. Starting in September 2009 the volumes of reused treated condensate have been measured by a flow meter and monthly average readings of this flow meter have been assumed in calculations.

Table D.2.1. Calculated and actual volumes of condensates generated and supplied for reuse in 2009

Parameter	Designation	Unit	September	October	November	December
Calculated volume of relatively clean condensate generated in month *j*	$PCG^{calc}_{PJ,j,y}$	m^3	65 270	82 637	88 578	96 341
Actual volume of relatively clean condensate supplied for reuse in month *j*	$PCG^{real}_{PJ,j,y}$	m^3	69 980	97 270	102 620	114 570
Calculated volume of treated condensate generated in month *j*	$TCG^{calc}_{PJ,j,y}$	m^3	145 399	184 085	197 320	214 613
Actual volume of treated condensate supplied for reuse in month *j*	$TCG^{real}_{PJ,j,y}$	m^3	45 490	66 780	111 450	108 780

D.3 Calculation of the GHG Leakages

Leakages during the year *y*, t CO_2e:

$$L_y = L_{ES,y},$$

where $L_{ES,y}$ is the leakages from fuel combustion by power plants to offset the reduction of electricity supply to the grid due to the project during the year *y*, t CO_2e.

$$L_{ES,y} = \Delta ES_y \times EF_{CO_2,grid,y},$$

where $EF_{CO2,grid,y}$ is the CO_2 emission factor for grid electricity, tCO_2/MWh. For Russia according to "Operational Guidelines for Project Design Documents of Joint Implementation Projects" [R4] depending on considered year: $EF^{2008}_{CO2,grid}$ = 0.565 t CO_2/MWh, $EF^{2009}_{CO2,grid}$ = 0.557 t CO_2/MWh;

ΔES_y is the reduction of electricity supply to the grid as a result of the project implementation during the year *y*, MWh.

$$\Delta ES_y = \Delta ES_{CHPP-1,y} - \Delta EC_{PJ,y},$$

where $\Delta EC_{PJ,y}$ is the total electricity savings in the pulp production cycle as a result of the project implementation during the year *y*, MWh;

$\Delta ES_{CHPP-1,y}$ is the reduction of heat-consumption-based electricity supply from CHPP-1 as a result of the project during the year *y*, MWh.

$$\Delta ES_{CHPP-1,y} = \frac{0.2445 \times \Delta HC_{PJ,y}\left(1 - e_{CHPP-1}\right)}{3.6 \times \left(1 - \omega_{HN}\right)},$$

where e_{CHPP-1} is the value of relative electricity consumption for auxiliary needs of CHPP-1. This value is assumed constant over years and equal to e_{CHPP-1} = 0.05 [R10, page 28];

ω_{HN} is the relative losses in the Mill's steam network. This value is assumed constant over years and equal to ω_{HN} = 0.02 [R6, page 22];

0.2445 is the factor which describes the relation between variation of heat-consumption-based electricity generation and variation of steam extraction from turbines (see Annex 3);

$\Delta HC_{PJ,y}$ is the total savings of heat in the pulp production cycle as a result of the project during the year *y*, GJ.

$$\Delta EC_{PJ,y} = \Delta EC_{CHP,PJ,y} + \Delta ES_{CHP,PJ,y},$$

where $\Delta EC_{CHP,PJ,y}$ is the reduction of electricity consumption for liquor evaporation as a result of the project during the year *y*, MWh;

$\Delta ES_{CHP,PJ,y}$ is the additional electricity supply from ETHPS due to additional heat production by liquor recovery boilers during the year *y*, MWh.

$$\Delta EC_{CHP,PJ,y} = EC_{CHP,BL,y} - EC_{CHP,PJ,y},$$

where $EC_{CHP,PJ,y}$ is the total electricity consumption for liquor evaporation under the project during the year *y*, MWh;

$EC_{CHP,BL,y}$ is the total electricity consumption for liquor evaporation under the baseline during the year *y*, MWh.

$$EC_{CHP,PJ,y} = EC_{CHP-2,PJ,y} + EC_{CHP-3,PJ,y},$$

where $EC_{CHP-2,PJ,y}$ is the electricity consumption by evaporator plant of CHP-2 under the project during the year *y*, MWh;

$EC_{CHP-3,PJ,y}$ is the electricity consumption by evaporator plant of CHP-3 under the project during the year *y*, MWh.

$$EC_{CHP,BL,y} = EC_{CHP-2,BL,y} + EC_{CHP-3,BL,y} + EC_{UkrNIIHimMash,BL,y},$$

where $EC_{CHP-2,BL,y}$ is the electricity consumption by evaporator plants of CHP-2 under the baseline during the year *y*, MWh;

$EC_{CHP-3,BL,y}$ is the electricity consumption by evaporator plant of CHP-3 under the baseline during the year *y*, MWh;

$EC_{UkrNIIHimMash,BL,y}$ is the electricity consumption by "UkrNIIHimMash" evaporator plant under the baseline during the year *y*, MWh.

$$EC_{CHP-2,BL,y} = \beta_{EC,CHP-2,BL} \times LE_{CHP-2,BL,y},$$

where $\beta_{EC,CHP-2,BL}$ is the specific electricity consumption by evaporator plant of CHP-2 under the baseline, MWh/t a.d.m. It is assumed constant over years and equal to $\beta_{EC,CHP-2,BL}$ = 0.0103 MWh/t a.d.m [R1, section B.1];

$LE_{CHP-2,BL,y}$ is the total quantity of liquors fed to evaporator plant of CHP-2 under the baseline during the year *y*, t a.d.m.

$$EC_{CHP-3,BL,y} = \beta_{EC,CHP-3,BL} \times LE_{CHP-3,BL,y},$$

where $\beta_{EC,CHP-3,BL}$ is the specific electricity consumption by evaporator plant of CHP-3 under the baseline, MWh/t a.d.m. It is assumed constant over years and numerically equal to $\beta_{EC,CHP-3,BL}$ = 0.0194 MWh/t a.d.m; [R1, section B.1];

$LE_{CHP-3,BL,y}$ is the total quantity of liquors fed to evaporator plant of CHP-3 under the baseline during the year *y*, t a.d.m.

$$EC_{UkrNIIHimMash,BL,y} = \beta_{EC,UkrNIIHimMash,BL} \times LE_{UkrNIIHimMash,BL,y},$$

where $\beta_{EC,UkrNIIHimMash,BL}$ is the specific electricity consumption by "UkrNIIHimMash" evaporator plant under the baseline, MWh/t a.d.m. It is assumed constant over years and numerically equal to $\beta_{EC,UkrNIIHimMash,BL}$ = 0.2153 MWh/t a.d.m; [R1, section B.1];

$LE_{UkrNIIHimMash,BL,y}$ is the total quantity of liquors fed to UkrNIIHimMash evaporator plant under the baseline during the year *y*, t a.d.m.

$$\Delta ES_{CHP,PJ,y} = \varphi_{ES,CHP,y} \times \Delta HG_{BLRB,PJ,y},$$

where $\varphi_{ES,CHP,y}$ is the factor of specific electricity supply from ETHPS under the project during the year *y*, MWh/GJ;

$\Delta HG_{BLBR,PJ,y}$ is the total additional heat production by liquor recovery boilers under the project during the year *y*, GJ.

$$\varphi_{ES,CHP,y} = \frac{ES_{CHP,PJ,y}}{HG_{CHP,PJ,y}},$$

where $ES_{CHP,PJ,y}$ is the electricity supply from ETHPS under the project during the year *y*, MWh;
$HG_{CHP,PJ,y}$ is the total heat production by ETHPS boilers under the project during the year *y*, GJ.

D.4 Calculation of the project GHG emission reductions:

GHG emission reductions during the year *y*, t CO_2e:

$$ER_y = BE_y - PE_y - L_y.$$

The calculation method of GHG emission reductions was implemented in the computational model in the form of excel-files (Annexes 4, 5). This model is integral part of the monitoring report. Main results of calculations are summarized in Table D.4.1.

Table D.4.1. Calculation of reduction of emissions GHG for 2008 and 2009

Parameter	Symbol	Unit	Value	
			2008	2009
Project emissions				
Natural gas consumption by the utilizing boiler and the flare	$FC_{NG,B+T,y}$	GJ	105 659	100 072
Emission factor for natural gas	$EF_{CO2,NG}$	t CO_2/GJ	0.05582	0.05582
Project emissions of CO_2 from natural gas combustion in the utilizing boiler and in the flare	$PE_{NG,y}$	**t CO_2e**	**5 898**	**5 586**
Baseline emissions				
Reduction of natural gas consumption at CHPP-1	$\Delta FC_{NG,CHPP-1,y}$	GJ	4 000 312	4 506 098
Baseline emissions of CO_2 from natural gas combustion	$BE_{NG,y}$	**t CO_2e**	**223 297**	**251 530**
Leakages				
Reduction of electricity supply to the grid	ΔES_y	MWh	191 528	216 016
CO_2 emission factor for grid electricity	$EF_{CO2,grid,y}$	tCO_2/MWh	0.565	0.557
Leakages from fuel combustion by power plants to offset the reduction of electricity supply to the grid	$L_{ES,y}$	**t CO_2e**	**108 213**	**120 321**
GHG emission reductions				
GHG emission reductions	ER_y	**t CO_2e**	**109 187**	**125 623**

GHG emission reductions for 2008 amount 109 187 t CO_2e, in accordance with the PDD, the projected GHG emission reductions amount to 157 152 t CO_2e**.**

GHG emission reductions for 2009 amount 125 623 t CO_2e, in accordance with the PDD, the projected GHG emission reductions amount to 172 955 t CO_2e**.**

The reasons for the monitored GHG emission reductions being lower than the projected values specified in the PDD are as follows:

- the PDD assumes that all treated condensate produced at the new Andritz evaporator plant is entirely used for production needs and in actual fact only 31,3 - 56,5 % of it is used;

- the actual warm water consumption proved to be lower than the projected level by 12% in 2008 and 23% in 2009.

CCGS LLC
17.05.2010

V. Dyachkov - Director of Project Implementation Department

Evgeniy Zhuravskiy, Specialist of Project Implementation Department

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[R4] Operational Guidelines for Project Design Documents of Joint Implementation Projects. Volume 1. General Guidelines. Version 2.3. Ministry of Economic Affairs of the Netherlands. May 2004.

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ANNEX 1.

Substantiation of the mass fraction of treated condensate in the total evaporated water quantity

Mass fraction of treated condensate in the total water quantity evaporated during a month was calculated based on the design technical data of the evaporator plant (see also www.ilimgroup.ru/techprocess/evaporator-station/facts1/).

The scheme of collection, treatment and utilization of condensates is given in Fig. A.1.1.

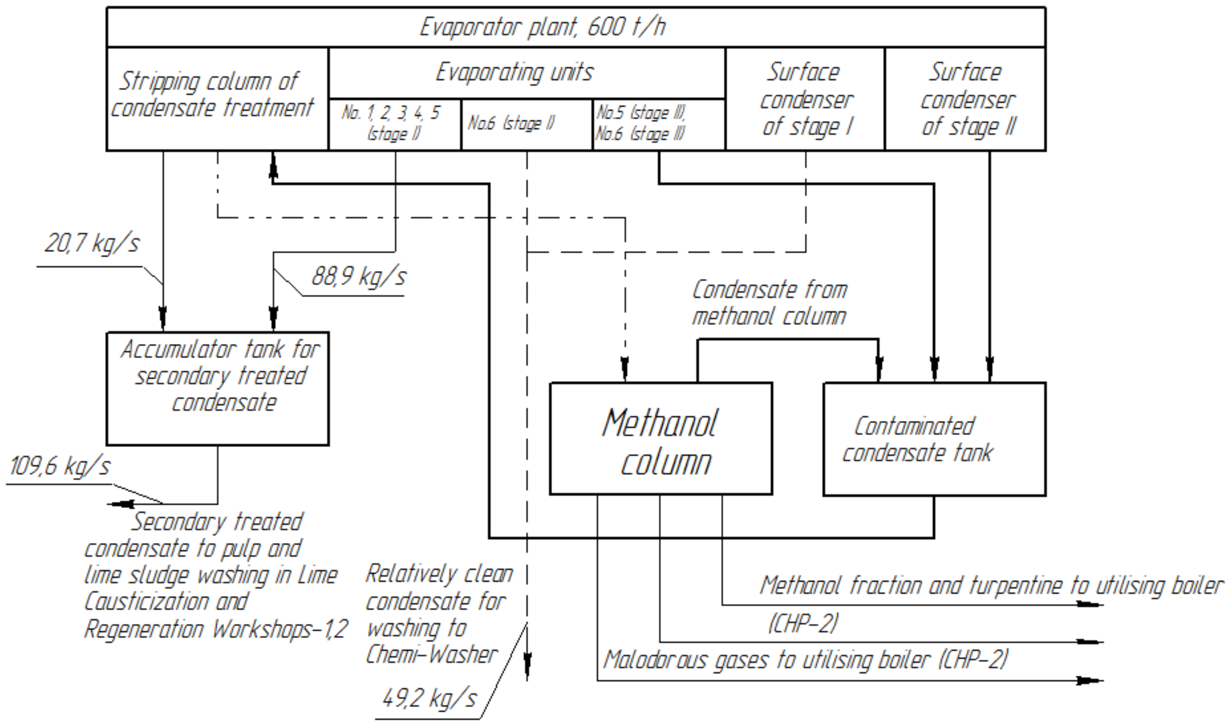

Fig. A.1.1. Scheme of collection, treatment and utilization of condensates from the new evaporator plant

Secondary condensate is pumped from units 1, 2, 3 and 4 and from the first stage of unit 5 to the secondary treated condensate tank where it is mixed with condensate treated in the stripping column, and then used for process needs.

Relatively clean secondary condensate from stage I of unit 6 together with condensate from the surface condenser of stage I is fed for pulp washing to "Chemi-Washer" unit.

Second stages of evaporating units 5 and 6 are equipped with an internal methanol stripping system. Steam is fed to the lower section of the heat exchanger and goes upward against the condensate flow. The heat exchanger functions like an internal stripping column. It is the counterflow scheme and a good contact of steam and liquid that ensure maximum treatment efficiency. Methanol-contaminated condensate is removed from a separate section in the upper part of the heat exchanger and is fed to the contaminated condensate tank, whence it is fed to the stripping column.

Treated condensate and dirty condensate streams are together pumped over for use on the PPM.

In accordance with the design technical data, second volumes of streams of condensates formed at new evaporator plant are following:

G_{condA}=88.9 kg/s for condensate A stream;

$G_{dirty.condensate}$=20.7 kg/s for dirty condensate;

G_{condB}=49.2 kg/s for condensate B stream (relatively clean).

Based on the aforesaid, the mass fraction of relatively clean condensate in the total evaporated water quantity can be determined by the following ratio:

$$\chi = \frac{49,2}{88.9 + 20.7 + 49.2} = 0.3098.$$

Accordingly the mass fraction of treated condensate is equal μ =1-0.3098=0.6902.

ANNEX 2.

The provisions for quality control procedure in relation to preparation of project design documents and monitoring reports for greenhouse gas emission reduction projects at CCGS LLC

CCGS

Approved by
Director General
M.Yulkin
December 8, 2009

REGULATIONS

on quality check and control of GHG emission reduction project design documents (PDD) and monitoring reports at CCGS LLC

1. GENERAL PROVISIONS

1.1. These regulations specify the quality control procedure for development of project design documents (PDDs) and monitoring reports for the projects aimed at GHG emission reduction from sources and/or increase of removal by sinks (hereinafter the "Projects").

1.2. The quality control of PDDs and monitoring reports is carried out in conjunction with the structural subdivisions (departments) of CCGS LLC (hereinafter the "Company") and the Project Owners (hereinafter the "Client").

1.3. The quality control of PDDs and monitoring reports precedes their submission to an independent auditor for review.

2. QUALITY CONTROL OF PROJECT DESIGN DOCUMENTS

2.1. The PDD developed by a specialist of the Project Development Department shall undergo the following quality control procedure:

2.1.1. The PDD shall be checked up by the Director of the Project Development Department or, on his instructions, by other specialist of the Project Development Department who was not directly involved in development of this PDD;

2.1.2. Corrective actions shall be taken by the PDD developer and all corrections and amendments shall be agreed with the Director of the Project Development Department;

2.1.3. The PDD shall be checked up by the Director of the Project Implementation Department or, on his instructions, by other specialist of the Project Implementation Department;

2.1.4. Corrective actions shall be taken by the PDD developer and all corrections and amendments shall be agreed with the Director of the Project Implementation Department;

2.1.5. Final check-up and correction of the PDD shall be made by the Director of the Project Development Department;

2.1.6. The PDD shall be submitted to the Client for review;

2.1.7. Corrective actions shall be taken by the PDD developer and all corrections and amendments shall be agreed with the Client and the Director of the Project Development Department and if necessary with the Director of the Project Implementation Department;

2.1.8. The PDD shall be furnished to the Director General and the Client.

2.2. Upon completion of the above-described procedure and if there are no comments from the Director General and/or from the Client the PDD shall be deemed ready for determination by an independent auditor. Otherwise the procedure shall be repeated.

2.3. The Director of the Project Development Department shall check all sections of the PDD.

2.4. The Director of the Project Implementation Department shall check those sections of the PDD which describe the project monitoring plan and procedure. Other sections shall be checked by the Director of the Project Implementation Department if necessary or at his discretion.

2.5. The Director General shall take the final decision regarding submission of the PDD for determination to an independent auditor.

3. QUALITY CONTROL OF PROJECT MONITORING REPORTS

3.1. The project monitoring report prepared by a specialist of the Project Implementation Department shall undergo the following quality control procedure:

3.1.1. The project monitoring report shall be checked up by the Director of the Project Implementation Department or, on his instructions, by other specialist of the Project Implementation Department who was not directly involved in preparation of this project monitoring report;

3.1.2. Corrective actions shall be taken by the monitoring report developer and all corrections and amendments shall be agreed with the Director of the Project Implementation Department;

3.1.3. The project monitoring report shall be checked up by the Director of the Project Development Department or, on his instructions, by other specialist of the Project Development Department;

3.1.4. Corrective actions shall be taken by the monitoring report developer and all corrections and amendments shall be agreed with the Director of the Project Development Department;

3.1.5. Final check-up and correction of the monitoring report shall be made by the Director of the Project Implementation Department;

3.1.6. The monitoring report shall be submitted to the Client for review;

3.1.7. Corrective actions shall be taken by the monitoring report developer and all corrections and amendments shall be agreed with the Client and the Director of the Project Implementation Department and, if necessary, with the Director of the Project Development Department;

3.1.8. The monitoring report shall be submitted to the Director General and the Client.

3.2. Upon completion of the above-described procedure and if there are no comments from the Director General and/or from the Client the monitoring report shall be deemed ready for verification by an independent auditor. Otherwise the procedure shall be repeated.

3.3. The Director of the Project Implementation Department shall check all sections of the monitoring report.

3.4. The Director of the Project Development Department shall check those sections of the monitoring report which contain results of calculations of GHG emission reductions from sources and/or increase of GHG removals by sinks. Other sections shall be checked up by the Director of the Project Development Department if necessary or at his discretion.

3.5. The Director General shall take the final decision regarding submission of the monitoring report for verification to an independent auditor.

ANNEX 3.

Characteristics of CHPP-1 steam turbines

Heat savings due to the project implementation lead to reduction of steam extraction from CHPP-1 turbines. In order to determine reduction of fuel consumption by CHPP-1 it is necessary to find the variation of fresh steam flow to the turbines. At the same time it is also necessary to determine the reduction of electricity generation on the basis of heat consumption (which in general case has to be compensated by additional electricity generation in the grid). The input parameter will be the variation of heat supply from the production stream extraction.

To generate electricity CHPP-1 operates 7 turbine units (No.No.1 to 3 of VPT-25-4 (PT-25-90/10) type; No.4 of PT-60-90/13 type; No.No.5 and 6 of PT-60-130/13 type; No. 7 of R-50-130/13 type).

One of the turbines installed at CHPP-1 is non-condensing (R-50-130/13). As a rule, non-condensing turbines, under a stable demand of industrial steam, operate in the base mode, and regulation of heat and electricity loads is ensured by turbines with less rigid operation modes, in this case by PT turbines.

Based on the steam-consumption diagrams and energy characteristics of the turbines presented in analytical form [R9, page 95, table 4.6], the following pairs of equations were established:

1. Turbines of VTP-25-4 type:

$$\Delta Q_0 = 1.204 \times \Delta Q_p$$

$$\Delta N_t = \frac{0.201 \times \Delta Q_p}{3.6}$$

2. Turbine of PT-60-90/13 type:

$$\Delta Q_0 = 1.181 \times \Delta Q_p$$

$$\Delta N_t = \frac{0.178 \times \Delta Q_p}{3.6}$$

3. Turbines of PT-60-130/13 type:

$$\Delta Q_0 = 1.310 \times \Delta Q_p$$

$$\Delta N_t = \frac{0.305 \times \Delta Q_p}{3.6}$$

where ΔQ_0 is the variation of heat (fresh steam) flow to turbines, GJ;

ΔQ_p is the variation of heat supply from the production steam extraction, GJ;

ΔN_t is the variation of heat-consumption-based electricity generation, MWh;

3.6 is the GJ to MWh conversion factor.

The worst, in terms of energy efficiency, are the turbines with the lowest initial steam parameters and the highest steam parameters of steam extraction. It is such least efficient turbines that the enterprise will try to unload in the first place as the opportunity arises. At CHPP-1 of KPPM such turbine is PT-60-90/13 turbine. However in actual practice it is impossible to determine precisely which of the turbines and how long will participate in load regulation, therefore for estimating GHG emissions we shall use averaged, in terms of installed capacity, characteristics of all PT type turbines (i.e. assuming uniform reduction of the number of running hours of all turbines), which is a moderately conservative solution:

$$\Delta Q_0 = \frac{1.204 \times 3 \times 25 + 1.181 \times 1 \times 60 + 1.310 \times 2 \times 60}{3 \times 25 + 1 \times 60 + 2 \times 60} \times \Delta Q_p = 1.2485 \times \Delta Q_p$$

$$\Delta N_t = \frac{0.201 \times 3 \times 25 + 0.178 \times 1 \times 60 + 0.305 \times 2 \times 60}{3.6 \times (3 \times 25 + 1 \times 60 + 2 \times 60)} \times \Delta Q_p = \frac{0.2445 \times \Delta Q_p}{3.6}.$$