**MONDI BUSINESS PAPER SYKTYVKAR INTEGRATED PULP AND PAPER MILL OPEN JOINT-STOCK COMPANY**

**KOMI REPUBLIC, SYKTYVKAR CITY, PROSPEKT BUMAZHNIKOV, 2**

**MILL DEVELOPMENT AND RECONSTRUCTION PROJECT**

# VOLUME 9
# ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

**U07411-0211-000-024**

| | |
|---|---|
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# Contents

# 1. INTRODUCTION

The composition and scope of this section is based on Code No. SP 11-101-95, The Development, Agreement, Approval and Content of Justifications of Investment in the Construction of Enterprises, Buildings and Facilities (Ministry of Construction Resolution No. 18-63), incorporating the requirements of the Regulation on Environmental Impact Assessments (Approval No. 372 of 30.06.95 ) and "Environmental Protection, a Practical Guide to SP 11-101-95", prepared by FGUP CENTRINVESTproekt, 2006.

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The purpose of the present work is to prepare the materials and carry out the calculations required for the environmental impact assessment of Mondi Business Paper Syktyvkar Integrated Pulp and Paper Mill (MBP SIPPM) at all stages of implementation of its development and reconstruction project.

The following regulatory documents, guidelines and reference documents were used in the preparation of this section:

- The Constitution of the Russian Federation (as amended on 9 May 2005), (in the wording effective from 1 January 2006), adopted on 12 December 1993;
- RF Environmental Protection Act No. 7-FZ of 10 January 2002 (in the wording effective from 5 February 2007);
- RF Atmospheric Air Protection Act No. 96-FZ of 4 May 1999 (as amended on 31 December 2005), (in the wording effective from 1 January 2006);
- RF Production and Consumption Waste Act No. 89-FZ of 24 June 1998 (in the wording effective from 1 January 2007);
- RF Water Code No. 74-FZ of 03.06.2006;
- RF Act No. 73-FZ of 3 June 2006 implementing the RF Water Code ;
- RF Subsurface Act in the wording effective from 6 March 1995, No. 27-FZ (as amended on 1 January 2007) No. 2395-1 of 21 February 1992;
- RF Fisheries and the Preservation of Biological Water Resources Act No. 166-FZ of 20 December 2004 (in the wording effective from 18.12.2006, No. 232-FZ);
- RF Wildlife Act No. 52-FZ of 24 April 1995 (as amended on 29 December 2006);
- RF Public Health Act No. 52-FZ of 30 March 1999 (in the wording effective from 1 January 2007);
- RF Act on the Protection of People and Land from Natural and Man-Made Disasters, No. 68-FZ of 21 December 1994 (in the wording effective from 1 January 2007);
- RF Act on Especially Protected Natural Sites, No. 33-FZ of 14 March 1995 (in the wording effective from 4 December 2006);
- RF Environmental Review Act No. 174-FZ of 23 November 1995 (in the wording effective from 1 January 2007);
- Federal Technical Regulation Act No. 184-FZ of 27.12.2002;
- RF Town-planning Code No. 190-FZ of 29.12.2004 (in the wording effective from 24.07.2007);
- RF Land Code No. 136-FZ of 25 October 2001 (in the wording effective from 22 July 2005);
- RF Forest Code No. 22-FZ of 29 January 1997 (as amended on 4 December 2006), ((in the wording effective from 12 August 2005);
- Building Code SNiP 11.01.95. The Preparation, Agreement, Approval and Content of Justifications of Investment in the Construction of Enterprises, Buildings and Facilities;
- SNiP 2.04.03.85. Sewerage Systems. External Networks and Facilities;

- SanPiN 2.1.5.980-00. Hygiene requirements concerning the protection of surface waters;
- Hygiene Standard GN 2.1.5.1316-03. Tentative Allowable Content of chemicals in sources of domestic and drinking water and in recreational water bodies;
- Hygiene Standard GN 2.1.5.1831-04 Approximate Allowable Content of chemicals in sources of domestic and drinking water and in recreational water bodies. Annex1 to GN.1.5.1316-03;
- Hygiene Standard GN 2.1.5.1315-03. Maximum allowable concentrations (MAC) of chemicals in sources of domestic and drinking water and in recreational water bodies;
- Fishery standards: Maximum allowable concentrations (MAC) and tentative safe exposure levels (TSEL) of harmful substances in fisheries waters. RF Fisheries Committee, 1999;
- Helsinki Convention on the Protection and Use of Transboundary Watercourses and International Lakes, 17.03.92;
- Surface Water Protection Against Pollution with Waste Water, 1991;
- Environmental Justification of Commercial and Other Operations, 1995;
- Guidelines on the Environmental Justification of Commercial and Other Operations in Pre-Investment and Design Documentation;
- GOST 17.0.0.01-76*. Environmental Protection and Improved Natural Resources Management Standards. Main Provisions. Moscow, 1976;
- GOST 17.2.1.01-76. Environmental Protection. Atmospheric Air. Classification of Emissions M., 1976;
- GOST 17.2.3.02-78. Environmental Protection. Atmospheric Air. Setting maximum allowable pollutant emission levels for industrial enterprises. M..1978;
- GOST 17.2.1.03-84. Environmental Protection. Atmospheric Air. Pollution control terminology. M., 1984;
- GOST 17.2.1.04-77*. Environmental Protection. Atmospheric Air. Sources and meteorological causes of pollution. Meaning of words. M., 1977;
- GOST 17.2.3.01-86. Environmental Protection. Atmospheric Air. Residential air quality control regulations. M., 1986;
- Practical Guide to Environmental Protection – Environmental Impact Assessment (EIA) of capital construction projects for project documentation purposes. M., FGUP CENTRINVESTproekt, 2006;
- Industry Building Standard VSN 13-84. The design of pulp and paper mill waste water treatment plants;
- Environmental Impact Assessment of Proposed Commercial and Other Activities in the Russian Federation. RF Environmental Committee, No. 372 of 16.05.2000;
- Public Health Regulations SP 11-102-97. Engineering Surveys for the Building Industry. Environmental Engineering Surveys for the Building Industry. GOSSTROI, M., 1997;
- Public Health Standards and Regulations SanPiN 2.1.6.1032-01. Hygiene Requirements Concerning Residential Air Quality. RF Ministry of Health, M., 2001;
- SanPiN 2.2.1/2.1.1.1200-03 Sanitary Protection Zones and the Sanitary Classification of Enterprises, Structures and Other Facilities. RF Ministry of Health, M., 2003;
- All-Union Regulatory Document OND-86. Calculation of the pollutant content of industrial emissions, Gidrometeoizdat, L., 1987;
- Recommendations on principal air protection issues (regulation of emissions, setting MAC levels, monitoring compliance and issuing emission permits) StP, NII Atmosfera, 1995;

- SNCH 2.2.4/2.1.8.562-96. Noise in the workplace, in residential and public buildings and in housing developments. M.: RF Ministry of Health, 1997;
- GOST 4.209-79 Building and Construction. Sound Absorbing and Sound Insulating Materials. Performance Indicators;
- GOST Comecon 4867-84 Noise Protection in the Building Industry. Sound Insulation of Enclosures. Standards;
- Catalogue of the Noise Properties of Process Equipment (Annex to SNiP P
- I-12-77) USSR Gosstsroi Research Institute, M. Stroiizdat 1982; SNiP 23-03-2003. Noise Protection Measures, M, RF Gosstroi 2004.
- Noise and Vibration Control in Cities. I.L. Karagodina, M, Meditsina 1979.
- Motorway Noise Control, P.I. Pospelov, M, Transport, 1984.
- Production and Consumption Waste Generation per Unit of Output, M, 1999.
- Federal Catalogue of Waste Classification. M, 2003.
- Recommendations on the Maximum Allowable Accumulation of Toxic Industrial Waste on Industrial Sites, M., 1988, USSR Ministry of Health, RSFSR Ministry of Housing.
- SanPiN 2.1.7.1322-03. Hygiene Requirements concerning the Disposal and Incineration of Production and Consumption Waste.
- Guidelines 82-202-96. The development and application of standards for persistent loss and waste of materials in the building industry.
- Guidelines on the calculation, regulation and control of pollutant emissions, StP, 2005;
- Environmental Standard PND 1-94. The Conduct of Environmental Reviews of Air Protection Measures and of the Impact of Air Pollution on the Basis of Project Documents RF Ministry of Environment, M., 1995;
- Government Report on the Environmental Status of Komi Republic in 2006.

## 2. COMPANY PROFILE

### The Client

**Company name**:

OAO Mondi Business Paper Syktyvkar Integrated Pulp and Paper Mill

Chief Executive Officer – **Andrei Nikolaevich Dribnyi**

**Project management team:**

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## The proposed facility and its location

The proposed facility is Mondi Business Paper Syktyvkar Integrated Pulp and Paper Mill (MBP SIPPM), to be developed and reconstructed under the MBP Syktyvkar Integrated Mill Development and Reconstruction Project.

The Mill is located in the Ezhva District of Syktyvkar, in Komi Republic, 18 km downstream of Syktyvkar.

MBP SIPPM is the anchor enterprise of Ezhva, the industrial district of the capital of Komi, Syktyvkar.

The Syktyvkar Integrated Mill was opened in 1969.

It was built in two stages.

The first stage consisted of:

- A pulp mill with a capacity of 345 000 tpa
- Paper making machine No. 11 with a capacity of 100 000 tpa
- Cardboard machine No. 21 with a capacity of 140 000 tpa
- Pulp drying machine K-07 with a capacity of 132 000 tpa
- Utilities and auxiliary facilities

The second stage consisted of:

- Thermomechanical pulp (TMP) unit with a capacity of 135 000 tpa
- Chemical thermomechanical pulp (CTMP) unit with a capacity of 135 000 tpa
- Paper making machines No.14 and 15
- A board and plywood manufacturing shop and others.

The Mill is now an Open Joint Stock Company. At the time of its incorporation, some of the auxiliary and associated production facilities were separated from the main plant and made into subsidiaries.

However, MBP SIPPM and the subsidiaries and sub-subscribers are all served by the same water supply and waste water collection, disposal and treatment system. The sewerage system has common outfalls discharging the effluent into water bodies.

In 1979, a Stage II Construction Project was prepared (and updated in 1986), while a Feasibility Study for Stage III was prepared in 1988. This study envisaged increasing pulp production capacity to 677 000 tpa and expanding the auxiliary production facilities as well as water treatment, circulating water supply and waste water treatment facilities.

Output for 2006 is shown in Table 2.1.

**OAO MBP Syktyvkar Integrated Pulp and Paper Mill output in 2006**

Table 2.1

| Departments and products | 2006 output, tpa |
|---|---|
| 1. Sulphate pulp production department | |
| 1.1. Pulping,<br>Including: | 551486 |
| - Softwood | 218364 |

| Departments and products | 2006 output, tpa |
|---|---|
| - Hardwood | 333122 |
| 1.2. Grade I bleached<br>Including: | 375255 |
| - Softwood | 119225 |
| - Hardwood | 256030 |
| 2. Raw tall oil production department | 12440 |
| 3. Paper-making department | |
| 3.1. Paper making machine No. 11<br>Including: | 150736 |
| - Offset printing paper | 135283 |
| - Office paper | 14380 |
| 3.2. Cardboard machine No. 21<br>Including: | 208446 |
| - Pure Pak cardboard | 9802 |
| - Imitation chromo-board | 215 |
| - Top liner cardboard | 122886 |
| - Kraft liner cardboard | 51230 |
| - Mottled white board | 22046 |
| - Tube board | - |
| 3.3. Paper-making machine No. 14<br>Including: | 254683 |
| - Offset printing paper | 67424 |
| - Office paper | 183280 |
| 3.4. Paper-making machine No. 15 | 187100 |
| - Newsprint | 179726 |
| - Book paper | 7374 |
| 3.5. TMP production department | 21765 |
| 3.6. CTMP production department | 153409 |

## The objective and necessity of the proposed work

The reconstruction of the pulp mill at the MBP Syktyvkar Integrated Pulp and Paper Mill has as its objective upgrading the existing plant in order to:

- Increase the capacity of the pulp mill, to enable it to supply fibre to the reconstructed paper mill;
- Improve the quality of the pulp;
- Increase the efficiency of the core operation in terms of raw material, energy and chemicals consumption;
- Optimise process flow;
- Mitigate the environmental impact of the mill: reduce pollutant emissions to atmosphere and the pollutant content of waste water discharged into the Vychegda as well as reducing the impact of unusable industrial waste.

### Supporting documentation

The Environmental Impact Assessment section of the Integrated Mill Development and Reconstruction Project is based on Building Code SP 11-101-95, The Preparation, Agreement, Approval and Content of Justifications of Investment in the Construction of

Enterprises, Buildings and Facilities (Ministry of Construction Resolution No. 18-63), incorporating the requirements of the Regulation on Environmental Impact Assessments (Approval No. 372 of 30.06.95 ) and "Environmental Protection, a Practical Guide to SP 11-101-95", prepared by FGUP CENTRINVEST, 2006.

**The aims and objectives of the EIA**

Project documentation is required to include an EIA conducted in compliance with the Federal Environmental Protection Act, No. 7-FZ of 10 January 2002 (Article 32), the Environmental Review Act, No. 174-FZ of 23 November 1995 (Article14) and the Annex to the National Environmental Protection Committee (Goskomekologia) Order No. 372 of 16.05.2000.

Environmental impact assessments have as their objective preventing or mitigating the environmental impact of the economic activity to which they relate, and its associated social, economic and other consequences.

The results of the assessment are documented in EIA materials which form part of the documentation submitted for environmental review and used in reaching management decisions associated with the activity.

The EIA makes it possible to:

- Ascertain that the developer has complied with Russian environmental protection laws;
- Avoid environmental problems arising in the course of project implementation or reduce their severity to a minimum.

The results of the EIA form the basis for the preparation and development of the subsequent stages of the project.

**2.5 The aims and objectives of EIA implementation**

The Federal Environmental Protection Act, No. 7-FZ of 10 January 2002 (Article 32), the Environmental Review Act, No. 174-FZ of 23 November 1995 (Article14) and the Annex to the National Environmental Protection Committee (Goskomekologia) Order No. 372 of 16.05.2000 require an EIA to form part of project documentation.

Environmental impact assessments have as their objective preventing or mitigating the environmental impact of the economic activity to which they relate, and its associated social, economic and other consequences.

The results of the assessment are documented in EIA materials which form part of the documentation submitted for environmental review and used in reaching management decisions associated with the activity.

The EIA makes it possible to:

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- Avoid environmental problems arising in the course of project implementation or reduce their severity to a minimum.

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# 3. ASSESSMENT OF CURRENT STATUS OF ENVIRONMENTAL COMPONENTS IN THE AREA WHERE THE PLANNED FACILITY IS TO BE LOCATED

## 3.1 Brief description of physical geography and climatic conditions for the area where the undertaking is to be sited

The MBP SIPPM undertaking is located on the left bank of the R. Vychegda on four of its terraces above the flood plain. The area is classed as flat, with river valleys and ravines cutting through it, and with minor elevations.

The climate is moderately continental with a comparatively long winter and short summer. The mean monthly temperature for the hottest month at 13.00 hours (July) is plus 22.2°C, while the mean monthly temperature for the coldest month (January) is minus 19.7°C. The prevailing winds are southerly and south-westerly.

The climatic characteristics for the undertaking location have been taken from a letter from the Komi Republic Meteorological Service, № 06-22б/60 of 26.02.07 and are given in table 3.1 (annex 1).

Air status in the industrial facility site area

Table 3.1

| Indicator | Measurement units | Indicator value |
|---|---|---|
| 1 | 2 | 3 |
| Climatic features<br>Climate type – moderately continental<br>Temperature regimen: | | |
| - mean air temperatures, by month: | °C | |
| - January | °C | -15.6 |
| - February | °C | -14.1 |
| - March | °C | -7.7 |
| - April | °C | 1.0 |
| - May | °C | 7.6 |
| - June | °C | 14.0 |
| - July | °C | 16.7 |
| - August | °C | 14.0 |
| - September | °C | 7.8 |
| - October | °C | 0.3 |
| - November | °C | -6.7 |
| - December | °C | -12.9 |
| - annual mean | °C | 0.4 |
| - temperature regimen: | | |
| Mean air temperature for the coldest month | °C | -19.7 |
| Mean and maximum air temperature for the hottest month | °C | 22.2 |
| - precipitation: | | |
| Mean annual precipitation | mm | 560 |
| - distribution of annual precipitation by months: | mm | |
| - January | | 30 |
| - February | | 22 |

| Indicator | Measurement units | Indicator value |
|---|---|---|
| 1 | 2 | 3 |
| - March | | 27 |
| - April | | 35 |
| - May | | 49 |
| - June | | 56 |
| - July | | 74 |
| - August | | 65 |
| - September | | 67 |
| - October | | 58 |
| - November | | 42 |
| - December | | 35 |
| - wind regimen: | | |
| degree of repetition of wind directions | % | |
| N | % | 15.8 |
| NE | % | 7.7 |
| E | % | 3.7 |
| SE | % | 5.5 |
| S | % | 22.8 |
| SW | % | 24.7 |
| W | % | 9.8 |
| NW | % | 10.8 |
| Calm | % | 6.8 |
| Greatest wind speed, with a 5% per annum rating for being exceeded for the area in question (*U) | m/s | 8.0 |
| Fogs | | |
| duration in year, by seasons | | |
| - January | days | 3 |
| - February | days | 2 |
| - March | days | 2 |
| - April | days | 2 |
| - May | days | 1 |
| - June | days | 0.9 |
| - July | days | 2 |
| - August | days | 3 |
| - September | days | 4 |
| - October | days | 4 |
| - November | days | 2 |
| - December | days | 2 |
| Aeroclimatic characteristics | | |
| Ground-level and higher temperature inversions | | |
| - repetition of ground-level inversions | % | |
| daylight hours | | 10 |
| evening and night-time hours | | 42-52 |
| - repetition of higher-level inversions | % | |
| in winter months | | 6-15 |
| in summer months | | 1-4 |
| - duration | h | |
| - height of lower boundary of inversion layer | | 0.1-0.25 |
| - thickness of inversion layer | km | |
| - coincidence of inversion phenomena and calms | % | only January, May, July - 1% |
| Overall characteristics | | |
| Weather situations giving rise to elevated atmospheric pollution levels | | None |
| Stagnation situations: | | |
| - repetition of situation – rate 0-1 m/s, ground-level inversion with lower boundary 0.01-0.05 km. | % | 17 |
| Situations favouring the formation of photochemical smog | | |

| Indicator | Measurement units | Indicator value |
|---|---|---|
| 1 | 2 | 3 |
| - repetition of combinations of stagnation situations (wind speed 0-1 m/s and ground-level inversion) with high direct and total radiation intensity at warm times of year | % | 1 |

### 3.2 Specification of ambient air pollution level in the Mill location area

Main sources of air pollution in the Ezhva district of Syktyvkar are Mondi Business Paper Syktyvkar IPPM, as well as the wood processing, building industry and automotive industry enterprises forming the Northern industrial hub.

Stationary air quality monitoring sites are not available in the Mill location. The nearest State Environmental Monitoring Service stationary air pollution monitoring site (PNZA No.10) belonging to the Central Office of Hydrometeorology and Environmental Monitoring is located in the Ezhva district at the intersection of Mir and Komarov streets (the Horizon cinema).

Maximum allowable concentrations of the pollutants emitted by the Mill have not been exceeded in any population centres.

The background concentrations include emissions from the Mill and are shown in Table 3.2 (Annex 1).

Background air pollution levels recorded at PNZA No. 10 in 2006

Table 3.2

.

| Item No. | Indicator | Unit of measure-ment | Background level | | | | |
|---|---|---|---|---|---|---|---|
| | | | At wind speed of 0-2 m/s | At wind speed 3 m/s and over | | | |
| | | | | N | E | S | W |
| 1 | Background air pollution by types of pollutants: | $mg/m^3$ | | | | | |
| | - nitrogen dioxide | $mg/m^3$ | 0.041 | 0.045 | 0.053 | 0.033 | 0.028 |
| | - sulphur dioxide | $mg/m^3$ | 0.002 | 0.003 | 0.002 | 0.002 | 0.002 |
| | - carbon oxide | $mg/m^3$ | 1.931 | 1.963 | 1.716 | 1.759 | 1.792 |
| | - formaldehyde | $mg/m^3$ | 0.019 | 0.019 | 0.019 | 0.022 | 0.019 |
| | - Hydrogen sulphide | $mg/m^3$ | 0.001 | 0.002 | 0.001 | 0.001 | 0.001 |
| | - suspended solids | $mg/m^3$ | 0.105 | 0.084 | 0.086 | 0.091 | 0.087 |
| 2 | Mean annual concentration of methanethiol (methyl mercaptan) for 2006 | $mg/m^3$ | 0.000056 | | | | |

The results of measurements conducted by the Central Office of Hydrometeorology and Environmental Monitoring of the Komi Republic on background concentrations are shown in Annex 3.

Air quality is determined on the basis of quantitative chemical analysis and a comparison of its results with Maximum One-Time MAC. Air pollution levels are determined on the basis of a composite public health index, the Air Pollution Index (API). Air pollution in the Ezhva district of Syktyvkar is classified as low.

### 3.3. Hydrosphere and the status and pollution of surface waters

#### 3.3.1 Hydrogeological characteristics of groundwater

Komi's supplies of groundwater containing up to 1 g/l of mineral salts, suitable for domestic and drinking water purposes, are estimated at 62.06 $Mm^3$/day, or 22.65 $km^3$/year.

The estimated quantity per head of population is 63.7 $m^3$/day, with areas enjoying the best supply being the Ust-Tsilemsky Municipality – 620 $m^3$/day, and those with the least supply being Syktyvkar – 0.8 $m^3$/day. In terms of the forecast availability of supply, 19 municipalities have reliable supplies, Syktyvkar being the exception.

Exploration for sources of domestic and drinking water supply has involved 89 deposits (areas), with total available reserves of 1197.2 $Mm^3$/day, of which 716.6 $Mm^3$/day had been prepared for commercial development. In 2006, explored available reserves increased by 125.5 $Mm^3$/day, of which 38.9 $Mm^3$/day had been prepared for commercial development. The increase resulted from 13 new deposits (sites) having passed the official review conducted by the Timano-Pechora Office of the Russian State Committee on Reserves and having been put into operation, and from the inclusion of sites not earlier included in the national register of groundwater deposits. As a result, additional reserves were established for 10 municipalities.

Domestic and drinking water reserves which have been neither explored nor forecast are evenly distributed over the country. Municipalities with the best provision (per person) are Vuktyl, Troitsko-Pechorsky, Syktyvdinsky, Pechora, Sosnogorsk, Ukhta, Usinsk, Inta and Vorkuta, which account for 88 % of total explored reserves. Explored groundwater reserves per head of population are 1.23 $m^3$/day, with the municipality with the best provision being Vuktyl at 3.69 $m^3$/day, and the least well provided municipality being Kortekrossky at 0.021 $m^3$/day. The municipalities of Kzhemsky, Koigorodsky and Ust-Tsilemsky have no explored reserves at all.

There are 43 groundwater deposits (areas) in operation, with booked reserves of 579.1 $Mm^3$/day. One freshwater area with reserves of 12.7 $Mm^3$/day has reached the design stage. Total water abstraction taken into account in the calculations was 87.8 $Mm^3$/day (23% of groundwater reserves prepared for commercial development). Abstraction is highest from deposits close to large industrial centres: Ukhta, Pechora, Vuktyl, Vorkuta and Sosnogorsk.

The Komi Republic has 46 groundwater deposits (areas) which are not in operation. The reasons for this include their uneven distribution over the country, the fact that some of them are far away from consumers (Klyamshorskoye, Kamenka, Troitsko-Pechorskoye and Chetlasskoye), which increases their development costs, and the tendency of the local authorities to use poorer quality surface waters for domestic and drinking water supply.

According to the Komi Subsurface Status Monitoring Centre, the total number of water users which had reported their consumption was 125, of which 81 held 229 groundwater abstraction licences. Throughout the country, licensed abstraction of fresh groundwater is partly based on unexplored reserves.

Komi has 10 industrial water deposits (areas) with available reserves of 24.5 $Mm^3$/day, of which 13.6 $m^3$/day have been prepared for commercial development. Explored mineral water reserves of 12 deposits (areas) remain at last year's level of 3.1 $Mm^3$/day (of which 1.956 $Mm^3$/day have been prepared for commercial development). 6 deposits (areas) have one borehole only, abstracting a total of 0.039 $Mm^3$/day. Seregovskoye-2 and Ukhtinskoye are deposits serving the Seregovo health resort and a Physiotherapy Polyclinic respectively.

Mineral water from Akim and Istok-D is bottled and sold. Water from the Ezhva deposit is used for balneotherapy at the Ezhva sanatorium.

Industrial groundwater, which may be valuable for industrial and treatment purposes, is widely available, but little is known about the deposits.

At operating water intakes groundwater depth has been determined on the basis of abstraction levels, and no depletion has been observed.

The quality of fresh water of various hydrogeological origins observed in situ is satisfactory, except for the greater than allowed content of iron and manganese of natural origin.

The hydrochemical composition of groundwater continues to deteriorate in areas under high development pressure. At the end of 2006, there were 69 industrial groundwater pollution sources, with 57 polluted domestic and drinking water intakes, of which 18 abstracted groundwater from freshwater areas.

At most water intakes, groundwater quality is below the requirements for drinking water, due to its fluoride, iron and manganese content, colour and turbidity, and occasionally boron content. Virtually all of these levels are due to natural hydrogeological conditions and occur throughout the operating life of the intakes. However, their iron and manganese content (classified as hazardous) has increased, since they draw in poor quality natural waters. Iron is present in moderately hazardous quantities (up to 10 MAC) at 28 water intakes, hazardous concentrations (10 – 15 MAC) at 6 water intakes and extremely hazardous concentrations (>15 MAC) at 5 intakes. The highest iron content – up to 23 – 54 MAC, continues to occur at the Pechorgorodsky water intake (abstracting over 11 $Mm^3$/day from the Pechorgorodsky deposit) which produces water from alluvial formations.

The manganese content of groundwater from operating deposits does not exceed moderately hazardous levels (up to 5 – 10 MAC).

Information about the hydrochemical status of groundwater in areas exposed to development pressure suggests that the availability and pollution of the waters depend on the extent of their protection, the nature of the sources of development pressure and its extent and duration. The above assessment of groundwater quality cannot claim to be complete, since in recent years the national observation system was reduced by 57 observation points, and all observation in northern, central and southern regions of the country has been discontinued. In addition, water and subsurface users either do not provide complete information about groundwater quality, or provide no information at all. Assessments and forecasts of groundwater quality can be made only if subsurface conditions are monitored at all levels (federal, local and by individual facility). Important steps towards the reproduction and replenishment of groundwater resources and reserves include estimation of available reserves in deposits with unconfirmed reserves, re-estimation of reserves in deposits with confirmed reserves which have come to the end of their design service life or whose water management or environmental conditions have changed and exploration for groundwater to provide sources of environmentally clean drinking water supply for cities and other population centres.

In the mill location, groundwater is used extremely rarely and in only very small quantities for domestic and drinking water purposes, since Syktyvkar and Ezhva District are supplied by a surface waters.

### 3.3.2 Hydrogeological characteristics of surface water

The river Vychegda serves as a source of water supply as well as receiving the Mill's waste waters.

The industrial site of the Syktyvkar IPPM is situated on the left bank of the Vychegda downstream of Syktyvkar in the area 398-393 km from the estuary. The Vychegda is a tributary of the Northern Dvina. The length of the river is 1130 km, and the total area of the basin is 121000 $km^2$. The river is replenished predominantly by snow (60-80% of the flow), with10-30% coming from rainfall runoff and 5-10% from groundwater runoff.

Spring floods begin in the third decade of April, reaching a maximum on 5-15 of May; the river freezes in the end of September - beginning of December. Minimum flow is observed in March. In terms of its length and water regime the Vychegda is a major typically lowland river. Its valley is mostly composed of alluvial formations. The bed has circuitous course with many dead channels, arms, and lakes. The flood plain is forested, covered with shrubs and grassland vegetation, partly marshy. The river bed is mainly sandy, partly sandy and pebbly, strongly re-formed, with alternating pools and shoals. Water from the river is used by the many industries located in the area.

The Vychegda is used by shipping and for logging. Navigation and timber-rafting are also carried out. The Slobodskaya log storage boom is located in this area (393.1-392.7 km from the estuary), which forms part of the Nizhnechovskiy water transport depot. The port of Syktyvkar is situated 410 km from the estuary on the left bank of the river. On the 395th km near the left bank there are the Mill's timber handling facilities.

The river is a source of water supply and a receiver of sewage water from population centres and industrial enterprises located in its basin.

The area contains a number of facilities with an impact on the water ecosystem.

Water consumption: The domestic drinking water intake of Syktyvkar (40 $Mm^3$/day) is situated 423.3 km from the estuary, domestic drinking water supply intake for Ezhva (12 $Mm^3$/day) is situated on the river Vychegda, on the left bank 400 km from the estuary; the Mill's industrial water supply intake (750 $Mm^3$/day) is situated 395 km from the estuary, on the left bank of the river.

Water disposal: Mill waste water accepted as clean is discharged on the left bank of the river Vychegda through two overhanging outfalls located 394 and 393 km from the estuary (from the power plant and Slobodskoy water transport depot respectively); treated waste water is discharged through the deep diffuser 354 km from the mouth on the left bank.

In 2006, 166793.5 $Mm^3$ , of water was discharged, including biologically treated water and water discharged through the Main Outfall – 99455.3 $Mm^3$, water accepted as clean discharged through the power station outfall – 58220.6 $Mm^3$, and through the outfall at the Slobodskoy water transport depot – 9117.6 $Mm^3$ . The quantities discharged through the power station and Slobodskoy outfalls include storm water.

In terms of its ichthyofauna, the river Vychegda ranks is among Komi's most important fisheries areas. The following fish live in the river: salmon, nelma, cisco, starlet, bream, orfe, chub, grayling, eelpout, pike, perch, ruff and others, including pike-perch and lamprey. The area contains the wintering holes and the breeding and feeding grounds of valuable species of fish.

The table below shows the estimated hydrological characteristics of the river Vychegda in the Mill area; they relate to the location of the outfall of waste water accepted

as clean – 395 km from the estuary, and to the location of the diffuser – 355.7 km from the estuary. The catchment areas are 67400 $km^2$ and 68400 $km^2$ respectively.

**Main characteristics of the Vychegda river bed in the two outfall locations**

Table 3.3

| Outfall | Distance from the mouth km | Water level, m BS | Section area, $m^2$ | Bed width, B, m | Av. depthm | Max. depth m | Peri-meter, P m |
|---|---|---|---|---|---|---|---|
| Mill site (water accepted as clean) | 395.0 | 75.26 | 815 | 474 | 1.72 | 3.75 | 475 |
| Diffuser | 355.7 | 72.06 | 561 | 194 | 2.89 | 5.80 | 195 |

Annual variations of water level in the Vychegda have their main peak during the spring tide and summer-autumn high water.

The spring tide lasts from 54 to 107 days (on average 65 days), the summer-autumn low-water period 60-70 days, and the winter low-water period 140-180 days.

Lowest water levels in m BS and their probability P are given in Table 3.4, and flow rates in Table 3.5.

The lowest river flow occurs at the time of winter and summer-autumn low-water periods, while the winter low-water period is very stable and is characterized by gradual reduction of water flow rates towards the end of winter, when ground water reserves are exhausted, while the summer-autumn low-water period is interrupted by several rainfall floods.

Estimated water flows representing minimum flowrates with different probability levels are shown in Table 3.6.

Tables 3.7 and 3.8 provide information about the annual flow distribution and the ice conditions as measured by the Syktyvkar water measuring station.

**Estimated water levels and their probabilities P Numerator: Mill site, outfall of water accepted as clean,**
**Denominator – Diffuser outfall**

Table 3.4

| Water level | Probability, P % | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 1 | 3 | 5 | 10 | 25 | 50 | 90 | 95 |
| inimum spring tide level, m BS | 88.20<br>79.40 | 81.96<br>79.16 | 81.77<br>79.00 | 81.50<br>78.75 | 81.00<br>78.25 | | | |
| inimum summer-autumn vel H, M BS | | | | | | 74.98<br>71.70 | 74.66<br>71.35 | 74.6<br>71.2 |
| inimum winter level H, m S | | | | | | 75.28<br>72.05 | 74.85<br>71.55 | 74.7<br>71.4 |

**Average annual maximum and minimumVychegda water flows and their probabilities P**
**Numerator: Mill site, outfall of water accepted as clean, Denominator – Diffuser outfall**

Table 3.5

| Water level | Probability, P % | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **5** | **10** | **25** | **50** | **75** | **90** | **95** | **97** | **99** |
| Average annual water flow, $m^3/s$ | 890<br>903 | 806<br>821 | 767<br>778 | 695<br>706 | 617<br>626 | 538<br>546 | 466<br>473 | 424<br>430 | 396<br>408 | 344<br>349 |
| Minimum spring tide water flow, $m^3/s$ | 7290<br>7400 | 6200<br>6290 | 5650<br>5740 | 4790<br>4860 | | | | | | |
| Minimum average monthly water flow in the summer, $m^3/s$ | | | | | | 219<br>221 | 179<br>182 | 161<br>164 | 150<br>152 | 131<br>133 |
| Minimum average monthly water flow in the winter, $m^3/s$ | | | | | | 123<br>125 | 109<br>110 | 100<br>102 | 94.5<br>95.9 | 84<br>85 |

## Estimated flowrates (m/s) corresponding to minimum water flows at the different probability levels

Table 3.6

| | Water flow | Water flow probability, P % | | | | |
|---|---|---|---|---|---|---|
| | | 50 | 90 | 95 | 97 | 99 |
| Mill site outfall | Min. summer | 0.38 | 0.34 | 0.32 | 0.31 | 0.30 |
| | Min. winter | 0.21 | 0.20 | 0.19 | 0.18 | 0.18 |
| Diffuser outfall | Min. summer | 0.54 | 0.43 | 0.41 | 0.40 | 0.39 |
| | Min. winter | 0.35 | 0.31 | 0.28 | 0.27 | 0.25 |

**Estimated monthly flow distribution, % of annual levels**

Table 3.7

| Water content | Monthly flow | | | | | | | | | | | | Seasonal flow | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | IV | V | VI | VII | VIII | IX | X | XI | XII | I | II | III | Spring IV-VI | Summer-Autumn VII-XI | Winter XII-III |
| Very high | 3.3 | 33.4 | 17.5 | 11.0 | 6.0 | 4.6 | 8.4 | 6.2 | 3.4 | 2.4 | 2.0 | 1.8 | 54.2 | 36.2 | 9.6 |
| High | 4.5 | 37.7 | 15.7 | 6.4 | 4.4 | 8.6 | 8.4 | 5.0 | 3.3 | 2.3 | 1.9 | 1.8 | 57.9 | 32.8 | 9.3 |
| Average | 5.2 | 37.4 | 19.0 | 7.0 | 4.9 | 3.8 | 7.6 | 5.7 | 3.2 | 2.3 | 2.0 | 1.8 | 61.7 | 29.0 | 9.3 |
| Low | 6.6 | 42.0 | 16.9 | 6.3 | 3.8 | 4.3 | 6.4 | 4.7 | 3.1 | 2.2 | 1.9 | 1.8 | 65.6 | 25.4 | 9.0 |
| Very low | 16.0 | 39.8 | 9.0 | 6.5 | 3.8 | 4.5 | 5.0 | 6.1 | 3.2 | 2.2 | 2.1 | 1.9 | 63.8 | 25.8 | 9.4 |

## Vychegda ice conditions as measured by the Syktyvkar water measurement station

Table 3.8

| Date and length | Autumn and winter ice phenomena | | | | | Spring ice drift | | | Duration of ice phenomena |
|---|---|---|---|---|---|---|---|---|---|
| | Appearance of ice formations | Start of ice drift (slush ice run) | Start of fast ice | Duration, days | | Start | End(river ice-free) | Duration, days | |
| | | | | ice drift (slush ice run) | Fast ice | | | | |
| Average | 26.X | 26.X | 12.XI | 17 | 168 | 29.IV | 5.V | 6 | 191 |
| Early (Longest) | 11.X-57 | 11.X-57 | 21.III-46 | 49<br>1966 | 198<br>1940-41 | 12.IV-75 | 21.IV-37,<br>51, 75 | 13<br>1966, 1972 | 211<br>1960-6 |
| Late (Shortest) | 22.XI-67 | 22.XI-67 | 4.XII-62.66 | 1<br>1937 | 134<br>1966-67 | 14.V-41 | 19.V-71 | 1<br>1925 | 169<br>1924-2 |

Maximum thickness of ice reaches 92 cm, the average thickness of ice reaches 61 cm (the second-third decade of March). In the Mill site area the maximum ice thickness – 84 cm was registered in the first decade of March in 1982.

In terms of its chemistry, Vychegda water is of the hydrocarbonate, calciferous type with medium mineral salt content during the minimum winter flow and brackish at other times of the year. The water is very soft, and soft in the winter low-water period. It has moderate leaching ability with respect to gravity-flow facilities built of normal density concrete during spring floods and low leaching ability during rainfall floods. In the time of summer and winter low water, it is as a rule non-aggressive. The water of the Vychegda does not as a rule cause acid corrosion.

### 3.3.3. Ichthyological characteristic of the river Vychegda

The river Vychegda belongs to the highest fishery category (GOST 17.12.04.77, Indicators of the condition of fisheries waters and rules for their valuation). The fishery characteristic is based on Letter No. 05-2815 of 21.10.2003 from the Komi Fish Farming Enterprise, Komirybvod.

The ichthyofauna of the river is represented by the following species of fish: sterlet, nelma, salmon, cisco (most valuable species). Besides, in the basin live: eelpout, pike, perch, pike-perch, ruff, white-eyed bream, carp bream, orfe, roach, dace, silver bream, lookup, crucian carp, lamprey, gudgeon, minnow and other species of fish.

The large variety of ichthyofauna of the river Vychegda and of the waters of its basin is due to the fact that virtually all its biotopes contain fish. Physical conditions, river bed evolution and hydrodynamic features of water courses, leading to biotope diversity, have resulted in the formation of different types of ichthyocenoses.

The fish fauna of the mountain and submontane watercourses is reophilic, consisting of Siberian white salmon, Atlantic salmon and whitefish which prefer cold, clean fast-flowing waters. The demanding environment means that there is no great species diversity.

The plains watercourses contain a greater variety of fish. Their slow-flowing, warmer waters favour phytophilous fish species (pike, roach, dace, perch etc) which spawn in newly flooded or aquatic vegetation.

All fish species to be found here represent Palaearctic faunal assemblages: boreal submontane, boreal lowland, arctic freshwater and Upper Tertiary.

Species representing the boreal submontane assemblage have adapted to life in fast-flowing rivers with clear, highly oxygenated waters, stony bottom and no submergent vegetation other than that covering the stones. These fish are highly sensitive to lack of oxygen in the water. All species (Siberian white salmon and Atlantic salmon) have typical streambed colouring and spotted sides. These fish have adapted to life in fast-flowing waters: they are strong swimmers with spindly bodies or have adapted to life among the stones on the river bottom. An important part of their feeding and nutritional environment is the food chain linking the fish to terrestrial fauna. There are no burrowing benthos feeders or herbivorous fish. The fish spawn in stony places in the spring and summer. Their roe is poorly adhesive or non-adhesive. The early development stages of the larvae take place at the river bottom, among the stones.

The boreal lowland assemblage is found mainly in the taiga, and is represented by pike, perch minnow and others, with species resistant to large fluctuations in dissolved oxygen content predominating. These fish inhabit slow-flowing, not necessarily transparent water areas, and flood plain waters. They are mainly benthophagous (both bottom feeders and burrowers). Since they spawn at relatively low temperatures, the roe of phytophilous fish species (other than carp) develops mainly on last year's vegetation and in a less favourable oxygen environment.

The Arctic freshwater assemblage is represented by two fish species: whitefish and freshwater cod. These fish too are sensitive to the oxygen content of the water. Terrestrial fauna plays a less important role in their nutrition, while the fish fry feed on zooplankton, with the assemblage including a large proportion of benthophagous fish, feeding mainly on epifauna on solid ground. The fish find their food mainly by sight. They are mainly lithophilous (spawning in stony places) or psammophilic (sand-specific), spawning in the autumn and winter.

The Upper Tertiary assemblage of the Vychegda is represented by one species only, the sterlet.

The spawning grounds of salmonid fish are in the tributaries of the Vychegda, while those of whitefish occur everywhere, from the estuary to the headwaters, as is the case with fish spawning in the spring.

The shallow, well-heated, slow-flowing river bank areas are home to perch, pike, roach and dace, as well as to the young fry of all species. The most valuable rheophilic fish prefer the river bed. Spawning depends on weather conditions and takes place in sandbars and stony-bottomed pools. Limnophilic fish species (pike, roach, dace and perch) spawn in riverbank shallows.

Some of the above species live permanently in the Vychegda basin, while others visit to feed or spawn. The most numerous of Vychegda's commercial fish species are roach, bream, orfe, pike, perch, ruff, freshwater cod, sterlet and whitefish, with roach predominating.

In the sixties and seventies, white-eyed bream, redfin, sabre fish and sander migrated to the Vychegda from the Kama and have spread throughout its basin.

In addition, the Vychegda contains an arthropod – the crayfish, whose numbers are steadily decreasing due to the changes in the chemistry of the waters.

It must be noted that the fisheries importance of the watercourses is not determined only by fish stocks and the variety of species, but also by the status of their food supplies.

Among the protoaquatic fauna, rotifers and lower crustaceans are especially varied. The river contains representatives of 31 groups of invertebrates, of which the most numerous are oligochaetes, nematodes, molluscs and the larvae of ephemeroptera, coleoptera, trichoptera, colepodes, hydrocarina, chironomids and other dipterans. The composition of some groups of aquatic animals (oligochaetes, molluscs and others) in the Vychegda is very similar to that of the Kama. It is thought that the Vychegda fauna has been enriched as a result of the migration of Volga fauna through the North Yekaterinsky Canal linking the Vychegda to the Kama. There is a regular pattern to the distribution of benthic flora and fauna in the river bed of the Vychegda, where the frequency of occurrence of Hydrida, leeches, molluscs, ostracodes and others is greater than in other Komi rivers. Aquatic fauna - trichoptera, ephemera and to a lesser extent molluscs and oligochaetes, is enriched by Siberian components, but has more European species than West Siberian fauna, including molluscs, some trichoptera, ephemera and chironomids.

The class-list of molluscs contains around 60 species, of which the well-known widespread species include 2 holoarctic, 10 paleoarctic, 10 Siberian, 4 European, 17 Euro-Siberian species as well as others.

The section of the Vychegda on which the Mill is located is the permanent home of around 10 fish species, including starlet, freshwater cod, lamprey, gudgeon, roach, dace, topmouth culter, perch, ruff and pike. In the immediate vicinity of the water intake, in the lower reaches of the Sert-Poloi, there is a 1500 m long wintering hole with starlet spawning grounds upstream and downstream of it. The upstream spawning sandbar is 2 km above the water intake trench. The adjoining secondary watercourses contain the feeding and spawning grounds of the main inhabitants of the Vychegda: bream, orfe, perch, pike and roach. The smaller fish spawn in May -July.

The river lies along the migration routes of valuable fish species which spawn in other locations. The fish capacity of the section is 2 centners per 1 km of river bed.

### 3.3.4. The environmental status of the Vychegda

In the upper and middle reaches of the river (in the village of Little Kuzhba, in Syktyvkar, and in Gavrilovka and Mezheg) water pollution according to all standard indices remained at previous year's levels. Based on composite indicators, the water was classified last year as Category 3 "a" and "b". In some places the categories were changing due to changes in

average annual pollutant concentration. Thus, below the village of Gavrilovka due to some decrease of the average annual content of copper the water was moved from Category 3b to Category 3a (the water changed from extremely polluted to highly polluted).

In 2006, typical pollutants remained iron and copper compounds, oxidation-resistant organic substances as indicated by their COD, and phenols and lignosulfonates in the region of the village Gavrilovka.

Average annual concentrations of iron and copper compounds are within 4-6 MAC. Average annual concentrations of zinc compounds do not exceed standard levels.

The average annual content of phenols measured at points near the city Syktyvkar and the village Gavrilovka were 3-4 MAC, the maximum concentration everywhere remains within 6-7 MAC.

Average annual content of oxidation resistant organic substances (based on their COD) in all control points was 2 MAC.

Methanol content limits (23 %) were exceeded most frequently upstream of Syktyvkar, the maximum concentration (3 MAC) was found within Syktyvkar city limits.

The maximum concentration of lignosulfonates (3 MAC) was found within Syktyvkar city limits.

Average annual content of oxidation-resistant organic substances (based on their $BOD_5$), nitrite nitrogen, nickel compounds and petrochemicals was within limits.

Above Syktyvkar and near the settlement of Mezheg there were found organochlorine pesticides of the dichlorodiphenyltrichloroethane group in concentrations of 0.02 μg/l (2 MAC) and 0.022 μg/l (2.2 MAC) respectively, with average annual values of 0.009 μg/l. and 0.012 μg/l respectively. Small quantities of hexachlorane, lindane and organochlorine pesticides of the dichlorodiphenylethylene group were also found (up to 0.007 μg/l).

The oxygen regime during 2006 was satisfactory.

In the investigated section of the Vychegda, the main sources of pollution are the industrial district of Syktyvkar and the area of the deep diffuser outfall of MBP SIPPM. In these areas the water has high pollutant content during all phases of the river regime

Elevated content of organic pollutants and those specific to the paper and pulp industry, such as phenols, methanol, formaldehyde, lignosulfonates and others, is found in the diffuser outfall area.

The chemicals content of the river water upstream of the outfall and water pollution levels are shown in Table 3.9.

The chemicals content of the river water upstream of the outfall

Table 3.9

| Description | Average concentration, $g/m^3$ Cav | MAC (fishery) $g/m^3$ $C_{MAC}$ | Pollution level (average) $\underline{Cav}/C_{MAC}$ | Comments |
|---|---|---|---|---|
| 1. Suspended substances | 14.9 | | | Letter No, 08-22-248 of 16.03.2004 from the Archangelsk Centre on environmental pollution monitoring |
| 2. $BOD_5$ | 1.7 | $BOD_n$ =3 | 0.57 | |
| 3. Ammonium ion | 0.01 | 0.39 | 0.26 | |
| 4. Nitrite-anion | 0.005 | 0.02 | 0.25 | |
| 5. Nitrate-anion | 0.02 | 9 | 0.0022 | |
| 6. Oil products | 0.01 | 0.05 | 0.2 | |
| 7. Phenols | 0.004 | 0.001 | 4 | |
| 8. Synthetic surfactants | 0.01 | 0.5 | 0.02 | |
| 9. Phosphates | 0.02 | 0.2 | 0.1 | |

| Description | Average concentrati-on, $g/m^3$ Cav | MAC (fishery) $g/m^3$ $C_{MAC}$ | Pollution level (average) $Cav/C_{MAC}$ | Comments |
|---|---|---|---|---|
| 10. Lignosulfonates | 1.2 | 1.8 | 0.67 | |
| 11. Formaldehyde | 0.01 | 0.05 | 0.2 | |
| 12. Methanol | 0.05 | 0.1 | 0.5 | Average data provided by Syktyvkar Timber Mill |
| 13. Sulphates | 17 | 100 | 0.17 | |
| 14. Chlorides | 2.1 | 300 | 0.007 | |
| 15. Copper | 0.0067 | 0.001 | 6.7 | |
| 16. Zinc | 0.0035 | 0.01 | 0.35 | |

In terms of its trophic and saprobic indices (GOST 17.1.2.04-77) Vychegda water may be classified as euthrophic.

### 3.4 The status of the land area and its geological environment

*Natural conditions of the proposed construction site*

The pulp mill reconstruction is to take place on the site of Mondi Business Paper Syktyvkar Integrated Pulp and Paper Mill.

The site is located on the left bank of the Vychegda, 18 km north of the capital of the Komi Republic, Syktyvkar to which it is linked by a motorway, railroads and waterways.

In the east, the site is adjacent to the river Vychegda, and in the west it is bounded by the Syktyvkar-Ukhta motorway and by the Mikun-Syktyvkar railway line.

In the south the site is adjacent to a construction depot and to the industrial and residential development of the Ezhva district of Syktyvkar. In the north it adjoins the mechanical and biological waste treatment plants.

The site is terraced throughout. The grade between the terraces is quite large and ranges from 85.0 m near the debarking and sawing shop to 124.5 m near the chips receiver and the pulp moulding shop.

There are no plans to acquire additional plots for other production facilities.

#### 3.4.1. Land use in the region

***Land categories***

Official statistics as at 01.01.2007 show the area of Komi Republic land resources to be 41677.400 ha.

The land falls into the following categories:

- Agricultural land 1855.800 ha (4.5%);
- Land under housing developments 197.300 ha (0.5 %);
- Industrial, power generation, transport, communications, radio and television broadcasting, IT, space programme support, defence, security and special purpose lands 271.100 ha (0.7%);
- Specially protected areas and facilities 2613.100 ha (6.3%);
- Forestry lands 35950.100 ha (86.3%);
- Water resources lands 142.500 ha (0.3%);
- Reserve lands 647.500 ha (1.6%).

***Land types***

Land types constitute the basic unit of official land inventory, and are subdivided into agricultural and non-agricultural land types.

Agricultural lands include arable land, fallow land, hayfields, pastures and perennial plantations. Non-agricultural lands are lands occupied by surface watercourses and include marshes, forests and shrubland, developed land, land occupied by roads, disturbed lands and others (gorges, sands etc.).

As at 01.01.2007, agricultural land of all categories occupied 418.400 ha (1% of KR land resources), while non-agricultural land occupied 41258.900 ha (99%).

KR land resources divide into the following types:

- Agricultural lands 418.400 ha (1.0%);
- Forests lands 30965.800 ha (74.3%);
- Trees and shrublands 135.300 ha (0.3%);
- Lands under water 641.200 ha (1.5%);
- Lands under housing developments 46.300 ha (0.1 %);
- Lands occupied by roads 144.700 ha (0.3%);

- Marshes 4073.100 ha (9.8%);
- Disturbed lands 12.500 ha (0.03%);
- Others 5239.900 ha (12.6%)

***Environmental protection lands***

Our region has a large number of conservancy areas, managed both at the federal and at the national level and established to preserve typical and unique ecosystems and the habitats of rare species.

As at 01.01.2007 Komi Republic had 253 specially protected areas of which 2 were of federal importance (the Pechora-Ilychsky National Biosphere conservancy area and the Yugyd Va National Park) as well as 251 specially protected areas of national importance (172 wildlife sanctuaries and 79 natural monuments). They occupy an area of approximately 6.1 million ha, which constitutes 14.62% of the area of Komi.

To ensure the sustainability of the specially protected areas system, specialists from the Institute of Biology at the Komi Research Centre of the Russian Academy of Sciences, commissioned by the Komi Republic Ministry of the Environment have for the past 5 years been engaged in compiling an inventory of the features of conservancy areas of national importance. The work is being financed by the central budget of the Komi Republic.

The conservancy areas contain undisturbed or only slightly disturbed land forms, most of which are typical of the country and some of which, associated with the foothills of the Urals and the highlands of Central and South Timman, are rare and unique not only for the region but also for the whole of the European North-East of Russia. Most of them provide habitats for rare plants, animals and fungi entered in the regional and Federal Red Book and in the Red Lists of the International Union for Conservation of Nature and Natural Resources. The principal adverse impact on wildlife results from the disturbance and direct persecution associated with hunting.

The change of the fish populations of watercourses flowing through the specially protected areas, the reduction in the size of valuable fish populations, above all salmonidae (Atlantic salmon, grayling and whitefish) and of the percentage of mature individuals in the populations is the result of uncontrolled removal (overfishing).

***Recreational lands***

The recreational potential of Komi forests is associated with the size of the forested area (30.0 million ha), the variety of its natural features, both in terms of their horizontal and vertical spread, the presence of rare and unique natural features and of valuable balneological resources which can form the basis of holiday and treatment centres as well as specialist sanatoria and health resorts.

All the country's land forms, the tundra, the taiga, the marshes and the meadows are of recreational value, some to a greater and some to a lesser extent.

The historical and cultural value of the country's recreational potential rests on the region's ethnic character and its past and present cultural artefacts (archaeological, architectural, religious and others) and traditional timber crafts. Our nature sites and historical and cultural monuments are able to satisfy 60-70% of the local and tourist demand for recreational facilities. Our forests attract by their environmental purity, the existence of developed taiga woods, the exoticism of Subpolar Urals landscapes and the unique nature of many components of our cultural heritage.

***Forest lands***

As at 01.01.2007 the total area of KR forest lands was 38695.500 ha (93% of its territory). A further 191.900 ha is occupied by forests not included in the total forest area (urban forests – 5.700 ha, Ministry of Defence forests – 4.300 ha, KR Ministry of

Education and Higher Education Ukhta Teaching and Experimental Forest Farm – 1200 ha and Ministry of Agriculture and Food farm land – 169.900 ha).

The Komi Republic Forestry Agency (since 01.01.2007 the Komi Republic Forests Committee) has under its management 36082.500 ha (93.2% of the total forest area), the Pechora-Ilchinsky Conservancy Area – 721.300 ha, and the Yugyd Va National Park – 1891.700 ha.

The percentage of forest-covered land in the various regions of the country varies and depends on their physical, geographic, climatic and soil conditions, the average being 77.6.

The total forest area remains fairly stable and changes little; the changes are mainly due to rezoning for civil and industrial development purposes.

Depending on their location, function and commercial use, the forests are divided into three groups, I, II and III, and further subdivided into categories on the basis of their protective function and use.

Group I forests function mainly as water and general protection, sanitary protection and recreational areas.

Group II forests are forest massifs located in fairly densely populated areas with well-developed industry and infrastructure and high demand for timber. Forests in those regions need to be protected from depletion, felling must be limited to the size of the annual increment and greater efforts need to be made to replace forest resources.

Group III includes all other forests within the national forest area, i.e. over 50% of the total. They are the main source of timber for the national economy, and are subdivided into commercial and reserved forests.

In addition to logging, felling and primary conversion, the forestry legislation of the Russian Federation allows other forms of forest use:

- Resin harvesting;
- Harvesting and primary conversion of secondary materials (stumps, bast, bark, birch bark and fir, spruce and pine twigs);
- Secondary uses (hay cutting, cattle grazing, apiculture, gathering and preparing forest fruits, mushrooms, berries and commercial raw materials, gathering moss, forest litter, fallen leaves, stones etc.);
- Hunting.

***Forest pastures and hay meadows***

KR taiga lands are rich in natural flood plain meadows. The flood plains of the Pechora, Vychegda, Mezen and their tributaries contain up to 94% of the total grassland area.

Alongside the grazing land owned by state farms, lands managed by forestry farms are also used as hay meadows and grazing lands. Hay meadows forming part of state forest lands are subdivided on the basis of their usage period into temporary, permanent and land improvement meadows. Only permanent hay meadows, identified by the forest manager, may be used for continuous or scheduled haymaking.

The size of forest hay meadow areas varies from 500 - 2000 ha. They yield between 6 -15 centners/ha. As at 01.01.2007, the country’s total hay meadow and pasture areas were respectively 54.500 and 13.100 ha.

## 3.5 Vegetation and wildlife

### 3.5.1 Vegetation

The natural complexes of the Komi Republic are characterized by their significant uniqueness.

The forest resources of the Komi Republic comprise 93% of the territory. The main forest-forming species are:

- fir 55.2% of forested area,
- pine 23.9% of forested area,
- birch 16.4% of forested area

Forest exploitation traditionally implies wood harvesting, consisting of principal felling carried out in declining and mature forest stands, and felling for other purposes (intermediate and thinning ).

The optimum size of principal fellings is based on a research-based standard, known as the design felling area. As at 01.01.2007 this area was 26.8 mln. $m^3$. In 2006 principal felling covered an area of 37382 ha, harvesting 6166.800 $m^3$ of wood, of which in Group III forests 5974.100 $m^3$, in Group II forests 146.600 $m^3$ and in Group I forests 46.100 $m^3$. Shelterwood and selective felling covered an area of 3813 ha, representing 10.2 % of total felled area. Timber yield per hectare was 165 $m^3$.

The planned size of principal felling coupes was 54.700 ha as compared with the actual size of 62.600 ha, of which 52.700 ha, i.e. 84% of the marked-out felling coupe, was based on the results of an enumeration survey.

Initially principal felling took place along the Kotlas-Vorkuta railway line, and subsequently in the Sysola, Luza and Vychegda river basins.

Forest clearing has resulted in reduced transpiration and has hampered conversion of surface run-off into groundwater runoff and has thus encouraged waterlogging of the felled ground.

***Rare and protected plant species***

The list of rare vascular plants included in the Komi Republic Red Book (1998) currently consists of 253 species in 63 genera.

It contains 161 species of bryophytes requiring protection, of which 10 are liverworts and the rest leafy mosses and 79 rare lichens.

The area contains plants protected throughout the world (Cypripedium calceolus L.), in the FSU (Epipogium aphyllum Sw., Lobaria pulmonaria (L.) Hoffm. and Bryoria fremontii (Tuck.) Brodo, Sparassis crispa Wulf:Fr.), and in Russia (Dactylorhiza traunsteineri (Saut.) Soo, Nardia japonica Steph., Cetraria laureri Krempelh., Gyroporus cyanescens (Bull:Fr) Quel).

### 3.5.2 Wildlife

The wildlife of the Komi Republic consists of over 4.400 species, of which more than 3000 are insects, 315 species are terrestrial vertebrates (amphibians, reptilians, birds, mammals). 47 species of fish inhabit Komi's watercourses.

34 species of birds, 11 species of mammals and 5 species of fish are rare species registered in the Red Book of the Komi Republic (1998).

***Invertebrates***. KR contains over 1185 identified species of aquatic invertebrates, over 50% of which are insect larvae. Of protoaquatic vertebrates, rotifers and lower crustaceans are the most varied. Representatives of 31 groups of invertebrates inhabit the river beds.

***Arthropods***. Over 3300 representatives of the Phylum Arthropoda have been identified in KR. Crayfish live in the basin of the Vychegda, but their numbers are steadily decreasing due to the changes in the chemistry of the waters. The Komi Red Book of 1998 contains 53 species of invertebrates.

***Cyclostomata.*** These are represented by two species of lampreys: the European river lamprey and the Siberian lamprey. Their larvae can be found in the basins of the

Vychegda, Mezen and Pechora, where mature individuals appear during the spawning season.

***Amphibians and reptilians***. Amphibians and reptilians are Komi's least well represented soil-dwelling animals, each consisting of 5 species only. They play an important role in the country's ecosystems, since some species occur in large numbers in some land forms: among the amphibians, two species of brown frogs, the moor frog, Rana arvalis, and the common frog, Rana temporaria, and among the reptilians the common lizard (Lacerta viviparia). One species of tailed amphibian has reached the north of the country – the Siberian salamander. The common triton and the grey frog occur in the waters of the south, where the common snake, adder, anguine lizard and sand lizard can also be found.

***Fish.*** In KR, there are 8 orders, 12 genera and 47 species of fish.

Migratory fish include the Atlantic salmon, Arctic cisco and smelt, while semi-migratory fish include the Siberian white salmon, whitefish and vendace. The latter form local fluvial, fluviolacustrine and lacustrine assemblages.

Watercourses of commercial importance contain 44 species of fish and pisciformes, of which the Pechora contains 31 species, the Vychegda 29 and the Mezen 24. The feature shared by all the rivers is the presence of the Atlantic salmon. A unique feature of the aquatic communities is the presence of other fish, such as sterlet, Siberian white salmon, local and migratory whitefish, Siberian and European grayling and the common goby (bullhead), found in Timan and Ural rivers. 33% of the fish are sturgeon, salmon, whitefish and other valuable species.

***Birds***. 247 species of birds are found in the Komi Republic, of which 213 nest here, while 11 have been observed in transit and during the autumn and winter migrations, while 23 species are visitors. Up to 50 bird species overwinter here.

Bird assemblages are of the taiga type, with the most common species predominating (86 species, 35%), followed by Siberian (57 species, 23%) and European assemblages (56 species, 23%). The percentage of arctic species is 15% (37 species). A small proportion is of Mediterranean, Tibetan and Chinese origin (a total of 4%).

Changes in habitat boundaries, varieties and bird numbers are associated with global changes of habitat, industrial and agricultural development, urbanisation and hunting.

There are approximately 180 species of migratory birds, of which 22 species are water fowl.

Migratory birds nesting in KR travel along two main routes: White Sea-Baltic or Norway and Volga-Caspian or Black Sea and Caspian.

***Mammals.*** Mammals are represented by 58 species, 17 genera and 6 orders. Chiroptera (5 rare species) include the water bat, whiskered bat and pond bat as well as long-eared bat and northern bat. Insectivores (8 species) are represented by the common European mole, shrew (common shrew) and the Eurasian water shrew. Rodents (22 species) are best represented. They include small rodents (voles, mice and rats) which are widespread and numerous, and play an important role as a source of food for predatory animals and birds. Many of them are valuable commercial species, including the squirrel, European beaver and muskrat. The nutria is farmed for its fur. Of the lagomorphs, the blue hare is found everywhere in large numbers. An isolated population of the mouse hare is found is the North and Subpolar Urals.

There are 16 species of wildlife, most of them of commercial value: sable, pine marten, European and American mink, ermine, otter, fox and other animals farmed for their fur.

Artiodactyles include moose, reindeer, and rarely roe deer.

### 3.6 Social conditions

Komi Republic is highly urbanized: 75.5% of its population lives in urban areas. The main features of the urbanization process are the gradual decrease of the number of population centres and of the size of both urban and rural populations. In total KR has 764 population centres. The urban network consists of 39 cities and towns (10 cities and 29 urban settlements) with a population of 737.306M; there are 725 rural population centres with a population of 237.311M (as at 01.01.2007). The overall urbanization rate (the ratio of settled areas to the total area of the region) is 0.5%; and of Syktyvkar 22.7%. The most urbanized are the municipalities of Ust-Vymskiy and Sysolskiy.

Green plantings of the urban and rural settlements of the republic play an important role in increasing the comfort and quality of life and in promoting environmental health. In 2006, the total green urban area was 25.096M ha, i.e. 30% of the urban lands. There are on average 340 $m^2$ of green plantings per head of urban population, with fewest green plantings in Vorkuta - 2 $m^2$ per head, due to the severe climatic conditions. Steps are taken to preserve the green plantings, and to improve urban health and architectural appearance and to create recreation spaces for the residents. Work is ongoing on restoring the health of the urban tree stock, pollarding poplars, removing dead wood and lawn maintenance (repairing, mowing, raking and other types of work). New trees and shrubs are being planted and squares are being restored. Flowers are planted every year, and lawns are sown and when necessary scythed out, and planting areas are prepared for trees and shrubs.

There have been no recent improvements in the medical and demographic situation of the region. On 1 January 2007 the population of Komi Republic was 974.617M. It had decreased by 10.412M (1.1%) in 2006 of which the urban population decreased by 7.204M (0.98%), and rural population by 3.208M (1.35%).

Population has fallen in all municipalities except for Ukhta and Syktyvdinsky, where the number of migrants exceeded the natural loss. Significant population losses have occurred in the municipalities of Inta (3.3%), Vorkuta (3.1%), Knyazhpogostsky (2.3%) and Ust-Tsylemsky (2.2%). This was due to natural wastage (the number of deaths exceeding the number of births) and emigration.

The fall in natural wastage in 2006 was due to a reduction in the number of deaths and an increase in the number of births.

Compared to 2005, in 2006 the absolute number of newborns fell by 0.1M (0.9%). The birth rate fell in 8 municipalities, with the greatest fall in the municipalities of Syktyvkar (8%), Vuktyl (6.6%) and Vorkuta (6.4%). Birth rate was higher than average in the municipalities of Izhemsky 14.9 births per 1000), Koigorodsky (14.5), Ust-Kulomsky (13.6), Ust-Tsilemsky (13.5) and Ust-Vymsky (13.2). Municipalities with the lowest birth rate were Inta (8.8 births per 1000), Vuktyl (9.6) and Troitsko-Pechorsky (9.8).

In 2006 the number of deaths fell by 1.55M (the death rate was 13.8 per 1000 as against 15.2 in 2005). In the cities, the mortality ratio fell by 10.5%, and in the countryside by 9.9%. Only the municipality of Troitsko-Pechorsky recorded an increase (by 2.6%). In all municipalities the number of deaths fell, most significantly in the municipalities of Syktyvdinsky (by 29.4%), Sysolsky (by 27.4%) and Vuktyl (by 25.9%).

51% of all child and teenage deaths up to the age of 15 were newborns who died at less than one year old. In 2006, infant mortality (the number of infant deaths per 1000 live births) was 17.6% lower than in 2005. It was highest in the municipalities of Koigorodsky (22.1), Ust-Tsilemsky (21.7) and Inta (13.6), and lowest in the municipalities of Usinsk (1.6), Izhemsky (3.3), Knyazhpogostsky (3.7), (5.09) and Syktyvkar (5.13). In 2006, there were no infant deaths in the municipalities of Vuktyl, Syktyvdinsky and Sysolsky. 68.3% of deaths were due to causes associated with the perinatal period (from the 28th week of pregnancy up to the birth and the first 7 days of the infant's life) and to congenital abnormalities (diseases closely associated with the mother's reproductive health). Infant

mortality due to injuries remained high (7.6%), while mortality due to nervous system disorders had almost tripled.

Mortality trends are associated with mortality among the working-age population. Compared with 2005, the number of deaths occurring at the height of working age fell by 16.1% and was 5.9M. Compared with 2005, in 2006 the proportion of working-age deaths in the total number of deaths fell from 45.5% to 43.7%. Accidents, poisoning and injury caused almost every third working-age death.

# 4. BRIEF DESCRIPTION OF THE PROPOSED FACILITY

Reconstruction of the production facilities will take place on the Mondi Business Paper Syktyvkar Integrated Pulp and Paper Mill site, using the existing unoccupied space as well as space resulting from the demolition of shut-down production areas.

## 4.1 Characteristic of the proposed facility

***SUMMARY***

| Item No. | Description | Particulars |
|---|---|---|
| 1. | Enterprise name | “MBP SPM” |
| 2. | Form of ownership | Open joint-stock company |
| 3. | Name of owner | **Mondi Business Paper** |
| 4. | Enterprise location | Komi Republic, Syktyvkar |
| 5. | Mailing address | Russia, 167026, Komi Republic, city Syktyvkar-26, Prospekt Bumazhnikov, 2 |
| 6. | Name and address of general design engineer, telephone, fax | CJSC “**Giprobum – Engineering**”<br>Russia, 190020, Rizhskiy Prospekt, 58<br>Phone: (812) 251 7266<br>Fax: (812) 251 8044<br>E-mail: giprobum@giprobum.spb.ru |
| 7. | Product range | Pulp, paper, cardboard, see 1.2 |
| 8. | Beginning of construction (date) | 1966 |
| 9. | Commissioning (date) | 1969 |

The current facilities consist of:

- Timber yard;
- Pulp mill with two production lines (softwood and hardwood);
- Production of TMP/CTMP;
- Papermaking machine No. 11 and cardboard machine No. 21;
- Papermaking machines No. 14 and No. 15. The present capacity of the existing SIPPM facilities is given in Section. 2.2.

The project envisages the reconstruction of the existing pulp mill to bring sulphate pulp production capacity to 703M tpa and thus to increase paper production to 795M tpa.

The technical solutions proposed by the pulp mill reconstruction project have as their objective:

- Increasing mill output
- Increasing the capacity of the pulp mill, to enable it to supply fibre to the reconstructed paper mill;
- Improving the quality of the pulp;
- Increasing the efficiency of the core operation in terms of raw material, energy and chemicals consumption;
- Optimising process flow;
- Mitigating the environmental impact of the mill: reducing pollutant emissions to atmosphere and the pollutant content of waste water discharged into the Vychegda as well as reducing the impact of unusable industrial waste.

The choice of process design solutions and pulp production equipment was based on the latest process developments.

The project envisages the construction of a new integrated pulp production chemicals regeneration system, based on new high-performance equipment.

The reconstruction will not involve shutting down the existing production facilities.

In the cardboard- and papermaking shops, papermaking machine No. 14 and cardboard machine No. 21 will be refurbished.

Papermaking machine No. 11 will continue its current operation.

## 4.2. Specification

### 4.2.1. Capacity and product range

The capacity and product range of the upgraded plant are shown below in Table 4.1.

**Capacity and product range**

**Table 4.1**

| Product description | Output, tpa |
|---|---|
| Pulp production | |
| Cooked softwood pulp | 313414 |
| including: | |
| Bleached Grade I | 188438 |
| Standard unbleached softwood pulp, *including softwood and hardwood waste* | 120610 |
| including | 14788 |
| Cooked hardwood pulp | 425940 |
| including: | |
| Bleached Grade I | 393984 |
| PAPER AND CARDBOARD PRODUCTION | |
| Office and offset paper, Papermaking machine No. 11 | 154 000 |
| Office and offset paper, Papermaking machine No. 14 | 330 000 |
| Newsprint, Papermaking machine No. 15 | 196 000 |
| White-coated cardboard and kraft liner, Papermaking machine No. 21 | 260 000 |
| **PRODUCTION OF TMP/CTMP** | |
| Thermomechanical pulp<br>Chemical thermomechanical pulp | 184745 |

### 4.2.2. Consumption of main types of fuel and energy

Estimated fuel and energy requirement of the proposed facility (p.a.)

Table 4.2

| Item No. | Consumer | Type of energy sources | | | | |
|---|---|---|---|---|---|---|
| | | Electric power | Gas | Oil products | Solid fuel | Heat |
| | | MW/h | $Mm^3$ | MT. | MTE | Gcal |
| 1 | Core operations | 1444086 | | | | 2196.2 |
| 2 | Power generation | 360050 | 860000 | 5.0 | | |
| 3 | Auxiliary operations | 201989 | | | | |
| 4 | Other consumers | 23174 | | | | 1747.7 |
| | | | | | | |

### 4.2.3 Raw materials

Feedstock, chemicals and auxiliary materials

Table 4.3

| Description | GOST/Specification No. | GOST/Specification requirements | Special requirements concerning feedstock, its preparation and delivery |
|---|---|---|---|
| Wood chips | GOST 15815-83, Grade C-2 | Mass fraction of bark, max. 1.5 | |
| | | Mass fraction of dote, max. 3.0 | |
| | | Mass fraction of mineral impurities, max. 0.3 | |
| | | Mass fraction of sieve residue on mesh size: | |
| | | 30 mm, max. 5.0 | |
| | | 20 and 10 mm, min. 84.0 | |
| | | 5 mm, max. 10.0 | |
| | | Drip pan residue, max. 1.0 | |
| | | Carbonised particles and metallic impurities - None | |
| Bleached softwood sulphate pulp | GOST 9571-89, Grade HV-2 | Mechanical strength when milled to $60^0$ CRA: | |
| | | - Breaking strength, km, min. 7.8 | |
| | | - Bending strength, No. of double bends, min. 800 | |
| | | Whiteness, %, min. 86 | |
| | | Dirt, no. of specks with an area of:<br>- 0.1 - 1.0 $mm^2$ incl., max. 70<br>- over 1.0 - 2.0 $mm^2$ incl., max. 2<br>- over 2.0 - 3.0 $mm^2$ incl., max. 0<br>- over 3.0 $mm^2$ - 0 | |
| | | pH of aqueous extract 5.5-7.0 | |
| | | Moisture, %, max. 20 | |
| Unbleached softwood sulphate pulp | GOST 11208-82 Grade NS-2, First Quality | Delignification 21.5-36.0 | |
| | | Mechanical strength when milled to $60^0$ CRA and $1m^2$ of cast weight 75 g:<br>- Breaking strength, m, min. 8200<br>- Tearing strength, mP (gs), min. 760(77) | |
| | | - Dirt, no. of specks per $1m^2$ of a sheet with an area:<br>- Over 2.0 $mm^2$ None<br>- Over 5.0 $mm^2$ None | |
| | | Moisture as supplied, %, max. 23 | |
| Bleached softwood /hardwood sulphate pulp | GOST 28172-89 Grade LS-1 First Quality | Mechanical strength when milled to $60^0$ CRA: | |
| | | - Breaking strength, km, min. 7.1 | |
| | | - Absolute tearing strength, cH (rc), min. 44(45) | |
| | | - Bending strength, No. of double bends,, min. 300 | |
| | | Whiteness, %, min. 87 | |
| | | Dirt, no. of specks with an area of:<br>- Over 0.1 - 1.0 $mm^2$ incl., max. 50<br>- Over.1.0 - 2.0 $mm^2$ incl., max. 3<br>- Over 2.0 $mm^2$ - 0 | |
| | | $pH_{x\text{э}}$ of aqueous extract 6-7.5 | |
| | | Moisture as supplied, %, max. 20 | |

| Description | GOST/Specification No. | GOST/Specification requirements | Special requirements concerning feedstock, its preparation and delivery |
|---|---|---|---|
| | | Note: With the client's consent, the pulp may have a maximum moisture content of 25% | |
| Magnesium sulphate | GOST 4523-77, analytical grade | Mass fraction of magnesium sulphate hepta ($MgSO_4 \cdot 7H_2O$),%, min. 99.5 | |
| | | Mass fraction of water-insoluble substances, %, max. 0.002 | |
| | | Acidity ($H_2SO_4$), %, max. 0.002 | |
| | | Alkalinity (MgO), %, max. 0.001 | |
| | | Mass fraction of nitrates ($NO_3$), %, max. 0.001 | |
| | | Mass fraction of phosphates ($PO_4$),%, max. 0.0005 | |
| | | Mass fraction of chlorides (Cl), %, max. 0.0005 | |
| | | Mass fraction of ammonium salts ($NH_4$), max. 0.001 | |
| | | Mass fraction of iron (Fe), %, max. 0.0002 | |
| | | Mass fraction of calcium (Ca), % max. 0.01 | |
| | | Mass fraction of manganese (Mn), % max. 0.0005 | |
| | | Mass fraction of arsenic (As), % max. 0.00004 | |
| | | Mass fraction of heavy metals (Pb), %, max. 0.0001 | |
| | | Mass fraction of zinc (Zn), % max. 0.001 | |
| Sodium chlorate | GOST 12257-93 liquid, Brand A | External appearance – solution or pulp | Solution temperature – min. 25°C to prevent crystallization |
| | | Mass fraction of sodium chlorate - min. 54% | |
| | | Mass fraction of water - Not specified | |
| | | Mass fraction of chlorides as NaCl - max. 0.25% | |
| | | Mass fraction of sulphates ($SO_4$) - max. 0.3% | |
| | | Mass fraction of chromates ($CrO_4$) - max. 0.003% | |
| | | Mass fraction of water-insoluble substances - max. 0.02% | |
| | | Mass fraction of iron (Fe) - max. 0.007% | |
| | | Note: The impurities content of liquid products is specified as the content of 100% of product. | |
| Sulphuric acid | GOST 2184-77, improved grade | Mass fraction of monohydrate ($H_2SO_4$) – 92.5-94% | |
| | | Mass fraction of free anhydride ($SO_3$) – Not specified | |

| Description | GOST/Specification No. | GOST/Specification requirements | Special requirements concerning feedstock, its preparation and delivery |
|---|---|---|---|
| | | Mass fraction of iron (Fe) - max. 0.006% | |
| | | Mass fraction of ash residue - max. 0.02% | |
| | | Mass fraction of NOx ($N_2O_3$) - max. 0.00005% | |
| | | Mass fraction of nitrous compounds – Not specified | |
| | | Mass fraction of arsenic (As) - max. 0.00008% | |
| | | Mass fraction of chlorine compounds (Cl) - max. 0.0001% | |
| | | Mass fraction of lead (Pb) - max. 0.001% | |
| | | Transparency – transparent without dilution | |
| | | Colour in $cm^3$ of comparison solution - max. 1 | |
| | | Note: With the client's consent, improved sulphuric acid may contain up to 98% of monohydrate. | |
| Hydrogen peroxide | Supplied by Eka Chemicals AB of Sweden | External appearance – colourless transparent odourless fluid. Mass fraction of hydrogen peroxide – 59-59.5%<br>Density - 1250 $kg/m^3$<br>Vapour pressure (30°C) - 1.0 kPa<br>Freezing point – 56°C<br>Boiling point – 119 °C | |
| Sulphur dioxide | GOST 2918-79 | Mass fraction of fixed residue - max. 0.01% | |
| | | Mass fraction of arsenic (As) - max. 0.000004% | |
| | | Mass fraction of water - max. 0.02% | |
| Technical grade caustic soda | GOST 2263-79, Grade – RD, First Quality | External appearance – colourless or coloured liquid. May contain crystallized sediment | |
| | | Mass fraction of sodium hydroxide - min. 44% | |
| | | Mass fraction of sodium carbonate - max. 0.8% | |
| | | Mass fraction of sodium chloride - max. 3.8% | |
| | | Mass fraction of iron as $Fe_2O_3$ - max. 0.02% | |
| | | Mass fraction of sodium chlorate - max. 0.3% | |
| Synthetic technical grade hydrochloric acid | GOST 857-95 Brand Б OKP 21 2211 0230 Grade I | External appearance – transparent yellow liquid | |
| | | Mass fraction of hydrogen chloride, %, min. 31.5 | |
| | | Mass fraction of iron (Fe), max. 0.015 | |
| | | Mass fraction of ash residue, %, max. 0.100 | |

| Description | GOST/Specification No. | GOST/Specification requirements | Special requirements concerning feedstock, its preparation and delivery |
|---|---|---|---|
| | | Mass fraction of free chlorine, % max. 0.008 | |
| | | Mass fraction of arsenic (As), %, max. 0.0002 | |
| | | Mass fraction of mercury (Hg), %, max. 0.0005 | |
| Talcum powder | GOST 19729-74 Brand TRPV | Calcined residue insoluble in hydrochloric acid, %, min. 87 | |
| | | Mass fraction of iron oxide in hydrochloric acid extract, %, max. 1.2 | |
| | | Mass fraction of iron, extracted with magnet, %, max. 0.08 | |
| | | Weight loss on calcination, %, max. 8 | |
| | | Mass fraction of moisture, %, max. 1 | |
| Crystallized sodium sulphate | GOST 21458-75 First quality OKP 21 4111 0630 | External appearance – white crystalline powder | |
| | | Mass fraction of sodium sulphate, %, max. 98.5 | |
| | | Total alkalinity as $Na_2CO_3$ ,%, max. 0.6 | |
| | | Weight loss on calcination,% max. 0.3 | |
| | | Mass fraction of water-insoluble residue, %, max. 1.0 | |
| | | Mass fraction of calcium and magnesium as $CaSO_4$ , %, max. 0.05 | |
| | | Mass fraction of iron ($Fe^{3+}$), %, max. 0.008 | |
| | | Mass fraction of zinc ($Zn^{2+}$), %, max. 0.3 | |
| | | Mass fraction of chlorides ($Cl^{-1}$**),** max. 0.06 | |
| | | Mass fraction of water, %, max. 0.05 | |
| Filtered process water | | Suspended solids, mg/l – 0<br>Chromacity – $15^{o}$<br>Turbidity, mg $SiO_2$/l – 5<br>pH – 6.0-7.5 | |
| | | Total content of soluble matter – 120 mg/l | |
| | | Salt content – Not specified | |
| | | Hardness: | |
| | | Total – 1.4 mg -eq/l; | |
| | | Carbonate – 1 mg -eq/l; | |
| | | Total alkalinity – 1 mg -eq/l; | |
| | | Fe total - 0.1 mg/l | |
| | | $Mn^{2+}$ - 0.05 mg/l | |
| | | $Al^{3+}$ - 1 mg/l | |
| | | $Ca^{2+}$ - 18 mg/l | |

| Description | GOST/Specification No. | GOST/Specification requirements | Special requirements concerning feedstock, its preparation and delivery |
|---|---|---|---|
| | | $Mg^{2+}$ - 6 mg/l<br>$Cl^{-}$ - 30 mg/l<br>$SiO_3^{2-}$ - 15 mg/l<br>$CO_2$ (free) – 10 mg/l | |
| | | Active chlorine – Not specified | |
| | | Permanganate oxidation susceptibility – 15 $mgO_2$/l | |
| | | COD – 20 $mgO_2$/l | |
| | | $BOD_5$ – 5 $mgO_2$/l | |
| Technical grade air (not dried) | GOST 17433-80, Class 1 (except for water content) | Mass concentration, mg/$m^3$, max, of.:<br>Sulphur dioxide – 3.0<br>Chlorine dioxide – 0.03<br>Nitrogen dioxide – 0.7<br>Hydrogen sulphide – 3.0<br>Methyl mercaptan – 0.2<br>Carbon oxide – 6.5<br>Formaldehyde – 0.17<br>Suspended solids – 0.4 | |
| | | Relative moisture content – 40-95% | |
| | | Pressure – 0.09MPa | |

## 4.3 Main design solutions

### 4.3.1 Raw wood preparation process

The project's main objectives in the area of raw wood preparation are: reducing wood consumption per unit of output, improving the quality of the chips and reducing emissions to atmosphere and waste water generation and disposal as well as the quantity of solid waste. This aim is to be achieved by building or upgrading the following facilities:

- New timber yard;
- New, two-line wood preparation shop;
- New Photo-Scan unit;
- New open hardwood and softwood chips storage yard;
- New bark storage facility;
- Upgrading softwood and hardwood chips screening system;
- Upgrading and providing new conveyor lines;
- New receiving facilities for imported chips;
- The existing wood preparation shop №1 to be converted to produce chips for CTMP/TMP production;
- Closing the existing wood preparation shops №2 and №3;
- Closing the existing open hardwood and softwood chips storage yards.

*Raw wood reception*

Raw wood arrives at the Mill in the following ways:

- By road -3200 $Mm^3$/year
- By rail -500 $Mm^3$/year
- By water-260 $Mm^3$/year.

The storage yard includes several timber stacking areas with a total capacity of 88 $Mm^3$, where the timber is stacked 10 m high.

*Wood preparation shop*

**Thawing and debarking**

Raw wood will be delivered to the thawing conveyor by a KALMAR clamshell timber loader.

It will be thawed by spraying log bundles with warm water. Water temperature will be controlled by injecting the appropriate quantity of steam into it.

The wood thawing system and washing roller conveyors will be supplied with water from the recirculating water system which includes dewatering conveyors, settlement pond, pumps, pipelines and valves.

The wood is debarked in dry debarking drums.

**Wood chip preparation line**

A chain conveyor will deliver the debarked logs to the washing rollers where it will be washed by four high-pressure jets. Due to the high efficiency of the system, bark residue and stones will be separated from the logs. The washing conveyor will have two stone traps, the first one fitted with a conveyor which automatically empties it and removes the stones, while the second one is emptied by hand.

From the washing conveyor the logs will be transported to a chipper producing high-quality chips which will then be transported to the open storage yards.

**Bark preparation line**

The bark and wood waste produced during debarking will be collected on a belt conveyor placed under the drum. The bark from the thawing conveyor and the washing roller conveyor will be dewatered, mixed with debarking waste and transported to the bark cutter. The finely cut waste will then be transported to dewatering presses and from there to the covered storage facility.

In the summer, when there is no need for thawing, and the bark is reasonably dry, the fine-cut bark and wood waste will be transported to the storage yard, bypassing the dewatering presses.

The thawing and pulpwood washing water will be processed to remove stones and sand and delivered to a pipeline which will transport it to the wood preparation shop. There, an auger pump will transfer it to a chute which will take it to the water treatment system. The thawing water will be steam-heated in a steam mixer placed at the drive end of the thawing conveyor. Its temperature will be controlled by injecting the appropriate quantity of steam.

The washing unit and stone traps at the end of the debarking process are fitted with water chutes which transport the water together with the bark via a trough to a drainage conveyor, where the bark and wood are separated and the bark is placed on tanbark belt conveyors. The water, sand and tanbark suspension from the drainage conveyors will be transported to a settling pond, where the smaller stones and sand particles (> 0.5 mm) will settle on the bottom and will be collected by a flight conveyor and transported to a container. The clean water from the settling pond will be transferred by horizontal pumps via a vacuum chamber and recirculated to the thawing and cleaning lines and to the stone traps. Waste water from the settling pond will be transported by an underfloor pipe to a separate well which will also collect the water from the bark dewatering presses and will

then be sent for further treatment. The recirculating water will be continually made up with fresh water, to maintain its quality.

**The open-air softwood and hardwood chip storage yard**

Softwood and hardwood chips from the wood preparation shop together with the imported softwood chips from the receiving hopper will be transported to the open-air storage yard by a conveyor belt system with the following storage capacity:

- Hardwood chips -57 $Mm^3$,
- Softwood chips-50 $Mm^3$.

**Wood chip screening unit**

Wood chip screening is a three-stage process. The first stage is coarse screening to screen out large particles, the second stage sort the chips by thickness while the third stage sorts the second stage fine fraction to separate out a part of the standard wood chips and return it to the main process.

The fine fraction will be transported by conveyer to the heat and power plant (HPP).

Standard-grade wood chips will be transported to the pulping line.

**Imported wood chip receiving hopper**

Imported wood chips will arrive at the mill by road and will be unloaded into the receiving hopper, where they will undergo preliminary screening and will be transported to the storage yard.

The coarse disc sorter will screen out foreign matter and large pieces and the waste will be sent to a waste heap.

**The covered bark storage facility**

A belt conveyor will transport the fine-cut and dewatered bark and wood waste from the wood preparation shop to the storage facility. The covered bark storage and continuous transport system will be built in two stages:

- During the first stage, the belt conveyor will transport the fine-cut and dewatered bark and wood waste from the wood preparation shop to a temporary open-air storage yard and from there along the existing routes to the boiler house;
- The second stage will consist in the construction of a covered bark storage facility with a bark and wood waste delivery system.

### 4.3.2 Pulping lines

Project objectives will be achieved by building or upgrading the following facilities:

- Upgrading the softwood and hardwood sulphate pulp lines consisting of the following facilities:
  - Softwood line – Digestion and washing shops, unbleached pulp and bark and wood waste screening and caustic treatment shop and bleaching shop;
  - Hardwood line - Digestion and washing shops, unbleached pulp and bark and chip waste screening and caustic treatment shop, bleaching shop and bleached pulp screening shop;

- Upgrading the existing evaporator units № 1 and № 3 and installing a new unit;
- Upgrading the lime causticizing and regeneration unit and installing a new lime regeneration unit.

**Softwood pulp line**

The pulp will be digested in a continuous double digester with a capacity of 1000 tpd of digested pulp.

The chips stored in the wood chip hopper will be heated to 100$^{o}$C with steam from flash tanks. Relief gas from the hopper will be cooled in the relief gas condenser.

Wood chips from the wood chip hopper will be mixed with the pulping liquor in a pipe and transferred to the saturation chamber where the wood chips will be saturated with pulping liquor before being transported to the digester.

The pulp will be digested in white liquor prepared in the lime causticizing and regeneration unit. Liquor consumption in NaOH units will be 21% of wood pulp consumption.

White liquor sulphidity 35%.

Pulp yield - 46%.

Pulp hardness - 28 kapp

Spent hot black liquor will be transported to a three-stage flash tank unit where the boil-off gas will be separated from the liquor, and the black liquor cooled and defibrated. The fibre will be returned to process, and the black liquor sent to evaporation.

The liquor boil-off gas will be condensed and the resultant turpentine condensate transported to the dirty condensate tank and from there to the evaporation plant for treatment.

Uncondensed vapour will be collected by the concentrated non-condensable gas system and sent for incineration.

The pulp will then be washed in a 5-stage countercurrent washing unit where the liquor loss is 8 kg/t. All washing equipment has been fitted with a new mesh cleaning system which uses the circulating filtrate.

The washed unbleached pulp will be transported to papermaking machine No. 21 where it will be used in cardboard production.

The bulk of the washed pulp from the wash press will be transferred to the soda-oxygen unit where it will be further delignified with oxidised white liquor.

White liquor will be oxidised with air in the existing unit with a capacity of 52-56 tpd of NaOH.

Following soda and oxygen treatment the pulp will be transported to a blow tank and then washed twice and transported to ECF bleaching.

The bleaching plant consists of the existing equipment with a capacity of 650 tpd of pulp.

The bleached softwood pulp will then be forwarded to papermaking machines No. 11, 14, 15 and 21 and to a new market pulp drier.

The alkaline bleaching run-off in quantities of 12 $m^3$/t of pulp and the acid bleaching run-off in quantities of 8 $m^3$/t of pulp will be cooled to 35 $^{o}$C in vertical heat exchangers with a heating surface of 550 $m^2$ each.

The acid and alkaline bleaching run-off and the pump seal and equipment washing water (2.2 $m^3$/t), a total of 22.2 $m^3$/t of pulp will be discharged into the drainage system and transported from there to the biological treatment plant.

The steam and gas from the acid bleaching stream and the soda extraction stream will be collected and sent for scrubbing in a Venturi GSC3200 scrubber which will treat both the softwood and the hardwood streams.

**Hardwood pulp line**

The pulp will be digested in the two existing continuous hydraulic digesters, Kamyur No. 1 and Kamyur No. 2 with a total capacity of 1500 tpd of digested pulp (750 tpd each). Each digester will be supplied by two wood chip delivery lines.

The pulp will be digested in white liquor prepared in the lime causticizing and regeneration unit. Liquor consumption in NaOH units is 18.5% of wood pulp consumption.

White liquor sulphidity 35%.

Pulp yield – 52.4%.

Pulp hardness – 17 kapp.

Spent hot black liquor will be transported to a new flash tank serving both digesters, where the boil-off gas will be separated from the liquor which will then be cooled and defibrated. The fibre will be returned to process, and the black liquor sent to evaporation.

The liquor boil-off gas will be condensed in a two-stage process in new condensers and the resultant turpentine condensate will be transported to a common softwood and hardwood dirty condensate tank and from there to the evaporation plant for stripping in a stripping column.

Uncondensed vapour will be collected by the concentrated gas system and sent for incineration.

The pulp will then be washed in a 5-stage countercurrent washing unit where the liquor loss is 8 kg/t.

The pulp, concentrated to 11-12%, will then be transferred from the DD washing unit to soda-oxygen treatment.

The project calls for upgrading the existing system by installing a second-stage soda-oxygen treatment unit where the pulp will be further delignified with oxidised white liquor to 11 kapp. The plant will have a capacity of 1433 tpd of pulp.

White liquor will be oxidised with air in the existing plant with a capacity of 52-56 tpd of NaOH.

The unbleached pulp screening process will be upgraded.

After soda treatment the pulp will be transported to a blow tank which will also serve as the screening system supply tank.

To reduce loss of fibre with screening waste, the plant will be provided with a new waste washing unit, KW4R.

The washed pulp will be transported to ECF bleaching.

The bleaching chorine dioxide will be heated to $37^{o}$C by heat recovered from the alkaline run-off by a horizontal heater with a heating surface of 96 $m^2$.

Bleached pulp will then be screened on a vertical screen in a three-stage process.

Standard-grade bleached pulp will be washed and transported to papermaking machines 11, 14, 15 and 21 for use in paper and cardboard making.

The alkaline bleaching run-off in quantities of 7 $m^3$/t of pulp will be cooled in the alkaline waste stream heat-exchanger and in the chlorine dioxide heater.

The acid bleaching run-off in quantities of 9 $m^3$/t of pulp will be cooled in four horizontal heat exchangers

The acid and alkaline bleaching waste streams cooled to 35$^oC$ and the pump seal and equipment washing water (~2 $m^3$/t), a total of 18 $m^3$/t of pulp will be transferred to the biological treatment plant.

The steam and gas from the acid bleaching stream and the soda extraction stream will be collected and sent for scrubbing in a Venturi GSC3200 scrubber which will treat both the softwood and the hardwood streams.

**Chemicals regeneration system**

During the chemicals regeneration process the organic substances dissolved during the pulp digestion process are incinerated, generating high pressure live steam, and the inorganic digestion chemicals are regenerated.

The regeneration system consists of:

- An evaporation unit;
- A caustic regeneration unit;
- A lime causticization and regeneration unit.

During the pulp digestion process, lignine and hemicelluloses are dissolved, and are washed out of the cellulose fibre together with the digestion chemicals, producing a weak black liquor containing 15-16% of dry matter.

The liquor is evaporated in evaporation units to produce strong black liquor which must be concentrated to above 70% to ensure efficient incineration.

**Evaporation unit**

To ensure that the required pulp production capacity can be achieved, the existing evaporation unit will be upgraded to a capacity of 820 t/hr on evaporated water, using the existing equipment to the greatest possible extent, and adding a new Andritz evaporator.

The capacity of the two existing evaporators, №1 and № 3 is 135 t/hr each, while the new evaporator will have a capacity of 550 t/hr of evaporated moisture.

The weak black liquor from the softwood line will arrive at the evaporator unit containing 15.9% of dry matter, will be concentrated to 20% and transported to the existing evaporators № 1 and № 3, where it will be further concentrated until its dry matter content reaches 45 - 50% and drained into the existing strong black liquor tank.

Crude sulphate soap from the softwood line will be separated out and sent for incineration to the soda regeneration unit.

The weak black liquor from the hardwood line which arrives at the evaporator unit containing 15.4% of dry matter will be mixed with the strong liquor from the hardwood line, transferred to the new evaporator and concentrated in units № 4 - 6 until it reaches 27-30% dry matter content. The intermediate black liquor will then be evaporated in units № 3 and № 2. From Unit № 2 a proportion of semi-evaporated liquor will be transferred directly to the concentrator, while the rest is used to strengthen the liquor.

After final concentration, the black liquor will be boiled down, and having reached a concentration of ~ 75% will be transferred to a new pressurised strong liquor storage tank and from there to the new soda recovery boiler for incineration.

The soap from the softwood line will be skimmed in the weak and intermediate liquor tanks. The recovered crude sulphate soap will be incinerated in the soda recovery boiler together with the black liquor.

The new evaporator unit will have an overflow recovery system with a settlement tank and an overflow collection tank.

The new concentrator will be supplied with low pressure steam. Condensed live steam will be returned to the Heat and Power Plant. Secondary steam from the last unit will be cooled and condensed in surface condensers and the vacuum system.

The new evaporator plant will separate out secondary condensate so as to reduce the amount of dirty condensate and ensure the highest possible methanol concentration.

The condensate streams will be separated by the existing evaporators. Highly contaminated condensate will be sent to the dirty condensate tank, and the slightly contaminated condensate to the clean or intermediate condensate tank.

Highly contaminated condensate will be treated in a stripping column integral with the new evaporator plant and removed to the clean condensate tank, while the blowdown from the stripping column is sent to the concentrated non-condensable gas (CNCG) system.

Condensate A (clean condensate) will be used to wash unbleached pulp and Condensate B (slightly contaminated) will be transferred to the causticization unit, where it will be used to wash lime sludge.

Dilute non-condensable gas (DNCG) will be collected from the unpressurised liquor, soap and clean and slightly contaminated condensate tanks, recovered from a scrubber sprayed with cooling water and transferred from there to the dilute malodorous gas gathering, transport and incineration system.

CNCG will be collected from the stripping column and the dirty condensate and the compressed liquor (pressurised) tanks forming part of the vacuum system and transferred to the CNCG gathering, transport and incineration system.

Cooling water for the existing surface condensers and for the condenser forming part of the new evaporator plant will be provided by a new cooling tower, and the warm water will be returned to it.

The methanol fraction recovered from the dirty condensates as well as crude turpentines and crude sulphate soap will be used as secondary fuel for the soda recovery boiler.

**Lime causticization and regeneration unit**

The existing lime causticization and regeneration unit will be upgraded in order to improve its performance, using the existing equipment to the greatest possible extent and also installing new Metso equipment.

The upgraded causticization unit will produce 8 200 $m^3$/day of white liquor, while the lime regeneration unit will produce 615 tpd of unslaked lime.

The end product of the regeneration plant will be roasted lime with the following parameters:

- Active CaO content – 85-90%;
- Max. $CaCO_3$ content – 3%;

Green liquor for causticization will be provided by the new soda regeneration unit and held in the existing green liquor tank. To enable the plant to achieve the required output, the green liquor will be clarified in three clarifiers. The existing weak white liquor clarifier (№ 9) will therefore be parallel-connected to the existing clarifiers (№ 2 and 4). To reduce soda losses as well as the quantity of solid waste, green liquor sludge will be washed in an existing clarifier (№ 7) and concentrated in a decanting centrifuge.

The clarified strong green liquor will be cooled under vacuum in an expansion chamber, where some of the liquid will evaporate. The vapour will be condensed in a tube condenser and returned to the cooled green liquor. The residual inert gas will be drawn off by a vacuum pump.

White liquor will be clarified by pressure filtering on a pressure disc filter (PDW$^{TM}$). The filtered white liquor will be transferred to three existing buffer tanks:

- Two white liquor tanks (№ 1 and №6);
- The existing weak white liquor clarifier (№ 8).

The white liquor will be used in pulp making.

The lime sludge will be diluted and dewatered on a disc vacuum filter (DLM) until 73-80% dry.

The concentrated lime sludge will be transported by a belt and an auger conveyor to a flash drier. The dried sludge will be separated from the gas in a cyclone and transferred to a lime kiln in the form of a powder at a temperature of 150-200$^{o}$C.

The lime regeneration kiln will use natural gas as its main fuel.

The slightly contaminated condensate from the evaporator plant will be used as dilution and cleaning water, for filter cleaning and to make up the weak liquor.

A new lime regeneration kiln (FFEM) with a flash drier will be used to roast the lime. The kiln will have a maximum capacity of 700 tpd of roasted lime.

Overflow will be collected in the weak liquor tank. The existing acid tank and auxiliary equipment will be used for acid washing new filters. There will be a lime sludge recovery system, to collect the sludge accumulated during the kiln shut-down period for subsequent regeneration.

**Black liquor incineration**

75% concentrated black liquor with high calorific value will be incinerated in a new soda recovery boiler with a capacity of 3560 tpd of dry matter.

Other products which will be incinerated in the soda recovery boiler and will serve as secondary energy sources will be:

- CNCG from the pulping lines;
- DNCG from the pulping lines;
- Byproducts of the pulp manufacturing and chemicals regeneration processes and of the dirty condensate clarification process (crude turpentines, crude sulphate soap and methanol fraction), as well as sodium sulphate from the production of chlorine dioxide, which is a product of the treatment of chemical-containing waste water.
- The existing soda recovery boilers will be withdrawn from service.

**CNCG and DNCG gathering, transport and incineration system**

The concentrated and dilute malodorous gas gathering, transport and incineration system is designed to collect the gases from their points of origin and incinerate them to reduce emissions of malodorous sulphur compounds (hydrogen sulphide, methanethiol (methyl mercaptan), dimethyl disulphide and dimethyl sulphide), as well as turpentine and methanol.

Incinerating CNCG and DNCG in the soda regeneration unit and the lime regeneration kiln will significantly reduce emissions of malodorous sulphur compounds, in line with the best available technology.

**Chlorine dioxide production**

Chlorine dioxide will be produced by the HP-ATM method. The plant will have a capacity of 31 tpd (100% $ClO_2$).

Chlorine dioxide is produced from sodium chlorate ($NaClO_3$), hydrogen peroxide ($H_2O_2$) and sulphuric acid ($H_2SO_4$).

The production process is based on a reaction between sodium chlorate and hydrogen peroxide in the presence of sulphuric acid at atmospheric pressure.

The finished product is an aqueous solution of chlorine dioxide at a concentration of 8 g/l, which will be stored in storage tanks and transferred by transfer pumps to the day tanks of the softwood and hardwood pulp bleaching shops.

**Sulphate soap decomposition**

In sulphate soap decomposition, sulphuric acid will be replaced with acid salts-containing waste from chlorine dioxide production.

The spent acid from the tallow oil unit will be piped to the weak liquor tank at the new evaporator plant to make up chemicals regeneration losses.

### 4.3.3 Paper and cardboard manufacturing

Papermaking machines No. 14 and 21 will be upgraded and their capacity increased while retaining the existing process design. The additional equipment will be installed in the available spaces of the existing plant.

Papermaking machine No.11 will not be upgraded.

Papermaking machine No.15 will not be upgraded.

**Market pulp drying**

Bleached softwood pulp will be dried by one integrated drying line with a maximum capacity of 250 tpd and operating width of 2000 mm, consisting of:

- An Andritz two-screen dewatering press
- A Stela flat bed air cushion drier
- A Metso pulp baling and packaging lines

The pulp, stored in a 1250 $m^3$ vat (to be located on the pulp mill site) at a concentration of 4% will be transferred to the drier's 100$m^3$ mixing tank, where it will be mixed with circulating broke, diluted to a concentration of 2.7% and transferred to the first stage of a three-stage screening unit consisting of three pressurised slotted screens with slots 0.2 mm wide.

The screened pulp at a concentration of 2.7–3.0% will be transferred to the two-screen dewatering press, while the screening waste is transferred to papermaking machine No. 21. The press will dewater the pulp until it is 45% dry and it will then be transported by screw conveyors to an opener. The opened pulp will be transferred to the drier by screw conveyors.

Water from the press will be drained into the return water basin. Return water will be used to dilute the pulp in the storage tower and during screening. Excess water will be returned to the softwood pulp bleaching shop where it will be used for process purposes.

The flat bed drier will dry the pulp until it is 88-90% dry, using low pressure steam as the air heating medium.

The dried pulp will be unloaded by a screw conveyor and other screw conveyors will deliver it to the pulp baling press.

Bale packs will be stored on the existing site of the former imported pulp storage yard.

### 4.3.4 Heat supply

To process the increased quantity of incinerated liquor, one new soda recovery boiler with a capacity of 3560 tpd will be installed. The steam generated by the new boiler will have the following parameters: 9.3 MPa (93 bar), 490°C. All three existing soda recovery boilers will be taken out of service.

The new soda recovery boiler will incinerate all malodorous non-condensable gases gathered at the plant, as well as all by-products such as soap, methanol and turpentine.

A new turbine will be installed, for 9.3 MPa (93 bar) live steam, with back pressure of 0.6 MPa (6 bar), and steam extraction pressure of 2.8 MPa (28 bar). This turbine is designed to operate in conditions of rapid steam load changes, typical of pulp mills. To enable the soda recovery boiler to operate at partial load or with the turbine shut down, the steam system will be fitted with a pressure reducer to reduce live steam pressure from the soda recovery boiler level to the steam extraction and back pressure level. Coolers will adjust steam temperature to each pressure level.

### 4.3.5 Utilities

**Compressed air supply**

The reconstruction project will leave the mill’s demand for the compressed air required to supply the reconstructed and new facilities with dried compressed and process air virtually unchanged (based on equipment suppliers’ estimates).

There are no plans to reconstruct or expand the existing compressed air system.

**Oxygen supply**

Due to the introduction of a second stage of soda-oxygen treatment into the softwood pulping line oxygen consumption by the soda-oxygen treatment unit will increase to 48-50 tpd.

To provide the required amounts of oxygen and create a backup capacity, a new oxygen plant will be installed to produce air separation products, equipped with a KKhz-0,5 air separation plant

## 5 FORECAST OF POSSIBLE ADVERSE ENVIRONMENTAL CHANGES DURING THE CONSTRUCTION AND OPERATION OF THE FACILITY

### 5.1 Air pollution levels in the mill location area

Main sources of air pollution of the Ezhva district of Syktyvkar are the Integrated Pulp and Paper Mill as well as wood processing, building industry and automotive industry enterprises comprising the Northern industrial hub.

There are no stationary air quality monitoring sites in the mill area. The nearest air monitoring station (Monitoring Station No.10) belonging to the Central Office of Hydrometeorology and Environmental Monitoring is located in the Ezhva district at the intersection of the Mir and Komarov Streets (Horizont cinema).

Maximum allowable concentrations of the pollutants emitted by the Mill have not been exceeded in any population centres. The background concentrations include emissions from the Mill and are shown in Table 5.1 (Annex 1)

Background air pollution levels recorded at PNZA No. 10 in 2006

Table 5.1

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| Item No. | Indicator | Unit of measure-ment | Background value | | | | |
|---|---|---|---|---|---|---|---|
| | | | At wind speed of 0-2 m/s | At wind speed of 3 m/s and over | | | |
| | | | | N | E | S | W |
| 1 | Background air pollution of air by types of pollutants: | $mg/m^3$ | | | | | |
| | - nitrogen dioxide | $mg/m^3$ | 0.041 | 0.045 | 0.053 | 0.033 | 0.028 |
| | - sulphur dioxide | $mg/m^3$ | 0.002 | 0.003 | 0.002 | 0.002 | 0.002 |
| | - carbon oxide | $mg/m^3$ | 1.931 | 1.963 | 1.716 | 1.759 | 1.792 |
| | - formaldehyde | $mg/m^3$ | 0.019 | 0.019 | 0.019 | 0.022 | 0.019 |
| | - Hydrogen sulphide | $mg/m^3$ | 0.001 | 0.002 | 0.001 | 0.001 | 0.001 |
| | - suspended solids | $mg/m^3$ | 0.105 | 0.084 | 0.086 | 0.091 | 0.087 |
| 2 | Mean annual concentration methanethiol (methyl mercaptan) in 2006 | $mg/m^3$ | 0.000056 | | | | |

The results of background concentration measurements conducted by the Central Office of Hydrometeorology and Environmental Monitoring of the Komi Republic are shown in Annex 3.

Air quality is determined on the basis of quantitative chemical analysis and a comparison of its results with Maximum One-Time MAC. Air pollution levels are determined on the basis of a composite public health index, the Air Pollution Index (API). Air pollution in the Ezhva district of Syktyvkar is classified as low.

### 5.2 Forecast impact of the facility on ambient air

Technical solutions envisaged by the mill development and reconstruction project are designed to reduce the mill's impact on atmospheric air in its location, in terms of the specific pollutants emitted by it.

The largest contributors to methane thiol (methyl mercaptan) and hydrogen sulphate pollution are the process equipment and extractor fans of the following shops:

- Digestion and bleaching (sources No. 101÷117, 121, 122, 124 and 125);
- Soda recovery boiler and black ash cake vats (source No. 204, 205, 206 and 207);
- Waste water treatment facilities (Sources No. 600, 601, 602 and 608);

Source No. 206 (black ash cake vat 4U) contributes 18% to the general level of methanethiol (methyl mercaptan) pollution while Source No.108 (extraction from the digestion and bleaching shop) contributes 9 %.

The plant includes a concentrated non-condensable gas (CNCG) recovery and incineration system serving the hardwood and softwood fibre lines and the evaporator unit. The collected gases are burnt in the burner nearby without heat or SO2 recovery.

There is no recovery system for dilute non-condensable gases (DNCG).

The problem of methanethiol (methyl mercaptan) and sulphur compound emission cannot be solved by the replacement of the existing equipment alone. Changes are required which will impact the main process lines, bearing in mind the need for environmental measures, such as CNCG and DNCG gathering, transportation and incineration systems.

2006 was used as the baseline year for the mill reconstruction project. The permitted emission level was 22904.9184 tpa (Annex 2), and as stated on Form 2-TP (Air), the mill emitted 19505.401 tpa (Annex 4).

The reconstruction project envisages the following environmental enhancement measures:

**Timber yard**

- Replacing the existing timber preparation shops with new softwood and hardwood shops

**Pulping plant**

- Upgrading softwood and hardwood sulphate pulp lines to achieve the maximum increase of the capacity of both lines and the plant as a whole, including:
  - The softwood line – the digestion and washing shops, the unbleached pulp screening shop and the bleaching shop;
  - The hardwood line – the digestion and washing shops, the unbleached pulp screening shop and bleaching shop and bleached pulp screening shop;
- Upgrading the existing evaporators and installing a new one;
- Upgrading the lime causticization and regeneration shop and installing a new lime regeneration kiln No. 4
- Installing a new soda recovery boiler 3560 to replace the worn out boilers 3U, 4U and 6U and their fusion cake vats
- Installing CNCG and DNCG gathering, transportation and incineration systems in the new soda recovery boiler unit and a DNCG unit in the causticization shop at the new lime regeneration kiln No. 4

**Paper and cardboard line**

- Upgrading papermaking machines No 14 and 21 to increase their capacity;
- Retaining papermaking machines No 11 and 15 lines at their existing levels;

- Ensuring that the demand for semi-finished fibre products is met internally by increasing pulp mill capacity. Discontinuing pulp imports;
- Creating a market bleached pulp line (drying excess pulp with steam)

To reduce pollutant emission levels, the following environmental measures are envisaged by the project:

**1. Timber yard**

The project's main objectives in the area of raw wood preparation are: reducing wood consumption per unit of output, improving the quality of the chips and reducing emissions to atmosphere and waste water generation and disposal and the quantity of solid waste.

This aim will be achieved by building new facilities which will use advanced storage and operating methods: open-air softwood and hardwood chip and bark storage yards and a two-line wood preparation shop.

The existing wood preparation shops No. 2 and 3 and open-air softwood and hardwood chip storage yards will be closed.

The following steps will be taken to reduce emissions to atmosphere:

- Installing dust and gas scrubbing systems in the wood preparation shop;
- Using air-tight equipment.

Pollutants released during the movement of raw materials, the operation of the wood preparation shop and open-air storage of wood chips include NOx, sulphur dioxide, carbon black, carbon monoxide, kerosene hydrocarbons and wood dust (Sources 957, 958 and 6005÷6008).

**2. Pulp mill**

*Pulp digestion*

The use of modern pulp digestion process layouts will require upgrading the chip delivery lines to the digesters, upgrading digesters No. 1, 2 and 3 and installing new condensers.

*Washing and screening unbleached pulp*

Both washing and screening lines will have new equipment and existing equipment will be upgraded to increase its capacity and will be sealed.

Sealed equipment reduces leakages of contaminated steam-and-air mixture into the working environment and thus emissions to atmosphere through the general ventilation system (Sources108÷ 111).

All steam and air from emission sources 101÷107, 112÷117, 121, 122, 124 and 125 generated by the two lines' digestion, washing, screening and soda-oxygen treatment will be piped to the DNCG gathering and transport system, mixed with secondary air and transported to the new soda recovery boiler (Source 955).

The use of two-stage soda-oxygen treatment in a countercurrent system will reduce the use of bleaching chemicals.

Pulp will be bleached using the ECF technology (eliminating the use of elemental chlorine).

Pollutants from softwood and hardwood lines (Sources 143÷147 and 149÷ 152) will be sent to a new GSC 3200 Venturi scrubber serving both lines. The Venturi scrubber will achieve the following pollutant removal levels:

- Chlorine -90 %;

- Chlorine dioxide – 93 %.

The resultant filtrate will be returned to the soda treatment wash filter tank. Scrubbed gas will be vented to atmosphere with gas from the hardwood line emission source 952.

The bleaching shop generates chlorine and chlorine dioxide.

**Chemicals regeneration system**

During the process of chemicals regeneration, the organic compounds dissolved during digestion are incinerated generating high pressure live steam, while inorganic digestion chemicals are regenerated.

The regeneration system consists of:

- An evaporation unit;
- A soda regeneration unit;
- A lime causticization and regeneration unit.

Taking the existing evaporator unit № 2, which is in a poor state of repair, out of service, upgrading evaporators No. 1 and 3 and installing a new evaporator will make the new soda recovery boiler more environmentally friendly. The fact that the black liquor will be evaporated to 75% of dry matter will reduce sulphur dioxide emission during its incineration.

Malodorous gases generated during the pulping process are divided into two groups: dilute non-condensable gases (DNCG) and concentrated non-condensable gases (CNCG).

DNCG and CNCG from the pulping lines will be piped to the new DNCG gathering and transport line and incinerated in the soda recovery boiler.

DNCG will be collected from the liquor, soap and clean and slightly contaminated condensate and cooled in the scrubber which will be sprayed with cooling water. After the scrubber, the non-condensable gases will be collected by the DNCG gathering and transport system and sent to the soda recovery boiler in the forced-air stream (source 955).

CNCG are collected from the stripping column, contaminated condensate and the incineration liquor vats (pressurised) and the vacuum system and collected by the CNCG gathering and transport system (source 955).

The methanol fraction remaining after scrubbing the contaminated condensate and the crude turpentine and crude sulphate soap will be used as secondary fuel for the caustic regeneration boiler.

Scrubbing the contaminated condensate will reduce the pollutant content of water sent to the treatment plant and this in turn will reduce methanethiol (methyl mercaptan) and hydrogen sulphide emissions from the treatment plant (source № 600÷602).

*Black liquor incineration (environmental benefit of the new soda recovery boiler)*

To process the increased quantity of black liquor sent to incineration, which has a concentration of 75 % and high calorific value, the plant will be provided with a new soda recovery boiler with a capacity of 3560 tonnes of dry matter per day (source 955).

The existing soda recovery boilers and fusion cake vats 3U 4U and 6U will be taken out of service (sources № 203, 0204, 0205, 0206 and 0207), and the worn out equipment will be replaced with a new soda recovery boiler with a fusion cake vat.

Other products which will be incinerated in the soda recovery boiler and will serve as secondary energy sources will be:

– CNCG from the pulping lines;

- DNCG from the pulping lines;
- By-products of the pulp manufacturing and chemicals regeneration processes and of the dirty condensate clarification process (crude turpentines, crude sulphate soap and methanol fraction), as well as sodium sulphate from the production of chlorine dioxide, a product of the treatment of chemical-containing waste water.

The environmental protection measures envisaged by the project and consisting in the replacement of the old soda recovery boilers № 3U, 4U and 6U fusion cake vats and the installation of the bigger soda recovery boiler with a capacity of 3560 tpd (including the fusion cake vat) will make it possible to eliminate four emission sources (sources № 0204, 0205, 0206 and 0207) and will introduce one new one (source 955).

*Possible deviations from process operating procedures*

CNCG contains a mixture of a large quantity of flammable compounds which are not normally likely to ignite in the piping system, since it does not contain a sufficient quantity of oxygen. Fire safety regulations must be observed in the vicinity of the system.

To ensure that CNCG can be incinerated safely and completely and prevent accidents, the project calls for the installation of electrical interlocks and an automatic fire prevention system.

The CNCG incineration system does not produce emergency releases or gas bursts.

For minor repairs to the new soda recovery boiler, the gathering and transport system will automatically redirect the CNCG to an 85 m high, 1.5 m diameter chimney stack, and the gases will be vented for one minute, while natural gas is supplied to the secondary furnace. During this time, the new soda recovery boiler stack (source 0955) will not be emitting gases to atmosphere.

Pollutants emitted by the chimney stack (source 0953) are dimethyl sulphide, dimethyl disulphide, hydrogen sulphide and methanethiol (methyl mercaptan).

When the afterburner has come up to temperature, the gases are automatically diverted. The afterburner will not be in operation for more than 30 minutes per year.

Flue gases from the CNCG secondary incineration process will be vented through an 80 m high 0.9 m diameter chimney stack (source 0954).

The CNCG incineration process converts all sulphur gases, dimethyl sulphide, dimethyl disulphide, hydrogen sulphide and methanethiol (methyl mercaptan) to the less toxic sulphur dioxide.

Burning natural gas in the secondary furnace will produce nitrogen dioxide, nitrogen oxide, sulphur dioxide, carbon monoxide and benzopyrene.

A circuit diagram of CNCG collection, transport and incineration in the new soda recovery boiler (source 0955) and secondary furnace (source 0954) and by-pass emissions discharge (source 0953) is shown in Fig. 1.

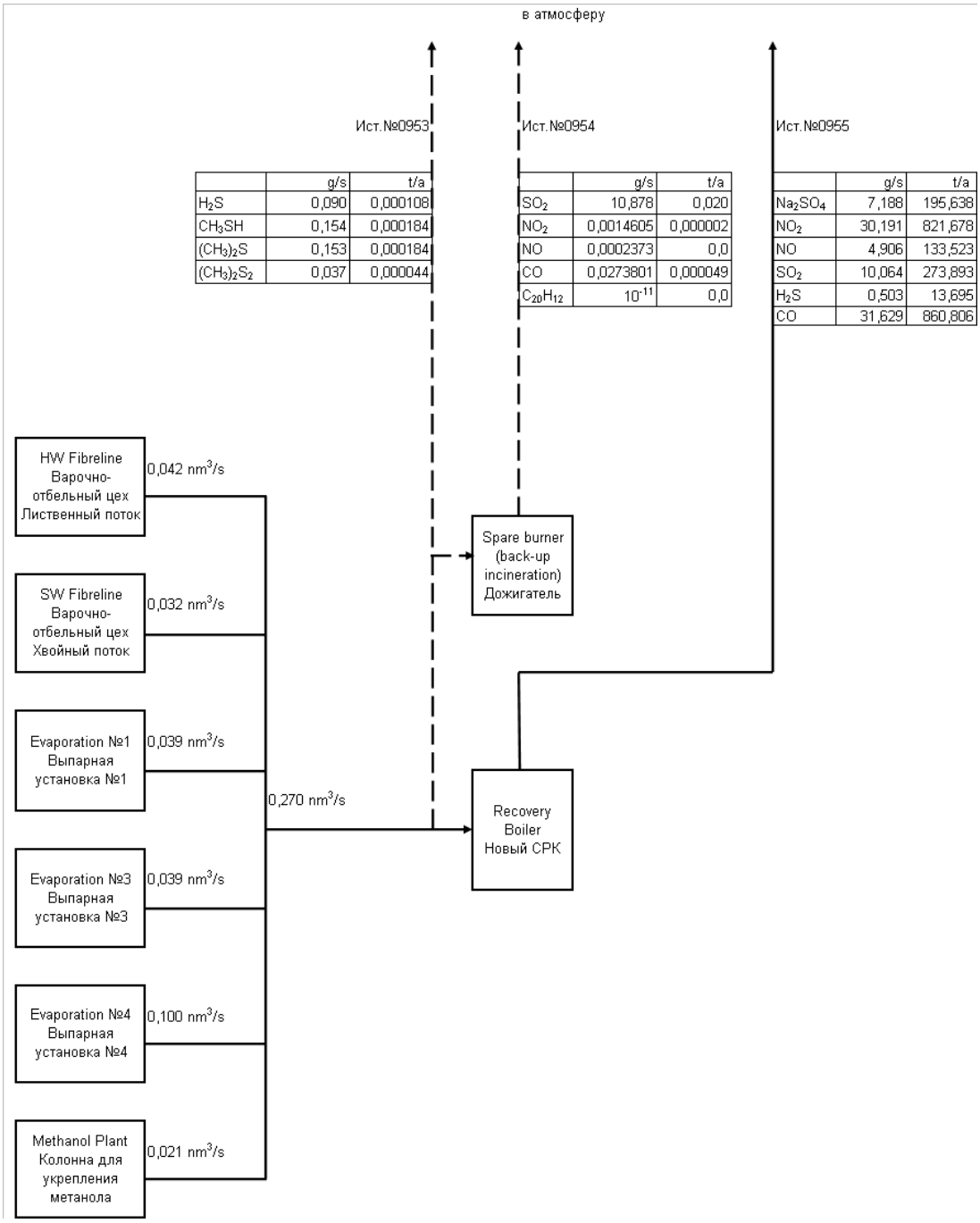
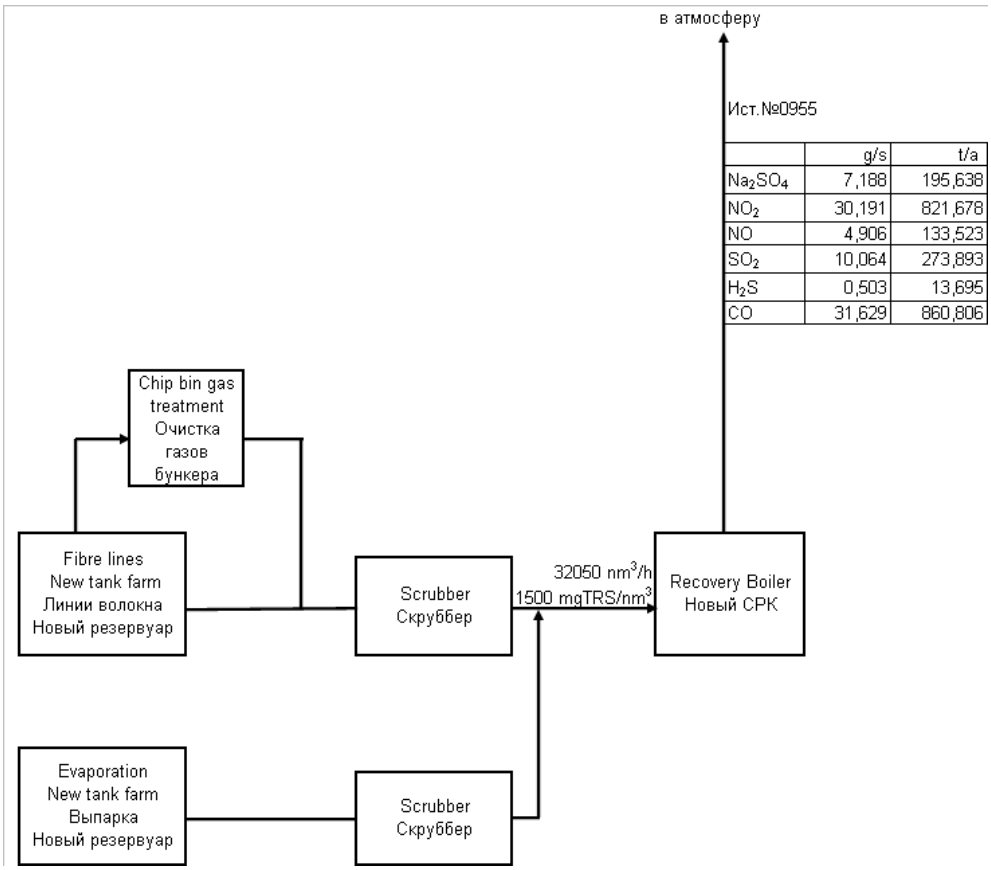



Fig. 1. Block diagram. CNCG gathering, transport and incineration system in the new soda recovery boiler (Source №0955), secondary furnace (Source №0954) and by-pass emission discharge (Source №0953)




| | g/s | t/a |
|---|---|---|
| $Na_2SO_4$ | 7,188 | 195,638 |
| $NO_2$ | 30,191 | 821,678 |
| NO | 4,906 | 133,523 |
| $SO_2$ | 10,064 | 273,893 |
| $H_2S$ | 0,503 | 13,695 |
| CO | 31,629 | 860,806 |

Fig. 2. Block diagram. CNCG gathering, transport and incineration system in the new soda recovery boiler (Source №0955)

The installation of the new soda recovery boiler and non-condensable steam turbine will increase the efficiency of steam and power generation.

At present, flue gases from soda recovery boilers № 3U and 4U and tanbark boilers № 1U, 2U and 5U are vented through one chimney stack (source 203). Boiler № 2U has been taken out of service. The project envisages installing a larger soda recovery boiler with a capacity of 3560 tpd.

Soda recovery boilers № 3U and 4U will be taken out of service, and flue gases from tanbark boilers № 1U and 5U will be vented through the existing chimney stack (source 203).

All the steam produced using biofuel is used by the pulp and paper lines, with some extra provided by the power generation gas boilers if necessary.

Dust emissions to atmosphere will be reduced to a minimum thanks to the use of an electric filter which will remove 99.8% of sulphate dust from the gas.

Flue gas from the soda recovery boilers will be vented via a new 150 m high 4.6 m diameter chimney stack (source №955), which will be designed separately and is not part of the project.

The new soda recovery boiler will emit the following pollutants: sodium disulphate, (sodium sulphate), nitrogen dioxide, nitrogen oxide, sulphur dioxide, hydrogen sulphide, carbon monoxide and benzopyrene.

*Causticization and lime regeneration unit*

The upgraded causticization unit with produce 8 200 $m^3$/day of white liquor and the lime regeneration unit 615 tpd of unslaked lime.

The end product of the green liquor causticization unit is white liquor, and of the lime regeneration unit – roasted lime.

Green liquor for causticization will be provided by the new caustic regeneration unit and held in the existing green liquor tank. The resultant white liquor will be used by the pulping line.

Before transfer to the lime regeneration furnace, lime sludge will be diluted and dewatered on a disc vacuum filter (DLM) until 73-80 % dry.

The slightly contaminated condensate from the evaporator plant will be used as dilution and cleaning water, for filter cleaning and to make up the weak liquor.

Using the slightly contaminated condensate to clean the lime sludge will reduce the load of the treatment plant and thus reduce pollutant evaporation from the surfaces of aeration tanks and settlement ponds (source 602).

A new lime regeneration kiln (FFEM) with a flash drier will be used to roast the lime. The kiln will have a maximum capacity of 700 tpd of roasted lime. Kilns No. 1 and 2 (emission sources 128 and 129) will be taken out of service

The concentrated lime sludge will be transported by a belt and an auger conveyor to a flash drier. The hot flue gas from the furnace will be conveyed to the bottom of the flash drier. There, lime sludge particles intermixed by the hot flue gas will be dried and heated to equilibrium temperature. The dried sludge will be separated form the gas in the cyclone and delivered to the lime kiln in powder form.

The lime regeneration kiln will use natural gas as its main fuel.

An electric (ESP) filter will be used to remove over 99% of lime dust from the flue gas. The dust will be collected in the lower bin and returned to the furnace.

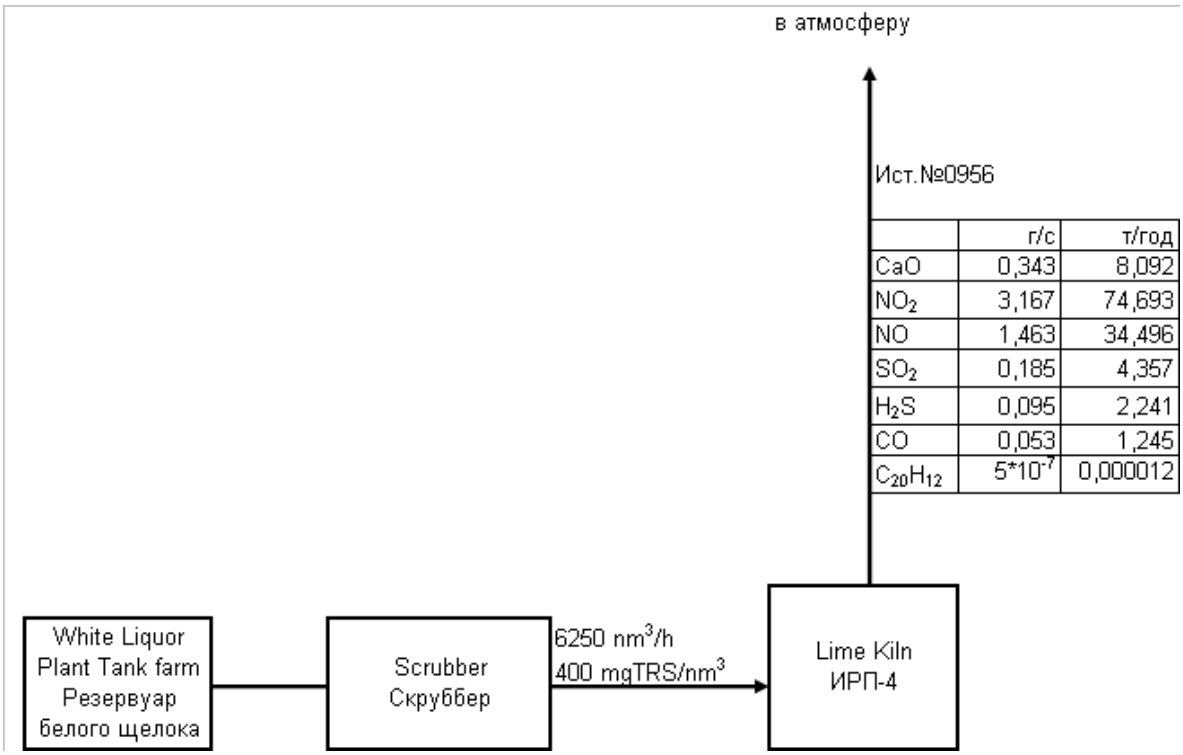
In the upgraded causticization and lime regeneration unit DNCG from the green liquor cooler, slaker, causticizer and while liquor filter will be collected and transported for incineration in the new regeneration kiln (emission source 956).

The flue gas will be vented through the new 50 m high, 2 m diameter chimney stack (source 956).

The new lime regeneration kiln will emit the following pollutants: sodium disulphate, (sodium sulphate), nitrogen dioxide, nitrogen oxide, sulphur dioxide, hydrogen sulphide, carbon monoxide and benzopyrene.

The environmental benefit of removing the sulphur compounds hydrogen sulphide, methanethiol (methyl mercaptan), dimethyl disulphide and dimethyl sulphide and other regenerated sulphur compounds from DNCG will result from the oxidation of those compounds to sulphur dioxide, whose MAC is higher than that of methyl mercaptan, hydrogen sulphide and other methyl and sulphur compounds, and also thanks to the fact that up to 50% of the sulphur will be combined.

A block diagram of DNCG collection, transport and incineration in the lime regeneration kiln is shown in Fig. 3.




| | г/с | т/год |
|---|---|---|
| CaO | 0,343 | 8,092 |
| $NO_2$ | 3,167 | 74,693 |
| NO | 1,463 | 34,496 |
| $SO_2$ | 0,185 | 4,357 |
| $H_2S$ | 0,095 | 2,241 |
| CO | 0,053 | 1,245 |
| $C_{20}H_{12}$ | $5*10^{-7}$ | 0,000012 |

Fig. 3. Block diagram. DNCG collection, transport and incineration in the lime regeneration kiln No. 4(source 0956)

**Sulphate soap decomposition unit**

The existing sulphate soap decomposition unit will be taken out of service, thus removing emission source No. 120.

All sulphate soap from the softwood and hardwood lines will be sent for incineration in the new soda recovery boiler (emission source No.955).

**Paper and cardboard line**

- Upgrading papermaking machines No 14 and 21 to increase their capacity;
- Retaining papermaking machines No 11 and 15 lines at their existing levels;
- Ensuring that the demand for semi-finished fibre products is met internally by increasing pulp mill capacity. Discontinuing pulp imports;
- Creating a market bleached pulp line (drying excess pulp).

Papermaking machines No 14 and 21 will be upgraded and their capacity will be increased while retaining the existing process flow. The lines will be provided with additional equipment, or existing units will be replaced with higher-performance ones. The same cardboard and papermaking chemicals will continue to be used.

Bleached softwood pulp will be dried by one integrated drying line with a maximum capacity of 250 tpd and operating width of 2000 mm, consisting of:

- A two-screen dewatering press
- A flat bed air cushion drier
- Pulp baling and packaging lines

The flat bed drier will dry the pulp until it is 88-90% dry, using low pressure steam as the air heating medium. Paper dust emission will remain at the existing level.

**Scrubbing plant**

The contaminated condensate produced during evaporation will be stripped in a stripping column, and the resultant gas and air mixture will be incinerated in the soda recovery boiler. Condensate stripping will reduce the pollutant content of water transported to the treatment plant by 50%.

Steam and gas from the bleaching plant will be scrubbed in scrubbers sprayed with fresh filtered water. The resultant filtrate will be returned to the wash filter filtrate container and reduce the pollutant content of bleaching water transported to the treatment plant by 20%.

The reduced load imposed on the treatment plant will reduce pollutant emissions to atmosphere by 60%.

Pollutants from this source include sulphur dioxide, hydrogen sulphide, carbon monoxide, methyl mercaptan, sodium hydroxide, nitrogen oxide, ammonia and methane (emission source No. 600÷6002).

In order to reduce emission of pollutants to atmosphere provision will be made for process and special measures to improve air quality in the Ezhva district of Syktyvkar.

The process measures will include:

**Timber yard**

- The use of chipping machines with conveyor lines to increase production of high quality technological woodchips of the desired size and to reduce wood dust creation;
- The use of sealed equipment to prevent emission of wood dust into the working environment;
- Use of a gas scrubbing unit (cyclone) in the chip screening line to prevent dust, gas and air emissions to atmosphere;
- The proposed system will allow the recovered material to be returned to production and significantly reduce wood dust emission to atmosphere.

**Pulping line**

The technical solutions proposed by the project (upgrading pulp digestion, washing and screening, the use of two-stage soda-oxygen treatment, ECF bleaching, modernization of the evaporation and lime causticization and regeneration shop, sealed equipment and removal of malodorous gases for incineration) are designed to ensure the maximum possible reduction of specific pollutant emissions from the sulphate pulp process:

- Modern bleaching process (five stage ECF-bleaching with reduced chlorine dioxide content, which reduces chlorine compound emissions);
- chlorine dioxide (ClO2) is the most widespread bleaching agent, which strengthens and whitens the pulp while at the same time reducing the content of organochlorine by-products, and thus reducing chlorine emissions by 3.837 tonnes, and chlorine dioxide emissions by 3.272 tonnes;
- sodium sulphate from production of chlorine dioxide is used to make up the chemicals (sodium and sulphur) used in the pulping line, which reduces consumption of chemicals while maintaining the existing level of emissions from the storage facilities;
- Use of enclosed equipment, which prevents pollutants from escaping into the working environment;
- Use of plate evaporators drying black liquor to 75% dry, which reduces emission of sulphur compounds from incineration in the soda recovery boiler;

- Use of a highly effective white liquor slurry washing method and its condensation up to 80%, thus reducing its residual alkalinity and as a consequence emissions of hydrogen sulphide;
- Installation of the new lime regeneration kiln No. 4 will allow 30-35 $Mm^3$ /year of fuel gas to be sent to Unikristall Komi for PCC manufacture, thus reducing emissions of calcium oxide, nitrogen dioxide, nitrogen oxides, sulphur dioxide, hydrogen sulphide , carbon monoxide and benzopyrene;
- Diverting DNCG to the new gas collection and transportation system for incineration in LRK No. 4 will eliminate emission of sulphur compounds to atmosphere;
- Using sealed equipment for processes producing malodorous gases and transporting them to incineration;
- Installation of a CNCG and DNCG gathering, transportation and incineration system and adding a gas scrubber will significantly reduce emissions of pollutants into the working environment and therefore emissions from the ventilation system and reduce pollution of ambient air with methanethiol (methyl mercaptan) from 41.5 to 3.3 tonnes per year;
- Taking the existing evaporation unit No. 2 and soda-regeneration boilers with fusion cake vats, which are the main sources of malodorous sulphur-containing gases and the largest contributors to air pollution out of service will reduce hydrogen emissions by 33.7 tonnes per year;
- The utilisation of the collected dilute gases and incineration of concentrated gases in the new SRB will significantly reduce emission of malodorous sulphur compounds, in line with the best available technologies;
- Use of the latest forced air system and the high content of dry substance in the incinerated liquor will virtually eliminate malodorous gas emissions to atmosphere.
- Stripping dirty condensate will contribute to reduction of emissions of sulphur-containing compounds from the treatment plant;
- Utilising the incineration heat of pulping waste – waste black liquor, turpentine, soap and methanol fraction, in the SRB;
- Utilising the incineration heat of waste products: de-watered bark and wood wastes, screening wastes from the tanbark boiler and thus reducing natural gas use, will reduce NOx, carbon and benzopyrene emissions;

Bark and wood waste provide the main fuel source for tanbark boilers. The methanol fraction, raw turpentine and raw sulphate soap from the pulping lines will be used as secondary energy resources in the soda recovery boiler.

Waste utilization will reduce the required storage space as well as reducing consumption of natural gas as fuel by 88 $Mm^3$/year. Vent gas heat will be used for process purposes.

**Special measures** designed to reduce emissions from the facility and ground level concentrations of pollutants include:

- Pollutant treatment and deactivation;
- Improving pollutant dispersion;

To make the process of transferring and diffuser impurities more comfortable, the plant will have individual smoke stacks with the new SRB smoke stack 150 m high, and the LRK stack 50 m high, so that ground concentration levels will be much lower.

Modern dust and gas scrubbing and trapping equipment will be installed. The specification of gas scrubbing and pollutant incineration equipment is shown in Table 5.2.

A list of pollutants generated by the mill before and after project implementation is shown in Table 5.3.

Gas emissions scrubbing and filtering equipment specification

Table 5.2.

| *Shop and equipment name* | *Emission Source No.* | *Scrubbing/Filtering Equipment name* | *Efficiency* | *Removed pollutants* | | *Emissions following scrubbing/filtering* | |
|---|---|---|---|---|---|---|---|
| | | | | *Code* | *Name* | *g/s* | *tpa* |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | |
| ***Wood preparation shop No. 1*** | | | | | | | |
| HW debarking drum | 957 | Scrubber | 98.0 | 2936 | Wood dust | 0.083 | 1.89 |
| SW debarking drum | 958 | Scrubber | 98.0 | 2936 | Wood dust | 0.083 | 1.89 |
| ***Bleaching shop*** | | | | | | | |
| HW and SW towers | 952 | Venturi scrubber | 90.0<br>93.0 | 349<br>378 | Chlorine<br>Chlorine dioxide | 0.00225<br>0.00387 | 0.068<br>0.103 |
| ***Causticization and lime regeneration shop*** | | | | | | | |
| Lime regeneration kiln | 956 | Electrostatic filter | 99.9 | 128 | Calcium oxide (unslaked lime) | 0.343 | 8.092 |
| | | | | | | | |
| ***Soda regeneration shop*** | | | | | | | |
| ***Soda regeneration boiler*** | 955 | Electrostatic filter | 99.8 | 158 | Sodium sulphate | 7.188 | 195.638 |

A list of pollutants affected by the project before and after reconstruction is shown in Table 5.3.

A description of emission sources and scrubbing efficiency before and after project implementation is shown in Table 5.4, Pollutant parameters for calculation purposes

The location of new emission sources and sources which will be affected by the reconstruction project is shown on the site plan in Annex 7.

## Pollutants emitted by sources at the Integrated Pulp and Paper Mill

Table 5.3

| *Substance* | | *Hazard category* | *Total emissions* | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| *Code* | *Name* | | *2 - TP (Air,) 2006.* | | *Project solution* | | *Emission permit 2006* | | *MAC* | |
| | | | *g/s* | *tpa* | *g/s* | *tpa* | *g/s* | *tpa* | *g/s* | *tpa* |
| 1 | 2 | 5 | 8 | 9 | 10 | 11 | 12 | 13 | 12 | 13 |
| 128 | Calcium oxide (unslaked lime) | | 5.017 | 122.284 | 1.264 | 34.166 | 7.483 | 107.756 | 7.483 | 107.756 |
| 150 | Sodium hydroxide (caustic soda) | | 0.0589 | 1.757 | 0.0253 | 0.75 | 0.4793 | 14.297 | 0.4793 | 14.297 |
| 158 | Sodium sulphate | 3 | 62.075 | 1773.382 | 7.188 | 195.638 | 109.732 | 1946.463 | 109.732 | 1946.463 |
| 214 | Calcium dihydroxide (slaked lime) | 3 | 0.224 | 6.677 | 0.0896 | 2.67 | 0.5 | 13.771 | 0.5 | 13.771 |
| 301 | Nitrogen dioxide | 2 | 101.697 | 2257.912 | 119.7906 | 2740.1166 | 113.831 | 2761.209 | 113.831 | 2761.209 |
| 303 | Ammonia | 4 | 0.122 | 3.851 | 0.122 | 3.851 | 0.122 | 3.851 | 0.122 | 3.851 |
| 304 | Nitrogen oxide | 3 | 16.548 | 367.157 | 20.4477 | 468.0802 | 17.52 | 446.344 | 17.52 | 446.344 |
| 328 | Carbon black | 3 | | | 0.0008 | 0.018304 | | | | |
| 330 | Sulphur dioxide | 3 | 20.1111 | 586.372 | 28.9046 | 506.4475 | 35.9904 | 909.465 | 35.9904 | 909.465 |
| 333 | Hydrogen sulphide | 2 | 1.89015 | 51.095 | 0.7303 | 18.978 | 7.3649 | 117.843 | 7.3649 | 117.843 |
| 337 | Carbon monoxide | 4 | 478.155 | 13815.222 | 297.1629 | 8697.1735 | 762.102 | 15322.176 | 762.102 | 15322.176 |
| 349 | Chlorine | 2 | 0.2185 | 4.265 | 0.072 | 2.16 | 0.218 | 4.265 | 0.218 | 4.265 |
| 378 | Chlorine dioxide | | 0.332 | 6.71 | 0.1275 | 3.945 | 0.332 | 6.71 | 0.332 | 6.71 |
| 703 | Benzopyrene (3.4-Benzopyrene) | 1 | | | 0.0000144 | 0.000391 | | | | |
| 1706 | Dimethyl disulphide | 4 | | | 0.037 | 0.000044 | | | | |
| 1707 | Dimethyl sulphide | 4 | | | 0.153 | 0.000184 | | | | |
| 1715 | Methyl mercaptan | 4 | 1.534 | 44.084 | 0.2212 | 3.3134 | 2.2558 | 61.7451 | 2.2558 | 61.7451 |
| 2732 | Hydrocarbons (on kerosene) | | | | 0.005 | 0.1218 | | | | |
| 2748 | Turpentine | | 0.151 | 4.147 | | | 0.151 | 4.262 | 0.151 | 4.262 |
| 2902 | Suspended matter | 3 | 6.199 | 182.03 | 5.037 | 150.505 | 39.4 | 1072.4 | 39.4 | 1072.4 |

| *Substance* | | *Hazard category* | *Total emissions* | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| *Code* | *Name* | | *2 - TP (Air,) 2006.* | | *Project solution* | | *Emission permit 2006* | | *MAC* | |
| | | | *g/s* | *tpa* | *g/s* | *tpa* | *g/s* | *tpa* | *g/s* | *tpa* |
| 1 | 2 | 5 | 8 | 9 | 10 | 11 | 12 | 13 | 12 | 13 |
| 2936 | Wood dust | | 0 | 0 | 1.685 | 38.22 | 0 | 0 | 0 | 0 |
| Other substances total: | | | 50.6362 | 1208.128 | 50.6362 | 1208.128 | 50.6362 | 1208.128 | 50.6362 | 1208.128 |
| Mill total: | | | 789.7639 | 19505.401 | **533.6997** | **14074.283** | 1132.6617 | 22904.9184 | 1132.6617 | 22904.9184 |
| Including solid matter: | | | 160.009 | 2096.162 | **56.9634** | **1504.5773** | 171.5958 | 3128.306 | 171.5958 | 3128.306 |
| Liquid/gaseous matter: | | | 629.75465 | 17409.239 | **476.5461** | **12569.706** | 961.0659 | 19776.6124 | 961.0659 | 19776.6124 |

## Parameter table 5.4

**This table takes up 8 A3 sheets**

### 5.2.1. Calculation of pollutant dispersion in atmospheric air

Calculating pollutant emissions makes it possible to evaluate their levels and if MAC is exceeded for some to put in place measures which will preserve the integrity of the neighbouring ecosystems.

Air contamination levels in the mill area were based on ground-level concentration of pollutants calculated in accordance with the Guidelines on the Calculation of the pollutant content of industrial emissions, OND-86[46].

Pollutant dispersion calculations used Version 3 of the Ekolog software developed by UPRZA, which implements the key provisions and equations contained in OND-86.

The calculation relate to the summer months.

Calculations of atmospheric pollution are based on maximum discharges of pollutants from each type of equipment operating at full load in normal operating conditions.

Three dispersion calculations were made:

- First calculation – actual status in 2006 according to data supplied by the Customer;
- Second calculation - after mill development and reconstruction;
- Third calculation – potential process deviations.

Air pollution was calculated for each pollutant and for following summation groups:

- Group № 6003, ammonia and hydrogen sulphide;
- Group № 6009, nitrogen dioxide and sulphur dioxide;
- Group № 6043 sulphur dioxide and hydrogen sulphide;

Atmospheric pollution was determined for each unit of the nominal calculation area, and ground level pollution was additionally determined in calculation points located on the boundary of the sanitary protection zones of the various facilities. The boundary of the sanitary protection zone, the nominal calculation rectangle and the location of the monitoring points are shown on the location plan (Annex 6).

The results of ground level calculations are shown in the form of isoline maps in Annex 5. The results of the calculations appear in Volume 8.3.2, Book 2, Pollutant dispersion calculation results.

The calculations have been used to determine the pollution of the nominal calculation area due to the operation of the proposed equipment.

They have shown that air pollution on the boundary of the Integrated Pulp and Paper Mill will be below MAC for all the pollutants and their summation groups.

Analysis of dispersion showed that the main contributors to atmospheric pollution were expected to be methyl mercaptan, nitrogen dioxide and hydrogen sulphide.

The results, together with the major contributors, are shown in the following tables:

- Table 5.5 Maximum design pollutant concentrations for the existing plant;
- Table 5.6 Expected maximum design pollutant concentrations following project implementation;
- Table 5.7 Expected maximum design pollutant concentrations in the event deviations from normal process conditions;

## Maximum design pollutant concentrations in the current situation

Table 5.5

| Pollutant code and name | Residential MAC, mg/m3 | Background concentration, MAC fractions | Maximum ground-level concentration MAC fractions | | | | | | | Major contributors | | Origin |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | At the boundary of the nearest housing development | | | | | Approved SPZ boundary | Statutory SPZ boundary | No. on map | % contribution | |
| | | | Ezhva District | Stroitel Housing Estate | Radio Centre | Former VDP | Gorizont | | | | | |
| 0128 Calcium oxide (Unslaked lime) | 0.3 | | 0.08 | 0.06 | 0.1 | 0.09 | 0.03 | 0.08 | 0.05 | 129 | 59 | Lime Caustic. & Regeneration (LCR) |
| | | | | | | | | | | 128 | 27 | LCR |
| | | | | | | | | | | 180 | 8 | LCR |
| 0150 Caustic soda | 0.01 | | 0.04 | 0.04 | 0.07 | 0.05 | 0.02 | 0.04 | 0.03 | 193 | 50 | LCR |
| | | | | | | | | | | 192 | 32 | LCR |
| | | | | | | | | | | 126 | 5 | Cook/bleach shop |
| 0158 Sodium disulphate | 0.3 | | 0.07 | 0.09 | 0.09 | 0.1 | 0.09 | 0.1 | 0.1 | 204 | 50 | KTЦ 2 |
| | | | | | | | | | | 2033 | 25 | KTЦ 2 |
| | | | | | | | | | | 2034 | 25 | KTЦ 2 |
| 0214 Calcium hydroxide | 0.03 | | 0.05 | 0.05 | 0.09 | 0.07 | 0.02 | 0.06 | 0.04 | 193 | 58 | LCR |
| | | | | | | | | | | 192 | 42 | LCR |
| 0301 Nitrogen dioxide | 0.2 | 0.205 | 0.28 | 0.28 | 0.32 | 0.36 | 0.27 | 0.37 | 0.36 | 129 | 17 | LCR |

| Pollutant code and name | Residential MAC, mg/m3 | Background concentration, MAC fractions | Maximum ground-level concentration MAC fractions | | | | | | | Major contributors | | Origin |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | At the boundary of the nearest housing development | | | | | Approved SPZ boundary | Statutory SPZ boundary | No. on map | % contribution | |
| | | | Ezhva District | Stroitel Housing Estate | Radio Centre | Former VDP | Gorizont | | | | | |
| | | | | | | | | | | 128 | 11 | LCR |
| | | | | | | | | | | 2031 | 3 | KTC 2 |
| 0304 Nitrogen oxide | 0.4 | | Cm≤0.01 | | | | | | | | | |
| 0330 Sulphur dioxide | 0.5 | 0.004 | Cm≤0.02 | | | | | | | | | |
| 0333 Hydrogen sulphide | 0.008 | 0.125 | 0.83 | 0.78 | 0.63 | 0.48 | 0.31 | 0.64 | 0.48 | 120 | 45 | LCR |
| | | | | | | | | | | 205 | 19 | KTC 2 |
| | | | | | | | | | | 206 | 13 | KTC 2 |
| 0337 Carbon monoxide | 5.0 | 0.386 | Cm≤0.05 | | | | | | | | | |
| 0349 Chlorine | 0.1 | | Cm≤0.02 | | | | | | | | | |
| 0378 Chlorine dioxide | 0.01 | | 0.28 | 0.23 | 0.33 | 0.32 | 0.11 | 0.31 | 0.23 | 162 | 51 | Cook/bleach shop |
| | | | | | | | | | | 143 | 17 | Cook/bleach shop |
| | | | | | | | | | | 146 | 11 | Cook/bleach shop |
| 1715 Methyl mercaptan | 0.001 | 0.056 | 4.22 | 4.45 | 3.53 | 3.35 | 1.96 | 3.81 | 2.95 | 206 | 24 | KTC 2 |
| | | | | | | | | | | 205 | 24 | KTC 2 |

| Pollutant code and name | Residential MAC, mg/m3 | Background concentration, MAC fractions | Maximum ground-level concentration MAC fractions | | | | | | | Major contributors | | Origin |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | At the boundary of the nearest housing development | | | | | Approved SPZ boundary | Statutory SPZ boundary | | | |
| | | | Ezhva District | Stroitel Housing Estate | Radio Centre | Former VDP | Gorizont | | | No. on map | % contribution | |
| | | | | | | | | | | 207 | 11 | KTIC 2 |
| 2748 Turpentine | 2.0 | | N/A | | | | | | | | | |
| 2902 Suspended solids | 0.5 | 0.210 | Cm≤0.02 | | | | | | | | | |
| 6003 (Ammonia, hydrogen sulphide) | - | | 0.81 | 0.76 | 0.58 | 0.45 | 0.28 | 0.59 | 0.45 | 120 | 46 | LCR |
| | | | | | | | | | | 205 | 19 | KTIC 2 |
| | | | | | | | | | | 206 | 13 | KTIC 2 |
| 6009 (Nitrogen dioxide, sulphur dioxide) | - | | 0.29 | 0.3 | 0.33 | 0.37 | 0.27 | 0.39 | 0.38 | 129 | 17 | LCR |
| | | | | | | | | | | 128 | 11 | LCR |
| | | | | | | | | | | 2031 | 4 | KTIC 2 |
| | | | | | | | | | | 128 | 17 | LCR |
| | | | | | | | | | | 2035 | 10 | KTIC 2 |
| 6043 (Sulphur dioxide, hydrogen sulphide) | - | | 0.85 | 0.81 | 0.65 | 0.5 | 0.33 | 0.66 | 0.5 | 120 | 44 | LCR |
| | | | | | | | | | | 205 | 19 | KTIC 2 |
| | | | | | | | | | | 206 | 13 | KTIC 2 |

**Expected maximum design pollutant concentrations following project implementation**

Table 5.6

| Pollutant code and name | Residential MAC, mg/m3 | Background concentration, MAC fractions | Maximum ground-level concentration MAC fractions | | | | | | | Major contributors | | Origin |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | At the boundary of the nearest housing development | | | | | Approved SPZ boundary | Statutory SPZ boundary | No. of map | % contribution | |
| | | | Ezhva | Stroitel | Radio Centre | Former VDP | Gorizont | | | | | |
| 0128 Calcium oxide (Unslaked lime) | 0.3 | | Cm≤0.02 | | | | | | | | | |
| 0150 Caustic soda | 0.01 | | Cm≤0.03 | | | | | | | | | |
| 0158 Sodium disulphate | 0.3 | | N/A | | | | | | | | | |
| 0214 Calcium hydroxide<br>0301 Nitrogen dioxide | 0.03 | | Cm≤0.03 | | | | | | | | | |
| 0304 Nitrogen oxide | 0.2 | 0.205 | 0.28 | 0.27 | 0.35 | 0.36 | 0.27 | 0.35 | 0.35 | 956 | 17 | LCR |
| | | | | | | | | | | 180 | 7 | LCR |
| | | | | | | | | | | 181 | 7 | LCR |
| 0330 Sulphur dioxide | 0.4 | | Cm≤0.02 | | | | | | | | | |
| 0333 Hydrogen sulphide | 0.15 | | N/A | | | | | | | | | |
| 0337 Carbon monoxide | 0.5 | 0.004 | Cm=0.01 | | | | | | | | | |
| 0349 Chlorine | 0.008 | 0.125 | 0.25 | 0.25 | 0.28 | 0.27 | 0.25 | 0.28 | 0.28 | 600 | 13 | Biol. treatment |
| | | | | | | | | | | 955 | 2 | Soda reg. |
| | 5.0 | 0.386 | Cm≤0.02 | | | | | | | | | |

| Pollutant code and name | Residential MAC, mg/m3 | Background concentration, MAC fractions | Maximum ground-level concentration MAC fractions | | | | | | | Major contributors | | Origin |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | At the boundary of the nearest housing development | | | | | Approved SPZ boundary | Statutory SPZ boundary | | | |
| | | | Ezhva | Stroitel | Radio Centre | Former VDP | Gorizont | | | No. of map | % contribution | |
| 0378 Chlorine dioxide | 0.1 | | Cm≤0.01 | | | | | | | | | |
| 1715 Methyl mercaptan | 0.01 | | 0.11 | 0.08 | 0.12 | 0.13 | 0.04 | 0.13 | 0.09 | 162 | 89 | Cook/bleach shop |
| | | | | | | | | | | 170 | 1 | Cook/bleach shop |
| | | | | | | | | | | 175 | 1 | Cook/bleach shop |
| 2748 Turpentine | 0.000001 | | N/A | | | | | | | | | |
| 2902 Suspended solids | 0.001 | 0.056 | 0.41 | 0.51 | 0.33 | 0.4 | 0.18 | 0.48 | 0.4 | 600 | 45 | Biol. treatment |
| | | | | | | | | | | 601 | 23 | Biol. treatment |
| | | | | | | | | | | 108 | 18 | Cook/bleach shop |
| 6003 (Ammonia, hydrogen sulphide) | 1.2 | | N/A | | | | | | | | | |
| 6009 (Nitrogen dioxide, sulphur dioxide) | 0.5 | 0.210 | N/A | | | | | | | | | |
| 6043 (Sulphur dioxide, hydrogen sulphide) | 0.5 | | 0.04 | 0.03 | 0.02 | 0.02 | 0.01 | 0.04 | 0.02 | 6005 | 40 | HW chips store |
| | | | | | | | | | | 6006 | 37 | SW chips store |
| | | | | | | | | | | 6007 | 13 | Bark store |
| 0128 Calcium oxide (Unslaked lime) | - | | 0.08 | 0.07 | 0.06 | 0.06 | 0.04 | 0.06 | 0.05 | 600 | 56 | Biol. treatment |
| | | | | | | | | | | 956 | 38 | LCR |
| | | | | | | | | | | 602 | 2 | Biol. treatment |
| 0150 Caustic soda | - | | 0.29 | 0.28 | 0.36 | 0.37 | 0.27 | 0.36 | 0.36 | 956 | 17 | LCR |
| | | | | | | | | | | 180 | 8 | LCR |

| Pollutant code and name | Residential MAC, mg/m3 | Background concentration, MAC fractions | Maximum ground-level concentration MAC fractions | | | | | | | Major contributors | | Origin |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | At the boundary of the nearest housing development | | | | | Approved SPZ boundary | Statutory SPZ boundary | | | |
| | | | Ezhva | Stroitel | Radio Centre | Former VDP | Gorizont | | | No. of map | % contribution | |
| 0158 Sodium disulphate | | | | | | | | | | 181 | 7 | LCR |
| | | | | | | | | | | 2031 | 18 | КТЦ 2 |
| | | | | | | | | | | 955 | 17 | Soda reg. |
| | | | | | | | | | | 720 | 35 | Assembly shop |
| | | | | | | | | | | 955 | 7 | Soda reg. |
| 0214 Calcium hydroxide | - | | 0.26 | 0.26 | 0.29 | 0.28 | 0.26 | 0.29 | 0.29 | 600 | 5 | Biol. treatment |
| | | | | | | | | | | 956 | 4 | LCR |
| | | | | | | | | | | 955 | 4 | Soda reg. |

## Expected maximum design pollutant concentrations in the event of deviation from normal process conditions

**Table 5.7**

| Pollutant code and name | Residential MAC, mg/m3 | Background concentration, MAC fractions | Maximum ground-level concentration MAC fractions | | | | | | | Major contributors | | Origin |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | At the boundary of the nearest housing development | | | | | Approved SPZ boundary | Statutory SPZ boundary | No. on map | % contribution | |
| | | | Ezhva | Stroitel | Radio Centre | Former VDP | Gorizont | | | | | |
| | | | | | | | | | | | | |
| 0301 Nitrogen dioxide | 0.2 | 0.205 | 0.27 | 0.27 | 0.35 | 0.35 | 0.27 | 0.34 | 0.33 | 956 | 18 | LCR |
| | | | | | | | | | | 180 | 7 | LCR |
| | | | | | | | | | | 181 | 7 | LCR |
| 0304 Nitrogen oxide | 0.4 | | Cm≤0.02 | | | | | | | | | |
| 0330 Sulphur dioxide | 0.5 | 0.004 | Cm≤0.05 | | | | | | | | | |
| 0333 Hydrogen sulphide | 0.008 | 0.125 | 0.25 | 0.25 | 0.28 | 0.27 | 0.25 | 0.29 | 0.29 | 600 | 11 | Biol. treatment |
| | | | | | | | | | | 953 | 5 | Soda reg. |
| | | | | | | | | | | 601 | 1 | Biol. treatment |
| 0337 Carbon monoxide | 5.0 | 0.386 | Cm≤0.02 | | | | | | | | | |
| 0703 Benzopyrene | 0.000001 | | N/A | | | | | | | | | |
| 1706 Dimethyl disulphide | 0.7 | | N/A | | | | | | | | | |
| 1707 Dimethyl sulphide | 0.08 | | Cm≤0.01 | | | | | | | | | |
| 1715 Methyl mercaptan | 0.001 | 0.056 | 0.88 | 0.79 | 0.73 | 0.83 | 0.34 | 0.9 | 0.67 | 953 | 54 | Soda reg. |
| | | | | | | | | | | 601 | 31 | Biol. treatment |
| | | | | | | | | | | 108 | 8 | Cook/bleach shop |
| 6003 (Ammonia, hydrogen sulphide) | - | | 0.31 | 0.29 | 0.37 | 0.38 | 0.27 | 0.36 | 0.35 | 956 | 16 | LCR |
| | | | | | | | | | | 180 | 7 | LCR |

| Pollutant code and name | Residential MAC, mg/m3 | Background concentration, MAC fractions | Maximum ground-level concentration MAC fractions | | | | | | | Major contributors | | Origin |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | At the boundary of the nearest housing development | | | | | Approved SPZ boundary | Statutory SPZ boundary | | | |
| | | | Ezhva | Stroitel | Radio Centre | Former VDP | Gorizont | | | No. on map | % contribution | |
| | | | | | | | | | | | | |
| | | | | | | | | | | 181 | 7 | LCR |
| 6043 (Sulphur dioxide, hydrogen sulphide | - | | 0.26 | 0.26 | 0.3 | 0.28 | 0.26 | 0.31 | 0.3 | 600 | 10 | Biol. treatment |
| | | | | | | | | | | 953 | 5 | Soda reg. |
| | | | | | | | | | | 954 | 5 | Soda reg. |

**Sanitary Protection Zone area size calculation**

SanPiN 2.2.1/2.1.1.1200-03 classifies the Integrated Pulp and Paper Mill as Class 1 chemical industry facility, required to have a 1000 m Sanitary Protection Zone (Section 4.1.1 (4).

The mill is located on the left bank of the Vychegda, 18 km from the centre of Syktyvkar, in the Ezhva industrial district of the city.

The eastern boundary of the site runs along the bank of the Vychegda, with the railway line running along its northern and north-eastern boundaries, except for the treatment plant settlement pond, activated sludge tank and aerator locations. In the west, the site boundary runs along the Stroitel housing estate, and parallel to the Ezhva residential area to the south.

The boundary of the sanitary protection zone was determined by the Chief Design Institute, Gidrobum, in 1991, during the preparation of the Mill construction and reconstruction project documentation. The boundaries were approved by Gosstroi Expert Review of 18 July1991.

Samples are taken at the boundary of the SPZ and air pollution levels are monitored by the Mill's environmental services and by the Federal Consumer Rights Service, Rospotrebnadzor.

Based on the dispersion calculation results shown in Tables 5.5, 5.6 and 5.7, none of the substances has exceeded residential MAC levels on the boundary of the SPZ. This confirms the adequacy of both the statutory and the actual SPZ.

The Mill's SPZ and its perimeter are currently occupied by other enterprises. In addition to industrial enterprises, there are depots belonging to retail and transport enterprises, car parks, private garages, filling stations, and office buildings.

Within the Mill's current SPZ there are:

- to the west, 237 m from the Mill fence, 3 residential houses of the Radio Centre housing estate;
- To the south-west, 117 m from the Mill fence, the first residential houses of the Stroitel housing estate ;
- To the north east of the boundary in the SPZ itself, there is the VPD housing estate
- To the south, 510 m from the fence, there are the Ezhva housing estates.

Paragraph 2.31 pf SanPiN 2.2.1/2.1.1.1200-03 requires their SPZ to be measured from the boundary of the Mill site.

The location plan (Annex 6) shows the boundaries of the Mill's approved and statutory SPZ.

The dispersion calculations shown in Tables 5.5, 5.6 and 5.7 lead to the conclusion that the size of the Mill's SPZ is adequate, and that the statutory SPZ could be reduced following the implementation of the development and reconstruction project.

### 5.2.2. Conclusions.

The above information about the proposed process solutions, supported by the relevant calculations, leads to the following conclusions:

- Mill reconstruction does not conflict with regulatory requirements for planned environmentally hazardous enterprises;
- The number of pollutant emission sources will be reduced by 44, there will be 60 stationary and 8 fugitive emission sources;
- Analysis of the factors presented in tables 5.5, 5.6, 5.7 has shown that maximum design concentrations (Cmax) will be as follows:
- methanethiol - 0.18MAC - 0.9MAC;

- hydrogen sulphide - 0.25MAC - 0.29MAC;
- dimethyl sulphide Cm ≤ 0.01MAC;dimethyl disulfide – N/A ;
- nitrogen dioxide - 0.27MAC - 0.36MAC;
- sulphur dioxide - within the range Cm ≤ 0.05MAC;
- carbon oxide Cm ≤ 0.02MAC;
- chlorine - Cm ≤ 0.01MAC;
- chlorine dioxide - 0.04MAC - 0.13MAC;
- suspended substances – N/A
- expected total gross emission of pollutants from production sources will be reduced by 5433.361 tpa (from 19505.401 tpa in 2006 to 14072.04 tpa ), i.e. by 28%;

The emissions permit will not need to be updated for any of the pollutants in the project.

Environmental protection measures envisaged by the project, whose implementation will improve air quality in the Mill location, including:

- the installation of a CNCG and DNCG gathering, transportation and incineration system in the new SRB and of a DNCG system in the new LRK No 4;
- the use of highly effective dust and gas scrubbing and filtration equipment

demonstrate the feasibility and the need for the implementation of the project from the point of view of air pollution.

### 5.3 Forecast of the facility's impact on surface water

The main factor impacting surface waters is water consumption and disposal by the facility.

To ensure proper management of water resources, a high-capacity recirculating water system has been designed which will reduce water consumption in spite of the greater production volumes and enable waste water to be discharged into the Vychegda.

#### 5.3.1 A brief description of the water supply system

**The current situation**

The Mill obtains its water from the Vychegda.

Water supply for the production needs of the IPPM and its subsidiaries is provided by a low-level chamber-type water intake with a design capacity of 750000 $m^3$ per day, commissioned in 1969. It is located 2.5 km southeast of the Mill site on the left bank of the Syert-Poloi branch of the river. The chamber is 410 m long and 25-30 m wide and the depth of the intake at low water is 2.5 m. On the river branch side and on the left bank side, the chamber is protected by non-overflow dikes.

At the end of the chamber there is a first elevation pump station consisting of:

- A shore well with multicontact pulse fish protection system intended to protect mature and young fish from entering the intake;
- A machine room containing seven 32B-12 pumps (five main and two standby).

The water intake is fitted with a special fish protection system, which is at least 70% effective for fish 12 mm long or longer.

The main purpose of the fish protection system is to protect mature and young fish from entering water intakes by generating an irritating impulse field causing the fish to leave the impact zone and avoid approaching it. There is also a device for removing fish

from the holding area upstream of the protection system. A patented system is used to protect fish fry from entering the intake.

The 70% effectiveness is achieved in a number of ways, all aimed at reducing the rate at which the water flows into the mouth of the device, enabling the fish fry to leave the electric field and pump station impact area and enter the safe part of the watercourse, and also by the positioning of the protective loop.

The fish protection system is a completely new multicontact pulse system, first installed in 2006.

The first elevation pump station pumps the water to the plant site via three 1400 mm channels of which two supply water to HPP and another one, reducing to d = 800 mm, directly to the treatment plant.

Domestic and drinking water is supplied by one water duct d = 700 mm connected to the Ezhva public water supply.

Depending on process requirements, the following water supply systems operate at the Mill site:

- mechanically treated water;
- filtered water;
- domestic and drinking water supply;
- industrial and fire water supply;
- timber yard fire water supply

The Mill uses fresh water from the thermal power plant in its main production facilities.

In the winter, river water from the first elevation pump station is used to cool thermal power plant turbine condensers and, heated to 8-10$^{o}$C, flows to water treatment plant № 1 where it is conditioned to meet process water requirements (mechanically treated and filtered through a filter-coalescer). Following mechanical treatment on drum screens, coagulant treatment and settlement in horizontal settling ponds, the water is filtered through high-rate filters and sent to the Mill. In the summer, since the water is very warm, up to 30ºC, after cooling in the existing cooling tower it is discharged into the river, so that the flow rate of fresh water through the water intake is higher in the summer.

The design carrying capacity of the industrial water supply system is:

- River water – 750000 m$^3$/day;
- Mechanically treated water – 280000 - 300000 m$^3$/day
- Filtered water – 350000 m$^3$/day

The design capacity of the water treatment facilities is:

- Water intake and first elevation pump station – 750000 m$^3$/day;

Water treatment facilities (filtered water capacity):

Water Treatment Plant No. 1 – 300000 m$^3$/day
Water Treatment Plant No. 2 – 50000 m$^3$/day

The actual fresh water consumption in 2006 is shown in Table 5.8.

**Surface water consumption**

**Table 5.8**

| Indicator | Flow rate, $Mm^3$/year | |
|---|---|---|
| | Water abstraction limit | Actual, (Form 2-TP – Water Management) in 2006 |
| **Surface water abstraction** | | |
| Water abstraction from the Vychegda | 158000.0 | **139612.1** |
| Ezhva municipal water supply line | | **6494.9** |
| Fresh water, total: | | **146107.0** |
| including:<br>▪ for the Mill's production needs<br>▪ for domestic and drinking water needs of the Mill<br>▪ for other needs<br>▪ for third party consumers | | <br>137557.2<br>3911.6<br>2429.9<br>2208.3 |

Water consumption per unit of output of the various IPPM products before reconstruction is shown in Table 5.9.

Table 5.9

| Department | Output, t | Standard consumption rate $m^3$/t | |
|---|---|---|---|
| | | Planned | Actual |
| Pulp digestion | | 9.51 | 8.59 |
| HW unbleached pulp (Digestion) | 49738 | 10.00 | 9.85 |
| Gas incineration | | | |
| Liquor evaporation | | 56.48 | 53.26 |
| Liquor causticization | | 2.00 | 1.89 |
| Digestion total | 551486 | 68.00 | 63.75 |
| Pulp bleaching | | 7.40 | 7.40 |
| SW unbleached pulp | 83312 | 45.00 | 40.69 |
| Bleaching chemicals preparation plant | | 7.00 | 14.11 |
| Bleached pulp total | 375255 | 23.51 | 21.51 |
| Lime roasting | | | |
| Oxygen production (kg) | 7724501 | 0.30 | 0.30 |
| Liquid oxygen | 73270 | 0.10 | 0.10 |
| Nitrogen | 1267 | 0.10 | 0.10 |
| Tallow oil | 12440 | 4.00 | 3.97 |
| Papermaking machine 11 | 150735 | 25.00 | 23.29 |
| Papermaking machine 21 | 208507 | 28.00 | 28.47 |
| Papermaking chemicals (t.m3) | | | |
| Papermaking machine 14 | 254683 | 14.00 | 11.07 |
| Papermaking machine 15 | 187099 | 23.71 | 21.77 |

| Department | Output, t | Standard consumption rate $m^3/t$ | |
|---|---|---|---|
| | | Planned | Actual |
| Papermaking total | | | |
| TMP | 21765 | 12.36 | 24.44 |
| CTMP | 153409 | 5.09 | 3.55 |
| Starch glue making | 1809 | 40.00 | 37.53 |
| Wood preparation (m3) | 2688159 | 3.50 | 2.14 |
| Compressor house (t.m3) | 505597 | 1.90 | 1.90 |
| Fire fighting | 24124 | 6.00 | 5.58 |

**Project solutions.**

The Mill's existing water supply system will be retained.

***Total water consumption***

The project envisages reconstructing and upgrading the existing pulp, paper and cardboard lines and shutting down sections using outdated technology and worn equipment.

The existing pulping line will be replaced, and a new integrated chemicals regeneration system will be installed.

The project calls for a water supply system making the maximum possible use of a closed cooling cycle for cooling the new equipment, the warm water having been cooled in the newly built HPP cooling towers and the surplus pulp mill hot and warm water cooled in the new cooling tower and returned to process.

Total water consumption following reconstruction, including water consumption by the evaporators and of the common soda regeneration HPP, will be as follows:

- fresh river water (winter/summer) – **205717 / 214264 $m^3$/day**

  – **73197.5 $Mm^3$/year**

- filtered water – 138251 / 140320 $m^3$/day;
- mechanically treated water – 36055 / 61747 $m^3$/day;
- return and reused water from cooling towers – 1495443.0 $m^3$/day;

A number of technical solutions are envisaged to reduce industrial water abstraction from the existing Vychegda water intake, including:

collection and use of evaporation condensates

- use of closed-cycle washing of unbleached and bleached pulp,
- collection and use of excess warm and hot water, cooling it in the cooling towers, treating it at the treatment plant and returning it to process.

***The proposed facility's water consumption per unit of output***

Table 5.10

| Production process | Product type, quantity | Water consumption, $m^3$/unit of output | | | | | |
|---|---|---|---|---|---|---|---|
| | | Fresh water | | | Circulating and reusable water | Circulating water use as proportion of overall water use, % | Fresh water use coefficient |
| | | Total | inc. drinkable water | | | | |
| | | | for production needs | for domestic needs | | | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Timber preparation shop | timber raw material, pl. $m^3$/day | 1.8 | - | - | 0.0 | 0.00 | 1.00 |
| | 3134.6 | | | | | | |
| Production of thermomechanical and chemico-thermomechanical pulp | thermomechanical pulp, t/day | 21.5 | - | - | 19.2 | 47.14 | 0.53 |
| | 528 | | | | | | |
| Cardboard and paper production | paper, t/day | 21.6 | - | - | 31.1 | 59.00 | 0.41 |
| | 1983 | | | | | | |
| | cardboard, t/day | 15.0 | | | | | |
| | 703 | | | | | | |
| *Production of bleached sulphate pulp from hardwood species* | bleached pulp after cooking, t/day | 31.7 | - | - | 50.2 | 61.34 | 0.39 |
| | 1126 | | | | | | |
| Production of sulphate pulp from softwood species | bleached/unbleached pulp after cooking, t/day | 42.2 | - | - | 48.9 | 53.67 | 0.46 |

| Production process | Product type, quantity | Water consumption, $m^3$/unit of output | | | | Circulating water use as proportion of overall water use, % | Fresh water use coefficient |
|---|---|---|---|---|---|---|---|
| | | Fresh water | | | Circulating and reusable water | | |
| | | Total | inc. drinkable water | | | | |
| | | | for production needs | for domestic needs | | | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| | 895 | | | | | | |
| Production of sulphate, softwood commercial pulp (with drying shop) | SFA bleached (commercial) pulp, t/day | 45.3 | - | - | 27.1 | 37.40 | 0.63 |
| | 171 | | | | | | |

After reconstruction, water consumption of fresh water per tonne of bleached digested sulphate pulp will be 31.7 – 42.2 $m^3$/t, which is a good indicator of the proposed technology and compares with modern best available technologies (BAT).

The planned modernization of cardboard and paper production will make it possible to reduce fresh water consumption per tonne of paper on average by 7-4 $m^3$/t to approximately 20 $m^3$/t of production.

Expected water consumption after the reconstruction of the Mill's production facilities is presented in table 5.11.

The balance of water consumption and disposal after reconstruction is presented in graphic form in Annex 22.

***Planned water consumption for production processes at the MBP SIPPM following investment project implementation***

Table 5.11

| *Production process* | *Water consumption,$m^3$/day* | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total | For production needs | | | | | | | | | Domes-tic/ drin-king needs |
| | | Total | Drinkable quality | fresh river water | mech. treated | filtered | With wood, extra-neous sour-ces | Circu-lating water | Re-usable water | Steam and con-den-sate | |
| **Main production process** | | | | | | | | | | | |
| Wood preparation shop *(new + existing WPS)* | 10684 | 5530 | | | 5530 | | 4109 | | | 1045 | |
| ***Pulp mill*** | 600000 | | | | | | | 600000 | | | |
| Production of bleached sulphate pulp from hardwood species (reconstruction) | 87046 | 24757 | | | 4327 | 20430 | | | 61143 | 1146 | |
| Production of sulphate pulp from softwood species (reconstruction) | 59657 | 14312 | | | 2777 | 11535 | | | 43761 | 1584 | |
| Drying machine (new) | 5572 | 540 | | | 70 | 470 | | | 4643 | 389 | |
| *Neutralisation unit* | 29719 | 0 | | | | | | | 29719 | | |
| *Liquor and lime recycling shop* | | | | | | | | | | | |

| *Production process* | *Water consumption,$m^3$/day* | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total | For production needs | | | | | | | | | Domes-tic/ drin-king needs |
| | | Total | Drinkable quality | fresh river water | mech. treated | filtered | With wood, extra-neous sour-ces | Circu-lating water | Re-usable water | Steam and con-den-sate | |
| Liquor concentration section | 130841 | 1404 | | | 1404 | | | | 124892 | 4545 | |
| Green liquor causticisation and lime recycling shop (reconstruction) | 24394 | 7296 | | | 2112 | 5184 | | | 16873 | 225 | |
| Bleaching agent preparation section (DKh preparation section, Oxygen production section) | 17173 | 17147 | | | 40 | 17107 | | | | 26 | |
| *Cardboard and paper production:* | | | | | | | | | | | |
| Paper-making machines № 11.14.15,cardboard-making machine №21 | 112287 | 42509 | | | | 42509 | | | 61691 | 8087 | |
| RSS (new production) | 8241 | 8228 | | | 24 | 8204 | | | | 13 | |
| *Thermomechanical and chemico-thermomechanical pulp production* | 21505 | 11350 | | | | 11350 | | | 10120 | 35 | |
| ***Energy facilities,,*** | 860465 | 77573 | | 72773 | 4800 | | | 56350 | 694933 | 21752 | 9857 |
| ***Auxiliary production facilities (compressor stations, oxygen units)*** | | | | | | | | | | | |

| *Production process* | *Water consumption,$m^3$/day* | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total | For production needs | | | | | | | | | Domes-tic/ drin-king needs |
| | | Total | Drinkable quality | fresh river water | mech. treated | filtered | With wood, extra-neous sour-ces | Circu-lating water | Re-usable water | Steam and con-den-sate | |
| Chemical shop for paper production (TsPKh) | 3008 | 2680 | | | | 2680 | | | | 328 | |
| New cooling tower | 115754 | 0 | | | | | | | 115754 | | |
| Existing cooling tower for HPP | 96000 | 0 | | | | | | | 96000 | | |
| New cooling tower for HPP | 597388 | 6207 | | | | 6207 | | | 591181 | | |
| Central compressor station with cooling tower | 26421 | 981 | | | 981 | | | 25416 | | 24 | |
| Compressor station for bleaching chemicals preparation shop | 342 | 342 | | | | 342 | | | | | |
| Fuel and lubricants and volatile liquids store. Chemicals store, finished products store. Sulphate soap store, construction industry base | 948 | 140 | | | 140 | | | | | 808 | |
| Materials and technical store, despatch shop | 273 | 273 | | | 273 | | | | | | |
| Vehicle shop | 92 | 92 | | | 92 | | | | | | |
| *repair and maintenance shop area* | 44887 | 1224 | | | 1224 | | | 43663 | | | |
| *Subsidiary undertakings* | | | | | | | | | | | |
| Syktyvkar Tissue Group OOO "Papirus" | 2657 | 2232 | | | | 2232 | | | | 389 | 35 |

| *Production process* | *Water consumption,$m^3$/day* | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total | For production needs | | | | | | | | | Domes-tic/ drin-king needs |
| | | Total | Drinkable quality | fresh river water | mech. treated | filtered | With wood, extra-neous sour-ces | Circu-lating water | Re-usable water | Steam and con-den-sate | |
| OOO "Syktyvkarskii fanernyi zavod" [plywood factory] | 3112 | 2253 | | | 2253 | | | | | 768 | 90 |
| ***Water supply and sewerage facilities*** | | | | | | | | | | | |
| Domestic and drinking water needs of Mill | 10449 | 0 | | | | | | | 3226 | | 7223 |
| Other consumers | 21613 | 5630 | | | 5630 | | | | 6632 | 8763 | 589 |
| Water treatment facilities (VOS-1,VOS-2, with existing cooling tower) | 218469 | 144144 | | 132944 | 1200 | 10000 | | 32889 | 41436 | | |
| Slurry collector № 2 | 764 | 0 | | | | | | | 764 | | |
| EMUP "Zhilkomkhoz", SMUP "Syktyvkarskii Vodokanal" [local housing and sewage organisations] | 69062 | | | | | | | | | | 69062 |
| Facilities for mechanical treatment of domestic waste water | 0 | 0 | | | | | | | | | |
| Biological treatment station for waste water | 3178 | 3178 | | | 3178 | | | | | | |
| **Total from production process:** | | | | | | | | | | | |

| *Production process* | *Water consumption,$m^3$/day* | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total | For production needs | | | | | | | | | Domes-tic/ drin-king needs |
| | | Total | Drinkable quality | fresh river water | mech. treated | filtered | With wood, extra-neous sour-ces | Circu-lating water | Re-usable water | Steam and con-den-sate | |
| **Total:** | **3182000** | **380023** | **0** | **205717** | **36055** | **138251** | **4109** | **758318** | **1902767** | **49927** | **86857** |
| Excluding circulating water | **2423682** | | | | | | | | | | |
| Excluding filtered and mechanically treated water which could be counted in the volume of fresh and re-usable water | **2249377** | | | | | | | | | | |

It follows from the tables and graphic balance of water consumption and disposal (Annex 22) that following reconstruction total industrial water consumption by the Mill and sub-subscribers will be reduced in spite of the increased capacity and reduced consumption per unit of output, as follows:

| Project | Consumption, $m^3$/day (winter/summer)<br>$Mm^3$/year<br>Fact, in 2006 | Limit for 2006-2007 | Reduction in comparison with fact |
|---|---|---|---|
| 205717/ 214264 | 382499 | – | |
| 73197.5 | 139612.1 | 158000 | 66414.6 |

Total water demand for production purposes is below the water consumption limit set for 2007.

With 34% increase of pulping capacity, reduction of water consumption per unit of output by an average of 20% in paper production and by 50 % in pulp production after reconstruction, total water consumption for production purposes is expected to decrease by 47.6%.

The required mechanically treated water capacity following reconstruction will be 142691/170452 $m^3$/day (summer/winter), and this quantity can be provided by the No. 1 treatment plant, which has a design capacity of 300000 m3/day.

The required filtered water capacity following reconstruction will be 138251/140320 $m^3$/day (summer/winter), and this quantity can be provided by the No. 1 and No. 2 treatment plants, which have a joint design capacity of 350000 $m^3$/day.

The required water quality, which can be provided by the treatment plant, is shown in Table 5.12

***The required bleached pulp process water quality***

Table 5.12

| Parameter | Unit of measurement | Standard requirement | 2005 data |
|---|---|---|---|
| Temperature | ºC | <25 | 15.3 |
| pH | | 6.5-7.5 | 7.0 |
| Clarity | Cm | >30 | 27.5 |
| Colour | º(Cr, Co scale) | <20 | 70.4 |
| Iron | mg/l | <0.2 | 0.14 |
| Aluminium | mg/l | <0.5 | 0.27 |
| Total hardness (Ca+Mg) | mg-eq./l | <3 | 1.9 |
| Total hardness | German degrees of hardness | <8.4 | 5.3 |
| $COD_{KMnO4}$ | mg/l | <10 | 1.9 |
| Suspended solids | mg/l | <2 | 0.7 |
| Turbidity(compared with standard solutions) | mg/l | <1.5 | 0.75 |

It follows therefore that the existing water intake and water treatment facilities have sufficient spare capacity (both in terms of water consumption and quality) to supply the reconstructed plant with the required quantity of water of the appropriate quality.

Domestic and drinking water supply will remain unchanged.

As it is not intended to increase personnel numbers, the plant's domestic and drinking water demand will remain unchanged 6494.9 Мм$^3$/year or 17794 m$^3$/day. Drinking water will be provided by the Ezhva municipal water supply system.

It follows therefore that the water demand of the reconstructed facility can be met in full by the existing water supply sources.

The impact of the water requirements of the reconstructed plant on the Vychegda's water reserves, in view of its minimum average monthly water flow in the winter of 95% and available flow of 80 m$^3$/s will be of the order of 3.0% (2.4 m$^3$/s).

### 5.3.2 Recirculating water systems

**Current status**

The plant currently uses a recirculating water system to enable it to use cooled water in the manufacturing process.

To cool the warm water, a cooling tower has been installed downstream of the turbine condensers, but it has insufficient cooling capacity, due to the design and process features of the existing HPP. The cooled water arriving at the two treatment plants is not sufficiently cold.

**Design solutions**

The project calls for a water supply system making the maximum possible use of a closed cooling cycle for cooling the new equipment, the warm water having been cooled in the newly built HPP cooling towers and the surplus pulp mill hot and warm water cooled in the new

cooling tower and returned to process. Unused cooled water at approximately 25-20ºC will be sent to the No. 2 treatment plant.

To cool the condenser of the new caustic recovery boiler turbine, the project envisages a closed recirculating water supply system where the spent water will be cooled by a new system (a new cooling tower at the soda recovery boiler unit) to approximately 20/25ºC.

The cooling system for the existing turbines will remain unchanged. In the winter and summer, they will be cooled with river water, using the existing HPP recirculating water system (the existing cooling tower).

The heated water from the HPP's existing air and gas coolers, at approximately 40ºC, travels along the existing route to Treatment Plants No. 1 and No. 2 at a total rate of 35400 $m^3$/day.

Treatment Plant No. 2 filters the warm water, the bulk of which has been used to cool the HPP equipment. The existing cooling tower is used to cool the filtered water used in softwood sulphate pulp manufacture.

Cooling tower capacity:

| | Flowrate, $\frac{m^3/day}{m^3/hr}$ Design | Flowrate, $\frac{m^3/day}{m^3/hr}$ Actual | Heat load MW | |
|---|---|---|---|---|
| Caustic recovery boiler cooling tower | $\frac{531300}{22167.5}$ | | 308.2 | New |
| HPP cooling tower | $\frac{444000}{18500}$ | $\frac{96000}{4000}$ | 41.8 | Existing |
| Pulping line cooling tower | $\frac{115754}{4840}$ | | 174 | New |
| Treatment Plant No. 2 cooling tower | $\frac{52800}{2200}$ | $\frac{31615}{1317}$ | 139.9 | Existing |

### 5.3.3 Water disposal. Predicted volumes and characteristics of waste water

MBP SIPPM removes, treats and discharges into the river return (waste) water from its own production facilities, from subsidiary enterprises, sub-subscribers and Syktyvkar and Ezhva municipal waste water. Waste water from the Mill as well as Syktyvkar and Ezhva domestic waste water are discharged into the Vychegda.

The terms of its water use license (surface water) SYK №00028 BREZKH of 18.12.2006 allow the Syktyvkar IPPM to discharge waste water via three outfalls:

- Main outfall – biologically treated Syktyvkar IPPM production and domestic waste water.
- HPP outfall – untreated slightly polluted waste water;
- Slobodskoy roadstead outfall - slightly polluted waste water and stormwater;

The Mill's 2007 discharge limits were as follows:

- Main outfall 115200.6 Mm3/year
- HPP outfall 62890.8 Mm3/year
- Slobodskoy Roadstead outfall 8518.1 Mm3/year

Form 2-TP (Water Management) for 2006 shows water discharge to have been as follows:

- Main outfall 99455.3 Mm3
- HPP outfall 58220.6 Mm3
- Slobodskoy Roadstead outfall 9117.6 Mm3

Best available technologies (BAT) planned for use at the Mill after its reconstruction will make it possible to limit discharge of polluted waste water from production to a maximum of 25.1 $m^3$ per tonne of output (based on digestion and excluding auxiliary processes) which is 2-3 times better than achieved by factories in Russia.

The modernization measures proposed by the project will reduce waste water discharge to levels close to modern European requirements.

Forecast quantities of waste water discharged into the river by the reconstructed Mill facilities will be as follows:

***Main outfall***

| | |
|---|---|
| 1. Polluted industrial waste water from Syktyvkar IPPM, its subsidiaries and sub-subscribers sent for biological treatment | – 168754 / 164120 $m^3$/day,<br>– 58202.9 $Mm^3$/year |
| 2. Domestic waste water from Syktyvkar Municipal Water Company, third party and subsidiary consumers and from the Mill's amenities sent for biological treatment | – 79338 $m^3$/day,<br>– 29075.3 $Mm^3$/year |
| ***Main outfall total:*** | – 247927 / 243459 $m^3$/day,<br>– 87278 $Mm^3$/year |

***HPP outfall***

| | |
|---|---|
| 1.Untreated slightly polluted and surface waste water ( ***HPP*** **outfall** | – 17219 $m^3$/day,<br>– 6049.8 $Mm^3$/year |

***"Slobodskoy roadstead" outfall***

2.Untreated slightly polluted and surface water ( – 2568 $m^3$/day,
"Slobodskoy roadstead" outfall) – 923.43 $Mm^3$/year

Discharge of treated water and water accepted as clean via the three outfalls after reconstruction will not exceed the levels allowed for 2007.

| Project | Flow rate, $m^3$/day (winter/summer) Mm3/year Fact, in 2006 | Limit for 2006-2007 | Reduction in comparison with fact |
|---|---|---|---|
| ***Main outfall*** | | | |
| 247927 / 243459 | | – | |
| 87278 | 99455.3 | 115200.6 | 12177.3 |
| ***HPP outfall*** | | | |
| 17219 | | – | |
| 6049.8 | 58220.6 | 62890.8 | 52170.8 |
| ***Slobodskoy roadstead outfall*** | | | |
| 2568 | | – | |
| 923.43 | 9117.6 | 8518.1 | 8194.2 |

The quantities of waste water discharged via the various outfalls are expected to be reduced as follows:

Main outfall by 12.2%
HPP outfall by 89.6%
Slobodskoy roadstead outfall by 89.9%

The expected water disposal by each department following project implementation, is shown in Table 5.13.

## *Water disposal for Mill facilities and subsidiary units following reconstruction*

Table 5.13

| *Production process* | *Water disposal, $m^3$/day* | | | | | | |
|---|---|---|---|---|---|---|---|
| | Total | Volume of re-usable | | Production waste water | Waste water accepted as clean | Domestic waste water | Irrevocable consump-tion and losses |
| | | water | steam and condensate | | | | |
| **Main production process** | | | | | | | |
| Raw timber preparation shop RTPS *(wood prep. shop new + existing)* | 10684 | 4089 | | 5769 | | | 826 |
| ***Pulp mill*** | | | | | | | |
| Production of bleached sulphate cellulose from deciduous timber (reconstruction) | 87046 | 81738 | 677 | 4431 | | | 200 |
| Production of sulphate cellulose from coniferous timber (reconstruction) | 59657 | 56495 | 385 | 2577 | | | 200 |
| Dryer (new) | 5572 | 2862 | 345 | 2082 | | | 283 |
| *Neutralisation unit* | 29719 | | | 29719 | | | |
| *TsRShchiPI [Liquor and lime recycling shop?]* | | | | | | | |
| Liquor concentration section | 130841 | 118842 | 3975 | 7706 | | 22 | 296 |
| Green liquor causticising and lime recycling shop (reconstruction) | 24394 | 17874 | 214 | 6025 | | | 281 |

| *Production process* | *Water disposal, $m^3$/day* | | | | | | |
|---|---|---|---|---|---|---|---|
| | Total | Volume of re-usable | | Production waste water | Waste water accepted as clean | Domestic waste water | Irrevocable consump-tion and losses |
| | | water | steam and condensate | | | | |
| Bleaching agent preparation section (UPDKh, oxygen production section) | 17173 | 17107 | | | 66 | | |
| *Cardboard and paper production:* | | | | | | | |
| Paper-making machines № 11.14.15,cardboard-making machine №21 | 112287 | 46166 | 6877 | 53656 | | | 5588 |
| RSS (new production) | 8241 | 7735 | | 506 | | | |
| *Thermomechanical and chemico-thermomechanical pulp production* | 21505 | 10226 | | 11279 | | | |
| ***Energy facilities,*** | 804115 | 741016 | 28175 | 25754 | 7200 | | 1970 |
| ***Auxiliary production facilities (compressor stations, oxygen units)*** | | | | | | | |
| Chemical shop for paper production (TsPKh) | 3008 | 1225 | | 1783 | | | |
| New cooling tower | 115754 | 111703 | | | | | 4051 |
| Existing cooling tower for HPP | 96000 | 93744 | | | | | 2256 |
| New cooling tower for HPP | 597388 | 591181 | | | | | 6207 |
| Central compressor station with cooling tower | 1005 | | 21 | 651 | | | 333 |
| Compressor station for bleaching chemicals preparation shop | 342 | | | 342 | | | |

| *Production process* | *Water disposal, $m^3$/day* | | | | | | |
|---|---|---|---|---|---|---|---|
| | Total | Volume of re-usable | | Production waste water | Waste water accepted as clean | Domestic waste water | Irrevocable consump-tion and losses |
| | | water | steam and condensate | | | | |
| Fuel and lubricants and volatile liquids store. Chemicals store, finished products store. Sulphate soap store, construction industry base | 948 | | 637 | 158 | | | 153 |
| Materials and technical store, despatch shop | 273 | | | 273 | | | |
| Vehicle shop | 92 | 2 | | 90 | | | |
| *repair and maintenance shop area* | 1224 | | | 132 | | | 1092 |
| *Subsidiary undertakings* | | | | | | | |
| Syktyvkar Tissue Group OOO "Papirus" | 2657 | | | 2607 | | 35 | 14 |
| OOO "Syktyvkarskii fanernyi zavod" [plywood factory] | 3112 | 47 | 354 | 1225 | 855 | 90 | 540 |
| ***Water supply and sewerage facilities*** | | | | | | | |
| Domestic and drinking water needs of Mill | 10449 | | | | | 10449 | |
| Other consumers | 21613 | | 8267 | 6219 | | | 7128 |
| Water treatment facilities (VOS-1,VOS-2, with existing cooling tower) | 11274 | 395 | | 2078 | 8485 | | 316 |
| Slurry collector № 2 | 764 | | | 514 | | | 250 |
| EMUP "Zhilkomkhoz", SMUP "Syktyvkarskii Vodokanal" [local housing and sewage organisations] | 69062 | | | | | 69062 | |
| Facilities for mechanical treatment of domestic waste water | 0 | 320 | | | | -320 | |

| *Production process* | *Water disposal, $m^3$/day* | | | | | | |
|---|---|---|---|---|---|---|---|
| | Total | Volume of re-usable | | Production waste water | Waste water accepted as clean | Domestic waste water | Irrevocable consump-tion and losses |
| | | water | steam and condensate | | | | |
| Biological treatment station for waste water | 3178 | | | 3013 | | | 165 |
| **Total from production process:** | | | | | | | |
| **Total:** | **2249377** | **1902767** | **49927** | **168589** | **16606** | **79338** | **32149** |

***List of pollutants***

The list of monitored pollutant indicators for waste water at the outlet into the water body for the MBP SIPPM was set by the permit for pollutant discharge into the environment issued by the Pechora Inter-Regional Technical and Environmental Inspectorate, a branch of the Federal Inspectorate.

***Norms for controlled pollutants and waste water outflow rates for discharge to the R. Vychegda via outfalls (MAC and limits) and reporting data for 2006***

Table 5.14

| Indicator | Actual discharge, 2006 | | MAC, 2006 | | Permit for pollutant discharge with waste water (**limit**), 2006 | | |
|---|---|---|---|---|---|---|---|
| | mg/l | t/yr | mg/l | t/yr | mg/l, summer | mg/l, winter | t/yr |
| **Main outfall** | | | | | | | |
| **Waste water flow, '000 $m^3$/yr** | **99455.3** | | **122652.2** | | **122652.2** | | |
| COD | 178.39 | 17741.83 | | | | | |
| BOD 5 | 12.20 | 1213.35 | | | | | |
| BOD full | 16.23 | 1613.76 | 13 | 1594.479 | 18.60 | 16 | 2068.7 |
| Suspended matter | 16.00 | 1591.28 | 20 | 2453.0 | 30.0 | | 1227 |
| Ammonium ion | 4.58 | 455.22 | 0.35 | 42.6 | 5.79 | 3.86 | 473.1 |
| Nitrite anion | 0.94 | 93.49 | 0.01 | 1.23 | 0.33 | 0.33 | 40.5 |
| Nitrate anion | 1.11 | 110.40 | 0.44 | 53.97 | 2.22 | 2.22 | 272.3 |
| Phosphates P | 0.7 | 64.65 | 0.16 | 19.62 | 0.7 | 0.6 | 77.7 |
| Chloride anion | 137.50 | 13675.10 | 80 | 9812.2 | 120.0 | 120 | 14718.0 |
| Sulphate anion | 239.60 | 23829.49 | 100 | 12265.2 | 250.0 | 250 | 30663.0 |
| Dry residue | 893.00 | 88813.58 | 1000.0 | 122652.2 | | | |
| Surfactants | 0.10 | 10.14 | 0.1 | 6.1 | 0.1 | 0.1 | |
| Phenols | 0.02 | 1.99 | 0.003 | 0.4 | 0.03 | 0.03 | 3.68 |
| Methanol | 0.31 | 30.83 | 0.05 | 6.1 | 0.50 | 0.5 | 61.32 |
| Formaldehyde | 0.11 | 10.84 | 0.1 | 12.3 | | | |
| **HPP outfall** | | | | | | | |
| **Waste water flow, '000 $m^3$/yr** | **58220.6** | | **56590** | | | | |
| BOD 5 | 0.70 | 40.75 | | | | | |
| BOD full | 0.91 | 52.98 | 3.0 | 169.77 | | | |
| Suspended matter | 10.80 | 628.78 | 19.80 | 1120.48 | | | |
| Ammonium ion | 0.12 | 6.74 | 0.51 | 29.94 | | | |
| Petroleum products | 0.09 | 5.24 | 0.30 | 16.98 | | | |
| **Slobodskoi roadstead outfall** | | | | | | | |
| **Waste water flow, '000 $m^3$/yr** | **9117.6** | | **6978.1** | | | | |
| BOD 5 | 1.4 | 12.8 | | | | | |
| BOD full | 1.8 | 16.6 | 6.0 | 41.9 | | | |

| Indicator | Actual discharge, 2006 | | MAC, 2006 | | Permit for pollutant discharge with waste water (**limit**), 2006 | | |
|---|---|---|---|---|---|---|---|
| | mg/l | t/yr | mg/l | t/yr | mg/l, summer | mg/l, winter | t/yr |
| Suspended matter | 8.9 | 81.1 | 19.8 | 138.2 | | | |
| Ammonium ion | 0.1 | 1.2 | 0.5 | 3.6 | | | |
| Petroleum products | 0.1 | 1.1 | 0.3 | 2.1 | | | |
| Phenols | 0.003 | 0.027 | 0.010 | 0.1 | | | |
| Formaldehyde | 0.038 | 0.346 | 0.038 | 0.3 | | | |
| Methanol | 0.1 | 0.5 | 0.1 | 0.4 | | | |

Following implementation of the investment project, the list of pollutants in waste water sent for treatment and for discharge into a water body remains the same, as the product range and its method of production will stay as they are at present.

### 5.3.4 Anticipated conditions of waste water discharge

Conditions of waste water discharge into the river will remain unchanged.

Waste water will continue to be discharged via the three existing outfalls, with no changes to system design, piping or facilities.

Following the planned measures, the rate of flow of waste water sent to the Main outfall after treatment, with subsequent discharge into the R. Vychegda, will diminish slightly compared to the current position (by around 12%), so no extra measures to alter the outfall's throughput capacity will be needed. In view of the technical condition of the diffuser outfall and the deterioration over the last 15 years in the objective hydrological characteristics of the R. Vychegda, which have seen changes as a result of a major re-shaping as well as continuing active river-bed processes, which in the section in question feature both branching and signs of free meandering, in its environmental protection plan the MBP SIPPM has taken the decision to reconstruct the Main diffuser outfall. In the light of the technical and environmental protection measures in this project, implementation of the decision to reconstruct the Main outfall is to be carried out as a separate project.

Following implementation of the planned measures adopted through the project's technical decisions, water accepted as clean sent to the HPP outfall, with subsequent discharge into the R. Vychegda, will be reduced, in comparison with the existing position, by 89.6%.

Following implementation of the technical decisions adopted by this project, the rate of flow of water accepted as clean sent to the Slobodskoy Roadstead discharge for discharge into the R. Vychegda will also see a major reduction (of around 90%) in comparison with the existing position.

The fundamental condition for waste water discharge into the R. Vychegda is achievement of the set MAC standards for each discharge.

The forecast volumes of pollutant discharges and waste water following project implementation are given in table 5.15

***Actual (2006) and forecast (after reconstruction) waste water and pollutant quantities discharged into the Vychegda compared with MAC ( discharge permit).***

Table 5.15

| Indicator | Actual discharge, 2006 | | After reconstruction | | MAC , 2007 | |
|---|---|---|---|---|---|---|
| | mg/l | tpa | mg/l | tpa | mg/l | tpa |
| **Main outfall** | | | | | | |
| **Flow rate of waste water, $Mm^3$/year** | **99455.3** | | **87278.2** | | **115200.6** | |
| COD | 178.39 | 17741.83 | 134.0 | 11664.7 | 30 | 3456.0 |
| BOD 5 | 12.20 | 1213.35 | 9.1 | 790.7 | 8.667 | 998.4 |
| BOD. total | 16.23 | 1613.76 | 13.0 | 1274.6 | 13 | 1497.6 |
| Suspended substances | 16.00 | 1591.28 | 13.4 | 1173.3 | 20 | 2304.0 |
| Ammonium-ion | 4.58 | 455.22 | 4.2 | 372.7 | 3.9 | 449.3 |
| Nitrite-acid ion | 0.94 | 93.49 | 0.08 | 7.4 | 0.6 | 69.12 |
| Nitrate-acid ion | 1.11 | 110.40 | 1.18 | 102.3 | 2 | 230.4 |
| Phosphates P | 0.65 | 64.65 | 0.7 | 67.0 | 1.5 | 172.8 |
| Chloride-acid ion | 137.50 | 13675.10 | 72.9 | 6392.0 | 140 | 16128 |
| Sulphate-acid ion | 239.60 | 23829.49 | 285.9 | 24898.8 | 200 | 23040.1 |
| Solid residue | 893.00 | 88813.58 | 794.6 | 68947.8 | 1000 | 115201 |
| Synthetic surfactants | 0.10 | 10.14 | 0.1 | 9.5 | 0.1 | 11.52 |
| Phenols | 0.02 | 1.99 | 0.008 | 0.7 | 0.003 | 0.3 |
| Methanol | 0.31 | 30.83 | 0.10 | 9.0 | 0.28 | 32.3 |
| Formaldehyde | 0.11 | 10.84 | 0.12 | 10.5 | 0.1 | 11.52 |
| **HPP outfall** | | | | | | |
| **Flow rate of waste water $Mm^3$/year** | **58220.6** | | **6049.8** | | **62890.8** | |
| BOD 5 | 0.7 | 40.75 | 0.70 | 4.23 | | |
| BOD. total | 0.91 | 52.98 | 0.91 | 5.51 | 5.50 | 345.90 |
| Suspended substances | 10.80 | 628.78 | 10.8 | 65.34 | 18.500 | 1163.48 |
| Ammonium-ion | 0.12 | 6.74 | 0.12 | 0.70 | 0.400 | 25.156 |
| Oil products | 0.09 | 5.24 | 0.09 | 0.54 | 0.125 | 7.861 |
| **Slobodskoy roadstead outfall** | | | | | | |
| **Flow rate of waste water $Mm^3$/year** | **9117.6** | | **923.4** | | **8518.1** | |
| BOD 5 | 1.4 | 12.76 | 1.4 | 1.29 | | |
| BOD. total | 1.82 | 16.59 | 1.82 | 1.68 | 6.88 | 58.605 |
| Suspended substances | 8.9 | 81.15 | 8.9 | 8.22 | 18.9 | 160.992 |
| Ammonium-ion | 0.129 | 1.17 | 0.129 | 0.12 | 0.4 | 3.407 |
| Oil products | 0.117 | 1.07 | 0.117 | 0.11 | 0.17 | 1.448 |
| Phenols | 0.003 | 0.03 | 0.003 | 0.003 | 0.003 | 0.026 |
| Formaldehyde | 0.038 | 0.35 | 0.038 | 0.04 | 0.1 | 0.852 |
| Methanol | 0.06 | 0.55 | 0.06 | 0.06 | 0.15 | 1.278 |

It can be seen from the table that discharge of pollutants into the Vychegda after reconstruction, in general will not exceed the levels set and approved by regulatory authorities for waste water quality and quantity except for sulphates and phenols, which is due to the nature of the pulping process.

Nevertheless, concentration of phenols and annual discharge will be 2.5 times lower than at present, which is a positive factor and will reduce the load imposed on the river.

### 5.3.5 Waste water treatment facilities

At present, all industrial and domestic waste water from the Mill, Ezhva district, the Northern industrial estate and Syktyvkar itself is treated jointly at the Mill's existing off-site biological treatment plant.

The design liquid load capacity of the existing plant 420 Mm3/day.

Industrial waste water arrives at the treatment plant inlet chamber and from there flows to the first stage pre-aeration tank which is supplied with surplus activated sludge from the biological treatment plant.

Domestic waste water undergoes separate mechanical treatment in two streams and is then combined with industrial waste water before being treated in aeration tanks.

The waste water treatment process is divided into three stages:

- *First stage:* Pre-aeration of industrial waste water in the first stage pre-aeration tank and mechanical treatment to remove suspended solids in radial settlement tanks;
- *Second stage:* Biological treatment of industrial waste water and pre-treated domestic waste water. The combined waste water stream is transported to second stage pre-aeration tanks where it undergoes bio-oxidation and is then settled in secondary radial settlement tanks;
- *Third stage:* The treated waste water from the secondary settlement tanks is polished in a surface-aerated basin. The polished waste water flows along a discharge channel into the waterside chamber and is discharged into the Vychegda via the diffuser outfall;
- *Sludge collector:* Domestic and industrial waste water sludge from the first and second stage settlement tanks together with the surplus activated sludge from the aeration tanks is transferred to the No. 2 sludge collector while the sludge dewatering section is not in operation.

The biological treatment plant has been under reconstruction since 2001. The project includes reconstruction of the aeration system, major overhaul of the first stage settlement tanks, reconstruction of the second stage pre-aeration tank and of the Syktyvkar and Ezhva mechanical treatment plant, and cleaning out the surface-aerated basins.

The current treatment flow diagram calls for the surplus activated sludge to be transferred to primary settlement tanks where it settles together with the sludge from the primary settlement tanks and is then transferred to the dewatering section.

The dewatering plant consists of two Andritz decanters. The process uses a flocculating agent and auger (screw) presses, and the sludge undergoes preliminary thickening. Dewatering efficiency is 95%, and the water content of the dewatered sludge, as reported by the Mill, is 55-60%.

The dewatered sludge is trucked to the No. 1 sludge collector for reclamation. The filtrate from the centrifuge and screw press flows by gravity to the industrial waste water

biological treatment plant. The mechanically treated domestic waste which has not been dewatered is transferred to the No. 2 sludge collector.

The project envisages transferring the dewatered sludge in quantities of 24124 tpa (absolute dry weight) and with the existing water content of 55-60% in exactly the same manner as before, for reclamation in the No. 1 sludge collector.

During the next stage of reconstruction the dewatered sludge will be transported to the tankbark boiler for incineration together with tankbark waste.

### 5.3.6. Waste water treatment measures. Project solutions.

The project does not envisage extending or reconstructing the biological treatment plant, as in spite of the 20% increase of pulp and paper capacity the load on the treatment plant will in fact decrease after reconstruction:

- COD – by 6077.2 tpa
- $BOD_5$ – by 422.7 tpa
- Suspended solids – by 418.0 tpa

Liquid load will decrease by 12177.1 Mm3/year.

In terms of other pollutants, the load on the treatment facilities after reconstruction will remain the same, as shown in Table 5.16 and 5.17.

**The operation of the biological treatment plant in 2006**

Table 5.16

| Indicator | Inlet chamber (industrial waste water) before treatment | | | Treatment efficiency after settling tanks | Industrial+domestic wastewater streams before treatment | | | Inlet chamber (industrial +domestic waste water) after treatment | | | Efficiency | Permitted discharg levels, 2006 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Average annual concentration | Pollutant load on treatment facilities | | | Average annual concentration | Pollutant load on treatment facilities | | Average annual concentration | Pollutant load on river | | | Average annual concentration | Pollutant load river | |
| | g/m3 | tpd | tpa | % | g/m3 | tpd | tpa | g/m3 | tpd | tpa | % | g/m3 | tpd | tp |
| Flow rate, $m^3$/day | 193478 | | | | 272480 | | | 272480 | | | | 315616,44 | | |
| $Мм^3$/year | 70380 | | | | 99455 | | | 99455 | | | | 115200000,6 | | |
| COD | 1368,2 | 264,72 | 96621,358 | 32,0 | 709,528 | 193,332 | 70566,355 | 178,39 | 48,61 | 17741,83 | 74,86 | | | |
| $BOD_5$ | 528,7 | 102,29 | 37336,436 | 40,0 | 241,374 | 65,770 | 24005,890 | 12,2 | 3,32 | 1213,35 | 94,95 | | | |
| $BOD_{total}$ | 608,005 | 117,6 | 42936,9 | 40,0 | 277,580 | 75,635 | 27606,774 | 16,23 | 4,42 | 1613,76 | 94,15 | 13 | 4,10 | 149 |
| Suspended solids | 628,3 | 121,56 | 44370,121 | 75,7 | 124,818 | 34,010 | 12413,792 | 16 | 4,36 | 1591,28 | 87,18 | 20 | 6,31 | 230 |
| Ammonium ion | 5 | 0,97 | 353,097 | | 12,035 | 3,279 | 1196,931 | 4,6 | 1,25 | 455,22 | 61,97 | 3,9 | 1,23 | 449 |
| Nitrite anion | 0,085 | 0,02 | 6,003 | | 0,077 | 0,021 | 7,625 | 0,94 | 0,26 | 93,49 | | 0,6 | 0,19 | 69 |
| Nitrate anion | 3,79 | 0,73 | 267,647 | | 2,761 | 0,752 | 274,605 | 1,11 | 0,30 | 110,40 | 59,80 | 2 | 0,63 | 230 |
| Phosphates P | 0,14 | 0,03 | 9,887 | | 0,996 | 0,271 | 99,065 | 0,65 | 0,18 | 64,65 | 34,74 | 1,5 | 0,47 | 172 |
| Chloride anion | 140,3 | 27,14 | 9907,891 | | 116,596 | 31,770 | 11596,130 | 137,5 | 37,47 | 13675,10 | | 140 | 44,19 | 1612 |
| Sulphate anion | 305,7 | 59,15 | 21588,327 | | 239,673 | 65,306 | 23836,710 | 239,6 | 65,29 | 23829,49 | 0,03 | 200 | 63,12 | 2304 |
| Dry residue | 1273 | 246,30 | 89898,398 | | 903,908 | 246,297 | 89898,398 | 893 | 243,32 | 88813,5829 | 1,2 | 1000 | 315,62 | 1152 |
| Synthetic surfactants | 0,272 | 0,05 | 19,208 | | 0,693 | 0,189 | 68,932 | 0,102 | 0,03 | 10,144 | 85,3 | 0,1 | 0,03 | 11 |
| Phenols | 0,926 | 0,18 | 65,393 | 18,6 | 0,539 | 0,147 | 53,612 | 0,02 | 0,01 | 1,989 | 96,3 | 0,003 | 0,00 | 0, |
| Methanol | 50,37 | 9,75 | 3557,095 | | 35,842 | 9,766 | 3564,699 | 0,31 | 0,08 | 30,831 | 99,1 | 0,28 | 0,09 | 32 |
| Formaldehyde | 0,758 | 0,15 | 53,529 | | 0,577 | 0,157 | 57,378 | 0,11 | 0,03 | 10,841 | 81,1 | 0,1 | 0,03 | 11 |

**The operation of the biological treatment plant (project solutions)**

Table 5.17

| Indicator | Inlet chamber (industrial waste water) before treatment | | | Treatment efficiency after settling tanks | Industrial+domestic wastewater streams before treatment | | | Outlet chamber (industrial +domestic waste water) after treatment | | | Efficiency | Permitted discharge levels, 2007 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Average annual concentration | Pollutant load on treatment facilities | | | Average annual concentration | Pollutant load on treatment facilities | | Average annual concentration | Pollutant load on river | | | Average annual concentration | Pollutant load on river | |
| | g/m3 | tpd | tpa | % | g/m3 | tpd | tpa | g/m3 | tpd | tpa | % | g/m3 | tpd | tpa |
| Flow rate, $m^3$/day | 168754,1 | | | | 248092,5 | | | 247927,5 | | | | 315,6 | | |
| $Мм^3$/year | 58202,9 | | | | 87335,9 | | | 87278,2 | | | | 115200,6 | | |
| COD | 1461,6 | 246,658 | 86330,2 | 32,0 | 729,8 | 181,053 | 63568,37 | 134,0 | 33,223 | 11664,656 | 81,65 | 30 | 9,469 | 3456,0 |
| $BOD_5$ | 549,7 | 92,766 | 32468,175 | 40,0 | 242,1 | 60,054 | 21084,93 | 9,1 | 2,252 | 790,685 | 96,25 | 8,7 | 2,735 | 998,4 |
| $BOD_{total}$ | 632,2 | 106,681 | 37338,40 | 40,0 | 278,4 | 69,062 | 27410,41 | 13 | 3,211 | 1274,584 | 95,35 | 13 | 4,103 | 1497,6 |
| Suspended solids | 719,6 | 121,437 | 42502,85 | 75,7 | 137,0 | 33,980 | 11960,05 | 13,4 | 3,333 | 1173,251 | 90,19 | 20 | 6,312 | 2304,0 |
| Ammonium ion | 7,0 | 1,189 | 416,225 | | 14,1 | 3,501 | 1260,06 | 4,2 | 1,036 | 372,735 | 70,42 | 3,9 | 1,231 | 449,3 |
| Nitrite anion | 0,1 | 0,017 | 5,780 | | 0,1 | 0,021 | 7,40 | 0,1 | 0,021 | 7,402 | | 0,6 | 0,189 | 69,1 |
| Nitrate anion | 4,2 | 0,707 | 247,387 | | 2,9 | 0,726 | 254,34 | 1,2 | 0,292 | 102,250 | 59,80 | 2 | 0,631 | 230,4 |
| Phosphates P | 0,2 | 0,039 | 13,530 | | 1,1 | 0,283 | 102,71 | 0,7 | 0,185 | 67,023 | 34,74 | 1,5 | 0,473 | 172,8 |
| Chloride anion | 79,6 | 13,439 | 4703,714 | | 72,8 | 18,064 | 6391,95 | 72,9 | 18,064 | 6391,953 | | 140 | 44,187 | 16128,1 |
| Sulphate anion | 383,6 | 64,737 | 22657,913 | | 285,8 | 70,897 | 24906,30 | 285,9 | 70,875 | 24898,752 | 0,03 | 200 | 63,124 | 23040,1 |
| Dry residue | 1181,6 | 199,400 | 69790,0 | | 803,7 | 199,400 | 69790,0 | 794,6 | 196,994 | 68947,835 | 1,21 | 1000 | 315,618 | 115200,6 |
| Synthetic surfactants | 0,3 | 0,043 | 15,050 | | 0,7 | 0,179 | 64,77 | 0,1 | 0,026 | 9,532 | 85,28 | 0,1 | 0,032 | 11,52 |

| Indicator | Inlet chamber (industrial waste water) before treatment | | | Treatment efficiency after settling tanks | Industrial+domestic wastewater streams before treatment | | | Outlet chamber (industrial +domestic waste water) after treatment | | | Efficiency | Permitted discharge levels, 2007 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Average annual concentration | Pollutant load on treatment facilities | | | Average annual concentration | Pollutant load on treatment facilities | | Average annual concentration | Pollutant load on river | | | Average annual concentration | Pollutant load on river | |
| | g/m3 | tpd | tpa | % | g/m3 | tpd | tpa | g/m3 | tpd | tpa | % | g/m3 | tpd | tpa |
| Phenols | 0,960 | 0,162 | 56,68 | 18,6 | 0,54 | 0,133 | 46,52 | 0,008 | 0,0021 | 0,729 | 98,43 | 0,003 | 0,001 | 0,346 |
| Methanol | 17,43 | 2,942 | 1029,72 | | 11,9 | 2,963 | 1037,32 | 0,103 | 0,026 | 8,972 | 99,14 | 0,28 | 0,088 | 32,256 |
| Formaldehyde | 0,88 | 0,148 | 51,94 | | 0,6 | 0,159 | 55,79 | 0,12 | 0,030 | 10,540 | 81,11 | 0,1 | 0,032 | 11,52 |

Calculations have shown that with the exception of sulphates, there will be no pollutant discharges exceeding MAC approved for 2007, based on the discharged quantities.

Table 5.18 compares pollutant discharge into the Vychegda per tonne of pulp with the quantities discharged by similar foreign plants, based on the use of best available technologies (BAT) and recommended by the European Union Integrated Pollution Prevention and Control Directive adopted in 2001.

Analysis of the comparison leads to the conclusion that overall the reconstructed mill's discharge levels will comply with IPPC recommendations subject to the use of BAT.

Therefore, it can be concluded that no additional waste water treatment measures need to be included in the project.

**Comparison of the pollutant content of discharged biologically treated waste water following the reconstruction of the Syktyvkar Integrated Paper and Pulp Mill with the current situation, RF regulatory requirements and European Union recommendations based on the use of best available technologies (BAT)**

Table 5.18

| Process | Product type | 2006 output | | Pollutant discharge into surface watercourses | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 2006 | After reconstruction | Indicator | 2006 | | | After reconstruction | | | Recommended by EU IPPC Directive | | | RF regulatory requirements (MAC) | | |
| | | tpa | tpa | | g/m3 | tpa | kg/t | g/m3 | tpa | kg/t | г/м$^3$ | tpa | kg/t | g/m3 | tpa | kg/t |
| Bleached sulphate pulp production from hardwood and softwood stock | Bleached and unbleached digested pulp | 551486 | 739354 | Suspended solids | 16,00 | 1126,08 | 2,04 | 17,4 | 1013,2 | 1,37 | - | - | 0,6-1,5 | 20,0 | 2304,01 | - |
| | | | | COD | 178,39 | 12555,09 | 22,77 | 185,1 | 10772,2 | 14,57 | - | - | 8,0-23,0 | * | 3456,02 | - |
| | | | | $BOD_5$ | 12,20 | 858,64 | 1,56 | 12,6 | 730,5 | 0,99 | - | - | 0,3-1,5 | 8,67 | 998,41 | - |
| | | | | Nitrogen (N) | 4,10 | 288,33 | 0,52 | 3,1 | 177,6 | 0,24 | - | - | 0,1-0,25 | 3,03 | 349,44 | - |
| | | | | Phosphorus (P) | 0,65 | 45,75 | 0,08 | 0,2 | 8,8 | 0,01 | - | - | 0,01-0,03 | 1,5 | 172,80 | - |
| | | | | NOx | | | 0,89 | | | 0,149 | - | - | Less than 0,25 | - | - | - |

*Note: MAC = 30 mg/l based on COD specified for recreational water bodies

## 5.3.7. Potential impact of the facility on surface waters

Russian standards classify pulp and paper manufacturing plants as a Class I chemical hazard, whose operation is associated with a number of environmental problems.

Organochlorines cannot be completely removed from the waste water, although their quantity can be much reduced if chlorine dioxide is used as bleach (in the Elemental Chlorine Free (ECF) process) in place of molecular chlorine.

This project envisages the use of the modern ECF bleaching process, using 15,6 kg/t of chlorine dioxide.

ECF bleaching is fully compatible with closed-circuit water use and the proposed process design which will have a minimal environmental impact.

The waste water will be virtually free of dioxins and long-lived toxic substances which could accumulate in living organisms. The residual content of organic compounds in the treated waste water will present no significant danger to aquatic ecosystems.

Following reconstruction, total industrial water consumption by the Mill and sub-subscribers will be reduced in spite of the increased capacity and reduced consumption per unit of output, as follows:

| Project | Consumption, $m^3$/day (winter/summer)<br>$Mm^3$/year<br>Actual consumption in 2006 | Limit for 2006-2007 | Reduction in comparison with actual consumption |
|---|---|---|---|
| 205717/ 214264 | 382499 | – | |
| 73197.5 | 139612.1 | 158000 | 66414.6 |

Total water demand for production purposes is below the water consumption limit set for 2007.

With a 20.3 % increase of pulping capacity, reduction of water consumption per unit of output by an average of 20 % in paper production and by 50 % in pulp production after reconstruction, total water consumption for production purposes is expected to decrease by 47.6%.

The impact of the water requirements of the reconstructed plant on the Vychegda's water reserves, in view of its minimum average monthly water flow in the winter of 95% and available flow of 80 $m^3$/s will be of the order of 3,0 % (2,4 $m^3$/s).

Following reconstruction, the forecast discharge of treated waste water and water accepted as clean into the Vychegda through the three outfalls, Main, TPP and Slobodskoye roadstead, will not exceed the quantities permitted for 2007 and will be as follows:

| Project | Flow rate, $m^3$/day (winter/summer)<br>Mm3/year<br>Actual flowrate in 2006 | Limit for 2006-2007 | Reduction in comparison with actual 2006 flowrate |
|---|---|---|---|
| ***Main outfall*** | | | |
| 247927 / 243459 | | – | |
| 87278 | 99455.3 | 115200.6 | 12177.3 |
| ***TPP outfall*** | | | |
| 17219 | | – | |
| 6049.8 | 58220.6 | 62890.8 | 52170.8 |
| ***Slobodskoy roadstead outfall*** | | | |
| 2568 | | – | |
| 923.43 | 9117.6 | 8518.1 | 8194.2 |

The quantities of waste water discharged via the various outfalls are expected to be reduced as follows:

Main outfall by 12.2 %
TPP outfall by 89.6 %
Slobodskoy roadstead outfall by 89.9 %

The forecast pollutant discharge quantities following reconstruction are shown in Table 5.19

***Pollutant and waste water discharge quantities following project implementation***

Table 5.19

| Components | Pollutant discharge | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Current status | | | | | | | Project solutions | | MAC 2007 | |
| | Actual quantities in 2006 | | Preliminary approved discharge for 2006 | | | MAC 2006 | | | | | |
| | mg/l | tpa | mg/l, summer | mg/l, winter | tpa | mg/l | tpa | mg/l | tpa | mg/l | tpa |
| **Main outfall** | | | | | | | | | | | |
| **Waste water discharge, Mm3/year** | **99455,3** | | **122652,2** | | | **122652,2** | | **87278,2** | | **115200,6** | |
| COD | 178,39 | 17741,83 | | | | | | 134,0 | 11664,7 | 30 | 3456,0 |
| $BOD_5$ | 12,20 | 1213,35 | | | | | | 9,1 | 790,7 | 8,667 | 998,4 |
| $BOD_{total}$ | 16,23 | 1613,76 | 18,6 | 16 | 2068,7 | 13,0 | 1594,5 | 13,0 | 1274,6 | 13 | 1497,6 |
| Suspended solids | 16,00 | 1591,28 | 30,0 | | 1227,0 | 20,0 | 2453 | 13,4 | 1173,3 | 20 | 2304,0 |
| Ammonium ion | 4,58 | 455,22 | 5,79 | 3,86 | 473,1 | 0,35 | 42,6 | 4,2 | 372,7 | 3,9 | 449,3 |
| Nitrite anion | 0,94 | 93,49 | 0,33 | 0,33 | 40,5 | 0,01 | 1,2 | 0,08 | 7,4 | 0,6 | 69,12 |
| Nitrate anion | 1,11 | 110,40 | 2,22 | 2,22 | 272,30 | 0,44 | 54,0 | 1,18 | 102,3 | 2 | 230,4 |
| Phosphates P | 0,7 | 64,65 | 0,7 | 0,6 | 77,70 | 0,16 | 19,6 | 0,7 | 67,0 | 1,5 | 172,8 |
| Chloride anion | 137,50 | 13675,10 | 120,0 | 120,0 | 14718,0 | 80 | 9812,2 | 72,9 | 6392,0 | 140 | 16128 |
| Sulphate anion | 239,60 | 23829,49 | 250,0 | 250,0 | 30663,0 | 100 | 12265,2 | 285,9 | 24898,8 | 200 | 23040,1 |
| Dry residue | 893,00 | 88813,58 | | | | 1000 | 122652,2 | 794,6 | 68947,8 | 1000 | 115201 |
| Synthetic surfactants | 0,10 | 10,14 | 0,1 | 0,1 | 12,3 | 0,05 | 6,13 | 0,1 | 9,5 | 0,1 | 11,52 |
| Phenols | 0,02 | 1,99 | 0,03 | 0,03 | 3,68 | 0,003 | 0,37 | 0,008 | 0,7 | 0,003 | 0,3 |
| Methanol | 0,31 | 30,83 | 0,5 | 0,5 | 61,3 | 0,05 | 6,13 | 0,10 | 9,0 | 0,28 | 32,3 |
| Formaldehyde | 0,11 | 10,84 | | | | 0,1 | 12,27 | 0,12 | 10,5 | 0,1 | 11,52 |
| **TPP outfall** | | | | | | | | | | | |
| **Waste water discharge, Mm3/year** | **58220,6** | | | **56590** | | **56590** | | **6049,8** | | **62890,8** | |
| $BOD_5$ | 0,7 | 40,75 | | | | | | 0,70 | 4,23 | | |

| Components | Pollutant discharge | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Current status | | | | | | | Project solutions | | MAC 2007 | |
| | Actual quantities in 2006 | | Preliminary approved discharge for 2006 | | | MAC 2006 | | | | | |
| | mg/l | tpa | mg/l, summer | mg/l, winter | tpa | mg/l | tpa | mg/l | tpa | mg/l | tpa |
| $BOD_{total}$ | 0,91 | 52,98 | | | | 3 | 169,770 | 0,91 | 5,51 | 5,50 | 345,90 |
| Suspended solids | 10,80 | 628,78 | | | | 19,8 | 1120,480 | 10,80 | 65,34 | 18,500 | 1163,48 |
| Ammonium ion | 0,12 | 6,74 | | | | 0,5 | 29,94 | 0,12 | 0,70 | 0,400 | 25,156 |
| Oil products | 0,09 | 5,24 | | | | 0,3 | 16,980 | 0,09 | 0,54 | 0,125 | 7,861 |
| **Slobodskoy Roadstead outfall** | | | | | | | | | | | |
| **Waste water discharge, Mm3/year** | **9117,6** | | | **6978,1** | | **6978,1** | | **923,4** | | **8518,1** | |
| $BOD_5$ | 1,4 | 12,76 | | | | | | 1,4 | 1,29 | | |
| $BOD_{total}$ | 1,82 | 16,59 | | | | 6,0 | 41,87 | 1,82 | 1,68 | 6,88 | 58,605 |
| Suspended solids | 8,9 | 81,15 | | | | 19,800 | 138,17 | 8,9 | 8,22 | 18,9 | 160,992 |
| Ammonium ion | 0,129 | 1,17 | | | | 0,5143 | 3,59 | 0,129 | 0,12 | 0,4 | 3,407 |
| Oil products | 0,117 | 1,07 | | | | 0,300 | 2,09 | 0,117 | 0,11 | 0,17 | 1,448 |
| Phenols | 0,003 | 0,03 | | | | 0,010 | 0,07 | 0,003 | 0,003 | 0,003 | 0,026 |
| Formaldehyde | 0,038 | 0,35 | | | | 0,038 | 0,27 | 0,038 | 0,04 | 0,1 | 0,852 |
| Methanol | 0,06 | 0,55 | | | | 0,06 | 0,42 | 0,06 | 0,06 | 0,15 | 1,278 |

It will be seen from the table that discharge of pollutants into the Vychegda after reconstruction, in general will not exceed the levels set and approved by regulatory authorities for waste water quality and quantity except for sulphates and phenols, which is due to the nature of the pulping process.

Nevertheless, the concentration of phenols and annual discharge will be 2.5 times lower than at present, which is a positive factor and will reduce the load imposed on the river.

The greater discharged quantities and sulphate concentrations in the monitored section are due to the nature of the process (sulphonation), the increased pulp production capacity and the fact that the sulphates cannot be removed by biological treatment. They affect aqueous organisms as well as the sanitary quality of the watercourse, increasing the hardness of the water and causing electrochemical corrosion. Sulphate concentration of the treated waste water discharged into the Vychegda does not exceed the sanitary requirements for general purpose water bodies, and slightly exceeds the standard (MAC) of 200mg/l specified for the Mill. Calculations of the approved MAC show that the allowable concentration of sulphates in treated waste water discharged into the Vychegda is 2066,028 mg/l, which means that the reconstructed Mill may have a slightly higher MAC of 300mg/l.

### 5.3.8. Water protection and management and waste water and pollutant discharge measures envisaged by the proposed engineering solutions

The OAO Mondi Business Paper Syktyvkar IPPM Environmental Protection Plan for 2007 and information on the implementation of the 2006 Plan appear in Annexes 9 and 10 respectively.

The engineering solutions included in the Mill reconstruction project envisage the following water protection measures:

**Water resources management:**

- Using surplus hot and warm water from the pulping plant, cooled in the new cooling tower, for process purposes;
- Delivering unused cooled water to the No. 2 water treatment plant;
- Using a closed cooling system to cool the new turbine condensers, and cooling the spent water in the new TPP cooling tower;
- Using the existing TPP recirculating water system (the existing cooling tower) to cool the existing turbines

**Timber yard management:**

- Local treatment of waste water containing bark waste, returning the clarified water for reuse.

**Pulping plant:**

- A closed circuit unbleached pulp washing system using high-performance pulp washing equipment to recover the largest possible quantity of dissolved organic substances for regeneration;
- Two stage soda-oxygen delignification to achieve a low Kapp number, and thus to reduce the consumption of bleaching chemicals and increase the quantity of dissolved organic substances for regeneration;
- A closed pulp screening process to prevent ingress of air and thus foam generation;
- Using hot water in the last unbleached softwood pulp washing zone;

- Modern ECF bleaching without elementary chlorine, which reduces the NOx content of the waste;
- Using oxygen, hydrogen peroxide and sodium hydroxide to reduce chlorine dioxide consumption for bleaching purposes and close the bleaching filtrate cycle as much as possible;
- Returning bleaching filtrates to process will reduce water consumption;
- Using clean evaporation condensate for pulp washing;
- Cleaning dirty evaporation condensate and reusing if for pulp washing after soda-oxygen treatment;
- Using slightly contaminated condensate to wash the sludge in the lime causticisation and regeneration shop;
- Cooling and neutralising bleaching effluent;
- Diluting the high density pulp in the high density towers with return water from the papermaking machine in place of fresh water;
- Collecting and reusing leaks and emergency overflows;
- Cooling surplus hot and warm water and returning it to process to replace fresh water;
- Taking worn and out of date equipment out of service (old soda regeneration boilers and the No.2 evaporation plant)

**Market pulp drying processes:**

- Closing the return water cycle as much as technically feasible (using it to dilute the pulp in the pulping line and break down dry waste, as well as in the couch pit and as cooling water), achieving a 90 % water recycling rate.
- Using fresh water only for spraying purposes and in seals and floor and equipment washing.

**Papermaking:**

- Using fresh water only in special papermaking machine sprays, to cool electric motors and equipment, to seal and cool gland seals and for floor and equipment washing;
- Closing the return and clarified water cycle as much as technically feasible (using it to dilute the pulp in the pulping line, regulate density, spray disc filters and centrifuges) achieving a 95% water recycling rate.
- Reducing fresh water consumption per tonne of output of papermaking machine No. 14 from 20 m3/t to 5 m3/t; and of papermaking machine No. 21from 29 m3/t to 15 m3/t, with an average of ~ 16 m3/t.

### 5.3.9 **Environmental control and monitoring**

Under the applicable law, OAO MBP SIPPM as water user is responsible for monitoring and reporting its water consumption and discharge.

The plant's environmental management system is certified to ISO 2014.

The plant has an environmental protection department, whose main responsibilities include:

– Preventing environmental pollution;
– Designing environmental impact mitigation measures;

– Monitoring discharges and emissions and waste generation and disposal;
– Ensuring that the plant has the required environmental permits.

The plant monitors, records and reports the following water streams:
– Water abstracted from the Vychegda;
– Untreated river water used by the TPP;
– Mechanically treated water;
– Water supplied to subscribers;
– Warm water from the TPP;
– Domestic water received from the Ezhva municipal water supply line;
– Waste water received from secondary users;
– Waste water discharged into the Vychegda through each of the outfalls,;
– Municipal and domestic waste water sent to the treatment plant.

Special documents specify the metering system to be used to meter water consumption and discharge, and meter location.

Statistical information about water consumption and discharge on Form 2-TP (Water Management) is regularly submitted to the authorities.

Quality control of discharged waste water complies with the requirements of the Guidelines on Surface Water Protection against pollution by Waste Water.

The plant has a certified industrial laboratory, which analyses its waste water using approved methods. Parameters to be monitored, sampling points and sampling frequency are agreed with the authorities.

### 5.3.10 Conclusions

The materials and calculations presented in this section, and the calculation results presented in the tables make it possible to assess the environmental impact of the Mill on the Vychegda after its reconstruction. The project envisages high output levels, consistent with European requirements.

The following conclusions may be drawn on the basis of an analysis of the process and of technical, organizational solutions and environmental measures:

1. In spite of the fact that pulping capacity will be increased by 34%, all main water consumption, water removal and pollutant discharge indicators will improve. Total water consumption will decrease by 47.6%. Discharge of waste water into the Vychegda will decrease: at the Main Outfall by 12.2%; at the HPP outfall by 89.6% and at the Slobodskoy roadstead outfall by 89.9%. The load imposed on the river will also decrease: COD by 6077.2 tpa, BOD5 by 422.7 tpa; suspended solids by 418 tpa and hydraulic load by 12177.1 Mm3/year.
2. The concentration and quantity of pollutants discharged together with waste water into the Vychegda will not exceed MAC levels set for SIPPM and will correspond to the standards recommended by the Integrated Pollution Prevention and Control Directive (IPPC) to foreign pulp and paper using BAT and accepted by the European Union.
3. The water use and waste water treatment systems envisaged by the project will allow the quality of water discharged into the river to comply with European environmental requirements.
4. The project envisages the greatest possible use of excess hot and warm water and evaporator and digester condensates for process purposes. All spent warm water will be used either as process water or in return systems, and will be cooled in cooling towers. The waste water generated by some lines and facilities will continue to be treated locally.

5. The existing water supply system is sufficient to supply the mill with water of the required quality and doesn't require reconstruction or extension.
6. The existing waste water treatment system is sufficient to ensure that water discharged into the river meets the required MAC standards, and doesn't require reconstruction or extension.
7. Collection of occasional and emergency leaks and overflows and their return to production has been provided for.
8. Process solutions prevent the formation of dioxins and thus the generation of especially hazardous emissions during the incineration of sediments and sludge.

The above confirms the advisability and environmental effectiveness of the SIPPM development and reconstruction project.

### 5.4 Forecast impact of facility on area, land utilisation conditions and geological environment

All work to reconstruct the operating pulp mill will be carried out within the boundaries of the MBP SIPPM.

No extra land has been requested for implementation of the technical decisions incorporated in the project.

#### 5.4.1 Impact factors

The main impact factors on the topography, soils and ground during operation and reconstruction of the MBP SIPPM may be subdivided into two types:

- mechanical damage to surface;
- pollution with chemicals and solid waste.

These factors will make themselves felt in varying ways at the stages of construction, operation and when accidents occur. The level of impact of these factors on the environment will depend to a large extent on the properties of the environment itself and the "encompassing" ecosystems. The scale of the damage when accidents occur will depend on the type and quantity of waste generated, and also on how much natural resources have suffered.

The man-made burden on the landscape will consist in a mechanical impact linked to the vertical layout of the topography.

Mechanical damage to the surface will be linked to the vertical rearrangement of the topography, movement of soil, removal of the top soil and vegetation layer occurring during construction, and also to operation of the facility.

During construction and operation of the undertaking, a chemical impact may arise through pollution of the soil by chemical reagents and waste water.

The soil and vegetation layer will also be polluted by toxic residues of products of incomplete combustion of pollutants and fuel and lubricant materials (during operation of equipment).

An impact on land resources while the MBP SIPPM is in operation may be manifested in the form of static (building) and dynamic loads (during operation of moving vehicles).

A change in the quality of land resources constitutes a significant type of impact on the natural environment during the performance of work.

## 5.5 Forecast impact of industrial facility waste on the state of the natural environment

At the MBP SIPPM, 58 different types of waste will be generated. The total quantity of waste, according to form 2-TP (waste), for 2006 was 656343.775 t/yr, of which:

- located at facilities belonging to the MBP SIPPM – 5343.055 t/yr;
- utilised at undertaking – 607253.45 t/yr;
- decontaminated at undertaking – 35148.000 t/yr;
- moved for processing and disposal at other undertakings – 9237.109 t/yr.

Of the total waste quantity:

- hazard class 1 - 7.538 t/yr;
- hazard class 2 – none;
- hazard class 3 – 168.700 t/yr;
- hazard class 4 –337949.463 t/yr;
- hazard class 5 – 318218.074 t/yr.

Selective waste collection has been instituted at the undertaking. Specially-equipped temporary waste storage (TWS) locations have been organised.

The reconstruction that is envisaged does not require the organisation and fitting out of new temporary production and consumption waste storage locations or an increase in the capacity of the facilities for siting waste belonging to the MBP SIPPM.

The details of sites for the storage (burial) of industrial production waste, from MBP SIPPM data, are shown in table 5.20.

# Details of sites for the storage (burial) of industrial production waste

Table 5.20

| Name of site | Location (coordinates on topographic plan, distance from nearest population centre, etc.) | Area ($m^2$, ha, $km^2$) | Height (m) | Type of fencing (screening) arrangement and description | Size of sanitary protection zone (m) | Total site capacity (‘000 $m^3$) | Quantity of waste taken per year (‘000 t/yr, ‘000 $m^3$/yr) | Means of transportation (delivery) of waste | Service life (years) | Development land, farming facilities falling within site impact zone | Methods used to monitor state of local natural environment |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| Industrial waste site | 3.5 km from Ezhva District, Syktyvkar | 58.6 ha | - | Embankment, storm water conduit | 3000 m | 5000000 t | 2970000 t | road transport | to 2030 | - | Monitoring of waste water quality and atmospheric air quantity |
| Bark dump | 4.0 km from Ezhva District, Syktyvkar | 25.6 ha | - | Embankment, storm water conduit | 3000 m | 1485000 t | 506198 t | road transport | to 2015 | - | - |
| №1 slurry lagoon | 2.5 km from Ezhva District, Syktyvkar | 76.0 ha | | Soil lining, embankment, fencing, storm and drainage water conduit | - | 3.3 mln $m^3$ | 2.038 mln $m^3$ | road transport | - | - | - |
| №2 slurry lagoon | 2.5 km from Ezhva District, Syktyvkar | 62.0 ha | | Soil lining, embankment, fencing, storm and drainage water conduit | - | 3.3 mln $m^3$ | 2.038 mln $m^3$ | road transport | - | - | - |

The envisaged reconstruction will not lead to any increase in waste arisings in comparison with the norms set for the undertaking, and will not have an impact on the state of the local environment.

### 5.5.1 The proposed facility as a source of production and consumption wastes

***Production and consumption wastes***

The implementation of the Mill Development and Reconstruction Project will not result in the formation of new types of wastes, while the quantity of existing wastes will decrease by approximately 52.52% from the current levels.

The main reasons for the reduction of the quantity of wastes are:

- significant reduction of wood losses during the production and transportation of wood chips;

- reduction of personnel numbers;

- reduction of water conditioning wastes and biological treatment plant sludges.

The expected quantities of production and consumption wastes before and after reconstruction are shown in Table 5.21.

Table 5.21

| Federal Waste Classification Catalogue [FWCC] code for waste | FWCC name for waste | Hazard class | Quantity, t/yr | |
|---|---|---|---|---|
| | | | After project implementa-tion | as in 2-TP form "Waste" for 2006 |
| | **TOTAL FOR UNDERTAKING** | | **311614.115** | **656343.775** |
| | **Total for hazard class I** | | **7.538** | **7.538** |
| 35330100 13 01 1 | Mercury lamps, luminescent tubes containing mercury, spent and scrap | I | 7.538 | 7.538 |
| | **Total for hazard class III** | | **168.700** | **168.700** |
| 54100203 02 03 3 | Spent diesel oils | III | 1.585 | 1.585 |
| 54100205 02 03 3 | Spent industrial oils | III | 44.390 | 44.390 |
| 54100213 02 03 3 | Spent hydraulic oils not containing halogens | III | 9.245 | 9.245 |
| 54100212 02 03 3 | Spent turbine oils | III | 40.882 | 40.882 |
| 54100201 02 03 3 | Spent motor oil | III | 28.646 | 28.646 |
| 54100206 02 03 3 | Spent transmission oils | III | 14.403 | 14.403 |
| 54100211 02 03 3 | Spent compressor oils | III | 25.957 | 25.957 |
| 54902701 01 03 3 | Swabbing material contaminated by oils (oil content 15% and over) | III | 1.453 | 1.453 |
| 35310202 01 01 3 | Lead scrap in lump form, uncontaminated | III | 0.000 | 0.000 |
| 92110102 13 01 3 | Spent lead batteries, not dismantled, with electrolyte drained | III | 1.950 | 1.950 |
| 54903000 00 00 0 | Waste from solid production materials, contaminated by petroleum and mineral grease products | III | 0.189 | 0.189 |
| | **Total for hazard class IV** | | **180332.203** | **337949.463** |

| | | | Quantity, t/yr | |
|---|---|---|---|---|
| 31404800 01 99 4 | Hearth cinder | IV | 9.280 | 9.280 |
| 31400100 08 00 4 | Hearth sand from casting | IV | 132.500 | 132.500 |
| 31402303 01 03 4 | Oil-contaminated sand (oil content less than 15%) | IV | 24.080 | 24.080 |
| 54902701 01 03 4 | Swabbing material contaminated by oils (oil content less than 15%) | IV | 12.130 | 12.130 |
| 31403702 01 01 4 | Asbestos waste in lump form | IV | 0.410 | 0.410 |
| 57500202 13 00 4 | Used tyres | IV | 40.203 | 40.203 |
| 17122000 01 01 4 | Timber waste with impregnation and coatings, unsorted | IV | 18906.600 | 18906.600 |
| 91200601 01 00 4 | Building rubble from clearance of buildings | IV | 5778.000 | 5778.000 |
| 91100100 01 00 4 | Waste from dwellings, unsorted (no large pieces) | IV | 681.9 | 686.760 |
| 17110101 01 00 4 | Bark waste | IV | 32712.000 | 262071.000 |
| 94300000 00 00 0 | Waste (precipitates) from mechanical and biological waste water treatment | IV | 21711.600 | 24124.000 |
| 97100000 00 00 0 | Medical waste | IV | 9.500 | 9.500 |
| 17190000 00 00 0 | Other waste from treatment and processing of timber | IV | 84548.000 | 12900.000 |
| 31602300 04 00 0 | Calcium carbonate sludge | IV | 12950.000 | 9735.000 |
| 94100000 00 00 0 | Waste (precipitates) from water treatment | IV | 2816.000 | 3520.000 |
| | **Total for hazard class V** | | **131105.674** | **318218.074** |
| 35130100 01 99 5 | Ferrous metals scrap, unsorted | V | 6557.000 | 6557.000 |
| 35120301 01 99 5 | Alloy steel scrap, unsorted | V | 48.740 | 48.740 |
| 35110101 01 99 5 | Cast iron waste, unsorted | V | 0.270 | 0.270 |
| 35310101 01 99 5 | Aluminium scrap, unsorted | V | 10.580 | 10.580 |
| 35410301 01 99 5 | Brass scrap, unsorted | V | 3.570 | 3.570 |
| 35410201 01 99 5 | Bronze scrap, unsorted | V | 2.030 | 2.030 |
| 92360000 13 00 5 | Insulated leads and cable waste | V | 12.780 | 12.780 |
| 35410112 01 99 5 | Waste containing copper alloys, in lump form | V | 6.740 | 6.740 |
| 31402301 01 99 5 | Waste sand not contaminated by hazardous substances | V | 435.550 | 435.550 |
| 31404302 01 99 5 | Spent abrasive discs, scrap from spent abrasive discs | V | 0.420 | 0.420 |
| 17110400 01 00 5 | Wood chip waste from natural clean timber | V | 16172.000 | 207411.000 |
| 91201400 01 00 5 | Waste (rubbish) from clearing of sites and premises of cultural and sports institutions and after entertainment events | V | 123.240 | 123.240 |
| 31300600 11 99 5 | Wood and straw ash | V | 6417.600 | 6238.000 |
| 35121601 01 99 5 | Residues and discarded metal from welding electrodes | V | 2.316 | 2.316 |
| 57500102 01 00 5 | Rubber off-cuts | V | 0.498 | 0.498 |
| 18710201 01 00 5 | Packing paper waste, uncontaminated | V | 782.600 | 782.600 |

| | | | Quantity, t/yr | |
|---|---|---|---|---|
| 18710300 01 00 5 | Paper and cardboard waste from office and stationery activities | V | 273.300 | 273.300 |
| 91201200 01 00 5 | Waste (rubbish) from clearing of sites and premises for wholesale and retail trade in industrial goods | V | 250.000 | 250.000 |
| 91200600 01 00 0 | Building rubble | V | 12743.000 | 12743.000 |
| 17110503 13 00 5 | Items made of natural timber which have lost their consumer properties | V | 90.700 | 90.700 |
| 18719901 01 00 5 | Other non-contaminated paper waste | V | 5.300 | 5.300 |
| 57100500 13 00 5 | Synthetic cords which have lost their consumer properties | V | 2.300 | 2.300 |
| 57102902 01 99 5 | Polythene waste in film form | V | 41.980 | 41.980 |
| 58101108 01 99 5 | Mixed fibre off-cuts and fragments | V | 218.330 | 218.330 |
| 57101800 13 00 5 | Non-contaminated plastic packaging which has lost its consumer properties | V | 192.000 | 192.000 |
| 17110500 01 00 0 | Wooden cases (non-returnable packing) and wood waste made of natural clean timber | V | 42.000 | 42.000 |
| 58100400 01 95 5 | Cellulose fibre waste | V | 14787.000 | 18728.000 |
| 18710101 01 00 5 | Paper waste from cutting and stamping | V | 20290.000 | 20290.000 |
| 18710400 01 00 5 | Paper and cardboard scraps | V | 51210.000 | 43322.000 |
| 18710202 01 00 5 | Packing cardboard waste, non-contaminated | V | 383.830 | 383.830 |

The expected quantity of wastes after reconstruction will be 311614.115 tpa, which will not have an adverse environmental impact.

### 5.6. Forecast impact of the facility on flora and fauna

The reconstruction of the mill will not affect the fauna and flora in the mill area, since it will take place on the existing site. Industrial impact of this facility on fauna and flora will extend for small distances from its location.

The territory under consideration is mainly occupied by industrial buildings. All proposed and reconstructed facilities will be located on the existing site.

The main impact on vegetation within the facility's impact zone will be exerted by sulphur dioxide and nitrogen dioxide. No MACs for the world of plants have been drawn up in the Russian Federation. The closest to this that has happened is that in 1984 a set of Temporary Norms… was adopted for the woods surrounding the Yasnaia Poliana museum on Lev Tolstoi's estate, according to which the admissible concentration norm for trees (MAC-T) ensuring normal tree vitality was set at 0.35 mg/m$^3$ for sulphur dioxide, or 0.7 MAC, and 0.04 mg/m$^3$ for nitrogen dioxide, or 0.2 MAC.

In 2005, the Komi Biology Institute Scientific Centre (Urals Branch of the Russian Academy of Sciences) was continuing its studies through local monitoring of the impact of man-made emissions from the MBP SIPPM on forest phytocenoses.

The areas studied are located in the middle *taiga* sub-zone of the Komi Republic. The zone covered by man-made atmospheric discharges from the MBP SIPPM takes in the Triokhoziornoe [Three Lakes] Forest Area of the Syktyvkar Forestry Administration and forests that are managed by the MBP SIPPM and agricultural undertakings. The afforested area of the Forestry Administration occupies 92.5%, including 41.8% pine and 35.3% spruce. To assess the effect of discharges from the mill on the forest, the Komi Biology Institute established 4 permanent observation posts (POPs) in a variety of different forest communities. Control studies were performed 50 km to the north of the pollution source in the Kniazhpogostnyi District of the Komi Republic, at 3 permanent monitoring posts. The studies performed to assess the condition of the vegetation cover where pines grow within the impact zone of industrial discharges from the MBP SIPPM provided results which led to the following conclusions from the Institute:

- sulphur builds up most of all on the forest floor, and its content in pine bark and lichens is almost identical. The lowest concentration of it is found in pine needles. Chronic contamination of pine phytocenoses by sulphur-containing substances leads to a rise in the gross sulphur content in vegetation (pine needles and bark, ground and epiphytic lichens) and on the forest floor by no more than 20%;
- over the last 7 years, an increase in reserves of timber in pine stands by 30% compared to 1988 and by 10% compared to the background area has been recorded;
- the reduction in harmful discharges from the mill in recent years has had a beneficial effect on the environment and has helped to restore the natural structure of forestry phytocenoses, which will be fully able to perform their environment-shaping, water-protecting, recreational and aesthetic functions.

During project implementation, the Vychegda, which has the highest fisheries classification, will find itself within its impact area. However, thanks to the use of modern waste water treatment processes, the quality of the fish habitat will not deteriorate.

Assessment of the reconstructed facility's impact on fauna and flora has shown that the impact on the variety of flora, on the structure of plant and soil cover in different parts of the land area, the composition of fauna and hydro-fauna, and the habitat, the number and size of animal populations will not change.

The main impact on vegetation during the operation of the mill will consist in an increase of the heavy metals content of soils and vegetation.
This impact will be limited in area and will be of local character, and will therefore not disturb the ecological balance.

It has been established that facilities occupying large areas have a profound impact on wildlife. The area where the reaction of some species cautious or sensitive to human presence will be apparent is located within a radius of 5 - 7 km.

The reconstruction of the enterprise will not have an adverse impact on wildlife habitats, as calculations show its impact area to be much less than that, and the impact is reduced with increasing distance from the facility.

Harm to wildlife as a result of the reconstruction work, caused by the temporary confiscation of part of the hunting grounds and the lowering of their biological productivity as a result of undesirable successions, will not be able to exert any major impact on game species. It is more likely that any negative impact of the work in question will be felt by the small avifauna, and will lead to an impoverishment in the species make-up of bird communities which are confined in terms of their nesting to the flood-plain vegetation complex.

The impact of the facilities when in operation on the wildlife habitat will be largely restricted to the noise impact zone.

We may therefore say that the negative impact of the envisaged reconstruction on wildlife will be local in nature. Since the reconstruction work is to be carried out within the area of an operating undertaking and without any enlargement of areas, this work will not have any major impact on the way hunting is managed overall.

Operation of the MBP SIPPM will have no impact on the habitat environment already in place, and will not impact on adjacent areas.

### 5.7. Forecast impact of the facility on social conditions and public health

The reduction of gross emissions in atmosphere will lead to environmental improvement in Ezhva region and reduce the risk of respiratory diseases. Surface water and soil pollution is not a determinant of public health.

Implementation of the reconstruction project will have many beneficial impacts on social conditions both in the mill location and in the logging areas:

- The increased raw materials requirement will create jobs in remote regions of the country and improve the living conditions in those regions;
- The increased regional and municipal tax revenues will improve the infrastructure, living conditions and health care in nearby regions;
- Bearing in mind the current socioeconomic situation, the increased mill capacity and reduced emissions and discharges will slow down and significantly reduce adverse environmental impact in the Mill area, and very probably improve the social conditions and health of the population

### 5.8. The impact of the facility in emergency situations

The Mill is a working enterprise and has made provision for the protection of the population and the territory in the event of natural or man-made disasters. The Mill is categorized as a hazardous facility which must have in place a system of emergency prevention and response measures.

For this reason, it pays special attention to the prevention, localization and mitigation of its environmental impact in potential emergency situations.

#### 5.8.1. List of possible emergency situations relating to the collection, transportation and treatment of waste water

This section looks at a list of possible emergency situations and measures to prevent them happening and to confine and clean up the aftermath in waste water collection and transportation systems.

The project thus envisages measures to prevent the production process from having an impact on the environment and on the public in emergency situations.

***The production process*** is one that has been tried and tested and in which no substances presenting an explosion hazard or chemicals of the hazardous or especially hazardous categories are used. Emergency situations could arise at the undertaking as a result of breaches of operating rules, damage to equipment, or power, steam or water supplies being disconnected. These could result in leaks and overflows of circulating water, pulp or chemicals in solution.

To ensure normal process operation and prevent emergency situations, the following have been provided:

- An automatic process monitoring and control system, including signalling of departures from normal values;
- A system of scheduled equipment and instrumentation maintenance;
- Buffer containers for pulp, return water and broke;
- The ability to shut down faulty equipment and processes without interrupting production, due to the availability of pulp storage capacity for 12 hours of operation ahead of sorting and drying, as well as of liquor reserve for 24 hours of operation;
- Liquor vats are provided with drip pans to return the liquor to process if the vat is damaged;
- Continuous monitoring of gas emissions by automatic gas analyzers and adjusting the process in accordance with measurement results;
- Drip pans at storage facilities for liquid chemicals, fuels and lubricants and flammable liquids;

The use of an hourly fresh water consumption and waste generation variation coefficient, which takes into account changes in water consumption and water removal systems.

If the supply of steam vapour, water or electric power is interrupted, the plant shuts down and so do discharges and emissions.

***Prevention of emergencies with potential impact on the soil***

A potential source of soil pollution is solid waste, such as bark and wood waste generated by the chips production process. To prevent emergencies resulting in the shutdown of the wood preparation shop and the bark incineration boiler house from affecting one another, the boiler house will have an adjacent bark storage facility.

**List of possible emergency situations in the waste water collection, transportation and treatment system**

Table 5.22

| Workshop, facility, section | Production process | Possible emergency situation and its consequences | Cause of emergency | Emer |
|---|---|---|---|---|
| Pumping plant for waste water, precipitate and sludge | Pumping waste water to treatment plants, and precipitate and sludge | 1. Power disconnection. Waste water ceases to be delivered to treatment plant. Waste water dumped on terrain and in water body without treatment | Failure in undertaking's cable networks or sub-stations or in pumping plant controls | Power s 2 indep feeders |
| | Pumping waste water to treatment plants | 2. Pump or motor failure. Reduced waste water flow rate, reservoir overfills, waste water spills into terrain and water body | Physical wear; failure to adhere to preventive maintenance schedule; equipment manufacturing fault | Back-up up conn operatin |
| Waste water header tanks | Pumping waste water to treatment plants | Fracture of delivery pipe. Waste water spillage onto terrain followed by dumping in river via storm drain system without biological treatment | Worn pipework, concealed defect, water hammer as a result of non-observance of operating rules | Automa monitor emerge pumpin observa pipes la |
| Waste water (domestic and production) treatment installation | Treatment of undertaking's waste water prior to discharge into water body to meet standards | 1. Disconnection of power. Waste water treatment process halted | Failure in cable network | Automa from su |
| | | 2. Failure of pump electric motor or other equipment. Treatment process disrupted | Physical wear or parts failure. Failure to adhere to preventive maintenance schedule | Installa automat capacity reserve hydraul |
| | | | Sectionalising facilities to give potential to disconnect aeration tank or settling tank section to allow routine or emergency repairs without any fall in overall output | |

| Workshop, facility, section | Production process | Possible emergency situation and its consequences | Cause of emergency | Eme |
|---|---|---|---|---|
| | | 3. Arrival of sudden waste water discharge at high concentration. Disruption to treatment regimen with deterioration in indicator values and discharge of inadequately treated waste water | Emergency in main production process, in storage areas, accidental discharge of alkalis or chemicals | Provisio aerator/ concent the pr emerge effluent aeration measuri facilitie control |
| | | 4. Biological treatment process out of balance. Bulking and elevated efflux of active sludge from domestic water installation. Deterioration in indicator values for treated waste water and discharge of inadequately treated waste water | 1. Arrival of sudden waste water discharges from production process<br>2. Disruption to operating regimen | Signalli specific |

It will therefore be seen that the project includes measures to prevent the facility impacting the environment and inhabitants in emergency situations

***The manufacturing process*** is well understood and proven, and does not use explosion-hazardous substances or hazardous or highly hazardous chemicals. Emergencies may occur in the case of process disruption, equipment breakdown, or the loss of power, steam or water supply, which could lead to leakages or overflows of recirculating water, pulp or chemical solutions.

The following systems and facilities have been provided to safeguard the process and prevent accidents:

- An automatic process parameter control system with deviation alarms;
- An equipment and instrumentation scheduled maintenance system;
- Buffer containers for pulp, recirculating water and off-specification product returned to process;
- Shut-down of faulty equipment or process without interruption production, thanks to the availability of spare pulp storage capacitys upstream of the screens and driers, sufficient for up to 12 часов, and of liquor storage capacity sufficient for 24 hours;
- Placing drip pans underneath liquor storage tanks to enable liquor to be returned to process if the tanks are damaged;

- Continous monitoring of gas releases by automatic gas detectors whose readings are used to adjust the manufacturing process
- Providing drip trays in liquid chemicals, fuels, lubricants and flammable liquids warehouses;
- The use of a hourly coefficient of variation factor of fresh and waste water consumption to allow for changes in the water consumption and disposal system.

In the event of loss of power, steam or water supply, the plant is shut down and waste water disposal and gas emission are stopped.

***Preventing potential emergencies with an impact on soils***

Solid production waste, such as bark and wood waste generated during the process of wood chip preparation, forms a potential source of soil pollution. A bark storage facility has been providedoutside the boiler house to avoid the mutual impact of emergencies caused by the shut-down of the wood preparation shop and of the bark-burning boiler house.

# 6 ANNEXES

**Annex 1.**
**Letter No. 06-22b/60 of 26.02.2007 from the Central Office of Hydrometeorology and Environmental Monitoring concerning the climate and background air pollution of Syktyvkar's Ezhva District**

**Annex 2.**

**Point source emissions permit No. 01062 of 01.04.2006 issued by the Pechera Interregional Office of the Federal Environmental, Engineering & Nuclear Inspectorate**

**Annex 3.**
**Air pollution in the Mondi Business Paper Syktyvkar Pulp and Paper Mill impact zone measured by the Komi Republic Central Office of Hydrometeorology and Environmental Monitoring at Monitoring Station No. 10 in Syktyvkar's Ezhva District in June and July 2006**

**Annex 4.**
**Form 2-TP (Air) – Information on air protection measures implemented by Mondi Business Paper SIPPM in 2006**

**Annex 5. Pollutant concentration patterns**:

## Annex 5.1 Actual status

## Annex 5.2. Proposal

## Annex 5.3.
## Potential deviations

**Annex 6. Site plan, Scale1:25000**

**Annex 7. Site layout, Scale 1:2000**

## Annex 8. Water consumption limits for 2006

## Annex 9. Water consumption limits for 2007

**Annex 10.**
**Water licence SYK No. 00028 BREZKH of 18.12.2006**

**Annex 11.**
**Schedule 1 to Water licence SYK No. 00028 BREZKH of 18.12.2006**

**Annex 12.**
**Form 2-TP (Water Management) – Information on water use in 2006**

**Annex 13**
**Pollutant discharge permit (water bodies) No. 215 of 29 June 2007**

**Annex 14.**
**The quality of water discharged by MBP SIPPM in 2006**

**Annex 15.**
**Schedule of MBP SIPPM biologically treated waste water discharges into the Vychega prepared by the Environmental Protection Department's Industrial Hygiene Laboratory**

**Annex 16.**
**MBP SIPPM environmental protection plan for 2007**

## Annex 17.
## Implementation of MBP SIPPM environmental protection plan for 2006

**Annex 18.**
**Letter No. 06-22/204 of 09.08.2005 from Komi Republic Central Office of Hydrometeorology and Environmental Monitoring**

**Annex 19.**
**Letter No. 06-22b/239 of 07.08.2007 from Komi Republic Central Office of Hydrometeorology and Environmental Monitoring**

**Annex 20.**
**Polluted waste water discharge requirements, 01.06.2005**

**Annex 21.**
**Letter No. 05-2815 of 21.10.2003 from the Komi Fish Farming Enterprise, FGU Komirybvod**

## Annex 22
## Post-reconstruction water consumption/discharge balance

**Annex 23. Form 2-TP (Solid Waste) for 2006**