Report on
modern waste water treatment methods implemented
by "Arkhangelsk Pulp and Paper Factory" OJSC

«Arkhangelsk Pulp and Paper Factory» OJSC produces bleached sulfate and unbleached kraft pulp, neutral sulfate semichemical pulp and manufactures on their basis commercial bleached pulp, container board, writing and printing paper, copybooks; fiber board. «Arkhangelsk Pulp and Paper Factory» OJSC produced 810.22 thousand tones of pulp in 2009.

The enterprise is one of the largest natural resources users in the Arkhangelsk region.

«Arkhangelsk Pulp and Paper Factory» OJSC provides water- and heat supply for Novodvinsk and carries out the city's waste water treatment.

In 2001 the enterprise adopted its environmental policy officially, then in 2003 it carried out assessment audit of ecological management system. Based on its results the decision was made to issue the ecological management system conformity certificate to 14001 ISO standard requirements and its mutual integration with quality management system.

At present «Arkhangelsk Pulp and Paper Factory» OJSC has well-functioning integrated management system which includes:

- quality management system according to ISO 9001.
- environmental management system according to ISO 14001
- labor safety management system according to OHSAS18001

During preparation for environmental management certification the environmental policy was improved, procedures and resources needed for environmental management were defined. The enterprise worked out a new standard which determines industrial environmental monitoring procedure and executives' responsibilities. The enterprise staff and executives were trained in environmental issues.

The enterprise property includes biological wastewater treatment facilities with 27.8 thousand m^3 per hour capacity, mechanical wastewater treatment facilities with 4 thousand m^3 per hour capacity.

«Arkhangelsk Pulp and Paper Factory» OJSC biological wastewater treatment facilities are for the enterprise industrial sewage and sanitary sewage and for Novodvinsk city sanitary sewage.

Biological wastewater treatment facilities were commissioned in 1967. The facilities were designed to carry out mechanical wastewater treatment (separately for sanitary and industrial sewage) and biological treatment in aerotanks with sludge.

After the construction and bleached sulfate production start the decision was made to enlarge treatment facilities so in 1977 additional facilities for sanitary and industrial sewage treatment were commissioned.

At present biological wastewater treatment facilities have the following flow chart (see the flowchart).

Sewage in total 17 thousand m^3 per hour enter the treatment facilities in 5 flows. First comes mechanical treatment which is carried out in three groups of primary sedimentation tanks. Industrial sewage mechanical treatment takes place in radial-flow tanks, sanitary sewage – in vertical tanks. The mechanical treatment phase includes sanitary sewage disinfection as well.

After mechanical treatment all sewage enters a balancing tank where it is mixed, its composition is integrated, and it undergoes oxygen saturation. Then in one flow sewage enters biological treatment which has three stages.

At the first stage sewage biological treatment is done in a bioreactor with the anoxic attached microflora technology applied. This technology was adopted in 2007 – 2008. Floating packing volume makes up 17% of the bioreactor volume. Air is supplied to the bioreactor to provide microorganisms' activity and to mix packing. Aqua ammonia and ammophos solution are used as biogenous nutrients.

During the 2^{nd} and 3d stages treatment is performed in sequence in aerotanks with active sludge applied. To saturate the sludge mixture with oxygen and to keep sludge suspended air is supplied to the aerotanks.

Sludge is settled in radial flow tanks: after the 2nd stage in intermediate tanks, after the 3d stage in secondary tanks. After that the effluent is disposed into a water object, the Northern Dvina river.

Excessive sludge and sediment from wastewater mechanical treatment are directed to sludge consolidation tanks for densifying and then to press-filters for dewatering. Dewatered sediment and excessive active sludge (150-170 tonnes/ day) are partially taken to industrial waste landfill of the enterprise (up to 70%) and partially burnt in bark boilers with the boiling bed in Thermal power plant 3 (up to 30%).

In 1999 the implemented technologies were analyzed and treatment facilities work was assessed. As a result a decision was made to take action aimed at intensifying treatment facilities work and to find technical solutions and decrease polluting substance content in sewage coming to the facilities.

In the period of 2000 – 2010 sewage biological treatment facilities were renovated:

1. The aeration system second stage was reconstructed and the fine bubble diffuser was installed;
2. The sewage sediment dewatering shop floor was reconstructed and more press filters were installed;
3. Secondary sedimentation tanks were reconstructed and thin-layer modules were installed;
4. The 1st stage aerotank was modernized utilizing the attached microflora technology;
5. The pump station was modernized of primary sedimentation tanks, biological treatment;
6. Flocculant supply started for primary sedimentation tanks and sludge consolidation tanks, biological treatment.

The data of 2008 – 2009 shows that biological treatment facilities efficiency was: KOI – 84%, BOD – 95%, phenols – 99.9%, thiolignin – 94%.

Mechanical treatment facilities were reconstructed. The reconstructed facilities list:

1. Sedimentation tanks: thin-layer modules were installed and water-collecting system was reconstructed;
2. The screens were replaced with new ones produced by “Riotech”;
3. The pumping boost was reconstructed with chemicals preparation unit and sediment pumping station.

Measures aimed at the water basin protection during this period cost 2545 million rub.

Simultaneously from 2000 till 2010 for the main production units:

1. New wood-preparation shop 4 was constructed and commissioned to replace deteriorated wood-preparation shop 2. Shop 4 utilizes timber dry-barking technology.

2. Cardboard machines 1 and 2 were reconstructed (cardboard production).

3. New cleansing equipment by Chemie-Washer was installed (cardboard production).

4. Screens were reconstructed (cardboard production).

5. Two bark boilers were replaced with boiling bed boilers, equipped with electric filters, gas-treatment machines for stack gases dry scrubbing.

6. The bark-preparing unit of wood-preparation shop was modernized.

7. Evaporation trains 1 and 2 were reconstructed (cardboard production).

8. Mechanical treatment of wood-preparation shop floor 3, FOS-2, DPV, was replaced with biological treatment.

Environmental measures costs were more than 5 billion rub.

During 2001-2008 measures aimed at implementing resource-saving technologies and minimizing pollutant content, improving biological treatment facilities efficiency and establishing modern environmental management system enabled us to increase production environmental efficiency.

From 2000 till 2009 alongside with cooking production growth by 18.8%:

- annual growth discharge of pollutants into the water object decreased by 70%, including solid soils by 80%, lignin substances by 66%, KOI rate decreased by 67%, BOD by 75%.
- specific pollutants discharge into the water object was the following:

- *for bleached pulp*: KOI – 9.69 kg per tonne, solid soils - 0.762 kg per tonne, BOD5 – 0.658 kg per tonne.

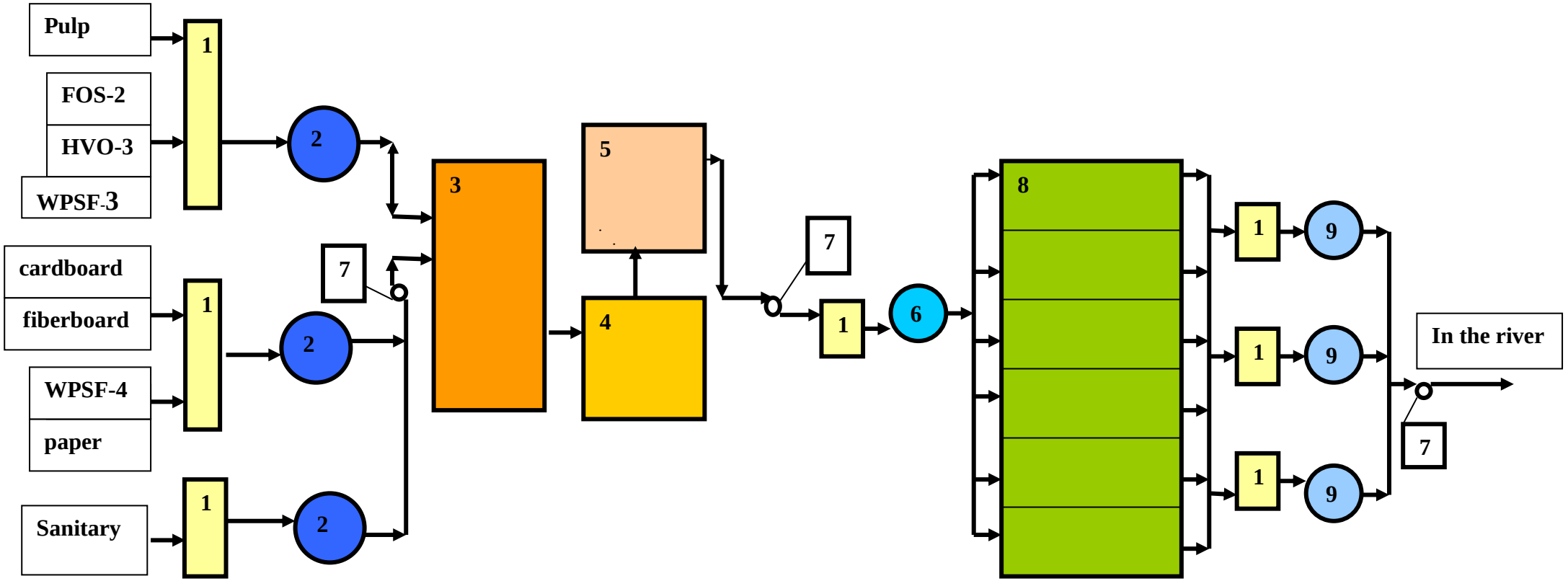
- *for unbleached pulp*: KOI – 11.247 kg per tonne, solid soils - 1.734 kg per tonne, BOD5 – 0.859 kg per tonne.

Picture:
Pollutants discharge and pulp cooking
«Arkhangelsk Pulp and Paper Factory» OJSC
2000 – 2009

At present the enterprise is in compliance with 13 Permissible Release standards out of 16 regulated measures of discharge in water and works within the set limits of solid soils, KOI, BOD.

In the nearest future the enterprise is planning to start investment project “Cardboard production reconstruction” implementation. It includes new semi-chemical pulping section construction, new evaporation train construction. There are also plans to install sewage local treatment for paper and cardboard shop floor and wood-preparation shop floor # 3.

Flow chart
Of sewage biological treatment facilities of«Arkhangelsk Pulp and Paper Factory» OJSC



1 – distributing basin
2 – primary sedimentation tanks
3 – balancing reservoir
4 – bioreactor
5 – aerotank of the 1st stage
6 – intermediate tanks
7 – pumping boosts
8 – aerotanks of the 2nd stage
9 – secondary sedimentation tanks