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**Federal Ministry for the
Environment,
Nature Conservation,
and Nuclear Safety**



**Federal Environmental
Agency**



**Federal Service
for Technological Supervision**

„Technology Transfer for the Improvement of Plant Security and Environmental Protection in the Russian Pulp and Paper Industry”

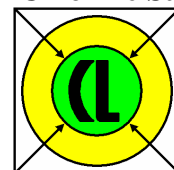
Summary of the Final Report

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WTTC



**Russian Center
for Chlorine Safety**



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1. Introduction

The cellulose industry is one of the most important branches of industry in the Russian Federation. Questions regarding improved plant safety and the reduction of the environmental impact of cellulose-producing installations are of the utmost importance to Russian regulative authorities and institutions as well as for international organizations and the public.

Those responsible for the implementation of the German-Russian agreement to cooperate in the area of environmental protection supported the suggestion to conduct this project because of the importance of the issues it addresses. Financing for the project was provided by the Consultation Assistance Program of the German Federal Ministry for the Environment, Nature Conservation, and Nuclear Safety available to countries of Central and Eastern Europe.

The Federal Environment Ministry in Germany and Gosgortekhnadsor (Federal Office for the Technical Supervision) in the Russian Federation took on the professional and institutional management of the project. WTTC (Berlin) in Germany and The Russian Center for Chlorine Safety (Moscow) in the Russian Federation were directly responsible for the implementation of the project. The region of Kaliningrad, which houses three cellulose manufacturing plants, was chosen as the pilot region for the implementation of the project. Due to its location at the border between the EU and Russia, it is an area of great importance for both the Russian Federation and the EU.

Numerous representatives of Russian and German as well as international organizations, governmental authorities, and companies contributed actively to the project and provided one another with reciprocal support.

2. Goal and Agenda of the Project

The primary goal of the project was to explore the possibilities for modernizing Russian companies by applying the experiences of Germany and other countries of the EU in this field to the pilot companies in Kaliningrad.

The main stages of project implementation were:

- Presentation the lessons learned in Germany from modernizing cellulose production to representatives of Russian companies and government authorities
- Analysis of current situation in the companies of the pilot region
- Improvement of the methods used to analyze current situation and development of concepts for modernization
- Development of exemplary modernization concepts for pilots
- Illustration and presentation of the project findings

3. Stages of Implementation

3.1. Presentation the Lessons Learned in Germany from Modernizing Cellulose Production to Representatives of Russian Companies and Government Authorities

The primary component of this stage of the project was an informational visit of representatives of Russian companies to Germany. The purpose of this visit was to gather information on the use of modern technologies by German cellulose manufacturers as a means of reducing environmental impact, increasing plant safety, and improving economic viability. The visit also allowed the representatives to observe how manufacturers and authorities in Germany develop and carry out modernization concepts within the restraints of company policies and regulations.

Particular attention was paid to prevailing standards required by European and national law, including the practices necessary to implement EU directives and international conventions (e.g. the EU directives IPPC, SEVESO II, the convention to curb the affects of industrial accidents across national borders, etc.) in practice. At the core of the presentation was BREF for the cellulose and paper industry (Reference Document on Best Available Techniques in the Pulp and Paper Industry), which was developed in the EU, and its practical use by companies as well as by the authorization-granting and regulation authorities.

The visiting participants were introduced to „Checklists for the Examination and Assessment of the Handling in Plants Utilizing Water Compromising Substances and Preparations“ which was devel-

oped in accordance with recommendations of The International Commissions for the Protection of the Rhine and Elbe Rivers within the context of projects directed by the German Federal Environment Ministry.

The following companies and institutions were visited during the informational visit: Pulp and Paper Factory Rosenthal GmbH & Co. KG, M-real Stockstadt GmbH, SCA Hygiene Products GmbH Mannheim, Federal Research Centre for Forestry and Forest Products at the University of Hamburg. A comprehensive consultation took place in the Federal Environment Ministry at the end of the stay, during which further stages of the project were discussed and at which various German firms presented innovative technological solutions to the problems of the pulp and paper industry.

During the visit to Pulp and Paper Factory Rosenthal GmbH and Co. KG, technological innovations that had been successfully applied to the modernization of production were demonstrated. The process by which the companies worked together with the authorization-granting and regulation authorities from beginning to end, starting with the development of a concept for modernization up through its complete implementation, was also elucidated. The integrated process of allocating permits through the so-called „Star Procedure“ (One-Stop-Shopping) was explained in detail to the Russian representatives. In this process, an only authority is responsible for the granting of the operation permit which, in this particular case, involved the co-operation of 25 government authorities and organizations.

Attention was paid particularly to the means by which they were able to meet the strict waste water quality requirements given the particular parameters set by the production site and the type of wood processed.

The complete modernization of the installations, which has a production capacity of 280 thousand tons of sulfate cellulose per year (spruce/pine) took 18 months, including a 7-month period during which production was shut down. The total investment was approx. 300 million Euro, 30% of which was a direct investment into the environmental protection. The timespan from the presentation of the first plan for modernization until the acquisition of an operation permit was 31 months.

During the visit of the company M-real Stockstadt GmbH (production of sulfite cellulose by the MgBi technology, capacity of 160 thousand tons cellulose per year, integrated paper production), attention was focused on the lessons learned from their step-by-step modernization of production. Since 1991, their cellulose is bleached with peroxide without use of chlorine (TCF). The degree of whiteness achieved is 88%. 70% of the energy requirements for production are covered by the incineration of concentrated black liquor, bark, and rejects. The technology used enables the recovery of chemicals to a great extent. The waste water treatment system, including an aerobic-biological waste water treatment plant, makes it possible to meet the strict quality requirements for the water that is discharged into the river Main. The CSB-, BSB-, and pH values as well as the conductivity

and solid-fuel levels will be daily controlled by the company. Reference was made to the system currently used in Germany which encourages investments that work toward reduced environmental impact while financing modernization. In this way, the company has been reimbursed for the costs of waste water discharge for the past three years and the result of this investment has been a 20% decrease in the CSB concentration.

The company SCA Hygiene Products GmbH Mannheim presented the results of its step-by-step modernization of production over the course of the past 30 years. At present, 225 tons of cellulose (magnesium-bisulfate procedure) are bleached each year by the company without the use of chlorine. The company's integrated production includes the manufacture of paper and tissue. In reference to the waste water problem, the need for a many-faceted approach to modernization was emphasized, including an integrated optimization of technological processes in keeping with both ecological requirements and the effective use of financial resources.

During the visit to the Federal Research Centre for Forestry and Forest Products at the University of Hamburg, an organizational scheme of applied research studies, including their sources of financing, was presented.

3.2 Present State Analysis at Companies in the Pilot Region

Included in the project plan was the carrying-out of a present state analysis on security and ecological conditions in two Russian pilot companies. Following the informational visit of Russian colleagues in Germany and the consultations that were conducted within the framework of this visit, the present state analysis was conducted in all three of the pulp and paper manufacturers in the Kaliningrad region: Nemanskij ZBK, Sowjetskij ZBS und AG »Zepruss« (Kaliningrad).

The present state analysis was conducted by the project working group. Active participants were those responsible for the implementation of the project, representatives of the companies in the Kaliningrad region, and representatives of Russia's regional administration of the Federal Service for Technological Supervision.

The following served as aids for carrying out the analysis:

- The „Checklists for the Examination and Assessment of the Handling in Plants Utilizing Water Compromising Substances and Preparations“
- Questionnaire developed by WTTC tailored to the needs of cellulose production, which build a core stone of additional check – lists..

The present state analysis also included:

- A comparison of production in the companies in the Kaliningrad region (incl. ecological parameters, e.g. water consumption during production, waste water values) and German companies using the parameters set forth in the document «Best Available Techniques».
- Information on existing plans, modernization proposals, and their current realization status.

The present state analysis examined the following important areas of production:

- Water treatment (preparation/processing/purification)
- Wood processing (preparation/treatment)
- Cooking
- Screening/Washing
- Bleaching
- Treatment and Utilization of black liquor/bleached stock
- Waste water purification

The results of the present state analysis served as the basis for setting modernization goals and determined the actual content of the step-by-step modernization concept for the pilot companies.

3.3 Development of a Model Concept for the Step-By-Step Modernization of Two Pilot Companies in the Region of Kaliningrad

In response to both the results of the present state analysis in the three pulp and paper manufacturing plants in the Kaliningrad area, and to the consultations regarding the modernization goals of the companies, the cellulose manufacturers ZBK Nemansk and ZBS Sowjetsk were chosen as pilot companies

The development of modernization concepts proceeded with a focus on :

- EU - Reference Document on Best Available Techniques in the Pulp and Paper Industry (<http://eippcb.jrc.es>). The goals of a comprehensive, long-term modernization of cellulose production were determined in accordance with the above-mentioned document. This includes a change in cooking to MgO/SO₂ including the ability to recover chemicals and bleach without the application of chlorine. Concerning the waste water treatment, a decrease in waste water of up to approx. 30% after the implementation of the above-mentioned measures was discussed. The results of this are illustrated in the diagram of the comprehensive modernization concept below.
- Documents that outline the current requirements regarding environmental impact (including the HELKOM recommendation 17/9, which comes into force for Russian companies on January 1, 2005 – see <http://www.helcom.fi/helcom/recommendations.html>).

In response to:

- the complex nature of the cellulose production process and the high cost of modernization
- the need to solve acute problems
- the unfavorable conditions, relative to those in Germany, for securing financing
- the lessons learned from the modernization of industrial production in countries with „transition economies“.

The modernization concepts are of a step-by-step nature and are categorized into blocks of short-, medium-, and long-term (or least expensive, more expensive, most expensive) measures for each given sector of production. They also contain, when possible, alternative suggestions. The individual blocks are recorded in the catalogue of modernization measures, which is accompanied by an investment plan. An excerpt of a catalogue for modernization measures is given in the table below.

Considering the nature of cellulose production and the working conditions of the Russian companies, the following criteria guided the process of developing a concept for modernization:

- it is essential that various branches of production be in agreement with one another on the modernization measures
- it is necessary, in the analysis of "investment costs → operative costs → results" for the modernization measures that affect individual areas of production to consider the possible effects they would have on other areas of production as well as on production as a whole.
- in order to achieve maximum economic effect, the short- and medium-term modernization measures should be implemented such that, when possible, they serve as the basis or components of the overall process of modernization (cube in cube methodology)

The exemplary modernization proposals developed for the two pilot companies in the Kaliningrad region – Nemanskij ZBK und Sowjetskij ZBS – were presented in consultations, discussed, and were recommended as the basis for the modernization of production. All interested parties participated in these consultations: companies, regulatory authorities, regional administrative organs, international organizations and, last but not least, public, non-governmental organizations.

	Area of Production	Short-term	Medium-term	Long-term
1.	Water Preparation	Estimate total water usage, water loop arrangement, Inspect plant technology/equipment, Study on intensifying fresh water processing	Decrease in need for fresh water to 1/3 of amount currently needed	
2.	Wood Processing	Inspection of the debarking drum, Inspection of the chipper Measure noise level	Mechanical reprocessing of poorly debarked wood	
3.	Cooking of Cellulose	Optimize running time of boiler	Change boiler heating process	Switch to Mg-Base Change in boiler emptying process

4.	Washing and Screening	Develop a plan to improve liquid waste collection and purification of waste water created by industrial processing	Multi-level washing Disposal of Waste Gas	Bring Laugen regeneration kettle/drum into service
5.	Bleaching of Cellulose	Plan for transition to chlorine-free bleaching and testing of models on laboratory scale Oxygen pre-bleaching	Process with ClO ₂ , or Process with two-step hydrogen peroxide bleaching	Transition to chlorine-free bleaching
6.	Black Liquor Treatment and Utilization	Modernization of the Barm production (minimal costs)	Increase in capacity of the evaporation facilities	Regeneration of bases with recovery of chemicals Incineration water loop arrangement
7.	Waste Water Treatment Plant	Monitoring of Sewage Quality (e.g. AOX measurements) Study of Partial Current Waste Water Treatment Waste Water Treatment Plant for Bleaching Waste Water	Reduce total waste water to 1/3 of the current amount	Introduction of mechanical-biological waste water treatment and possible construction of a central waste water treatment plant

The costs of previous modernizations, those from the above-mentioned EU document, and/or from the operations of the German cellulose manufacturers were used to calculate the estimated investment costs for the individual areas of production. When available, the estimates of suppliers or the company itself was used. The investment plan was divided into the following categories: primary facilities, secondary facilities, repair/reconstruction of existing equipment, pipeline, insulation, instruments, control panels, electronic technology, assembly and disassembly, replacement parts, construction, indirect costs, and misc..

3.4 Improvement of the Tools Used to Conduct Present State Analysis and the Development of Modernization Plans in Keeping with the Particular Requirements of Cellulose Manufacturing

One of the most pressing tasks of this project was to develop the tools for conducting a present state analysis and to develop a modernization plan in keeping with the needs by cellulose manufacturing industry. This was done using „Checklists for the Examination and Assessment of the Handling in Plants Utilizing Water Compromising Substances and Preparations“, which were developed in accordance with the recommendations of the International Commission for the Protection of the Rhine, Danube and Elbe Rivers.

The starting point for this approach was to examine the appropriateness of existing checklists („Basic“ Checklists) for conducting the present state analysis and the development of modernization concepts in the pilot cellulose production plants.

The result of this was the suggestion that the „Basic“ checklists have been expanded by two additional blocks:

- "Information" Check - lists
- „Technology“ Check - lists

The „Information Checklists” contain essential information on:

- the character and scope of production
- the use of water compromising substances and preparations specific to cellulose production
- the goals of modernization at individual stages

The "Technology" checklists serve to identify remaining technological deficits through a comparison of the technologies implemented in the company to those presented in the „Reference Document on Best Available Techniques in the Pulp and Paper Industry“, published by the EU. In doing so, each significant area of production will receive its own separate checklist.

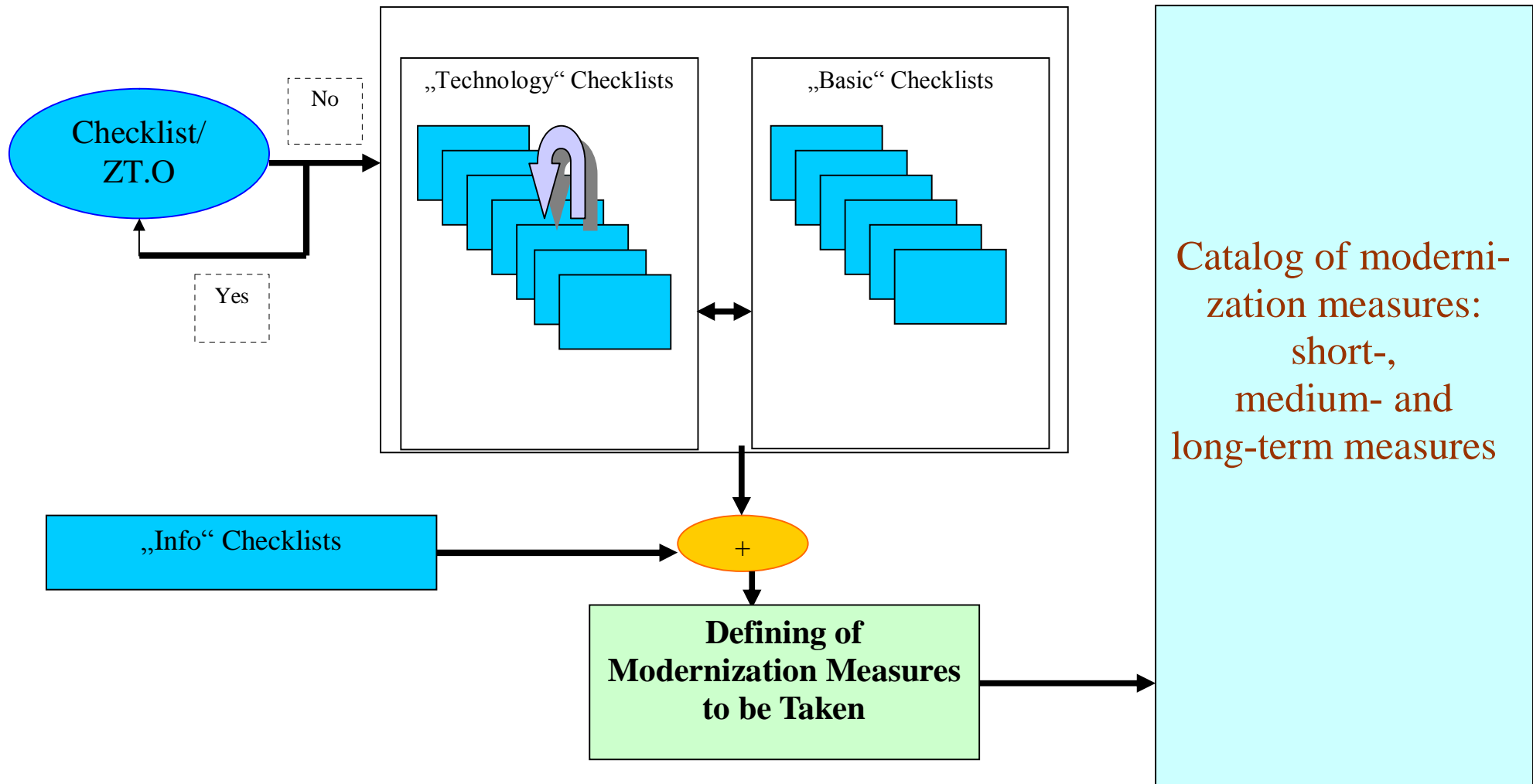
The algorithm for application of the checklists (see diagram below) anticipates a series of a iterative steps that will make possible an in-depth analysis of production and, upon the weighing of various alternatives, can lead to balanced modernization plan:

- Step 1 – Comparison of the technologies used in each important area of production of the company with the technologies described in the BREF document.
- Step 2 – in the case that there are discrepancies between the two:
 - Identify possible alternative measures for technological modernization
 - Examine need for simultaneous modernization measures for the remaining areas of production
 - Examine the need for technological and technical changes as outlined in the „Basic“ checklists,
 - Comparison of the predicted results of modernization with the goals or tasks of modernization as determined by the evaluation of the "Information" checklists
 - Where the predictions and checklists coincide, look into options for financing

These checklists are an effective instrument that can be used to:

- Control the conditions of production through company management and the regulation authorities and enable organizations of experts to analyze the conditions of production.
- Create and make available databanks on production plants that are potentially dangerous on either a national or international scope.
- Develop modernization concepts for production plants
- Improve the controlling conditions in the production plants of companies, the organization of technical maintenance, development of an alarm system, and prevention of accidents/breakdowns.

Algorithm for the Use of Checklists



4. Primary Findings of Project

- The representatives of the Russian companies and government authorities were informed about the requirements of and lessons learned in the process of modernizing cellulose production installations in Germany.
- A present state analysis was conducted on three cellulose production installations in the region of Kaliningrad in the Russian Federation.
- The exemplary modernization concepts developed for two pilots - Nemanskij ZBK und Sowjeskij ZBS – were recommended as the basis for carrying-out modernization in the cellulose production facilities of the Russian companies.
- The „Checklists for the Examination and Assessment of the Handling in Plants Utilizing Water Compromising Substances and Preparations“ extended for the implementation in pulp industry, which were amended during the Russian-German co-project to accommodate the special requirements of cellulose production, were recommended by the UN/ECE working group for implementation in countries that have agreed to the terms of the International Convention to Prevent and Limit Transboundary Effects of Industrial Accidents.

The primary findings of the project are presented on the internet: www.wttc.de/projekte.htm and www.umweltbundesamt.de/anlagen.