

Impressions of Research Management and Some Programs of Research in the U.S.S.R. Pulp and Paper Industry

by Dr. Pierre R. Gendron
and Dr. Lionel A. Cox

Information
Report
DPC-X-4



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Directorate of Program Coordination
Department of the Environment
Canadian Forestry Service
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Introduction

In September 1971, an initial meeting was held in Ottawa between representatives of the Forest-Based Industries of Canada and the Union of Soviet Socialist Republics. At this meeting a protocol agreement was signed, providing for the exchange of delegations to study the "Organization and Administration of Research and Development in the Pulp and Paper Industry of the U.S.S.R. and Canada".

The Canadian delegation, under the sponsorship of the Canadian Forestry Service of the Department of the Environment, consisted of the following representatives, one being from eastern Canada and the other from western Canada:

Dr. Pierre R. Gendron,
President,
Pulp and Paper Research Institute of
Canada
and
Dr. Lionel A. Cox,
Director of Research,
MacMillan Bloedel Limited.

These two delegates visited the U.S.S.R. during the period of October 1 to October 16, 1972. This report deals with that visit.

Following the U.S.S.R. trip by the Canadian delegation, two U.S.S.R. delegates visited Canada from November 22 to December 7, 1972. The U.S.S.R. representatives were:

Mr. Nikolay G. Nikolsky,
Chief, Technical Department and Member
of the Board,
Ministry of the Pulp and Paper Industry of
the U.S.S.R., Moscow
and
Yarov V. Nikitin,
Head, Water Usage Laboratory,
State Scientific Research Corporation,
Ministry of the Pulp and Paper Industry,
Leningrad.

This report contains the authors' impressions, observations, and conclusions which resulted from their two-week tour of the industry in the U.S.S.R. While the short duration of this visit restricted to some extent the scope of the survey, it is hoped that the report will give the reader some understanding of the organization and administration of the research and development programmes of their pulp and paper industry, the methods of planning and operation used in their science and technology institutes, and the results they have obtained in applying their research.

Most of the conversations held during this tour required a two-way translation. Because of this some minor misunderstandings may have occurred, although the authors acknowledge with much appreciation the high calibre of the two interpreters who accompanied them on the trip. If any reader notes any errors in fact contained herein, the authors would appreciate being advised of them.

The Main

Purposes of the Trip

1. To visit and make contact with key personnel in the following U.S.S.R. organizations:
 - a) Ministry of the Pulp and Paper Industry, Moscow.
 - b) The major research and development institutes in Moscow, Leningrad and Kiev connected with the Ministry.
 - c) Higher educational institutes—parts of the Academy of Sciences of U.S.S.R. doing pulp and paper research.
 - d) Experimental factory for the production of prototype machines and equipment in Leningrad—part of the Petroleum and Chemical Industry.
 - e) The Mill Design Institute in Leningrad—part of the Ministry of Pulp and Paper Industry.
2. To determine the organizational structures of the research and development institutes in the Soviet Pulp and Paper Industry.
3. To observe their facilities and equipment.
4. To assess the nature and quality of their R&D work.
5. To learn how they train and recruit technical personnel for their industry.
6. To discuss the financing and establishment of priorities for their research and development work.
7. To determine the main technical problems in the U.S.S.R. pulp and paper industry, and how they are solving these in their research laboratories.
8. To outline new Canadian products and processes which Canadian companies may wish to sell to the Soviet Union.
9. To learn how the U.S.S.R.'s technology in the pulp and paper industry is transferred from R&D institutes into products and processes in their mills.
10. To determine how the U.S.S.R. coordinates all its research for the industry at technological institutes and universities.
11. To improve relationships and to suggest how to make future exchanges more feasible and valuable to Canada and the U.S.S.R.

Major Findings and Accomplishments

1. At the present time, the U.S.S.R. lags behind Canada in pulp and paper technology. However, the Soviets have made and are continuing to make large increases both in quantity and quality of staff involved in research and development for their industry. We believe that in five years' time, they will have achieved a technological level equivalent to that existing today in the Canadian industry; and quite possibly their pulp and paper technology may surpass that of Canada 10 years from now, unless Canada increases considerably its research and development efforts. The U.S.S.R. industry has been given a higher priority by GOSPLAN (top State Planning Committee) in its latest five-year plan.
2. Bureaucratic organizational structures in the U.S.S.R. result in certain inefficiencies and delay in exploiting technical developments. However in view of the major effort being put into research and development, and their strong interest in obtaining the best technology available from the Western World, we believe that the Soviets can and will streamline their organizations in order to speed up the application of the latest technology—either "home grown" or imported.
3. The Soviets are willing to exchange with other countries both their technology and their scientists and engineers, in order to improve their technological competence in pulp and paper. By such exchanges, they believe they can adopt Western productivity methods, and thus become a greater force in the industrial economy of the world. We believe however that the biggest stumbling block to such development of their industry will be the concentration of decision-making at high organizational levels, and a rigid adherence to bureaucratic structures. Only if they are able to push decision-making well down the ladder, will they be able to achieve their goals.
4. Up to the present time, the U.S.S.R. pulp and paper industry has been directed mainly towards producing certain specialty papers needed for their higher priority industries, such as electronics, heavy electrical industry and computers. However, it is now moving rapidly into consumer products. Initially, this is to satisfy the domestic market, but in the long run may result in competition in world markets.
5. Although the Soviets are currently exporting wood chips to Finland, they are determined to produce more pulp in their own country, and to export only wood pulp, and paper products. This could introduce additional competition for Canadian pulp and paper exports throughout the world.
6. The Russians make better use of pulp mill wastes—by converting them into by-products—than most Canadian mills. They have developed various types of chemicals and fertilizers from bark and lignin wastes, and they claim that these are quite economical, although their understanding of the word "ecocomics" is rather different from ours.
7. The scientific and technical work being done for the U.S.S.R. pulp and paper industry in their three institutes, in their universities, and in their mills, appears to be well integrated and coordinated.
8. A major accomplishment of the visit to the U.S.S.R. was the advancement of a proposal for mutual cooperation and exchange of scientific and technical knowledge relating to pulp and paper. Such a programme could lead to opportunities for increased trade between the two countries, including possible sales of technology. The proposed programme is dealt with in detail in another section of this report.

Soviet Organizational Structure

Organization of Councils, State Committees and Ministries.

The industrial scientific and technological approach of the U.S.S.R. starts with the Council of Ministers and the State Committees under this Council. The State Committees of the Council of Ministers, such as the State Committee on Science and Technology, are organizations of the central administration of the U.S.S.R. They perform state-wide planning, coordination and direction of activities by various ministries, and consequently their work crosses industrial lines (see Chart B). Their coverage is in contrast to that of the industrially specialized ministries, such as the Ministry of the Oil Industry, Ministry of the Gas Industry, Ministry of the Coal Industry, Ministry of the Building Materials Industry, Ministry of the Chemical Industry, and Ministry of the Pulp and Paper Industry (see Chart A).

The Central State Planning Committee of the U.S.S.R. (GOSPLAN) is the economic and industrial planning body, responsible to the Council of Ministers. GOSPLAN coordinates the industrial and technological planning of all ministries both of the central state and of the individual Republics of the U.S.S.R. It further acts as a planning link between the various committees of the Council of Ministers, and is especially concerned with the State Committee on Science and Technology.

Organization of the Ministry of the Pulp and Paper Industry

Each major branch of industry, such as those listed in the Organization of Councils, State Committees and Ministries section, is controlled by a central ministry located in Moscow. They are responsible for the development of their particular branch as a whole, and for the management of mills, R&D institutes and other related enterprises. There are 24 All-Union Ministries and 32 Union-Republic Ministries. It is our understanding that the number of ministries changes from time to time, as and when needs dictate.

The Ministry of the Pulp and Paper Industry is responsible for planning and directing the activities of the pulp and paper industry throughout the U.S.S.R. Their responsibility for pulp and paper mills includes general administration, maintenance of old facilities and construction of new ones, technical management and main production management and economics. The only exception is the development and construction of new prototype mill machinery

for the pulp and paper industry. This is under the Ministry of Chemical Machinery Construction, which we were informed was part of the Ministry of Chemical and Petrochemical Industry (see Chart C).

The organizational structure in the Ministry of the Pulp and Paper Industry in the U.S.S.R. is very complicated. Thus, there is no doubt that the process of introducing research results, taking them through the various innovative steps, and finally exploiting them commercially in Soviet mills, is a very slow process.

The Russians are well aware that their ability to innovate is not as highly developed as in many countries in the west. They hope that through the exchange of working groups with Canada and the United States they can learn how to apply western technology in order to improve their productivity. The adoption of new technological methods will not by itself be sufficient to greatly improve their position. We firmly believe that they must also streamline their organizational structures and substantially reduce the amount of red tape. They must break down their complicated "levels of authority" so that decisions can be made at lower levels. Their present procedure of having to go up and down the hierarchy for decisions is extremely time-consuming and inefficient. If they can manage to substantially improve their organizational structure and procedures, they are likely to become an important force in the economy of the world's forest industry within the next 10 to 20 years.

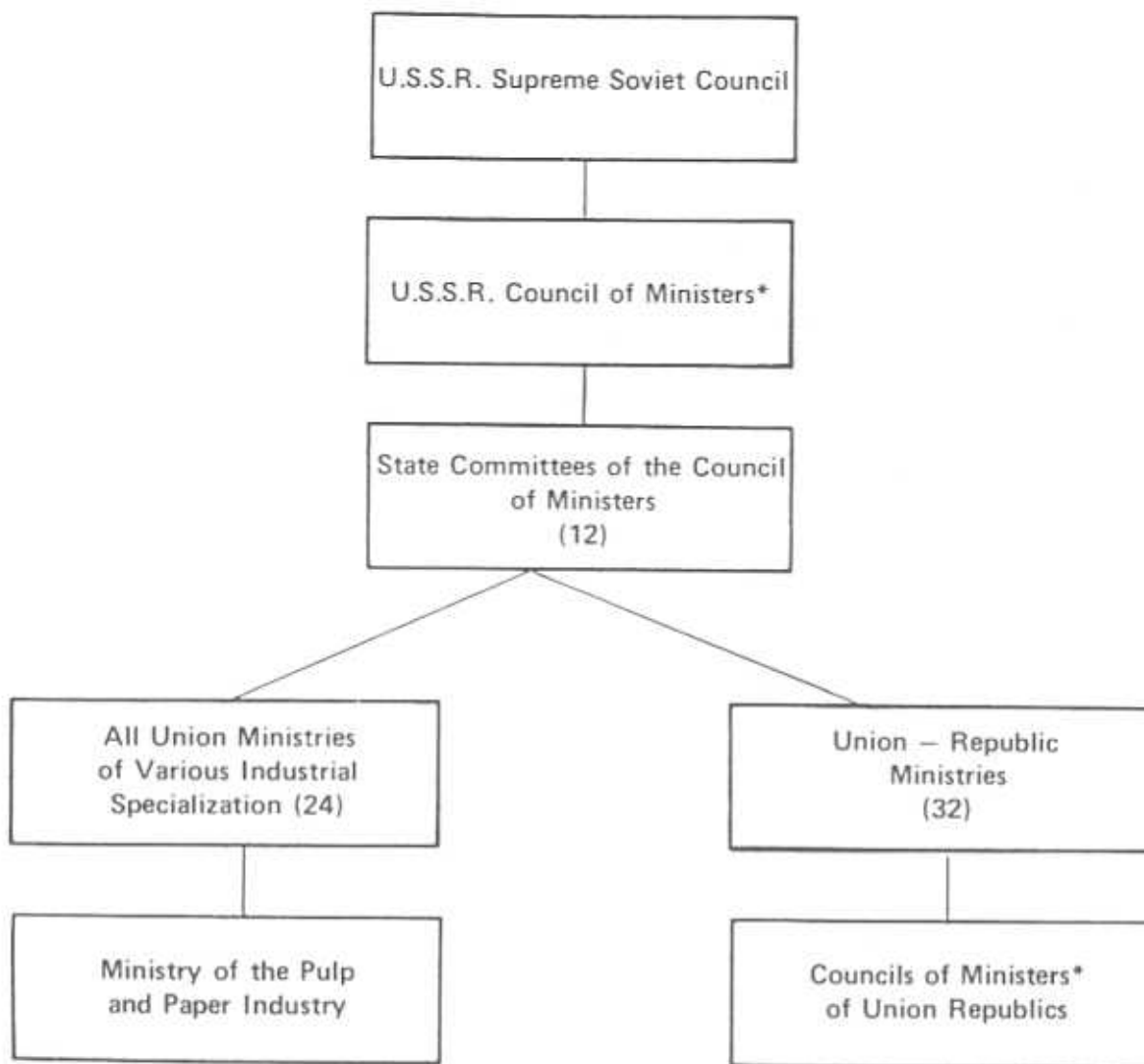
The U.S.S.R. Council of Ministers has upgraded the economic importance of the pulp and paper industry in their ninth five-year plan. As a result, they will be increasing their R&D effort. For example, the Ministry of the Pulp and Paper Industry states that they have 3,000 to 4,000 employees doing R&D work at the present time, and that this number will be more than doubled by 1975 (not including mill technical personnel). In contrast, Canada has only about 800 to 1,000 research workers in our government, industrial and institute laboratories combined.

Scientific Institutes of the Ministry of the Pulp and Paper Industry

The various R&D centres and research institutes are no longer controlled by the Academy of Science. Instead, they report directly to their respective industrial ministries, such as the Ministry of the Pulp and Paper Industry. However, the State Committee for Science and Technology (in

Chart A

U.S.S.R. and Union Republics Organization



- * NOTES: (1) Membership includes all Ministers and all Chairmen of the State Committees of the Council.
- (2) All committees of organizations under the Council of Ministers are subordinate to the Council's committees on financing, general and R&D planning, external relations, etc.

Chart B

U.S.S.R. State Committees of the Council of Ministers*

1. State Committee for Science and Technology
(Chairman — German M. Gvishiani)
2. State Committee for Construction
(Chairman — I.T. Novikov)
3. State Committee for Supplies and Services
4. State Committee for Labour (salaries and wages)
5. State Committee for Foreign and Economic Relations
6. State Committee for Inspection
7. State Committee for Reforestation and Maintenance
8. State Committee for Education and Preparation of Skilled Workers
9. All-Union Academy of Agriculture Science
(Not a State Committee but on the same level)
10. State Committee on Prices
11. State Committee on Standards
12. State Committee for Publications
(printing and distribution of books)

* Information from V. Alekhine of the Ministry of the Pulp and Paper Industry.

conjunction with the Academy of Science) is still responsible for research on major items of long range importance and for programmes that span a number of ministries.

There are three main scientific Institutes of the Ministry of the Pulp and Paper Industry, located at Leningrad, Kiev (see Chart D) and Moscow; and three regional laboratories or institute branches at Perm in the Urals, Volski and Astrakan.

The physical condition of the laboratory facilities that we saw were below North American standards, except for the new laboratories at Kiev. The space provided for their scientists was inadequate, and we were constantly struck by the rapid deterioration of their buildings and their very poor maintenance.

a) The Nature of the Research Work at the Institutes

- i) Fundamental research.
- ii) Applied research.
- iii) Economic or cost reduction projects for improving production.
- iv) Application of automation to all processes.
- v) Determination of information for appraising new projects.

b) Types of Research

- i) Improving the quality of pulp products.
- ii) Improving quality of dissolving pulp for acetate and viscose.
- iii) Upgrading quality and reducing cost of packaging paper.
- iv) Developing technical specialty papers (e.g., photographic papers, electrical condenser papers, and computer papers).
- v) Designing of new instruments for process control of paper machines and laboratory testing of pulp and paper.
- vi) Developing new effluent treatments (which includes biological, chemical and mechanical treatments) for improving the quality of air and water, and for solid waste management.
- vii) Evaluating new special finishes and coatings for medical products and special high quality printing papers.
- viii) Improving and developing new sanitary tissue papers and hygienic pads.
- ix) Standardization of pulp and paper products.

c) Division of Research Work

The work is divided between the three major scientific pulp and paper institutes in such a way as to minimize duplication. The division of effort is as follows:

i) The All Union Research Institute of Pulp and Paper at Leningrad

This is the leading research centre of the pulp and paper industry in the U.S.S.R. It carries out research work in pulping, papermaking, air and water effluent treatments, solid waste disposal, and technological process control of pulping and paper machines by means of computers (it has its own computer centre). Being the main centre in the U.S.S.R., it coordinates the research work of the other Institutes at Kiev and Moscow, its branches in Siberia and its model pulp and paper mill at Krasnoe Selo.

ii) The Ukrainian Pulp and Paper Research Institute at Kiev

Carries out quality and process control work on paper machines, and development of instruments for laboratory testing and process control. Work is also done on specialty papers, such as electrical condenser papers, computer papers, and packaging and converting materials.

iii) The Central Scientific Research Institute of Pulp and Paper at Moscow (Pravda)

Develops a number of consumer products, medical products and other specialty products from coated and uncoated papers and non-woven fabrics and from combinations of these materials. These include sanitary papers, toilet tissue and sanitary pads. It also has a pilot plant for applying special coatings and finishes to papers.

d) The Number of People at the Various Institutes

i) Institute at Leningrad

There are 1,500 people connected with this Institute, including its three branches at Perm, Volski and Astrakan. At the Leningrad Institute itself, there are 800 people, plus another 80 working in the Economics Division (see bottom page 00).

ii) Institute at Kiev

There are 700 people at Kiev, including two with the U.S.S.R. equivalent of a Ph.D., 60 candidates for this degree and 450 technicians. The rest are a mixture of graduates and local university trainees in the pulp and paper industry. The Director claims that by 1975 the staff alone at the Kiev Institute will number 2,000.

iii) Institute at Moscow

There are 550 people on the staff at Moscow, of which 60 percent are university graduates and 40 percent technicians. In the professional group

Chart C
Organization of the Ministry of the Pulp and Paper Industry

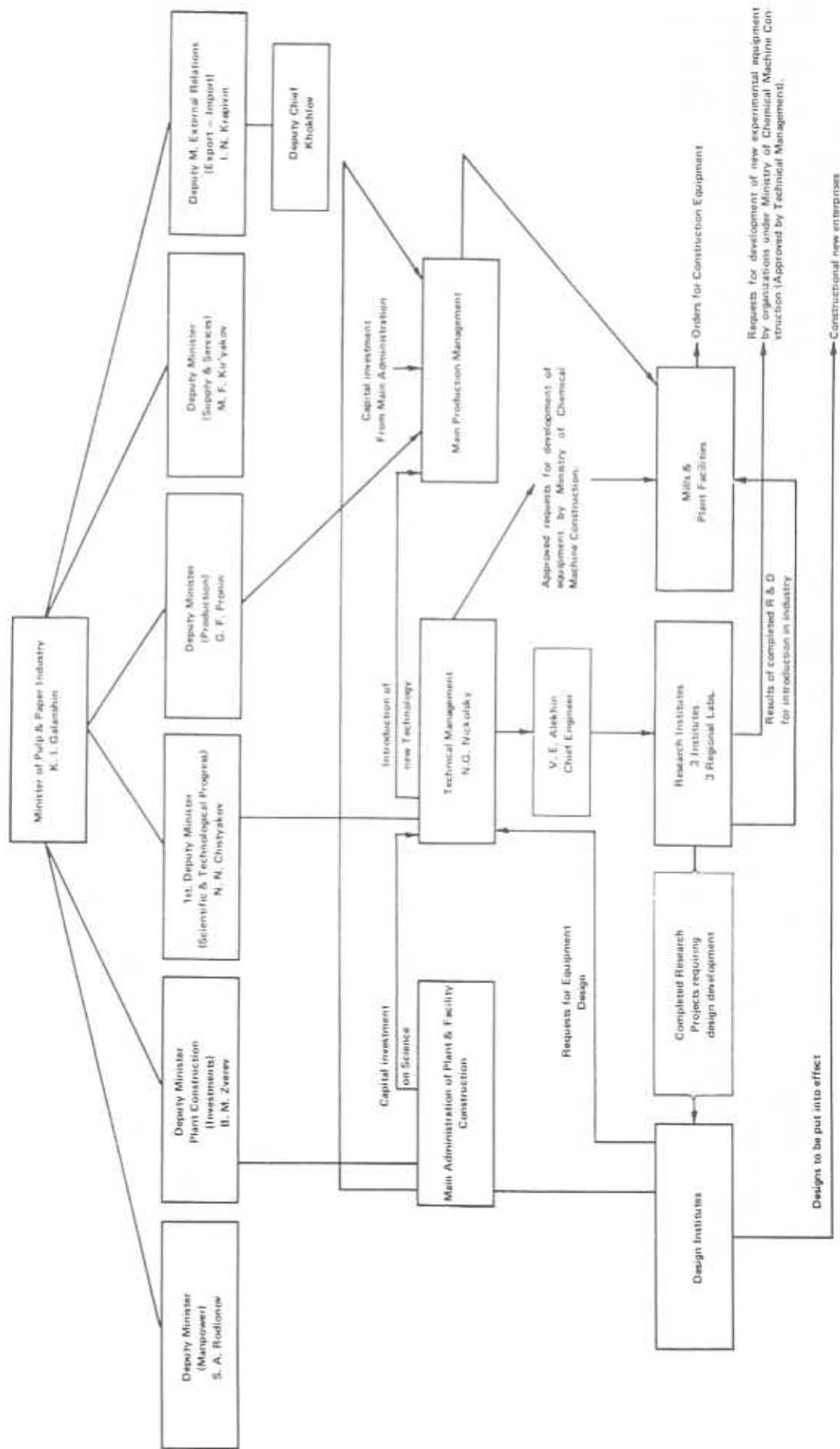
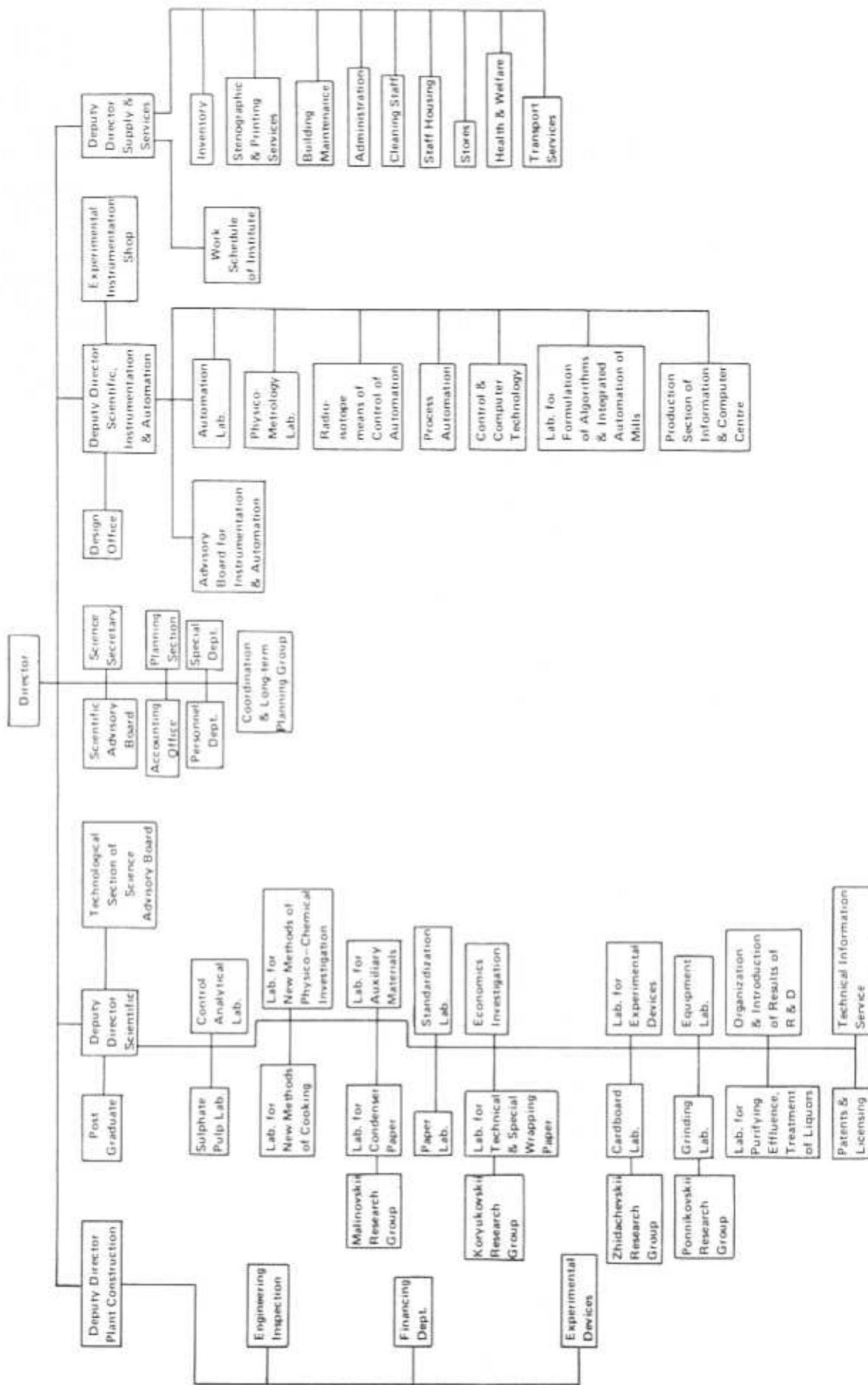


Chart D
Organization Chart of the Ukrainian Pulp & Paper Research Institute



there are two with the U.S.S.R. equivalent of a Ph.D. and 30 candidates for this degree. There are also 150 experts carrying out mechanical experimental work.

e) Support Services at the Institutes

These include:

- i) *An administrative group* at the Kiev Institute. This organization consists of 44 people who handle all accounting, economic studies of projects, etc. (see viii below).
- ii) *Libraries*
The libraries at the three Institutes visited were not modern. The Russians realize this and try to cover up by emphasizing how well integrated and organized their technical libraries and information services are. However, in our opinion, the organization of the libraries at their Institutes was in need of being up-dated. At the present time they have no cooperative exchange of publications between the pulp and paper institutes in Russia and Canada. An exchange of this sort should be encouraged although PPRIC receives a number of pulp and paper and forestry journals through an exchange arrangement with The State Lenin Library of the U.S.S.R., Moscow.
- iii) *Patent and Licensing Service.*
- iv) *Post Graduate Group*—for training technical people.
- v) *Long Range Forecasting.*
- vi) *Design of Equipment*—mainly drafting services.
- vii) *Mechanical Shops.*
- viii) *An Economics Division* at the Leningrad Institute has 80 people whose job is to plan industrial production, and to determine the cost of wood supplied to the mill and the cost of pulp produced. This information is required by the Ministry, which fixes the price of the final product.
We were also told that this information is needed to give direction to their plans for mechanization and automation of processes. They feel that during the next five years they must find ways to automate most of the processes in the pulp and paper industry. They are therefore developing various types of control systems, which we did not have the opportunity to see. It does seem that this group is doing a great deal of mathematical modelling, which serves as staff work for the Ministry

f) The Design Institute of the Pulp and Paper Industry at Leningrad

This is a consulting engineering group. It carries out feasibility studies, technical design and working drawings for the construction of pulp and paper mill complexes. Their work includes determination of location, availability of water and hydro, transportation and so forth. One of their new complexes, which was to be built at Bratsk, included a kraft pulp mill, a bleached kraft pulp mill for dissolving pulp, a linerboard mill, two sawmills, equipment for drying lumber, a plywood mill, a wallboard mill, a hardboard mill, and a chemical plant for the recovery of wastes and their conversion into by-products.

Management of R&D in the U.S.S.R.'s Pulp and Paper Industry

The first section of this part of the report is concerned with financial matters and was collated by one of the authors. The last three sections are concerned with planning of research and evaluation and application of research results in the U.S.S.R. They were written for us by the Ministry of the Pulp and Paper Industry and translated by G. Belkov, our Canadian interpreter from the National Research Council.

Budgeting and Financial Matter

a) U.S.S.R. Expenditure on Pulp and Paper R&D

The annual expenditure on R&D for the pulp and paper industry in the U.S.S.R. is about 6 million roubles, or \$7 million. This is about 0.3 percent of their total sales of pulp and paper products. This is slightly lower than Canadian and U.S. expenditures. The figures quoted do not include capital costs or depreciation on the buildings of the research Institutes, which are paid for out of other state funds.

b) Source of Funds for the Research Institutes

All funds for support of R&D at the research Institutes are eventually derived from income made by the pulp and paper industry. However, various levels of control are exercised over the R&D expenditure for the industry.

i) State Committee of Science and Technology

The State Committee has the responsibility for determining the major long-term R&D needs in all industrial sectors of the U.S.S.R. The individual needs of each industry are determined as part of an overall assessment of what is required for the general good of the U.S.S.R. The State Committee allocates funds to the Ministry of the Pulp and Paper Industry, which is then responsible for implementing the major programmes established by that Committee.

ii) The Ministry of the Pulp and Paper Industry

The Ministry has direct responsibility for determining all current R&D needs for the industry. This requires substantially greater funding than that provided by the State Committee. The Ministry collects the required funds from the industry in the form of a royalty based on the volume of production from each mill.

The Ministry decides on the disposition of the R&D funds to the various research Institutes. In doing this it must take into consideration the capacity and expertise available at each Institute for carrying out the various projects envisaged. Large projects of broad interest to the industry, or concerned with problems common to many of the mills, may require division of the research work between two or more Institutes.

iii) Research Institute Contracts and Royalties

The Research Institutes obtain additional funds through contracts for technical work, which are drawn up directly with individual mills. They also collect royalties from the first mill that utilizes any of their successful R&D work. However, any other mill subsequently using the same technology may do so without charge.

iv) Percentage of Funds from the Various Sources

The total income for all the research Institutes is currently derived as follows:

- 30 percent from the State Committee of Science and Technology.
- 60 percent from the Ministry of the Pulp and Paper Industry.
- 10 percent obtained directly by the Institutes—from contracts with individual mills or from royalties for the use of newly developed technology.

c) Distribution of Budgeted Funds to Various Types of R&D Work

- i) Exploratory Projects—10-14 percent (Determined mainly by the scientists, with some suggestions from the Ministry).
- ii) Engineering Projects—20 percent (This consists mainly of selection of existing equipment and some new equipment, costing it, etc., and the use of pilot plants to prepare new design data).
- iii) New Products—7-8 percent
- iv) Problems from factories—55 percent (This technology uses existing equipment).
- v) Trouble Shooting—7-8 percent (Carefully controlled. Mills are encouraged to solve their own problems).

d) Salaries of Scientists and Engineers

The salaries of scientific people depend mainly on which Institute employs them and on their university qualifications. The average professional salary for people at the Institutes (scientists and engineers) is \$10,000 to \$12,000 per year. It is hard to compare Canadian and Soviet salaries, as the Soviets are given much in the way of low rental apartments, special vacation benefits and monetary prizes for successfully completed projects (similar to company bonuses).

Planning of Research (written by the Ministry)

- a) The plan for research work in an industrial sector takes into consideration those scientific and engineering problems that are of most concern to the entire economy, and which have been approved by the State Committee of the U.S.S.R. Council of Ministers on Science and Technology, as well as those problems dealing specifically with a given industry.
- b) The industrial sector plan is worked out by the Technical Management Department of the Ministry (which includes Sections dealing with Research, Automation, Standardization, Water Management) with the participation of research institutes under the authority of the Ministry. It takes into consideration the requirements of the particular industrial sector for further refinement of production technology, increasing the economic efficiency and quality of the products, the prevention of air and water pollution, improving working conditions, etc., as well as suggestions from other industrial sectors which use pulp and paper products.
- c) The plan for research work to be carried out by the Ministry is approved by the Minister.
- d) Requests for carrying out research work are given out by the Technical Management Department to research institutes belonging to the Ministry, and to universities or organizations under the authority of other ministers, taking into consideration the fields in which they specialize.
- e) The organization assigns a research project, depending on the requirements of the Ministry, determines the expected results of the research project and technological level of these results, reaches an agreement with the Technical Management Department (Research Section) regarding cost and completion date, and works out a program and

schedule for carrying out the research project.

- f) The organization assigned a particular research project determines whether it will require the assistance of design offices and other specialized organizations, the amount of work required and the time when the work is to be completed.
- g) The Technical Management Department resolves questions concerning the inclusion of these additional supporting tasks in the plan of the appropriate organizations.
- h) The Technical Management Department, taking into consideration the projects assigned, distributes the necessary financing and signs contracts for completing the research work.
- i) Control of the progress of research is carried out by the Technical Management's Sections of Research, Automation, Standardization and Water Management, which provide payments as the work progresses.

Evaluation of Research Results (written by the Ministry)

- a) To examine completed research projects and to evaluate their results, the Technical Management's Research Section appoints commissions of qualified specialists within the Ministry, design institutes and mills. The composition of the commissions and the time allotted to review completed research projects are confirmed by the First Deputy Minister.
- b) The organization responsible for research projects gives the commission all the necessary documentation on the completed work.
- c) The commission hears the report of the supervisor of each project, examines the data presented, evaluates the suitability of the project, the technological level of the results obtained, and makes recommendations regarding the application of the results in industry.
- d) If the research organization has not done a satisfactory job of developing the project, it is obliged to carry out additional research without receiving any additional payment.
- e) If additional design work is required to put the results of investigations into effect (designing new production facilities or designing new equipment), a request is made for a design project to develop the equipment. In either of these cases the results of the research project are reviewed by the appropriate design office of development organization.

Application of Research Results ***(written by the Ministry)***

- a) On the basis of the evaluation of completed research projects the Technical Management's Section of New Technology prepares plans for the introduction of research results into industry.
- b) The plan for introducing the new technology is confirmed by an order of the Minister.
- c) The plan indicates the enterprise or mill where the results of the investigation are to be introduced, the time and the amount of work required, as well as the expected economic benefits.
- d) The introduction of new technology at the plant is controlled by the Main Production Management Department and the Technical Management's Section of New Technology.
- e) The organizations responsible for carrying out the research project must give the necessary technical assistance to the mills where the results of their work are being introduced. They also bear the responsibility, along with the plant, for achieving the stated technological and economic benefit.

Comments on some Technical and Academic Research Work in the U.S.S.R.'s Pulp and Paper Industry

Pilot Plant and Museum of Leningrad Research Institute at Krasnoe Selo

The Leningrad Institute is responsible for the operation of a model pulp and paper mill, 50 km south of Leningrad, at Krasnoe Selo. The first paper made in the U.S.S.R. was produced here in 1714, in the time of Peter the Great. This mill was completely destroyed during World War II, in 1944. It was rebuilt after the war as the Leningrad Institute's experimental pulp and paper mill.

In this mill there are nine paper and board machines, none of them high-speed. There is one dry-forming paper machine running at 3 metres per minute (about 9 ft/min). They hope to increase the speed of this dry-forming machine to 60 metres per minute this year, and within the next two or three years they should be able to produce non-woven fabrics on this machine at 250 metres per minute (about 750 ft/min).

There is an experimental effluent treatment plant which is rather conventional, but elaborate.

Specifications for all types of papers are developed at this pilot plant and some very specialized papers are produced here. For example, a very high quality paper produced at Krasnoe Selo is used by Professor Flatte of the Hermitage Museum as a special paper on which old manuscripts are copied.

In the last five years, they have specified and made 350 different types of papers and boards here. Every year this facility produces 50 to 70 new types of paper and board. The Soviets awarded the Krasnoe Selo experimental plant the "Order of Lenin" six years ago, for its services to the U.S.S.R. pulp and paper industry. The factory has also won 80 medals and diplomas and everyone in the plant is extremely proud of the recognition of their achievements by the U.S.S.R. Government.

This Institute is working on a number of problems which are directly related to the operation of pulp and paper mills. For instance, they are working on developing new felts, increasing mill productivity and preparing data for designing new machinery.

Pulping and Bleaching Research at Institutes in Leningrad and Kiev, and the Forest Technical Academy

The major portion of applied pulping and bleaching research work in the U.S.S.R. is

carried out at the All-Union Research Institute of Pulp and Paper in Leningrad and the Ukrainian Pulp and Paper Research Institute in Kiev. The more basic type of research work is carried out at educational research institutes, such as the Forest Technical Academy in Leningrad. Development work is done in the pilot plant at Krasnoe Selo and in laboratories connected with the larger mills.

This part of our report discusses the chemical pulping and bleaching research work at the institutes we visited in Leningrad and Kiev. Much of the information in this report was obtained from papers that were given us. As pointed out in the diary by Dr. Cox, the Russians seemed to be reluctant to discuss details of their research with us. This may be due to language difficulties or a reluctance on their part to disclose information until it has been approved and is in print. In any case, we were not told of any recent major innovations or breakthroughs that they had made or anticipated making.

Their main research objectives seem to be to adapt western pulping and bleaching technology to their particular wood species and to develop process modifications to fit their pulp and paper mill complexes.

a) Chemical Pulping of Larch

The most predominant and important softwood species in the Soviet pulp and paper industry is larch. Large amounts of larch are concentrated in Siberia (32 percent of all softwoods).

The Ministry has carried out considerable research to improve its scientific knowledge and understanding of the structure of larch. This work includes research projects on the physical and chemical properties of larch wood; the chemical composition of its hemicellulose content; kraft and bisulphite pulping of larch; and potential paper end uses of pulps from larch. Most of this work has been carried out by scientists at the Forest Technical Academy and the All-Union Research Institute in Leningrad.

The Soviet research work on larch has shown that this is not a particularly desirable wood species for pulping. The wood is dense, contains a large percentage of water soluble compounds, gives pulps with lower yields on a weight basis, and poorer bursting and tensile strengths than other softwood species, such as spruce and northern pine. On the basis of the fibre dimensions, it can be concluded that larch pulp has poorer

opacity, formation and printability than many other softwood pulps. An outstanding feature of larch pulp is its high tearing resistance. However, for many paper products, this property is of secondary importance.

Extensive pulping studies on larch wood with different chemical compositions have been performed by the magnefite, ammonium and sodium bisulphite processes. These are the preferred methods for their purposes. It has also been concluded that usable paper pulps can be prepared from larch by the bisulphite processes. Presteaming of chips is beneficial, especially for batches of larch which are rich in hot water soluble compounds.

Two stage sulphite pulping of a mixture of 45 per cent larch and 55 percent spruce has also given good results. The two stages are:

- i) Bisulphite stage with pH to 4.5.
 - ii) Acid sulphite stage with a lower pH.
- Research on kraft pulping of larch for chemical conversion to cellulose acetate (presumably for films, plastics and textiles) and for the production of tire cord and staple fibres by the viscose process, have been emphasized. For this purpose, a modified kraft pulping method—the so-called prehydrolysis kraft process which was developed many years ago in Germany—has been investigated, and optimum conditions have been established. The results have shown that high quality pulps for chemical conversion can be prepared from larch.

Conventional kraft pulping experiments have indicated that linerboard with acceptable properties can be produced from larch. However, as pointed out above, the quality is somewhat inferior to that obtained with other northern softwoods.

Single stage polysulphide pulping, has been applied to larch wood. A yield increase of approximately 4 percent (based on wood) was obtained.

Dr. L.A. Cox believes that MacMillan Bloedel Limited's high yield hydrogen sulphide pretreatment kraft process would be of much value to the Soviets and would help them to solve some of the technical problems they encounter with larch. The MB process would give more uniform pulping, higher yields and better quality larch pulp. There is no indication that the Soviet pulp and paper researchers have evaluated the hydrogen sulphide pretreatment kraft process on larch. However, it is interesting to note that the Soviet researchers confirmed yield increases of 5 percent to 6 percent (based

on wood) with pine by this pretreatment process.

b) Kraft Pulping of Unbarked Aspen

In most pulp producing countries, more hardwoods, such as aspen, will have to be pulped in the future. Similar to Canada, the Soviet Union has large, unused aspen stands. One of the main drawbacks of this hardwood is the problem encountered in debarking it. Therefore, a project on kraft pulping of unbarked aspen was carried out at Kherson mill. The idea of pulping unbarked chips is not new. So far, pulp mill operators have insisted on barked chips due to potential dirt problems created by bark. However, with the advent of efficient centricleaning and bleaching methods, pulping of unbarked woods has aroused interest. Each wood species has to be evaluated individually.

Experience at the Kherson mill has shown that bleached kraft pulp with good cleanliness can be produced from unbarked aspen chips. At this mill, a Pandia Chemipulper, which is a North American design, was modified. The modification of this digester, especially reconstruction of the screw feeder, has made it possible to process these unbarked chips.

c) Assessment of Chemical Pulping Processes in the Ukraine

i) Production of Dissolving Pulp

At the Ukrainian Pulp and Paper Research Institute, research related to the production of dissolving pulp by the prehydrolysis-kraft process has been undertaken. The results have made possible improved understanding of the chemistry of pulping prehydrolyzed wood. Optimum conditions for the prehydrolysis have also been established.

ii) Rapid Kraft Pulping

In rapid kraft pulping, non-uniformity of the product is not uncommon. In order to improve pulp uniformity, a chemi-mechanical impregnation of the chips prior to rapid pulping has been developed. This method is based on the principle that pressed chips, which are in contact with pulping liquor, absorb liquor readily at the moment of their expansion, due to pressure relief. Birch chips did not suffer from this treatment, while aspen chips showed a slight deterioration. Pine chips were degraded very badly, especially when liquors with relatively high chemical concentration were used. Presumably other softwood species would also respond unfavourably.

We believe that a pressure impregnation of softwood chips without

mechanical action is required to preserve pulp quality. For example, two-vessel pulping, developed by Kamyr, is a much better approach.

iii) Use of Additives in Alkaline Pulping

The Leningrad Institute has explored the use of additives in kraft and soda pulping to facilitate delignification and prevent the condensation of lignin. After some fundamental considerations related to lignin chemistry, studies on the reaction of lignin model compounds with reducing agents such as sodium borohydride were carried out. It was found that the concentration of radicals, which contribute to lignin condensation, decreases significantly with increasing concentration of borohydride. Simultaneously, the molecular weight of the lignin model compounds decreases. The same effects were observed with increasing sulphidity in kraft pulping. Thus, reducing agents seem to be effective in inhibiting lignin condensation and polymerization. In addition, it has been found that amines, especially ethylamine, have similar effects. Although U.S. patents, which were issued in 1936, cover the use of ethylamine in alkaline pulping, the mechanisms were not understood until the Soviets carried out their research. They also discovered that mercapto-benzothiol, tetrabutyl-thioalcohol and benzylthio-alcohol have similar effects. Unfortunately, all these compounds are relatively expensive, and thus the Soviet research in this area is almost exclusively of theoretical interest. The least expensive of the inhibitors is monoethanolamine, which costs 13 to 14 cents per lb. and thus may be of some value under special circumstances.

iv) Sulphur-free Pulping

Soda pulping with hydrazine as a carbohydrate stabilizer has been assessed. This approach is also well known and documented in the literature. Yield increases of 5 to 10 percent are obtained. The pulps have a lighter colour and a lower bleaching chemical consumption than comparable kraft pulps. However, the method is not economical due to the high cost of hydrazine. No research on soda-oxygen pulping seems to have been done. Nitric acid pulping has received considerable attention. The bonding strength of the pulps is slightly higher than that of sulphite pulps and yields are comparable. This pulping method is, of course, also well known. The

Soviets' interest is mainly in the by-products of the process, especially the nitrogen compounds for use as fertilizer.

v) Other Work

Two-stage sulphite kraft pulping has been explored. No details were disclosed. Again, this method is not new and would be complicated because of the two different types of pulping liquors involved.

Whole tree pulping is also being evaluated. This gives inferior pulp. However, the Soviet researchers have concluded that this pulp is suitable for use in the manufacture of low grade linerboard. Possibly, the quality requirements of Soviet linerboard are lower than ours.

d) Assessment of Bleaching Processes for Chemical Pulps

i) Oxygen bleaching

Delignification of pulps with oxygen was originally discovered by Nikitin of the Leningrad Institute. However, the use of oxygen in bleaching became practical only after French researchers had discovered that magnesium carbonate inhibits pulp degradation by oxygen.

Spruce sulphite and hardwood sulphite pulps were bleached to 85-87 brightness and to 90-92 brightness respectively, by oxygen bleaching only. In contrast, kraft pulps reached only 55-60 brightness by an oxygen bleaching stage.

Scientists at the Leningrad Institute have reviewed the chemistry of oxygen bleaching. This included oxidation of lignin and carbohydrates and the function of magnesium compounds as carbohydrate stabilizers. They have found that complex magnesium compounds which are decomposed at a pH of 9 are most effective. A highly dispersed magnesium hydroxide is formed, which has a large specific surface and thus inactivates heavy metal ions. It has also been found that the alkali application has a significant effect on pulp degradation. For example, a 0.2 percent alkali concentration without magnesium compound gave an even higher pulp viscosity than an alkali application of 0.4 percent together with magnesium carbonate. Similarly, milder alkali treatments, such as with sodium carbonate or bicarbonate, gave less pulp degradation than sodium hydroxide, but much larger chemical applications are required.

One of the major conclusions of the

basic research on oxygen bleaching is that pulp degradation can be reduced by decreasing the rate of hydroperoxide decomposition. Hydroperoxides are formed from oxygen in the presence of lignin or monosaccharides. The rate of decomposition can be decreased by magnesium compounds or by reducing the pH of the system.

Oxygen bleaching of kraft hardwood pulps by the Swedish-Canadian or MoDo-CIL process has been studied. Published work on this process describes only the results with softwood pulps. It was shown that hardwood kraft pulps respond favourably to the process and that, at low sodium hydroxide consumptions, similar pulp quality is obtained with and without stabilizers. Magnesium carbonate retards delignification somewhat. Sodium carbonate can replace sodium hydroxide and gives good pulp quality without a stabilizer.

ii) *High Consistency Bleaching for Electric Insulating Papers*

One laboratory is specializing in the preparation of pulps for electrical insulating papers. This includes choice of wood species, pulping and bleaching. Chip treatments prior to pulping may be of benefit.

However, the nature of the treatments was not disclosed. The kraft process is the preferred pulping method, and the mineral impurities of the pulps should be as low as possible.

Bleaching of the pulps in the gas phase, i.e., at high consistency (20 to 30 percent) has been evaluated. A three- and a four-stage bleaching sequence have been chosen. The three-stage sequence consists of chlorination, alkaline extraction and chlorine dioxide bleaching. In a pilot plant of one of the mills this type of pulp has been prepared.

They are also interested in chlorine monoxide bleaching, and the high consistency bleaching process, which have been developed by PPRIC.

It is well known that pulp to be used for the manufacture of electrical insulating papers has to be thermally stable, and requires a very low electrical conductivity. It is not obvious why the pulps should be bleached. The Soviet researchers did not elaborate on this point.

iii) *Other Work*

Hydrogen peroxide bleaching, especially of sulphite pulps, has been evaluated by the All-Union Institute.

This is an obvious way of reducing water pollution from the bleach plant.

Education and Training for the Pulp and Paper Industry

In the U.S.S.R. there seem to be three main centres of learning for people in the pulp and paper industry. These are: the Forest Technical Academy in Leningrad; the Leningrad Institute for Pulp and Paper, and the Ukrainian Polytechnic Institute in Kiev. We only visited the first two.

a) *Forest Technical Academy, Leningrad*

This is the oldest forest educational institute in the world, dating back to 1803. It is also the largest in the world. At the present time it has 12,000 students with a staff of more than 2,000. Amongst the students are people who come for upgrading. They also have 250 candidates working for higher degrees. One must remember that these are research workers who work for many years before obtaining a Ph.D. degree, since in Russia it is unusual for anyone to obtain a Ph.D. before the age of 40 or 45, sometimes even later. Therefore, the Academy does not only do teaching, but a great deal of research.

The Academy is divided into six faculties. These are:

- i) Forest Management;
- ii) Landscape Engineering;
- iii) Forest Economics;
- iv) Chemical Technology;
- v) Mechanical Conversion of Wood;
- vi) Forestry Engineering.

The Academy also has two research institutes with seven laboratories, which are mission oriented. The Academy has its own library with over 1 1/2 million books. It also has its own botanical gardens (64 hectares or about 175 acres) which contain 1,500 species from around the world. They exchange seeds with about 500 other such organizations in the world. They also have a model forest of about 32,000 hectares (around 87,700 acres), which is 100 km from Leningrad. Here students working in logging can have practical experience.

The undergraduate course is five years after 10 years of general schooling. These students, when they graduate, are usually managers for the forest industry. Entrance is by competition and there are about five applications for every place. They also offer a preparatory course for entrance which lasts from 9 to 12 months. About 2,200 students follow these courses. Those who follow this preparatory course do not need to sit for an entrance

examination. Students start here at about the age of 17.

Our visit here consisted of a meeting with the Rector and his most senior professors. In chemical pulping alone there are 90 professors and they produce some 50 engineers per year.

In answer to some of our questions about the results of their work we were told only briefly about their main areas of research. What information we did gain is given in the section on pulping and bleaching research (page 14).

b) Leningrad Institute of Technology

This is another large teaching and research institute, equivalent to a Canadian university. It has 5,500 students and four departments, namely, Chemical Engineering, Economics Engineering, Mechanical Engineering and Power Engineering. It is really run as a Polytechnic Institute. In the Chemical Engineering Department they train people for the pulp and paper industry and also for the polymer industry, plus some specialists in pollution control and industrial safety.

This institute is 20 years old and is now expanding its research work. The staff spend about 30 percent of their time on research work. They have 132 candidates for the Ph.D. degree. This institute is not only associated with the Pulp and Paper Ministry, but also with the development of machinery for pulp and paper, which comes under another Ministry.

About 60 percent of the Institute's research work is financed by pulp and paper mills in the U.S.S.R., of which there are approximately 200. The rest of the money comes from the State Committee on Science and Technology. The impression we have is that they have good people, but not of the calibre of the Forest Institute.

Universities, institutes and mills in the U.S.S.R. are well integrated to retrain people in the pulp and paper industry. About 2,000 people are given sabbatical leave each year from the Pulp and Paper Industry in order to upgrade their educational standards.

Experimental Factory for Making Prototype Machines for the Pulp and Paper Industry (Leningrad)

This plant, which has over 1,200 people, is not part of the Ministry for Pulp and Paper, but is under the Ministry of Chemical Machinery Construction of the petroleum and chemical industry. This plant makes prototypes of machines for the pulp and paper industry, usually two or three of each, which

are tested in the plants and, once all the problems have been solved, the designs are transferred to the large factories for production.

Before the Revolution, this plant was a casting plant for sculptors. After the Revolution, it continued in this role and started to make some machinery parts. In the 1930's it was converted and became the first machinery plant for the pulp and paper industry. Two years ago it became an experimental plant.

Today, this Experimental Factory produces prototypes of paper machines, cutters, dryers and calenders. They even claim to be working on a twin-wire machine, which is not yet in production, and which they are designing for a speed of 1,500 metres per minute, at a width of 840 mm. They are also developing a new dryer for computer controlled paper machines.

Their work on calenders is most interesting. They are evaluating different types of materials for the soft rolls, and are working on reducing the number of nips for calendering. In the case of super calenders, they have developed a roll of asbestos latex compound which has been used to produce very thin condenser paper. They claim that they have been able to produce condenser papers down to 4-microns thick. The paper machine that was used to produce this paper ran at 120 metres per minute.

They showed a great deal of interest in PPRIC's Papriformer and Papridryer, and asked us many questions about them.

In this plant we saw a number of narrow calenders and some of the new rolls mentioned above. We did not see a fully erected paper machine, but only parts of it, and we did not see their prototype twin-wire machine.

Design Institute of the Pulp and Paper Industry (Leningrad)

We paid a brief visit to the Design Institute, which is charged with the design and building of pulp and paper mills throughout the U.S.S.R. It is really the equivalent of a large consulting engineering firm in our country.

We were received by the chief engineer, Mr. E. D. Tsvetkov, who is very famous in the U.S.S.R. He described the design of the huge Kotlass forest products mill complex in the northeastern part of the European section of the U.S.S.R. which has already started, and even has some phases in production. This complex will eventually make 600,000 tons a year of bleached kraft pulp and 110,000 tons per year of dissolving pulp. At the present time their kraft yield is about 48 percent and they are trying to bring it up to 52 or 53

percent. This mill will also produce 85,000 tons per year of printing paper and semi-chemical pulp for bag production. In addition, this complex has an alcohol factory, a yeast plant, a power station and a huge primary and secondary water treatment system with large lagoons. The plant will require 4.3 million cubic metres of wood yearly. All their paper machines are 4.2 metres wide.

Research on By-Products

At the Forest Technical Academy, Professor Nepenin has worked on the production of a dye from alkali lignin, and on the use of lignosulphonates in drilling mud. They are also developing the use of lignosol in building materials. The main use found for lignin obtained from wood hydrolysis is in the production of activated charcoal.

Apparently, the hydrolysis of wood makes it possible to produce ethanol at half the cost of preparing it from potatoes or wheat. The cheapest ethanol is obtained from sulphite pulping spent liquors. Another valuable by-product from sulphite pulping liquor is yeast for animal feed. Both the production of ethanol and yeast from sulphite spent liquors has been practised in central Europe and Scandinavia for many years.

One of the Forestry Institutes is investigating the oxidation of bark in alkaline medium. This approach breaks down the phenolic compounds.

Considerable effort has been devoted to the utilization of the volatile sulphur compounds emitted from kraft pulp mills. One end product is dimethylsulphoxide. This is a well known solvent for certain polymers. The Soviets have used this compound successfully in the treatment of severe burns on humans, as have the Americans.

Another important research area is the production of fertilizers from spent pulping liquors containing nitrogen, such as nitric acid and even ammonium sulphite liquors. Bark and activated sludge have also been used in the preparation of fertilizers, together with spent pulping liquor. The final product has a granular structure and can be easily handled. The composition of one fertilizer they are producing is 100 parts of activated sludge, 50 parts of lignin from pulping liquor, 50 parts of larch bark and a certain amount of fine fibres and minerals. The fertilizers have been tested in semi-commercial conditions.

The Soviet researchers reported that use of their fertilizers increases crops by 20 to 50 percent; and in some cases even by as much as 200 percent. The organic content of the soil in some parts of the Soviet Union is low, especially in sandy soils, and the use of an organic rather than inorganic fertilizer is frequently more desirable.

Uses for the water-extractives from larch wood are also being sought. One promising use is their application as anti-oxidants.

Design and Development of Instruments at the Ukrainian Institute at Kiev

The design of instruments for the pulp and paper industry is one of this Institute's main activities. The U.S.S.R. wants to be autonomous in the use of instruments for the testing and controlling of processes in their pulp and paper industry. Consequently, they have already designed quite a number of instruments and will be increasing their effort in this area in the future. They claim they can design instruments starting from scratch through to prototype in the space of two to three years. When the instruments reach the prototype stage they are taken over by the Institute's own factory, where three or four instruments are produced at a time and sent to the mills for trials. Once these trials are completed, the design is then turned over to a factory for commercial production.

Many of the standard instruments used in the western countries have been duplicated here. In most cases they are rather heavy and reflect the design used in the west about 10 to 15 years ago.

Their newer on-machine instrumentation development also seems to be following western thought although they may have improved upon its application in some cases. For instance, they are developing a micro-profile or roughness tester for paper, which looks quite good. They feel the need for this for multi-colour printing on paper. This machine should be ready in two to three years and they have agreed to keep Canada informed, through PPRIC, of this development.

In one laboratory, we saw the development of sensors for control processes and a consistency meter for the range 0.3 percent to 1.0 percent of fibre concentration. They are using the Norwegian method of polarized light, but they claim that they have doubled the sensitivity of the instrument by using two infrared wavelengths and measuring the difference in intensity at the two wavelengths. They also claim that this instrument will differentiate between cellulose and clay or other fillers in the stock system.

In another laboratory, we were shown a prototype machine for measuring the strength of paper by ultrasonics. This non-destructive testing machine is being developed to measure the strength in both the machine direction and cross-machine direction at speeds of up to 800 metres per minute. The on-line ultrasonic technique has already been

studied extensively in the west and North American equipment is available for this type of measurement.

They are also developing devices to measure gloss, brightness and smoothness on the paper machine. These instruments are intended to do this continuously at high speed. Unless these prove to be based on new operating principles, there should not be any advantage over the instruments already available in North America for these purposes.

Possibly one of the most interesting pieces of apparatus we saw was one that they call a fractionator. This appears to be an extension of the principle of operation of the Coulter particle counter that has been applied to the measurement of fibre length in the West on a laboratory scale. The Russian instrument, under development, automatically measures on a continuous basis the length and the cross section of fibres in a stock system. It consists of a ten-channel fractionator which is fed by a continuous sample diverted from the stock system. It is claimed that the machine will measure fibre lengths from one-tenth of a millimetre to five millimetres and that any one of the ten fractions can be adjusted within that range. It operates on the principle that the suspension goes through calibrated micro holes and when the fibre goes through the hole it gives an electric impulse. These pulses are sorted and counted electronically. The duration of the pulse is directly proportional to the length of the fibre and the strength of the pulse is proportional to the cross section of the fibre. The whole process is integrated electronically and can be connected to a computer, presumably to change the parameters of a refiner and thereby control the pulp fibre length automatically.

They assured us that, through PPRIC, Canada would be kept informed of future developments on this instrument.

We were very impressed with the quality of the personnel working in the instrumentation laboratories at this Institute. It seemed to us that this is an area where continued close contact would benefit the Canadian pulp and paper industry.

Specialty Papers Research in the U.S.S.R.

a) Specialty Paper Processes

- i) *Finishes* are applied by a conventional method on a special pilot-plant paper machine at the Moscow Institute.
- ii) The *Coating* Laboratory at the Moscow Institute uses similar equipment to that used in Canada (standard knife-coater and dryer on the machine).
- iii) *Non-woven fabrics* are made mainly at the Leningrad Institute by standard

cross-laid dry and wet forming processes, using rayon and other fibres and polyvinyl acetate and other types of binders.

b) Types of Specialty Papers Produced

i) Leningrad Pilot Plant at Krasnoe Selo

- copying papers (e.g. diazo papers).
- photographic papers.
- document papers (containing synthetic fibres).
- electrical condenser papers containing synthetic fibres.
- electrical insulation paper containing polyethylene and polypropylene fibres.
- printing papers.

ii) Ukrainian Institute at Kiev

- electrical insulation papers (using high alpha pulps, low in cations).
- electrical condenser paper.
- cigarette paper (work on additives to improve taste and work on new filter-tips).
- transfer papers—transfer designs to cloth.
- high temperature insulation papers, which contain mineral fibres, e.g., asbestos.
- regular insulation and / or heat resistant papers.
- highly absorbent pulps for pads (see c below).

iii) Moscow Institute at Pravda (37 km from Moscow)

- printing papers for books.
- copying papers, e.g. diazo and photo-conductive papers.
- fine writing papers.
- wall papers.
- corrosion resistant papers.
- consumer goods, e.g., towel and tissue paper (not facial tissue).
- antifungal agents applied to book covers and cable papers.
- wet strength paper and board for pipe lines.
- fire-resistant paper and board.

c) Non-Woven Fabrics

- sanitary combination pads (made from paper, gauze and soft, non-woven fabric covers) and diapers.
- air filters.
- oil filters (to remove metal particles).
- beer and wine filters.
- hygienic products, e.g., sanitary pads.
- disposable sheets for hospitals (from rayon and cotton).

d) Laminated Products (include paper, non-wovens and other materials)

- waterproof papers (asphalt laminated paper).
- laminated board and foil for insulation.
- mulch paper for controlling growth of wheat.

- fiberglass and waterproof paper to replace canvas as a cover for equipment kept outdoors.

e) Miscellaneous Types of Papers for

- packaging food products (e.g., bread).
- medical dressings (e.g., bactericidal papers, blood filters and papers to cover small cuts and wounds).
- air and water filters (e.g., microorganism paper filters).

Research on Mechanical Pulping

At Perm, in the Urals, research on mechanical pulping is carried out (we did not see this). They claim the percentage of long fibres in stone groundwood is improved somewhat by slowing down the grinders. An objective of their research is to retain the fibre length at increased grinder speeds.

The following methods for removing decayed wood at the sorting areas have been developed:

- a) Rapid immersion of logs in water—the logs with a high percentage of wood rot tend to sink.
- b) Rapid agitation of chips in water under vacuum causes decayed chips to sink, with a four and one half percent loss on the average.
- c) Rotate a hammer at the right speed so that only decayed wood breaks down and chips are not damaged.

Proposed Programme for Mutual Cooperation, Exchange of Scientific and Technical Knowledge and Know-How in the Pulp and Paper Industry between U.S.S.R. and Canada

We understand that the agreement for exchange of U.S.S.R. and Canadian working groups will enable Canadian scientists, engineers and businessmen to visit their appropriate ministries in the U.S.S.R. and selected factories and institutes throughout the Soviet Union, to learn at first hand about Soviet techniques and technical problems. The Canadian Government hopes this approach will lead to a greater understanding of each other's problems and a better definition of opportunities both for trade and the purchase of technology.

The Soviet Ministry for Foreign Trade, which acts as an agent for the industrial ministries and is the final purchasing authority, is seeking to encourage Canadian firms to maintain closer contacts with their respective working groups in Soviet industries. This would be done through the State Committee for Science and Technology, which includes senior Soviet officials of virtually all the ministries connected with the scientific sector in the U.S.S.R.

To improve the U.S.S.R./Canadian relationship, as far as the Canadian pulp and paper industry is concerned, and to speed up the exchange of technology that could lead to opportunities both for trade and purchase of technology, a four point program of action has been outlined by Cox and Gendron. The program must be accomplished within two years or less. This will only be possible if all companies in the Canadian pulp and paper industry, through the Canadian Pulp and Paper Association and the Canadian Government's Department of Industry, Trade and Commerce, carry out point 3 of the proposed program (see below). That is, establish a "top level committee" to develop "a concrete program of action".

The four main points of the proposed program are:

1. Two top practising Canadian scientific administrators of R&D will visit Russia and review their existing R&D programs, techniques and research management systems, as outlined in the PURPOSES of the trip referred to earlier. (This has been accomplished by the visit of Dr. P.R. Gendron and Dr. L.A. Cox).
2. Two or more top Russian directors or officials will visit Canada in 1972 or 1973 and carry out a similar program with PPRIC and the Canadian pulp and paper industry. (This has been accomplished by

the visit of Nikolay G. Nikolsky and Yakov V. Nikitin to Canada in November/December, 1972).

3. A top level committee will be set up between the U.S.S.R. and Canada to develop from these visits a *concrete plan or program of action*. The committee will identify the technological, economic and other needs of the U.S.S.R. and Canada in the pulp and paper industry. This would include producing a list of scientific knowledge and technology that each country would be willing to provide on some equitable financial or other basis for the mutual progress of our two countries. This would be our formal *plan of action*.
4. The *plan of action* should be carried out efficiently and as soon as possible. This will mean that objectives must be clearly defined, projects identified with their respective benefits, costs and priorities, protocol blocks removed, etc.

The implementation of this *plan of action* implies that the U.S.S.R. and Canada must not only learn to work together in spite of their different languages and political and economic systems, but must believe that such an exchange of trade and technology on some equitable financial basis is for the good of the two nations. High U.S.S.R. officials told us that each country could learn much from the other, if there was more "give and take". To date, these same Soviet officials have said they are not satisfied with the results of some of these exchanges of working groups in the pulp and paper industry, and they welcomed the Cox-Gendron proposal as a step in the right direction. They hoped the *plan of action* would be implemented soon. The Canadian Ambassador, Mr. Ford, agrees.

[This is the function of the joint Canada/U.S.S.R. Working Group on Forest-Based Industries, which meets at approximately yearly intervals to plan the coming year's programme of collaboration.]

Acknowledgements

Drs. Gendron and Cox would like to express their sincere appreciation to the Department of Environment of the Canadian Government for making this trip possible, and to our kind hosts in the U.S.S.R. for making it so pleasant and profitable. All of our meetings and discussions were friendly, on a person to person basis, and very worthwhile. It is our sincere hope that the exchange of technology between our two countries in the pulp and paper industry will lead to improved relations between the East and the West and to a greater and more friendly understanding between the peoples of Canada and the U.S.S.R.

Appendices

Appendix A—Tour Programme for Canadian Delegates on "Organization and Administration of R&D in the Pulp and Paper Industry"

Sunday, October 1, 1972

- 5:25 p.m. Arrive in Moscow from Canada via London on Aeroflot Flight No. SU 581, an Ilyushin 62.
Drive to Intourist Hotel—register.

Monday, October 2

- 10:00 a.m. Welcome by E.K. Khokhlov and V. Alekhine at the Ministry of the Pulp and Paper Industry, Moscow, and brief discussion.
- 12:25 p.m. Aeroflot flight to Leningrad—arrive 2:00 p.m.
Drive to Astoria Hotel—register.
- 3:00 p.m. Arrival of our Russian interpreter, N.V. Zinoviev.
- 4:00 p.m. Review of programme of trip.
- 8:00 p.m. Arrival of Canadian interpreter, Gregory Belkov, from the National Research Council of Canada.

Tuesday, October 3

- 10:00 a.m. Drive around Leningrad sight-seeing.
- 11:00 a.m. Visit to the State Hermitage Museum (Winter Palace).
- 1:00 p.m. Lunch break.
- 2:00 p.m. Welcome by E.I. Pechko to the All-Union Research Institute of Pulp and Paper (AURIPP), Leningrad.
Discussions of type of technical work carried out at all the Soviet Institutes in the Pulp and Paper Ministry. General discussion of U.S.S.R. research programmes and financial operating costs with L.B. Gregenev.
Discussion with M.A. Ivanov on the type of research work being done at the Leningrad Institute and its branches.
Discussion with U.E. Vyukov on automation and systems control in industry.
- 6:00 p.m. Refreshments at the Institute.
- 8:00 p.m. Canadian delegation entertained members of the Ministry of the Pulp and Paper Industry at Astoria Hotel.

Wednesday, October 4

- 9:00 a.m. Drive to Institute at Krasnoe Selo (50 km south of Leningrad).

- 10:00 a.m. Discussions of history and nature of experimental work with E.Y. Pechko, N.A. Sibirgoff and his staff.
- 10:30 a.m. Trip through pilot plant operations and museum.
- 1:00 p.m. Lunch break.
- 3:00 p.m. Sight-seeing at Petrodvorets. (Saw Great Palace, fountains and gardens).

Thursday, October 5

- 9:00 a.m. Visit to All-Union Research Institute of Pulp and Paper (AURIPP)—area of Chemical Pulping.
- 1:00 p.m. Lunch break.
- 3:00 p.m. Visit through AURIPP continued—area of Computer Research.

Friday, October 6

- 9:00 a.m. Visit to Forest Technical Academy and Botanical Gardens.
- 12:45 p.m. Lunch at the Ministry of Chemical Machinery Construction's plant, which develops new prototype equipment for the pulp and paper industry, with E.M. Golovko, First Deputy Director and his staff.
- 2:30 p.m. Trip through machine construction plant.
- 4:30 p.m. Visit Design Institute of the Pulp and Paper Industry.
Discussions with U.F. Smin, Director, and E.D. Tsvetkov, Chief Engineer.
- 6:00 p.m. Supper.
- 7:30 p.m. Swan Lake Ballet at Kirov Opera and Ballet Theatre.

Saturday, October 7

- 1:00 p.m. Leningrad Institute of Technology.
Discussions with the Rector, Professor I.D. Kugushev and his staff.
Trip through Institute's facilities to see and discuss their basic research work.
- 3:00 p.m. Sight-seeing at the Empress's Palace at Pavlovsk.

Sunday, October 8

- 9:00 a.m. Sight-seeing trip through Leningrad.
- 6:00 p.m. Aeroflot flight to Kiev. Arrival 8:45 p.m.
Met by A.F. Tistchenko, Director of the Ukrainian Pulp and Paper Research Institute.
Registered at Hotel Dnipro.
- 8:00 p.m. Supper at hotel with A.F. Tistchenko.

Monday, October 9

- 11:00 a.m. Visit Ukrainian Pulp and Paper Research Institute, Kiev.
Discussions on history and technical work of the Institute.
- 1:30 p.m. Lunch break.
- 2:30 p.m. Tour of city.
- 5:30 p.m. Entertained by Soviets at Ukrainian Windmill.

Tuesday, October 10

- 9:00 a.m. Trip through the Ukrainian Pulp and Paper Research Institute, Kiev, and further discussions with staff on their research work.
- 1:00 p.m. Lunch break.
- 2:30 p.m. Sight-seeing in Kiev.
- 7:00 p.m. Cultural Theatre of Kiev—Ukrainian Song Festival.

Wednesday, October 11

- 9:00 a.m. Ukrainian Pulp and Paper Research Institute, Kiev.
Discussions on organization and administration of research in Canada compared with U.S.S.R.
- 1:00 p.m. Lunch at Ukrainian Restaurant.
- 2:00 p.m. Sight-seeing (Saint Sophia Cathedral).
- 7:30 p.m. Georgian Opera.

Thursday, October 12

- 9:15 a.m. Aeroflot flight to Moscow. Arrival 12:45 p.m. Registered at Intourist Hotel 3:00 p.m.
- 4:00 p.m. Visit to Canadian Embassy.
Discussions with G.M. Deyell, Commercial Secretary, and R.H. Gaynor, Commercial Counsellor.

Friday, October 13

- 9:00 a.m. Shopping.
- 2:00 p.m. Visit Ministry of Pulp and Paper Industry, Moscow.
Discussions with N.N. Chistyakov, First Deputy Minister on Scientific and Technological Progress.
- 3:00 p.m. Drive to Central Scientific Research Institute of the Pulp and Paper Industry in Pravda (54 km from Moscow).

Welcomed by First Deputy Director, M.V.O. Frolov.
Reviewed work of the Institute.

Saturday, October 14

- 8:00 a.m. Drive to Central Scientific Research Institute of Pulp and Paper.
- 9:00 a.m. Breakfast at Institute.
- 10:00 a.m. Tour through Institute and discussions on nature of their projects.
- 2:00 p.m. Drive to Zagorsk and sight-seeing at St. Sergius' Trinity Monastery (a national museum of architecture and applied arts).
- 6:00 p.m. Entertained by V. Alekhine, Deputy Director, Technical Department and associates at Metropole Restaurant.

Sunday, October 15

Sight-seeing and shopping in Moscow.

Monday, October 16

- 9:00 a.m. Ministry of the Pulp and Paper Industry.
Discussions with V. Alekhine, Deputy Director, Technical Department and E.K. Khokhlov, Deputy Chief, External Relations (Export-Import).
- 11:00 a.m. Canadian Embassy.
Discussions with Canadian Ambassador, R.A.D. Ford, G.M. Deyell and R.H. Gaynor.
- 5:30 p.m. Departure on BEA flight to London. Arrival 7:30 p.m.

Appendix B—Soviet Organizations Visited and Personal Contacts Made

The following names and titles were compiled from the notes of Pierre R. Gendron and Lionel A. Cox. We regret that some names were not recorded and some may be misspelled.

MOSCOW—MINISTRY OF THE PULP AND PAPER INDUSTRY

a) Scientific and Technological Progress

Department

Nickolai N. Chistyakov, First Deputy Minister.

N.G. Nickolsky, Chief, Technical Management and Member of the Board of the Ministry.

Valentine Alekhine, Chief Engineer, Technical Management.

L.V. Grebenev, Chief of Section, Technical Management.

Mrs. O.V. Viatkina, Chief Specialist.

b) External Relations Department, Export and Import Deliveries Division

I.N. Krapivin, Deputy Minister.

E.V. Khokhlov, Deputy Chief.

Nickolai F. Zinoviev, Senior Engineer and Interpreter.

Mrs. N.P. Merkulova, Senior Engineer.

LENINGRAD—ALL-UNION RESEARCH INSTITUTE OF PULP AND PAPER

Evgeni Yakovlevich Pechko, Director General.

(Mrs. Nina Donitrievna Pechko—wife).

Mihaie Alekseevich Ivanov, First Deputy Director, Scientific.

U.E. Vyukov, Deputy Director, Automation & Mechanization.

Yarov V. Nikitin, Chief of Section, Water Usage Laboratory.

E.D. Perminov, Chief of Section, Chemical Pulping Laboratory.

— Urakin, Scientist in Charge, Chemical Pulping.

KRASNOE SELO—PILOT PLANT AND MUSEUM OF LENINGRAD INSTITUTE

N.A. Sibirgoff, Deputy Chief of Institute (Administrative).

Albert S. Khramenko, Chief Engineer of Pilot Plant.

B.B. Gutman, Chief of Laboratory for Technical & Specialty Papers.

LENINGRAD—MANUFACTURING OF EQUIPMENT FOR THE MINISTRY OF THE PULP AND PAPER INDUSTRY (done by part of Oil-Refining and Petrochemical Industry).

Director—(absent)

E.M. Golovko, First Deputy Director and Chief Engineer.

LENINGRAD—DESIGN INSTITUTE OF THE PULP AND PAPER INDUSTRY

U.F. Semin, Director.

E.D. Tsvetkov, Chief Engineer.

LENINGRAD—FOREST TECHNICAL ACADEMY (MINISTRY OF SECONDARY AND POST SECONDARY EDUCATION)

Professor V.E. Sharkov, Director

Professor A.E. Kipriyanov, First Deputy Director, Scientific

Professor M.M. Ovmoychinikov, Deputy Director, Education

Professor Y.N. Nepenin,

Professor E.S. Khutorschikov,

Professor D.M. Flatte:

Famous researchers in pulp and paper at the Academy.

LENINGRAD—LENINGRAD INSTITUTE OF TECHNOLOGY

Professor I.D. Kugushev, Rector of the Institute.

K.P. Mischenko, First Deputy Director, Scientific.

A.D. Volkov, Deputy Director, Education.

Vladimir I. Maximov, Professor and Head of the Department of Environment (famous man).

KIEV—UKRAINIAN PULP AND PAPER RESEARCH INSTITUTE

Alexander F. Tistchenko, Director.

Yuri (George) M. Bogomol, First Deputy Director, Scientific and Chief of Laboratory.

Ivan T. Prilipko, Deputy Director, Economic Control.

Mrs. Irena G. Chegornaya, Foreign Relations.

PRAVDA—CENTRAL SCIENTIFIC RESEARCH INSTITUTE OF PULP AND PAPER

Boris V. Orehov, Director (absent).

Mikhail V.O. Frolov, First Deputy Director, Chief of Laboratory.

Appendix C—Dr. Lionel A. Cox's Diary

Sunday, October 1, 1972.

We left London Airport at 10:35 a.m. and flew on one of Aeroflot's new Ilyushin 62 planes to Moscow, arriving at Sherematiyevo Airport at about 6 p.m. It was a cool day, with a temperature of around 41 °F. (5 °C).

It took two hours to have our bags cleared through Customs and ourselves through Immigration, change our dollars to roubles, receive our Intourist vouchers for the hotel and meals, and finally get an Intourist taxi, so that it was close to 8:30 p.m. before we left for down-town Moscow, about 25 to 30 miles away.

We then experienced, as any western visitor will confirm, the harrowing efforts of checking into a Moscow hotel. However, we were given very nice accommodation at the Intourist Hotel, where we had dinner at 10 p.m. and reviewed our proposed two week program.

Apparently, we were not met at the airport because the Canadian Embassy in Moscow and the Ministry of the Pulp and Paper Industry did not expect us to arrive until October 2. This mix-up actually made us lose a day of our trip, and was not an auspicious beginning to our visit, but the sincerity of the people we were to meet soon put it out of our minds.

Monday, October 2

We were up quite early, but because of the mix-up in the expected date of our arrival and Intourist's inability to get us a taxi, we were late arriving at the Ministry of the Pulp and Paper Industry. Mr. E.V. Khokhlov, Deputy Chief, External Relations Department, and Mr. V. Alekhine, Chief Engineer of the Technical Management Department of the Ministry, greeted and welcomed us to the Soviet Union. Mr. Khokhlov expressed the hope that the exchanges of Soviet and Canadian Working Groups would prove beneficial to both countries. He apologized for the inconveniences and problems we had encountered through arriving a day earlier than the Ministry expected us.

We were then introduced to Mr. Nickolai F. Zinoviev, Senior Engineer of the Foreign Relations Department of the Ministry, who was to be our Soviet translator from the Ministry and would accompany us on our trip.

Our visit to the Ministry was cut short as we were booked on a flight for

Leningrad at 12:25 p.m. So we took our leave and drove to the airport. The Aeroflot flight arrived in Leningrad at about 2:00 p.m. and we were taken by an Intourist taxi to the lovely old Hotel Astoria, where the accommodation and food were quite good.

That evening, Mr. N.F. Zinoviev joined us for supper, and with his help we reviewed the places we would visit and the people we would meet. After supper we were surprised to meet Mr. Gregory Belkov of the National Research Council of Canada, who had been sent over by the Canadian Committee to be our official Canadian interpreter.

Mr. Belkov and Mr. Zinoviev proved to be not only excellent companions while we were in the U.S.S.R., but both did an outstanding job, which made our trip much more productive and interesting.

Tuesday, October 3

At 10 a.m. Dr. Gendron and Dr. Cox were taken on a trip through ancient Leningrad. The Russian guide, Emma, pointed out that although the facings of the buildings are old, the interiors have been completely remodelled. Thus, the charm of the city at the time of the Czars has been retained, while the old buildings have been modernized inside.

From 11 a.m. to 1 p.m. we visited the marvellous State Hermitage Museum, which includes the Winter Palace of Catherine The Great and is beside the Neva River. Here we saw one of the world's great art collections, located in lavish buildings. Paintings by Leonardo da Vinci, Titian, Raphael, Rubens, Van Dyck and Rembrandt will long be remembered.

After lunch we visited the All-Union Research Institute of Pulp and Paper on the outskirts of Leningrad. There we met Mr. Evgeni Y. Pechko, General Director of the Research Institute and its three regional laboratories; Dr. L.V. Grebenev, Chief of the Section of the Technical Management Department of the Ministry of the Pulp and Paper Industry in Moscow; Mr. M.A. Ivanov, First Deputy Director for the Industry's Scientific Unit; Mr. E.D. Perminov, Chief of the Section on Chemical Pulping; Mr. Y.V. Nikitin, Chief of the Section on Water Utilization; and Mr. U.E. Vyukov, Deputy Director of Automation and Mechanization Unit of the Pulp and Paper Industry; and Mr. Urakin, Scientist in charge of Chemical Pulping.

Mr. Pechko, in his humorous way, outlined for us the general organization of scientific research of the U.S.S.R., pointing out that the Leningrad Institute coordinates all other institutes and branch institutes in pulp and paper in the U.S.S.R. He went on to tell us a little about the various scientific and academic institutes which we would be visiting and the nature of the research work done in the Soviet Union.

Mr. L.V. Grebenev, who had come down especially from Moscow for this meeting with us, discussed mainly research financial matters in the U.S.S.R. He was followed by Mr. Mihaie A. Ivanov, who briefly outlined the types of research work that they are doing in the U.S.S.R. and the raw materials they use. He made the interesting comment that the largest wood resources in the world are owned by Canada and the U.S.S.R. He said most of their wood is concentrated in Siberia, where there are tree species such as pine, spruce, birch and aspen up to 2 metres (80 inches). He also discussed briefly the economic feasibility and cost of doing research and development in the U.S.S.R.

The final speaker was Mr. U.E. Vyukov, whose comments were concerned with the automation of technical processes and the construction of control systems that could be used in the mills in the U.S.S.R. He said that work on computerization was being applied to both batch and continuous pulping and bleaching systems, to effluent treatments and to optimizing production on board and paper machines. He said we would be taken on a trip through the Computer Centre at the Institute in a couple of days' time.

This was a very interesting and useful introductory meeting. We ended our first day with the usual Soviet vodka party, with many toasts and much good will.

Wednesday, October 4

At 9 a.m. the Canadian delegation was driven to the All-Union Research Institute's Pilot Plant outside Leningrad at Krasnoe Selo. There we were welcomed by our new friends E.D. Perminov, Y.V. Nikitin, M.A. Ivanov and E.Y. Pechko. Mr. Pechko introduced us to the Deputy Chief of the Pilot Plant, N.A. Sibirgoff and some eight members of his staff, plus Professor D.M. Flatte of the Forest Academy.

In his introductory comments, Mr. Pechko informed us that Krasnoe Selo was one of the oldest paper mills in Russia (see page 14). It first produced paper in 1714 but had been completely destroyed by the Germans in February 1944 during the Second World War. After the war, it was completely rebuilt and converted into the main experimental pilot plant for the U.S.S.R. pulp and paper industry. This pilot plant has been very productive and six years ago received the

Order of Lenin for its excellent work. When we later visited the museum part of the pilot plant, we were shown many other Government certificates and medals that the pilot plant had received over the years for developing new high grades of high quality paper.

The *Krasnoe Selo Institute* is working on various pulping processes, including kraft pulping, sulphite pulping and various modifications of these major processes. They are studying bleaching of pulps; investigating new methods of beating and refining of pulps; improving water purification systems and water effluent treatments; making different types of non-woven fabrics by a dry-laid web process; producing special papers from synthetic fibres for electrical insulation and other special uses on Fourdrinier paper machines and various types of paperboards on cylinder machines. They informed us that we would be given details of these various processes tomorrow.

During our trip through the pulping section of the pilot plant, a light sulphite cooking process was in progress, which they claim gives a 92 percent yield of pulp with strengths only slightly less than that of standard sulphite pulp.

Most of the pulping equipment in the pilot plant was old and conventional. There were two KMW stainless steel lined digesters (2 cubic feet capacity). One was being used for sulphite cooking and the other for kraft cooking. These digesters were built to stand 25 kgm of pressure, but were usually run at only 16 kgm pressure. Also, there was a very old Sprout-Waldon type refiner, through which they refined their high yield sulphite pulps. Then there were four bleaching towers in which they carried out their standard four-stage bleaching process. Next, was a batch digester which makes 250 kgm (or 550 lb. or 0.25 short tons) of pulp in 24 hours. Finally, they mentioned they had other experimental batch digesters at their Baikal and Debrouk mills. None of these experimental digesters was continuous.

We were shown a very neat and compact viscose rayon pilot plant. Here sulphite dissolving pulps were xanthated, dissolved in dilute sodium hydroxide to make the viscose solution, and spun into rayon cord for tires and yarn for clothing. The viscose spinning equipment and the instruments for measuring strength and other properties of spun yarns were quite conventional.

They were quite proud of their new experimental dry-process paper machine. This appeared to us to be a conventional non-woven fabric production line, consisting of a high speed cotton card or web former, a cross lapper to produce equivalent machine and cross directional strengths, a complicated

bonding applicator, and finally, drying and/or curing equipment. The process seemed very similar to that used by Chicopee (a Division of Johnson and Johnson) for making non-woven fabrics 20 years ago. While we were visiting the U.S.S.R. pilot plant, they were producing a non-woven material for use in oil filters at 3 metres (or about 10 feet) per minute. It was one metre wide with a weight of 200 grams per square metre. They gave us very little other information on this non-woven machine. However, we did see another Fourdrinier type paper machine producing electrical and document grades of paper from synthetic fibres, such as polyethylene, polypropylene and polyesters. This machine was running at 8 metres (or about 25 feet) per minute, but could run up to 24 metres (or about 81 feet) per minute, depending on the type of synthetic fibre used and the thickness. In fact, they claimed they had produced non-woven fabrics at 60 metres (or about 200 feet) per minute. In another part of the pilot plant, we were shown a piece of equipment for drying coated papers from various types of solvents by means of a so-called "infrared impulse drying process". They also pointed to a locked room where a new type of ultrasonic beater for pulp was located. Finally, they showed us a complicated machine for depositing metallic coatings from special solutions on paper under vacuum, by means of electrical conduction. This paper is used for producing printed electrical circuits and other types of special scientific and medical papers.

We were then taken down into the basement to see their various types of paper machines. First there was a high speed cylinder machine which had six vacuum forming cylinders. Most of the boards being made were specialties for use as gaskets, air filters, and so forth.

Then, we saw seven old, experimental Fourdrinier paper machines with standard types of headboxes. These machines operated with a closed water system, at a low speed of about 65 metres (or about 216 feet) per minute, and had a 7-roll calender stack. Most of the paper being made on these Fourdrinier machines were specialty grades, such as kraft electrical paper. The only interesting instrument on these machines was an analyzer for measuring the number of breaks and the caliper.

They do little work to improve their experimental paper machines. However, they did tell us that they have been experimenting with foils, and since these were running quite well, they were planning to convert one machine completely over to foils from table rolls.

The last part of the pilot plant was concerned with purifying water taken from the nearby lake. They showed us the equipment

used for purifying the water, such as clarifiers and sedimentation tanks. The sedimentation tanks were particularly interesting in that the water is directed to the bottom of the tank and then up through sand to another tank. As the water moves from tank to tank it is purified and eventually goes back into the paper mill for further use. They claim this way for removing fines is excellent and the sand, since it is reverse flushed, only has to be changed once a year. We did not take many notes on purification of water and effluent treatment processes, as we thought this would be thoroughly covered by the Canadian Working Committee on Pollution Abatement, which also visited Leningrad.

The one thing that intrigued us, as we walked through the plant, was the display of lovely trees and plants which they had round the place. We were told these were to give enjoyment to the workers and to bring them as close to nature as possible.

The last part of this trip was a very interesting visit to the Krasnoe Selo Institute Museum. There we saw the history of the pulp and paper making industry in the U.S.S.R., through the aid of pictures of their mills and equipment, inventors and workers with outstanding performances, and the various grades of paper and board which they have manufactured. They claim 350 new types of paper and board products have been developed, 250 during the last five years.

After we left the museum, we returned to the Deputy Chief's office, where more discussions were held about the technical work programme of the pilot plant and its value to the U.S.S.R. pulp and paper industry.

A pleasant lunch was held, with the usual vodka and exchange of toasts for the success of our pulp and paper exchange programmes between Canada and the Soviet Union.

After lunch, we motored from Krasnoe Selo to Petrodvorets, which lies 18 miles west of Leningrad. There we saw the amazing postwar restoration of the former royal summer palace and beautiful gardens, which Hitler's war machine had converted to ruin and ashes. The restoration of the Great Palace of the Czars to its original splendour was amazing. We enjoyed our walk in the gardens along Samson's canal, passed the many fountains—Pyramid, Adam, Eve, Roman, Sun, Bell and Great Cascade—and up alongside Chessboard Hill. The gold statues, such as the Statue of Psyche and those beside the Great Cascade Fountain were especially beautiful and delightful to behold. We could have stayed on this estate for hours but as the sun set we decided to drive back to our pleasant Astoria Hotel and "call it a day".

Thursday, October 5

At 9:00 a.m. on a rainy day, we were

driven to the All-Union Institute of Pulp and Paper at Leningrad, where we again met with Mr. E.Y. Pechko, Director General, and Mr. E.D. Perminov, Chief of the Section on Chemical Pulping. Mr. Pechko informed us that this Institute does research work on all types of chemical pulping, and that this morning Mr. Perminov would introduce us to their key scientists and give us an opportunity to discuss some of the U.S.S.R.'s pulping and bleaching problems and research programs. The information we obtained from these discussions is presented at pages 14 and 18 of this report.

The main chemical pulping and bleaching research work discussed was:

1. Their new ammonium bisulphite method of cooking larch wood.
2. The suitability of the kraft (or sulphate) process for chemical pulping of eastern Siberian pine, and especially *larch* wood.
3. Their recent work on alkali pulping, using an organic amine stabilizer.
4. A study of the mechanism of the sulphite process to improve the yield and brightness of their dissolving pulps for acetylation.
5. A new four-stage bleach process for sulphite pulp, using hydrogen peroxide to reduce effluent pollution. This appears to be similar to work reported by PPRIC.
6. Their work on increasing pulp yield by the polysulphide cooking process. (At this point Dr. Cox outlined MacMillan Bloedel's new high yield hydrogen sulphide pretreatment kraft process and they were very interested.)
7. Whole tree pulping for production of low grade container boards.
8. Conversion of lignin and bark wastes into by-products, such as fodder, yeast, alcohol, rosin size, turpentine and tall oil.

After lunch we briefly visited their computer research centre. There they showed us their facilities and equipment and mentioned their work on the application of computers to pulping and paper machine process control. This work included the development of a number of mathematical models that were now being used in many of their pulp and paper mills.

The construction of the building which houses the All-Union Research Institute of Pulp and Paper in Leningrad was completed in 1959. Building maintenance was poor by Canadian standards. The laboratories in the building which we saw, and we were only shown a few of them, were small and crowded compared to Canadian standards. The research instruments in use appeared adequate. Some of them were copies of standard pulp and paper instruments developed in other countries, and others were made in Japan, Sweden, U.S.A. and Germany.

The quality of their research work on pulping and bleaching and the competence of their scientists and other technical staff members cannot be judged on the basis of the short discussions we had. However, they seemed reluctant to give us any details of their research work and so we obtained most of our knowledge from a few reports they gave us written by Soviet pulping and bleaching experts. These reports, plus the discussions, gave us the distinct impression that Soviet scientists are still empirical workers, and lack basic knowledge on the mechanism of pulping and bleaching reactions. Thus, much of their research is a duplication of the technical work published in other countries using Soviet wood species. There is no doubt in our minds that Canada is ahead of the U.S.S.R. in the area of new methods of pulping and bleaching.

We ended our visit with lunch in the Director General's office. This consisted of black caviar on black bread and open-faced cheese, lamb and fish sandwiches and some delicious fruit, plus vodka, cognac and mineral water. We were then driven to our hotel and fortunately had a free evening to catch up on our notes, diary and sleep.

Friday, October 6

At 9 a.m. we were taken to the Leningrad Forest Technical Academy. It was a beautiful day—summer and blue sky, quite a contrast to yesterday's rain.

This academy comes under two Ministries, the Ministry of Pulp and Paper Industry of the U.S.S.R. and the Ministry of Secondary and Post Secondary Education. This is the first Forest Institute in Russia (founded in 1803) and one of the largest forest institutes in the world. Its official name is the "Order of Lenin, Kirov Forestry Technical Academy", Kirov being the name of the outstanding leader of the CPSU and the Soviet State (Mr. S.M. Kirov), while the Order of Lenin was awarded to the Academy for its great service to the country on its 150th anniversary in 1953.

We were welcomed by the Director, Professor V.E. Sharkov, and introduced to a number of professors, including the famous pulp and paper professors at the Academy, Professors Y.N. Nepenin, E.S. Khutarchikov and D.M. Flatte (whom we had met on Wednesday at Krasnoe Selo).

The Director, V.E. Sharkov, told us that the Academy trains engineers in eleven specialties, including forest management (i.e., city landscaping and parks), mechanization of lumber operations, transportation of timber by land and water, operation and repair of logging machinery, mechanical technology of wood conversion (i.e., conversion of wood to plywood, furniture, boxes and special

products such as matches and skis), pulp and paper industry, wood plastics (i.e., building boards) and hydrolysis and wood chemistry products (i.e., food, turpentine and tall oil).

Details of how the Soviets recruit young people to attend the Academy, train engineers in their eleven specialties and carry out research work in pulp and paper are presented under "Education and Training for the Pulp and Paper Industry", in this report.

The Director gave us some information on their nearby and famous botanical gardens, whose total area amounts to 64 hectares (or about 158 acres). It contains 1,500 different species of trees and bushes, collected from all over the world. In these gardens, research work is carried out on the growing of new hybrids of woody plants and their acclimatization to Russian weather conditions. The Academy also has two experimental forest stations of 32 hectares (or about 79 acres) at Lysino and Okhta, where students carry out forestry experiments.

The meeting concluded with the Canadian delegates asking Professors N.Y. Nicolaevich and K.I. Semenovich questions about the fundamental research work being carried out at the Academy on the kraft process. These professors also discussed briefly their bisulphite method of cooking larch, and an improved magnesite process; a two-stage sulphite-sulphate process; a soda-hydrazine (too expensive) sulphur-free pulping process; and verified that MacMillan Bloedel's hydrogen sulphide pretreatment process increases the yield of Siberian pine by 5 to 6 percent.

At noon, we went to the Ministry of Chemical Machinery Construction where new prototype equipment is manufactured for the Ministry of Pulp and Paper Industry. In the absence of their Director, we were welcomed by their First Deputy Director, E.M. Golovko, and his staff of engineers. After general introductory remarks by E.M. Golovko, we were invited to have lunch, consisting of cheese, sturgeon and lamb on sliced bread, apples and grapes, candies and plenty of vodka, cognac and mineral water.

After lunch we went on a trip through their impressive workshops, which are located in several large buildings. These included large machine shops, such as one we would find at Dominion Engineering Works Limited in Montreal. There were large lathes, drills, presses, overhead cranes and so forth, capable of making full size prototype paper machines and auxiliary paper mill equipment (e.g., presses, dryers, winders, cutters, calenders, etc.). A description of the Experimental Factory where full scale prototype mill equipment is designed, constructed or modified in cooperation with the Ministry of Pulp and Paper Industry, is

given at page 18 of this report.

Our last stop for the day was at the Design Institute of the Ministry of the Pulp and Paper Industry. There we met the Director, U.F. Semin, and his Chief Engineer, E.D. Tsvetkov. This Institute's job is to carry out engineering, planning and design, not only of pulp and paper mills, but for large wood processing complexes, such as at Bratsk in Siberia and the Kotlass integrated mills near the Urals in the northeastern part of the European section of the U.S.S.R. The enormous complex at Kotlass produces bleached pulp and dissolving pulps by the sulphite process, unbleached and bleached pulps by the sulphate process, linerboard and corrugated medium, printing papers and yeast and alcohol by-products. In addition, the mill runs a power station and a large water treatment plant. More details of the work of the Design Institute are given at page 18.

After returning to the hotel about 5:30 p.m., we went, as guests of Evgeni Y. Pechko and his wife Nina, to the Leningrad Kirov Opera and Ballet Theatre, to a performance of "Swan Lake". We found the dancing and staging magnificent and Tchaikovsky's music played by the 83 piece orchestra, directed by K.M. Sergeyev, was most exciting. The principal dancers were K.I. Feditcheva (Queen of Swans) and P. Abdiev (Prince). They were excellent. At the end of the first act, Evgeni Pechko took us on a tour of the beautiful theatre. At the end of the second act, our Russian host and his staff from the Institute and their wives, had arranged refreshments in a small room near our box, consisting of open faced sandwiches, fruit, vodka and Champagne. After several friendly toasts of good will between our countries, we returned to our box, overlooking the right side of the stage, for the final act of Swan Lake. At the end of the ballet, we all moved to a large dining room in the theatre and had a real Russian feast with many toasts in vodka and cognac. This was a very memorable evening.

Saturday, October 7

This being the first day of the weekend we had the morning free. After lunch our host drove us to the Leningrad Institute of Technology of the Pulp and Paper Industry. This is another large teaching and research institute associated with the Ministry. Mr. E.Y. Pechko introduced us to the Rector of the Institute, I.D. Kugushev, and other members of his scientific and educational staff. One of the most famous men we met at the Institute was Professor Vladimir I. Maximov, Head of the Department of Environment.

The research work carried out at this Institute was concerned with all aspects of environmental conservation, including development of techniques for reducing air

and water effluents and handling of solid waste materials. They were developing methods to warn people when certain types of pollutants are present and methods to remove these wastes by converting them into useful by-products.

We were taken on a trip through the Institute's laboratories where we had an opportunity to see the research work going on in the area of air and water pollution abatement. Then, Professor Maximov showed us an excellent film on how they purify water in Lake Baikal, which is said to contain about one fortieth of the world's supply of fresh water.

Mr. Pechko mentioned that this Institute does many research projects directly for various mills, and so has very close relationships with the pulp and paper industry in the U.S.S.R. He also said that as Director General, he coordinates all the R&D work that is carried out at the Pulp and Paper Institutes in Leningrad, Kiev and Moscow. In this way, duplication of work is avoided as far as possible. In conclusion, he told us that only the best students in Russia attend the Leningrad Institute of Technology, and that over 2,000 people are sent there each year from industry to up-grade their technical knowledge in the pulp and paper industry. We had a very pleasant and profitable two-hour visit.

We were driven to Pavlosk to visit the Great Palace of Catherine the Great. This building, like the palace at Petrodvorets that we saw on Wednesday, had been completely restored after being badly damaged by the Germans. The restoration was amazing. This restoration of buildings is an art that the Russians have developed to a very high degree.

We walked through the Great Palace and saw its great gallery, Hall of War, Library of Paul I, Library of the Empress Maria Fiodorovna, the magnificent state bedchamber, the throne room, the bay window study and the picture gallery of world famous artists.

When we left the Palace, our delightful host, Mr. Pechko, took us on a short walk through the woods with several of his colleagues from the Kresnoe Selo and Leningrad Institutes. Then, to our amazement, we arrived at a picnic table spread with typical Russian foods, vodka and cognac. Being a cool, dull day, we sat down with our overcoats on, and enjoyed the vodka and cognac, the good food, the good will and friendliness of our cordial hosts. A unique ending to our official visit to Leningrad.

Sunday, October 8

This was our last day in Leningrad and arrangements had been made to show us

more of this great city. In an Intourist car we visited the only mosque in Leningrad, which was very beautiful. From there we were taken through the Cathedral of Our Lady of Kazan, which was built to the Glory of God but now serves as the museum of the history of religion and atheism. Its exhibits range from splendid icons to instruments of torture used during the Spanish Inquisition. At our next stop we took pictures of the beautiful Theatre Square with its green toned buildings. Then, we drove along the Neva River and saw Peter and Paul's Cathedral and Fortress, the Admiralty buildings, St. Isaac's Cathedral (now a museum) and then back to our Hotel Astoria.

After packing, we drove to the airport, where Mr. Pechko and Mr. Perminov bade us farewell. Our flight was on an Aeroflot Il-18 jet. We arrived at the Borispol Airport in Kiev at 8:45 p.m. and were met by the Director of the Ukrainian Research Institute of the Pulp and Paper Industry, Alexander F. Tistchenko. After we had checked into the Hotel Dnipro, Dr. Tistchenko kindly took us to supper in the hotel's attractive restaurant, where one whole wall contained many colourful ceramic plates of all sizes. There we had our first Ukrainian food, which was very delightful, especially since the vodka had now given way to wine. At dinner, Mr. Tistchenko outlined to us our program for the next few days in Kiev.

Monday, October 9

We were picked up at our hotel at 11 a.m. and driven to the Ukrainian Pulp and Paper Research Institute, where we were welcomed by the Director, Alexander F. Tistchenko; his First Deputy Director, Yuri (George) M. Bogomol; Deputy Director, Ivan T. Prilipko; and a very pleasant woman who was in charge of Foreign Relations, Mrs. Irena G. Chegornaya. They took us to the Director's office and introduced us to the senior members of the staff. Dr. Tistchenko then outlined the programme of our visit in detail, including technical discussions, which we would have with their specialists, visits through their Institute and various social arrangements, which he had made for us in order to make our trip as pleasant as possible.

Dr. Tistchenko gave us the history of the pulp and paper industry and the Institute in the Ukraine. He mentioned that the first paper mill existed here in 1637 and in those days paper was made from flax. The Ukrainian Institute was not started until 1932 and since then it has grown rapidly, especially during the last 10 years. The Institute was created mainly to solve problems for the Ukrainian pulp and paper industry, but today it does special work for the whole of the Soviet Union. The main areas of scientific research and technology at the Institute are as follows:

1. Production of different kinds of pulp for electrical insulation and condenser papers.
2. Investigation of pulping of various species of hardwood to make them suitable for electrical condenser paper. (Most of the other work on pulping is carried out at the Leningrad Institute.)
3. Recycling of waste papers, including deinking.
4. Development of new types of high quality paper (e.g., insulation paper); water, humidity and heat resistant papers; special computer papers and cigarette papers.
5. Development of laboratory instruments for testing the physical properties of papers, such as tensile strength, dirt count, brightness, fibre length, etc.
6. Development of mill instruments for quality control in pulp and paper production.
7. Development of special instruments for continuous process control of bleaching, grinding, beating and so forth.
8. The use of computers for automation of measurement and control-pulping and paper-making processes. To assist in this work, they are developing non-destructive methods of testing paper and paperboard, such as measuring the tensile strength by means of ultrasonics.

The Ukrainian Institute has a number of services to support its research work. These include:

1. Investigation of the economics of all processes.
2. Long term forecasting of technology for the pulp and paper industry.
3. Patent services, mainly for their own use.
4. A fully equipped library with over 100,000 books and a large number of journals.
5. A post-graduate department where they have over 50 students being technically trained for the pulp and paper industry.
6. An administrative department for the Institute composed of 40 people out of a total staff of 1,000.

Dr. Tistchenko discussed some of their future building plans at the Institute. These are outlined as follows:

1. The completion of a new building next year in which instrument design research will be done.
2. Building of a large pilot plant which will include an experimental paper machine. On this paper machine, they will evaluate the various types of instruments being developed at the Institute. They claim that their objective is to become world leaders in the development of instruments for the paper industry. They were quite proud of this new experimental machine and informed us that it would have a trim

width of 1 metre and a speed of 150 metres per minute. They were confident that the use of this machine plus their new instruments would greatly improve the quality of their special papers.

3. They informed us that they are going to build a new factory to design and manufacture instruments developed at the Ukrainian Institute. This factory would be part of the Institute. It would be responsible for developing pulp and paper instruments for the whole of the U.S.S.R.
4. The size of the Ukrainian Institute (not including the factory) will reach 2,500 people by 1975. The large number of staff increases at the Institutes in Russia by 1975 made us wonder whether our technical effort in North America in the years to come was going to be sufficient. There is the possibility that they could overtake us in the production of high quality papers, if our present level of technical manpower is maintained in Canada.

Other aspects of the management of R&D and design and building of instruments at this Institute is discussed at page 19.

At about 2 o'clock, the Director and his key staff members gave us a very delightful lunch without vodka. We had cognac, fruit and some delightful open faced sandwiches. Then they took us on a tour through the lovely city of Kiev.

Our first stop was at Central Recreation Park, where we walked along Dnieper Heights, up to Vladimirskaya Hill. From here we had a splendid bird's eye view of Podol and the stretches of land on the other side of the Dnieper River. Vladimirskaya Hill was so named in 1853 when a lovely bronze statue of Prince Vladimir of Kiev was erected on its summit. The statue holds a cross in its right hand. From this vantage point on the hill we also saw the Park (pedestrian) Bridge which enables residents to cross over to the white, sandy beaches of Trukhanov Island.

Our next stop was at the beautiful Church of St. Andrew, erected in 1747 by Bartolomeo Rastrelli. From here we drove to the magnificent stadium and sport grounds of the Central Stadium which seats almost 100,000 spectators.

Our final stop of the day was at Obelisk in the Park of Eternal Glory to the Fallen in the Great Patriotic War (1941-45). There we saw the eternal flame on the grave of the unknown soldier and heard the sombre music in the background.

We drove back to the Dnipro Hotel across from Lenin Komsomol Square. At 5:30 p.m. we were driven by the Director and his Deputies to the Windmill Restaurant, where we had a delightful Ukrainian supper and an enjoyable evening.

Tuesday, October 10

We were driven from our hotel to the Ukrainian Institute at about 9 a.m. There we were met by the Director and his deputies who took us on a tour of the Institute.

The first place we visited was a large conference room where a number of charts and pictures of their new factory for designing and manufacturing instruments for the U.S.S.R. pulp and paper industry were displayed. We also saw several new instruments for measuring tensile and tear strength. There was a chart showing what a completely automated paper machine controlled by computers would look like. Finally, there were large maps of the U.S.S.R. showing lines of communication between the Kiev Institute and various mills in the Soviet Union.

At this Institute there were a large number of instruments for measuring the physical properties of pulp and paper and for automatically controlling pulp and paper mill processes. A description of this particular visit, written by Dr. Pierre Gendron, is given at page 19 of this report.

A short discussion with one of their experts on how they modify the structure of cigarette papers by various additives was interesting; as was the bird's eye view given us of high temperature papers containing mineral fibres and various binding agents.

Dr. Markel and Mr. Kroskovich in the Cellulose Pulping Lab told us how they produce high quality papers for use as electrical condenser papers. They claim that the nitric acid process enables them to reduce the mineral content in these grades of papers. They also described the by-products that they are producing from sulphite liquor wastes. The main products we discussed were an organic fertilizer and a yeast for animal food. This by-product research work is discussed by Dr. L.A. Cox at page 19.

As mentioned above, the Ukrainian Institute has developed some very fine instruments and we believe that these should be further investigated by Canadian experts to see whether or not any of them could be of value to the pulp and paper industry in Canada. The Director informed us that it took two to three years to develop most of these instruments. The various stages in the development are as follows:

1. Define the purpose of the instrument.
2. Use designers to solve the design aspects of the instrument.
3. Draft the first concepts on paper.
4. Make an experimental model.
5. Carry out trials with the particular instrument being evaluated.
6. If all goes well, go to production.

The list of the various instruments that they have produced is shown in two

catalogues which they gave to us. See Appendix D, references 3 and 4. Most of these instruments are not new but are adaptations of existing instruments on the market.

However, Dr. Pierre Gendron wrote to the Ministry of the Pulp and Paper Industry on February 13, 1973 to get more information on a number of the instruments, as follows:

- List A—An instrument for automatic control and recording of pulp freeness in mill flow.
- An instrument for controlling the uniformity of paper opacity.
- List B—Meter for determining consistency of highly diluted pulps.
- Mass and moisture meter for paper sheets.
 - Method for controlling the fractional characteristics of fibre length distribution in pulp.

At 1 o'clock we had an enjoyable lunch at the Ukrainian Restaurant with American wine, borsch and other good foods.

The Intourist taxi then took us across the Dnieper River to see a modern, attractive residential area called Darnitsa Estates, which covers 273 hectares (or 673 acres). The first section of this estate consisted of 83 modern buildings with over 5,000 flats, built largely of prefabricated brick. The Darnitsa Estates has metro and other transportation facilities to Kiev, schools and day-care centres, hospitals, cinemas and various other public services.

From the Estate we crossed the river to the Kiev-Pechersky Monastery, where we spent the rest of the afternoon. This was the first monastery in Russia, built in the 11th century. Unfortunately we arrived a little too late to see the grave-like cells of the monks, but we did have an opportunity to walk through part of this huge building before it closed, although we could not get inside to see the extensive collection of valuable jewels and books.

In the evening we were taken to the Ukrainian Palace of Culture, where we heard an excellent Ukrainian Song Festival. This theatre was modern, with a large stage and excellent acoustics. We were told it could hold over 4,000 people.

Wednesday, October 11

We were driven to the Institute at 9 a.m. The Director, Dr. Tistchenko, had assembled all of the Institute's top scientists as well as his deputies. For the next few hours we exchanged views on R&D management in our two countries, how we carry out technological forecasting and how research projects are exploited in our mills.

Dr. Tistchenko was very keen to have us present case studies of how a project moves from an idea to commercialization. He wanted to know each step in our innovation process and how long each step took. The examples

we presented were the Papriformer and the hydrogen sulphide pretreatment kraft process. When we had finished discussing these, Dr. Tistchenko said he was impressed with the efficient manner in which we carry out our R&D developments in Canada. In fact, he was amazed at how fast we can complete projects and get a return on our investment. In the U.S.S.R., it takes considerably longer. He congratulated us on our excellent laboratory achievements. This discussion and exchange of know-how was very worthwhile and enabled us to get a better understanding of the problems in implementing new technology in the U.S.S.R.

After lunch we were taken on a sight-seeing trip to St. Sophia's Cathedral and Museum. One attractive and excellent guide told us that the Cathedral was founded in 1073 during the reign of Yaroslav the Wise. It was a magnificent building, with many priceless architectural monuments and finely carved ornaments. We were told that its appearance had changed many times over the centuries, as a result of reconstruction and the significant additions to the building made in the 17th and 18th centuries. Numerous mosaics, frescoes and neo-family portraits have and are being discovered under the coatings in the Cathedral. Most important, however, St. Sophia's Cathedral is a symbol of Christianity and has played a tremendous cultural role in the life of the State, since it was the centre for the writing of manuscripts and under its auspices the first Russian library was organized.

As we left the Cathedral we strolled by the newspaper archives of the Central Scientific Library of the U.S.S.R. Academy of Science.

In the evening we went to the Sbevechenko Opera and Ballet Theatre to hear a Georgian opera. The costuming and the singing were magnificent. From here the Director and key members of his staff took us back to the Dnipro Hotel, where we had a delightful Ukrainian supper which included meat-in-a-pot stew with greens, called Zharkoe Gorshochke.

Thursday, October 12

At the airport we bade farewell to the Director, Irena Chegornaya and George Bogomol and boarded our delayed Ilushian 18 jet at 11 a.m. instead of 9:45 a.m. We arrived in Moscow at 12:15 p.m. After the usual delays at the airport, we arrived at 3 p.m. at the Intourist Hotel where we had started our Soviet trip 11 days before.

After a quick lunch, we visited the Canadian Embassy, where we met Gerry M. Deyell, Commercial Secretary and Robert H. Gayner, Commercial Counsellor for the Embassy. They were quite interested in how the Russians were treating us and our

impressions. They were pleased that we had worked out a programme for mutual cooperation and exchange of scientific and technological knowledge in the pulp and paper industry between our two countries.

In the evening we wandered through Moscow's Red Square. We saw the box-like Lenin Mausoleum, which was closed at night; the flood-lit Spasskaya (Saviour's) Tower, topped by a glowing star; the fairy-like onion-domed St. Basil's Cathedral which was built by Ivan the Terrible to commemorate his victory over the Tartars in 1552; and the crenelated walls of the Kremlin.

Friday, October 13

Meetings for this day were held at the Ministry of the Pulp and Paper Industry, where we met Nickolai N. Chistyakov, First Deputy Minister, and renewed acquaintances with Mr. E.V. Khokhlov, Mr. V. Alekhine, and Mrs. N.P. Merkulova, Senior Engineer in the External Relations Department. Also accompanying us was Mr. Robert H. Gayner of the Canadian Embassy.

Mr. Chistyakov informed us that the Deputy Minister, G.F. Pronin, in charge of production for the Ministry of the Pulp and Paper Industry, was unable to be with us today because of illness. Mr. Chistyakov then outlined the history of the forestry, wood working and pulp and paper industries in the U.S.S.R. He mentioned that the pulp and paper industry was made into a separate ministry in 1968 by order of the Council of Ministers.

Mr. Chistyakov asked us to give him our impression of the U.S.S.R. pulp and paper industry, based on what we had seen in Leningrad and Kiev. We gave him a fair appraisal but pointed out that the Soviets seemed to be quite concerned with Canada's intention to exchange information between our two countries. As Bob Gayner of the Canadian Embassy said "The Committee of Science and Technology in the U.S.S.R., and even Mr. Kosygin himself, have expressed the need to achieve some concrete action and results between Canada and the U.S.S.R.". Mr. Kosygin realizes that he must be patient and enable us to learn how to work together with our different systems, but there is a need for us to develop, as quickly as possible, methods of cooperation. At this point, we outlined our proposed Canadian programme for future cooperation and exchange of scientific and technological knowledge and know-how in the pulp and paper industry between the U.S.S.R. and Canada (see page 22 of this report). This proposal was very well received by the Soviets and to them was a firm indication that Canada wants to cooperate with the U.S.S.R. in the promotion of technical growth and economic growth for

the good of both of our pulp and paper industries.

Mr. Alekhine then discussed some of the areas in which he felt the U.S.S.R. research work in the pulp and paper industry had not been successful. He wanted to know more about how Canadians evaluated progress in their industry. He then discussed some of their major problems in Perm, Bratsk and various parts of Siberia. He told us about the difficulties the Soviets have had to pulp larch and what is being done to solve this problem.

After our meeting ended, we were driven to the Central Research Institute of Paper at Pravda, about 37 kilometres (22 miles) outside Moscow. There we met the First Deputy Director, Mr. M.V. Frolov, who outlined to us the history of the Institute, the nature of its research work and how the Institute is organized since it moved from the centre of Moscow in 1966.

At about 5 p.m. we drove back to our hotel. Unfortunately, our translator Mr. Greg Belkov had come down with the flu.

Saturday, October 14

At 8 a.m. we went to the Moscow Central Research Institute of Paper where we had breakfast. After being introduced to many members of the staff who had come in especially on Saturday, we were taken on a tour of the Institute. We were shown their library with over 20,000 books; their patent and licensing department; their equipment design office and shops; their 26 laboratories for working on various types of consumer products such as printing books, wallpaper and non-woven fabrics; their physical testing laboratories; their computer centre; their coating laboratory and pilot plant; and their large auditorium which can seat over 400.

At about 1 o'clock we were driven to a very nice restaurant where we had lunch and again too much vodka. Our next stop was the city of Zagorsk, where we were taken to St. Sergius' Trinity Monastery. There we saw a number of buildings including the imposing white-walled Trinity Cathedral (built in 1443) and other interesting buildings such as the Cathedral of the Dormition (1554), the Chapel over the Wall, the Bell Tower (1850), the Church of St. John the Baptist (1692), the Pilgrim's Tower (1800) and St. Parasceve Monastery (1650). In the Monastery are rich collections of ecclesiastical vestments and of the ancient Russian, Oriental and Western European jewellery made in the 15th century. We also saw Zagorsk's famous hand-made wooden toys. We left this national museum of architecture and drove back to Moscow. In the evening the Ministry of Pulp and Paper put on an impressive dinner for us at the famous restaurant Metropole. There we were given very many special dishes and a number of

toasts were made with vodka and cognac.

Sunday, October 15

This day, being Sunday, was a free day. We spent some time with our friend Belkov, who was now quite sick but fortunately under the care of two doctors. Being a very wet day, we did some shopping at the B.K. Foreign Currency store, visited the Hotel Russia and saw a few of the large buildings including the Moscow Hotel and the Bolshoi Theatre.

Monday, October 16

At 9 a.m. we visited the Ministry to discuss with Mr. Alekhine and Mr. Khokhlov the organization charts of the Ministry of the Pulp and Paper Industry. We also discussed how greater cooperation could be developed between our two countries.

At 11 a.m. we visited the Canadian Ambassador, Mr. R.D. Ford. We gave him our impression of our trip and how we had tried to improve the exchange of technology between our two countries. The Ambassador was delighted with our progress and was quite encouraged about future relationships between Canada and the U.S.S.R. in the pulp and paper industry.

We were invited by Bob Gayner of the Canadian Embassy to have lunch at his delightful apartment. This was most enjoyable.

We then picked up our bags at the hotel and were driven to the Sheremetjevo Airport for our evening flight to London. At the airport, we were met by Mr. Khokhlov, Mr. Grebenev, and our fine translator and companion on this trip, Mr. N. Zinoviev. Each of us expressed our sincere appreciation and thanks to our kind hosts and with our Canadian interpreter, Mr. Greg Belkov, who was now recovering from the flu, we exchanged our money and went through Customs and Immigration into the lovely new section of the airport. After a short wait we boarded the BEA plane for London where we began to outline and draft this report.

Appendix D—Literature Given to Canadian Delegates by the Soviets

1. "Sulphate Pulping and Oxygen Bleaching". Report of Soviet Specialists at Soviet-Finnish Symposium, September 12-13, 1972. Ministry of Pulp and Paper Industry, Ukrainian Pulp and Paper Research Institute, Kiev, 1972.
2. "Use of Larch as Raw Material for Pulp and Paper Industry". Reports by Soviet Experts at the Soviet-Finnish Symposium, November 15-19, 1971. Ministry of Pulp and Paper Industry of USSR, Ministry of Higher and Secondary Special Education of the RSFSR, Order of Lenin-Kirov Forest—Technical Academy, Leningrad, Leningrad, 1971.
3. Catalogue of Pulp and Paper and Paperboard Testing and Research Instruments and Equipment, Ministry of Pulp and Paper Industry of USSR, Science and Research Institute of Pulp and Paper Industry of Ukraine, Published by "Reclama", Kiev, 1970.
4. List of Instruments developed by the Pulp and Paper Research Institute of the Ukraine from 1969-1973, not included in the Catalogue featuring experimental units. Given to L.A. Cox by N.G. Nikolsky, Chief, Technical Department and Member of the Board, Ministry of the Pulp and Paper Industry, when he was in Vancouver in December 1972.
5. "Purification and Recovery of Industrial Waste in Pulp and Paper Industry". Volume I, V.F. Maximov, V.B. Lesohin, L.M. Isianov, A.I. Torf and G.V. Maximov, published by the Forest Industry, Moscow, 1972.
6. "Sanitary Protection and Conservation of Air Basin, Purification and Recovery of Gaseous and Dust Wastes". Volume II, V.F. Maximov, V.B. Lesohin, L.M. Isianov, A.I. Torf and G.V. Maximov, published by the Forest Industry, Moscow, 1972.
7. "Work Safety in Pulp and Paper Industry". Professor V.F. Maximov, approved as a textbook for intermediate and highest institutes of the Pulp and Paper Industry, published by the Forest Industry, Moscow, 1972.
8. "Largest Forestry College of U.S.S.R.", the Technical Academy of Forestry at Leningrad, named after S.M. Kirov and awarded the Order of Lenin. Chief editor, V.I. Sharkov, published by the Forest Industry, 1967.
9. Collection of Works of the Science and Research Institute of the Pulp and Paper Industry of the Ukraine, Volume 14, edited by A.F. Tistchenko, published by the Forest Industry, Moscow, 1971. (Contains papers related to development and applications of technology in pulp, paper and paperboard production, developments of methods, instruments and systems for quality control and also some papers on subject of economics.)

Appendix E

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