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POTASH INDUSTRY

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## PREFACE.

At its first session in April 1926, the Preparatory Committee for the International Economic Conference decided that it was necessary to submit to the Conference a series of memoranda describing the present position in certain major industries. The Committee at the same time outlined the general scheme on which these studies were to be carried out.

The Secretariat was instructed to prepare for the Committee's second session, in November 1926, memoranda on certain key industries. With regard, however, to the other more important industries, among them the potash industry, it was thought better to obtain memoranda from the competent organisations in certain countries. Consequently, at its second session, the Committee was placed in possession of a Memorandum on Potash prepared by the Deutscher Kali-Verein.

At its November session, the Committee decided that the memorandum from the above-mentioned German association should be transmitted by the Secretariat through the members of the Committee to those countries to which a study of it might be of interest and which might desire to offer observations upon it.

In accordance with this decision, and following on an exchange of views between the German and the French producers, the present publication contains, in addition to the revised memorandum of the Deutscher Kali-Verein, a Survey of the Potash Industry in France, drawn up by the Société commerciale des Potasses d'Alsace, and a Note on the Potash Industry in Poland, submitted by M. Gliwic.

Geneva, March 1927.

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# THE POTASH INDUSTRY.

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Memorandum prepared by the DEUTSCHER KALI-VEREIN, Berlin.

*Communicated by* Dr. C. LAMMERS.

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# THE POTASH INDUSTRY.

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## I. GROWTH OF THE GERMAN POTASH INDUSTRY.

The birthplace of the world's potash industry is to be sought in Central Germany. Here, in the little town of Stassfurt, in the year 1851, the first shafts were sunk, and four years later the mining was begun. At the time, interest was concentrated almost exclusively upon the rock-salt; the potash salts deposited upon it were regarded as worthless and were shot on to the attle-heaps. It was not until the year 1857 that their enormous economic value for agricultural and manufacturing purposes was recognised.

Soon after the recognition of the great economic value of the potash salts, the two sole producers then existing, namely, the State works at Stassfurt and Leopoldshall, started a sort of loose co-operation and concluded agreements which permitted the development of the crude salt business along non-competitive lines. These agreements were followed in 1876 by a convention of the potassium chloride factories, a price-fixing syndicate being formed called the "Chlorkalium-Preisbestimmungs-Syndikat", the members of the convention undertaking to observe the prices fixed week by week. The convention only lasted until the year 1879; in that year the first formal cartel — known as the first Carnallit Convention — was formed, which became determinative for the further development of the industry. In the succeeding years, various further agreements were concluded in regard to the allotment of the quotas of crude salt among the producers, while, on January 1st, 1884, the first selling syndicate of potassium chloride works was founded, the number of participating factories being twenty.

The winning of potassium salts had been confined to the original Stassfurt district for a short time only; fresh installations were very soon commenced in the neighbouring State of Anhalt, and others sprang up in Brunswick and Thuringia. In 1886, the first shaft in the Province of Hanover was completed, and others were sunk in Mecklenburg and elsewhere. Whereas, up till then, the production of potassium salts was scarcely able to keep pace with the demand, the continued increase in the number of works joining the syndicate gradually reversed the situation, and, despite successful efforts to increase the sales, serious difficulties ultimately ensued. Help was sought in legislation, and the Potassium Act was passed on May 25th, 1910. This Act provided for the fixing of maximum prices

on the home market. Uniform prices were thus obtained, but the Act was unable to prevent the squandering of national wealth by the continued and useless increase in the number of potash works. This disproportionately rapid extension of the industry by the opening of new shafts without a parallel increase in the absorptive capacity of the potash market was distinctly disadvantageous. The result of these developments was that, just before the outbreak of war, the number of mines and factories to which quotas had been allotted totalled 164. Among the newest shafts in the German potash industry were those in Upper Alsace which were ceded to France under the Treaty of Versailles and which, since 1919, have been further developed by the French State Potash Works and the Mines Sainte-Thérèse.

In April 1919, the German Potash Law was amended by a new Act entitled "Gesetz über die Regelung der Kaliwirtschaft", the object of which was to realise the idea of a general development of the potash industry while preserving the legal provisions passed in 1910. Consequently, the new law incorporated the potash producers in an association called "Das Deutsche Kali-Syndikat". Mention must also be made of the ordinances of October 23rd, 1921, and February 26th, 1924, which contained fresh stipulations concerning the closing-down of shafts. The purpose of these new provisions was to restrict production essentially to the most capable works and to exclude inefficient concerns in order to prevent the prices of potash salts from rising too high.

This legislation determined the lines on which the German potash industry was to develop, with the result that production was confined to the best deposits and the works fitted with the most modern plant. Parallel with this movement there was progressive concentration, that is to say, smaller works combined to form big wealthy companies, which, in their turn, endeavoured to get the quotas of inefficient concerns transferred to works owning the best salts and possessing the cheapest labour conditions. By the middle of 1926, the independent potash works, which, in pre-war years, had numbered 198, were reduced to 12. This dozen of associations — varying in size, but all fairly large — proceeded to close, in favour of the better works, those of lesser efficiency and those which, by reason of the inferior quality of their salts, were not sufficiently remunerative. The quotas of the closed works having been transferred to the others, increased demands were naturally made upon the capacity of the latter, a circumstance which necessarily meant improvement in working methods and progress in the construction of plant.

This rationalisation, combined with the return to peace-time working hours, prevented any rise in the price of potash products corresponding to the general index. To effect the concentration and rationalisation of the industry, considerable funds were required, which, owing to the scarcity of money in Germany, were obtained abroad by way of loans. One such loan of R.M. 300,000,000 was arranged by the Deutsche Kali-Syndikat in the year 1925; of this nominal sum, R.M. 240,000,000 has so far been allotted. The rush of subscribers was so great that the subscription lists opened at 9 o'clock were closed within 15 minutes. The

applications received by British, Swiss, Dutch and Scandinavian banks totalled 1,200 million marks.

## II. PRESENT ORGANISATION OF THE POTASH INDUSTRY.

By the Law of April 1919, regulating the potash industry, all producers of potash were amalgamated in the Deutsches Kali-Syndikat, G.m.b.H., 38/39, Dessauer Str., Berlin, S.W. 11. The Deutsches Kali-Syndikat is the selling organisation for the industry. It is responsible for the entire selling mechanism, both at home and abroad. Special mention must be made of the agricultural propaganda rendered feasible by the fusion of the potash works and so thoroughly carried out by the Deutsches Kali-Syndikat.

*It is not possible to overstress the fact that the world's present demand of millions of tons of potash is due solely to the educative efforts of the Propaganda Organisation of the German Potash Industry.*

Manufacturers having been from the very first fully alive to their need of potash, it was unnecessary to canvass among them; but, great efforts were required to awaken agriculturists to the necessity for using potash and to enlighten them as to its mode of application.

In endeavouring to extend the use of agricultural potash, the Deutsches Kali-Syndikat employed, from the outset, scientific methods of explanation regarding the effects of potash fertilisers, being well aware that a knowledge of the proper application of artificial manure would necessarily lead to an increase in potash sales. The agricultural propaganda of the Deutsches Kali-Syndikat is conducted by an agricultural department attached to the headquarters of the syndicate, the staff consisting of agricultural and chemical experts. Working under this agricultural department, there are, both at home and abroad, a large number of agricultural information offices, to each of which is allotted the canvassing of a district. From the point of view of political economy, the labours of the agricultural department must be characterised as particularly productive, since the increased use of potash due to their activities benefits not merely the potash industry but, in an even higher degree, the agricultural industry of the districts concerned, inasmuch as the information offices impart to the inhabitants ways and means of augmenting the remunerativeness of their farms.

For the scientific study of manufacturing methods and the discovery and industrial application of new processes, the Kaliforschungsanstalt (Potash Research Institute) was founded at Leopoldshall in the year 1920. This institute established a close connection between science and technology, such as had already proved a great success in other extensive domains of Germany's chemical industry. To this collaboration between the chemists engaged in the works and those experimenting in the Research Institute we owe a large number of improvements as well as

the perfecting of the apparatus used. Thermic economy was also included in the scope of the Research Institute's labours.

The central mining organisations of Germany's potash industry are the Deutsche Kali-Verein, E.V., and the Arbeitgeberverband der Kali-Industrie, both in Berlin.

The former association concerns itself with the industrial interests of potash mining; in particular, with questions relating to legal matters, the mining police, taxation, traffic and drainage (mother liquor). Attached to it is the Bergbauliche Werkstoff- und Seilprüfungsstelle, mainly devoted to testing the materials and ropes used in the mining.

The Arbeitgeberverband der Kali-Industrie, E.V., represents the German potash industry in all social and socio-political matters, particularly where these concern social legislation, social insurance, the regulation of wages and salaries and the settlement of other tariff conditions, such as working hours, etc.

Mention must also be made of the Reichskalirat (Potash Council) created by the Potash Act. Under this Council are placed the Landwirtschaftlich-Technische Kalistelle, the Kaliprüfungsstelle I und II Instanz, and the Kaliberufungsstelle.

The Reichskalirat conducts the potash industry on the socio-industrial lines laid down in the legal provisions.

The Landwirtschaftlich-Technische Kalistelle is concerned with agricultural chemistry and agricultural experiments adapted to extending our knowledge of the value of potash manuring.

The Kaliprüfungsstelle fixes the selling quotas of the various works.

The Kaliprüfungsstelle supervises the carrying-out of any regulations issued by the Reichskalirat for ensuring the average wages of the hands and the staff.

The Kaliberufungsstelle deals with appeals against the regulations and decisions of the Kaliprüfungsstelle.

The foreign sales and the propaganda work of the Deutsches Kali-Syndikat abroad are organised on principles similar to those for sales and agricultural propaganda in Germany. Activities abroad are conducted in harmonious co-operation with the French potash producers and in accord with the Franco-German Potash Agreement of December 29th, 1926.

### III. PRODUCTS OF THE GERMAN POTASH INDUSTRY.

The German potash industry manufactures the following articles, the active principle of which is, in each case, potash:



(a) *For agricultural purposes:*

	Percentage of pure potash
Carnallit . . . . .	with 9-11
Kainit-Hartsalz and sylvinit . . . . .	,, 12-15
Hederich-Kainit. . . . .	
(for combating charlock and other weeds, and also slugs and snails)	
20 per cent potash manure salt . . . . .	,, 12-15
30 ,, potash manure salt . . . . .	,, 18-22
40 ,, potash manure salt . . . . .	,, 28-32
50 ,, potash manure salt . . . . .	,, 38-42
	50
(Muriate of Potash)	
Sulphate of potash . . . . .	,, 48
Sulphate of potash-magnesia . . . . .	,, 26

(b) *For manufacturing purposes:*

- Carnallit bathing salt
- Carnallit thawing salt
- Carnallit
- Kainit-Hartsalz and sylvinit
- Potassium chloride (50%-62% pure potash)
- Double refined potassium chloride (over 62% pure potash)
- Sulphate of potash (48%-52% pure potash)
- Double refined sulphate of potash (over 52% pure potash)

Besides the above, the German potash works manufacture a number of other articles required by the trade in large quantities.

#### IV. THE USES OF POTASH SALTS.

Upwards of 90 per cent of the potash salts produced are used as fertilisers in agriculture. Modern agricultural chemistry has demonstrated that, in order to thrive properly, vegetation requires an adequate supply of three fundamental plant-goods, namely, nitrogen, phosphoric acid and potash. The special rôle played by potash was well typified by Liebig when he said: "Potash is somehow connected with the carbon hydrates". Scientific and practical experiments, conducted for many years, have confirmed the fact that, for all cultivated plants and for all types of soil used in agriculture, potash is essential for the achievement of a maximum yield. A lack of potash results not only in a reduction of yield but also in deterioration of quality, to an extent which may culminate in morbid

conditions of the plant. These symptoms, which have been the subject of thorough investigation at the Experimental Station of Bernburg in Germany, make themselves apparent in a discoloration of the leaves and, in severe cases, in a complete decay of the plant. The favourable qualitative effects of potash fertilisers are most noticeable in the case of first-class products. Thus the flavour of fruit and wine is improved, the durability of vegetables is increased, the strength of the fibre is augmented in fibrous plants, the proportion of albumen to starch in brewing barley is rendered more favourable, and the combustibility of tobacco is enhanced, which means, in its turn, a betterment of the aroma.

A noticeable illustration of the need for potash in agriculture occurred during the war in the United States, where there was an inevitable lack of this fertiliser. The results fully confirmed the experience gained in the agricultural experimental stations, these results being all the more striking, inasmuch as a maximum of production was demanded from agriculture in the United States to meet the exceptional requirements of the war. Unsatisfactory crops in consequence of the lack of potash were reported particularly from the intensively cultivated southern and eastern States. The U.S.A. Government pointed out that, for the economic welfare of the country, the import of potash as a plant food was imperative, and that without potash the farmers could not adequately meet the requirements of a continually increasing population. For want of potash, the crops suffered both in quality and quantity. An official publication of the American Department of Commerce states that, owing to the lack of potash in the years 1917 and 1918, enormous quantities of vegetables reached the markets in a rotten condition, so that the farmers experienced a serious loss, and detriment was caused to the nourishment of the people as a whole.

While the employment of potash in agriculture is due to the discoveries of recent years, its use in industry dates back to early times, not, it is true, in the form of mineral salts, but in the form of potassiferous wood-ash. Owing to the development of the chemical industry in the nineteenth century, this source of potash ceased to meet the demands; consequently, industry welcomed particularly the discovery of the Stassfurt potash deposits.

The most important compound manufactured from potash salts by the chemical industry is caustic potash, which is obtained from potassium chloride by an electrolytic process and forms the basic material for producing acids and salts. Whereas in agriculture there is no possibility of replacing potash by any other element, in the chemical industry other alkalis and alkaline earths can to some extent be used as substitutes. Nevertheless, potash is preferred, partly because of the special features of the potash compound, partly because the potash salts frequently crystallise better and can therefore be more easily produced in a pure form than is the case with sodium salts.

### V. STATISTICS OF POTASH PRODUCTION.

The gigantic increase in the demand for potash, which has resulted from the educational efforts of the Deutsches Kali-Syndikat, will be readily seen by reference to the subjoined table concerning the production of potash salts:

1865 . . . . .	890,596 metric quintals <sup>1</sup>
1885 . . . . .	9,290,488 „ „
1905 . . . . .	48,785,984 „ „
1925 . . . . .	120,442,395 „ „

As regards home and foreign demands, the sales were divided as follows:

	Germany Pure Potash (K <sup>2</sup> O)	Foreign Countries Pure Potash (K <sup>2</sup> O) (Metric quintals)	Total Pure Potash (K <sup>2</sup> O)
1925 . . . . .	7,671,640	4,583,477	12,255,117

The great consumption of potash in Germany is due partly to the proximity of the farms to the German potash works and the resultant lower freight costs, but more to the exceptionally intensive cultivation and the greater demand for potash manure thereby necessitated. Nevertheless, the maximum consumption of potash per hectare is not found in Germany but in Holland. Stated in kilograms of pure potash, the consumption per square kilometer of cultivated area in the leading agricultural countries of the world in the year 1925 was as follows:

	Kilos
Holland . . . . .	2,600
Germany . . . . .	2,300
Scandinavia . . . . .	500
France . . . . .	350
Great Britain . . . . .	250
United States of America	100

A comparison of these figures reveals at once how restricted the use of potash as a fertiliser still is in many countries. However, the Franco-German Potash Agreement will undoubtedly serve to develop the propaganda organisation abroad in favour of using potash fertilisers in agriculture; and the farmers in those countries where small use is at present made of potash need only to be properly instructed as to the necessity for employing potash fertilisers in order to effect a rapid rise in its use. No anxiety need be felt as to the capacity of the German potash works

<sup>1</sup> 1 metric quintal = 220.46 lbs.

to meet any increase in the demand for potash, be that demand ever so great, since the German potash deposits are fully adequate to supply the world's requirements for centuries to come, even assuming an enormous increase in the demand.

#### VI. PRICE POLICY OF THE DEUTSCHES KALI-SYNDIKAT.

The price policy of the Deutsches Kali-Syndicat has exercised great influence in the direction of a continued extension of the potash market. It has always aimed at promoting the remunerativeness of manuring with potash by keeping the price of potash as low as possible. How successful this has proved will be seen on reference to the graph on the following page,

On this question we confine ourselves to quoting from an American source:

“The successes accomplished by the potash syndicate in the fulfilment of its task of making potash fertilisers freely available are not only shown in the increase of potash consumption but in the trend of prices since the institution of the syndicate.

“The following table shows the lowering of prices, since before the war, of muriate, of sulphate of potash, of 20 per cent potash fertiliser, and of kainit:

	Prices f.o.b. German Ports, for			
	Muriate of potash	Sulphate of potash	potash fertiliser	Kainit
First half-year 1914	\$37.07	45.57	11.58	6.36
Average 1925 . . .	\$31.55	42.85	8.00	4.75

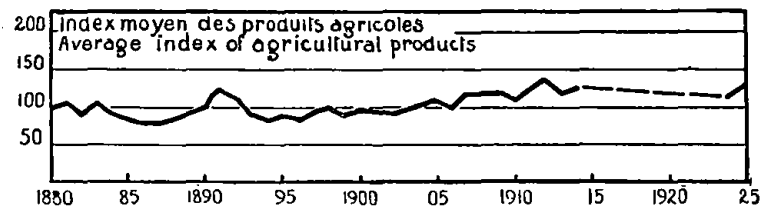
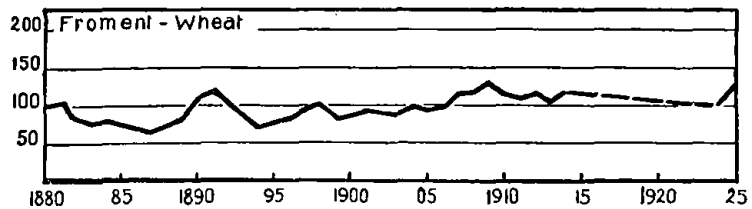
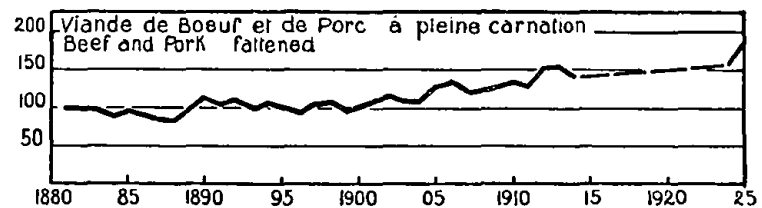
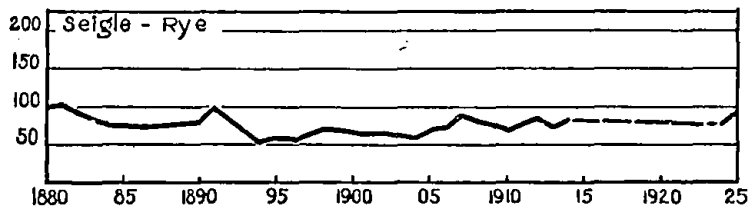
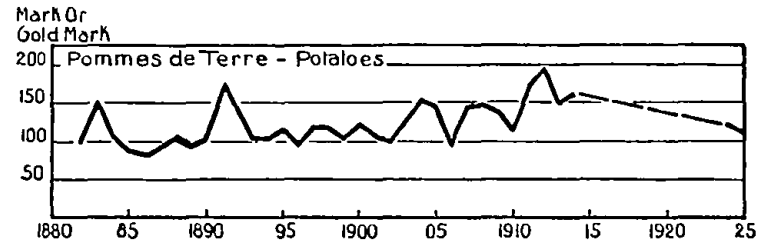
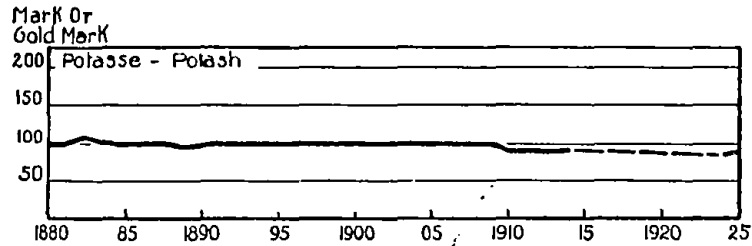
“The reduction of the price of potash at the mines has been somewhat counteracted through an increase of the cost of German railroad transportation, particularly trans-Atlantic freight, and through the increase (in the cost) of packing material (bags), over which, of course, the potash syndicate has no control. The following table shows how these costs have increased:

#### *Trans-Atlantic Freights from German Ports.*

	Per ton	P.T.O. prices of bags
1914 average.....	\$ 2	about 13 cents per bag
1924 average.....	\$ 3	about 22 cents per bag
1925 average.....	\$ 3	about 27 cents per bag
Increase.....	50 %	about 110 %

“Lately trans-Atlantic freights have risen to \$3.50 and even \$4.50 per ton; that is, to about twice the pre-war figures.

**Movement of Prices of German Potash and of the most Important Agricultural Products  
in the Years 1880 - 1925.**



Gold-mark prices for the years 1915-1923 cannot be determined on account of inflation of the currency. The index numbers for potash are calculated from the average prices for kainit 20, 30, 40 per cent of potash fertilising salts and 50 to 60 per cent of chlorate of potash.

“The reduction of the price for muriate of potash c.i.f. American ports to \$34.55 for 2,000 lbs. in 1924, against the price of \$39.07 in 1914, has thus only been possible through the most rigid economies in methods of production, as the same period witnessed an enormous increase in the cost of labour and practically every material entering into the production of potash, as shown in the following table:

*Increase of Material and of Labour entering into the Production of German Potash from 1913-1925:*

	Percentage
Portland cement . . . . .	97.-
Mine carts . . . . .	41.-
Oil . . . . .	42.6
Sleepers, 1 yard long . . . . .	46.9
Structural iron . . . . .	19.1
Explosives . . . . .	30.2
Coal . . . . .	37.3
Freights . . . . .	41.4
Wages . . . . .	24.9

“The maintenance of so low a price for potash fertiliser was largely due to the scientific co-ordination promoted by the potash syndicate, and this low price has certainly exerted an appreciable beneficial influence upon the cost of producing agricultural products.”

VII. CAPACITY OF PRODUCTION AND LABOUR CONDITIONS.

One of the most interesting features of the German potash industry is the fact that the increase of the output of crude potash salts has not been accompanied by a proportionate increase in the labour employed. On the contrary, thanks to the most extensive use of technical contrivances, the number of workmen sank from 43,853 in the year 1921 to 28,449 in the year 1925, representing a reduction of one-third in five years. In the same period the output was increased by one-third. This achievement was due to the vast rationalisation begun in the German potash industry and now almost completed. By confining the production to the best mines and by creating a reserve in the shape of laid-up mines which can resume working at any moment, it has been found possible to ensure not merely the best conditions for the present production but also the adaptability of the industry to meet any enhanced demands.

Owing to the absence of mine gases, the relatively low temperatures, the very extensive use of electrical contrivances and the excellent ventilation, the labour conditions in the German mines may be characterised as ideal: they are, indeed, unrivalled throughout the mining industry of the world.

The work in the mines is based upon the principle of the eight-hour day.

### VIII. OUTLOOK.

The total potash production of Germany satisfies three-quarters of the world's requirements; in conjunction with the French works, with which amicable co-operation exists, nineteen-twentieths of the total demands of the world are met.

Despite this commanding position, no endeavours have ever been made to oust foreign competition.

Monopolistic aims have always been alien to the policy of the Deutsches Kali-Syndicat. The Franco-German Association has no reason to deviate from this policy or to take any steps to interfere with production in other countries, such as, above all, the United States of America, and, in a lesser degree, Poland and Spain.

At various times, news has come to hand concerning the discovery of potash deposits in other countries, *e.g.*, Abyssinia, India, Russia and Argentine, but as yet none of these has proved to be of any consequence.

In any case, it may safely be assumed that, with the growing recognition of the necessity for using potash in agricultural manuring throughout the world, the products of the German potash industry will, in future, be employed in even greater quantities than is at present the case. As an increased purchase of potash by agriculturists means heavier crops and an increase in the wealth of the farming population, a happy identity of interests between the German potash industry and the farming community of the world may prove a step, be it ever so small, towards that industrial peace on earth for which the intelligent of every nation are striving.

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# THE FRENCH POTASH INDUSTRY.

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Statement drawn up by

la SOCIÉTÉ COMMERCIALE DES POTASSES D'ALSACE

*Communicated by* M. DE PEYERIMHOFF DE FONTENELLE.

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# THE FRENCH POTASH INDUSTRY.

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## I. BRIEF HISTORICAL SKETCH OF THE FRENCH POTASH MINES.

The deposits of potash salts discovered in 1904 in Upper Alsace in the neighbourhood of Wittelsheim, north-west of Mulhouse, by a syndicate which was formed under the management of M. Joseph Vogt, of Niederbrück, with the object of searching for coal and oil, have been worked since the month of February 1910.

Of the fourteen mining companies which were floated with a view to exploiting these deposits, in August 1914, ten were controlled by three German financial groups, and the others by a Franco-Alsatian group, the group Kali Sainte-Thérèse.

The ten companies controlled by the German financial groups were sequestered at the time of the Armistice of November 11th, 1918, and wound up in accordance with Article 74 of the Treaty of Peace of Versailles of June 23rd, 1919. The French State, acting on a law passed on March 26th, 1921, which conferred upon it the necessary authority, acquired the potash mines which had thus been sequestered and liquidated, and since January 1st, 1924, these mines have been directly exploited by the State under the name of Mines domaniales de Potasse d'Alsace, whereas the concessions of the Sainte-Thérèse group are still worked by a private company, La Société anonyme des Mines de Kali Sainte-Thérèse.

## II. PRESENT ORGANISATION OF THE FRENCH POTASH INDUSTRY.

The Mines domaniales de potasse d'Alsace and the Société anonyme des Mines de Kali Sainte-Thérèse are at present the only two companies working potash mines in France. A decree dated September 14th, 1925, granted a concession for the working of potash in the neighbourhood of Blodelsheim, east of the bed now being worked, but the company which was floated, the Compagnie des Mines de potasse de Blodelsheim, has not yet been able to complete the erection of its plant.

Although there were no provisions to compel the French potash mines all to belong to one large commercial organisation — as is provided for by law in the case of the German mines — the Mines domaniales and the Mines de Sainte-Thérèse combined in the year 1919 in setting up a common sales organisation, which they

have since maintained, and which is known as the Société commerciale des Potasses d'Alsace; to their organisation they entrust all propaganda work on their behalf and for their account, and all commercial operations in connection with the sale of potash fertilisers in France and abroad. The activities of the Société commerciale des Potasses d'Alsace are not limited to simplifying the accountancy and reducing the overhead charges of the mines. The company also plays a very active and particularly useful part in stabilising the market in potash fertilisers, by distributing orders among different producers, and by introducing uniform methods in regard to the working of the mines and in regard to contracts for sales abroad.

### III. PRODUCTS OF THE FRENCH POTASH INDUSTRY.

The following are the trade products supplied by the French potash mines for agricultural or for industrial purposes:

#### *Crude Salts.*

*Sylvinite*, or ordinary sylvinite, having a pure potash content of 12 to 16 per cent of  $K^2O$ ;

*Rich sylvinite*, having a content of 18 to 22 per cent of  $K^2O$ .

#### *Concentrated Salts.*

*Potassium chloride*, with a content of 50 per cent of  $K^2O$ .

*Industrial potassium chloride*, with a  $K^2O$  content of 52 per cent and upwards.

*Sulphate of potassium*, with a  $K^2O$  content of 46 per cent and upwards.

#### *Fertilising Salts.*

*30 per cent fertilising salts*, with an average content of 30 per cent of  $K^2O$ .

*40 per cent fertilising salts*, with an average content of 40 per cent of  $K^2O$ .

The salts having 30 and 40 per cent  $K^2O$  contents are obtained by means of selecting the crude salts or by adding a certain quantity of concentrated salts.

### IV. PRODUCTION STATISTICS.

The working of the potash mines of Upper Alsace began in 1910, and in 1913 the quantity extracted was 355,341 metric tons of crude salts.

In 1921 and the following years this extraction of crude salts increased to the following figures:

1921 . . . . .	903,134	metric tons
1922 . . . . .	1,326,726	„ „
1923 . . . . .	1,577,736	„ „
1924 . . . . .	1,664,608	„ „
1925 . . . . .	1,926,346	„ „

#### V. PRICE POLICY OF THE FRENCH MINES.

Following German example, the French mines have endeavoured to keep the selling price of potash fertilisers as low as possible, in spite of the increase in the cost of labour and materials, and also of transport and freights. In foreign markets this policy was forced upon them by the necessity for sales development, and in the French internal market it was ensured by the intervention of the Government.

#### VI. POSSIBILITY OF DEVELOPMENT OF THE FRENCH POTASH INDUSTRY.

The potash mines on the Upper Rhine, the exploitation of which was not begun until approximately 60 years after that of the mines at Strassfurt and Leopoldshall, have benefited by the experience of the German mines and have been able, without any experimental period and without loss of time, to apply the methods of concentration which it took the German mines many years to develop. As a result their production is continually on the increase, and this increase, due to the building of new factories for the preparation of concentrated salts, and of workmen's cottages intended to increase the number of personnel available, and supplemented by the sinking of new shafts so far as this is rendered necessary by sales development, seems likely to continue steadily.

The rapid increase in the use of potash fertilisers in France will probably continue for a number of years; this development will be necessary to give the country an opportunity of catching up with neighbouring countries, which have a low start in this connection. In the year 1925 France only used 350 kilos of pure potash per square kilometer — against 2,600 used in Holland and 2,300 in Germany.

In foreign markets the long-term agreement entered into between the Deutsches Kali-Syndikat and the Société commerciale des Potasses d'Alsace will ensure the wholehearted co-operation of these two groups with the object of rapidly increasing the use of potash fertilisers throughout the world on as large a scale as possible; it will provide the benefits of a matchless soil fertiliser for the agriculture of all countries, and at the same time act as a guarantee of security and prosperity for the development of the potash industries in Germany and France.

## THE POLISH POTASH INDUSTRY.

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*Note transmitted by M. H. GLIWIC.*

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# THE POLISH POTASH INDUSTRY.

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## I. HISTORY OF THE POTASH INDUSTRY IN POLAND.

The discovery of potash deposits at Kałusz (Department of Stanisławów) dates back to 1854, during the Austrian occupation. It was only in 1867, however, that this wealth was first exploited. The work was begun by a company, the "Gesellschaft zur Gewinnung des Kaluscher Abraumsalze A.-G.", organised by Count Alfred Potocki and two Viennese bankers, Margulies and Oppenheim.

Financial difficulties, or the crisis of 1872, which shook the foundations of many industrial undertakings in Austria, probably contributed to the winding-up of this company. Agricultural circles tried again, with the assistance of the Diet of Galicia, to exploit the potash at Kałusz, but their attempt was greeted with undisguised hostility by the Austrian Government, which was not generally favourable to the advancement of industry in Galicia. The Austrian Government's attitude may, however, have been influenced in this matter by foreign elements to whose interest it was to impede the development of the Kałusz potash industry. The Austrian Government only yielded in 1909 to the energetic pressure brought to bear by the Provincial Diet of Galicia, and in 1911 granted the "Kali" Company a concession for the working of the potash salts at Kałusz. The company got into touch with the Provincial Delegation (Wydział Krajowy) and the Industrial Bank, and with their assistance, shortly before the world war, organised a new company, the "Towarzystwo Eksploatacji Soli Potasowych" (Company for the Exploitation of Potash Salts).

Military operations in Eastern Galicia forced the company to suspend its work. In 1917, however, although Kałusz was at the time only 18 kilometres from the front, the first trucks of potash were despatched from that town.

After the fall of the Austrian Empire, the majority of the shares, which then belonged to the Provincial Delegation, passed over to the Polish Government, the latter thereby acquiring a decisive influence over the future development of this branch of industry, which is of such importance from the point of view of potash agriculture.

The 1919 campaign and the Bolshevist invasion in 1920 for some time impeded the progress of mining activities at Kałusz. It was thus not until 1921 that steps were taken to extend the working of the Kałusz mines. While the potash industry

in Germany and France is the outcome of many decades of regular work, the exploitation of potash in Poland has been proceeding regularly for barely five years.

## II. PRESENT STATE OF THE POTASH INDUSTRY IN POLAND.

The exploitation of the potash industry in Poland is at present in the hands of a single undertaking, the "Spółka Akcyjna Eksploatacji Soli Potasowych". This company has a capital of five million złoty, divided into 200,000 shares, 67 per cent of which belong to the State, represented by the "Bank Gospodarstwa Krajowego"; four delegates of the latter have seats on the Board of Administration, which consists of seven members.

The Polish Government's participation in the potash exploitation is most important from the point of view of the development of that industry. First and foremost, it constitutes a guarantee that the subsequent development of the industry will be in conformity with the general lines of the State policy.

The above-mentioned Potash Salts Company is at present working two mines:

"Kałusz", open since 1917, and

"Stebnik" (Department of Lwow, near Drohobycz), open since 1923.

The mines service authorities subsequently granted the company exclusive mining rights for a large number of areas in the zone which extends from Drohobycz to Stanisławów and might be described as the Kałusz-Stebnik potash field.

Experimental borings to a slight depth, which have been carried out for the past year in the Kałusz mining district, and preliminary work executed by means of galleries and horizontal borings in the Kałusz and Stebnik mines, have produced results which are proving more satisfactory every month, and the many workings of new deposits of potash salts and kainit guarantee the future progress of the Polish potash industry and considerable benefits for the State and the national agriculture.

### (a) Output of the Polish Potash Industry.

	Metric tons			
1920 . . . . .	14,903,400			
1921 . . . . .	24,133,225	=	4,511,271	metric tons K <sup>2</sup> O
1922 . . . . .	55,700,470	=	11,430,886	" " "
1923 . . . . .	55,650,988	=	11,302,275	" " "
1924 . . . . .	64,961,769	=	14,859,727	" " "
1925 . . . . .	151,401,123	=	31,745,906	" " "
1926, from January to				
October . . . . .	164,025,000	=	31,060,008	" " "

The above figures are not imposing, but it must be remembered that this output was the result of preliminary work, that the work is not yet complete and that it is comparatively recent, so that these results may be regarded as most encouraging. When the scheme of exploitation has been entirely carried out, the output of the Polish mines will not only supply the country's demands but will also permit of the exportation of a certain quantity of potash salts.

(b) *Number of Workers.*

The following shows the average number of surface and underground workers:

In 1925 . . . . .	718
In 1926 . . . . .	710

(c) *Hours of Work.*

The hours of work are eight per shift. During the season for deliveries, there are three shifts a day and during the dull season two shifts.

(d) *Workers' Output.*

The following shows the output per shift:

In 1925 . . . . .	709 kilos of raw salts
In 1926 . . . . .	1,075 " " "

(e) *Wages (average per working day).*

In 1925 . . . . .	5.10 zloty
In 1926 . . . . .	6.40 "

Wages and hours in the potash industry are governed by collective agreements (with the representatives of the trades unions).

(f) *Potash Prices.*

The Polish potash industry goes on the principle of supplying Polish agriculture with potash fertilisers at moderate prices which will ensure a profit on the use of these artificial products.

In 1925 the prices of natural salts were as follows:

100 kilos containing 25 per cent of potash . . . .	3.96 zloty
100 kilos " 30 " " " . . . .	6.25 "

As the result of the drop in the Polish zloty, the prices are now:

100 kilos containing 25 per cent of potash . . . .	7.— zloty
100 kilos „ 30 „ „ . . . .	8.70 „

These might be compared with the prices of German potash at Nordhausen:

100 kilos containing 20 per cent of potash . . . .	7.32 zloty
100 kilos „ 30 „ „ . . . .	10.20 „

(g) *Sales Organisation.*

The potash industry supplies farmers with its products through big agricultural-commercial associations, for the most part of the co-operative type.

The farmers, who were impoverished by the war, cannot pay for artificial fertilisers before getting in the crops obtained by means of these very fertilisers, so that sale is generally effected on the basis of long-term credits. The rate of interest is comparatively low.

The Polish potash industry and other branches of the artificial fertiliser industry have organised suitable propaganda (exhibitions, lectures, publications, etc.) in the interests of agriculture.

(h) *Transport Tariffs.*

Polish potash, like all artificial fertilisers, enjoys reduced tariff rates under tariff "G".

(i) *Works for the Concentration of Potash Salts.*

It is proposed before the end of 1926 to open a factory at Kałusz for the treatment of raw materials with a low potash content in order to supply farmers with a more concentrated product, that is, a product containing a higher percentage. The output of the works corresponds to the 700-1,000 tons (per day) of raw materials treated. If certain supplementary improvements were carried out, it might be considerably increased.

As regards the arrangement of its various sections, the Kałusz works are equal to similar works in Germany. In some respects they even surpass them, as advantage was taken of the latest technical improvements when equipping them.

### III. POSSIBILITIES OF DEVELOPMENT OF THE POTASH INDUSTRY IN POLAND.

The future success of the potash industry is guaranteed, owing to the wealth of natural deposits of potash salts and the possibilities of ready sale over the immense agricultural expanse of Poland.



(a) *Geological Conditions.*

(From the study by Dr. Olszewski, Engineer: "Kalusko-Stebnicki pas soli potasowytch i jego powstanie").

On the northern and north-eastern slopes of the Carpathian range, from Dobromik as far as Roumanian Bukowina, stretches a geological formation consisting of light and dark grey deposits. From these deposits (especially on the eastern side) there flow in abundance salt-water springs known as "Salanki", the nature of which proves the presence of salts in the subterranean deposits from which they are derived. These clay-beds are called in Poland "solonośnymi", which means "rich in salts". From the geological point of view they belong to the neogene system.

The same thing occurs in the Sub-Carpathian region, which extends from Przemyśl in the direction of Cracow, similar salts deposits being found in abundance between Wieliczka and Bochnia, where they are now being worked.

The Wieliczka and Bochnia salt mines have been known for more than six centuries and still contain large reserves of salt.

These deposits contain two kinds of salt. The whole of the Sub-Carpathian region contains rock salt, while in the region extending from *Kalusz (in the Department of Stanisławów as far as Stebnik (near Drohobycz), in addition to rock salt, are found potash salts, more particularly sylvinite and kainit, and less frequently mirabilite and polyhalite.*

In the Kalusz and Stebnik mines, the saliferous clay, known as "Zuber", contains accumulations of potash salts which are sometimes found next to rock salt, gypsum, anhydrite, etc. These veins of potash salts vary in thickness, ranging at Kalusz from 1.5 to 40 metres and at Stebnik averaging 10 metres. They also vary in extent, being from 300 to 600 metres wide and 400 metres deep. At Kalusz they are being worked to a depth of 107-297 metres and at Stebnik to a depth of 95-151 metres. The line joining these two areas is 70 kilometres long and from 3 to 4 kilometres wide. It is known as the Kalusz-Stebnik potash salts zone. Mineral springs (salt) have been found in this zone at Turza-Wielka, Morszyn, Truskawiec and Tustanowice. The reserves of potash salts in the Kalusz-Stebnik zone are very considerable. Apart from these deposits, there are traces of potash salts in other parts of the Eastern Carpathians, as, for example, in the district of Otynia.<sup>1</sup>

Rock salt mixed with potash salts appears in this zone in the saliferous clays in the form of shells or lenses.

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<sup>1</sup> In Couyavia (Department of Poznań), near Szubin, deep boring also led to the discovery of potash salts similar to those at Stassfurt.

(b) *Foreign Markets.*

As soon as the Polish potash industry has supplied the requirements of Polish agriculture, it will find ready export markets for its products, more particularly in Slovakia, Hungary and Roumania, and also in the Balkans, as agriculture develops in the Balkan States.

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