DEVELOPMENT OF INDUSTRIAL ECOLOGY IN RUSSIA

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Contents

Summary

Some examples of the possibilities of technological improvements at industrial enterprises in Russia are discussed. The measures in question might include complex usage of the raw materials, as well as low waste technologies.

The advantages of the approaches mentioned above are illustrated using the example of complex usage of the apathito-nepheline concentrate (the products obtained being alumina, soda ash, cement, and K_2CO_3).

Another example deals with the reprocessing of potassium-magnesium salts, the products obtained being potassium fertilizers, soda ash and sodium chloride of technical purity grade.

The last example deals with the shift from coal to natural gas as a measure to reduce the atmospheric pollution.

1. Introduction

It is well known that one of the main factors that has an aggravating influence on the condition of the natural environment is industrial production. Therefore, the environmental performance of industrial management may become the determining factor for impact on the biosphere. It is becoming more and more evident that there is a correlation between industrial production and natural processes. We observe the merging of industrial and economic activity with the environment and biosphere, developing into a unified system according to laws not yet studied. A new scientific line of investigation has arisen comparatively recently—that of industrial ecology. Its objective is to protect the natural environment by means of rational and integrated utilization of energy resources and raw materials in the following cycle: primary resources of raw materials—production—consumption—secondary resources of raw materials.

If we analyze the scheme of formation and implementation of the ecological policy of an industrial enterprise, we can easily see that the results of the economic activity depend primarily on the scientific and technological policy governing the activity of the enterprise (see Figure 1). All other measures undertaken (improving the normative and technical documentation for management, strict observation of the technological discipline, monitoring, etc.) allow us to make judgments only about the effectiveness of the technological processes and about the condition of the education.

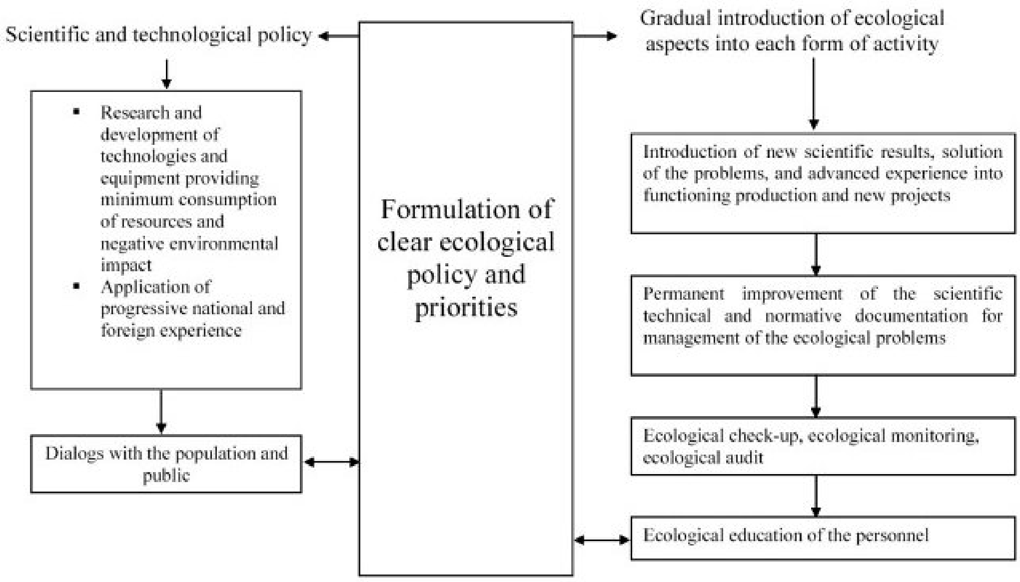

Figure 1. System of organization of ecological policy within an enterprise.

2. Zero-waste technology

It is generally acknowledged among Russian specialists, as well as among foreign ones, that the best way to solve the problem of protection of the environment from pollution is development and organization of zero-waste technology, or pure production. Numerous research projects and, what is more important, the totality of the experience, indicates that the development of various cleaning installations as the final element of the technological cycle do not provide a satisfactory solution to the problem of pollution of the environment. Pure (zero-waste) production was characterized at the meeting of the United Nations Environmental Programme UNEP/CEA on zero-waste production (1989), as the application of a nature protecting strategy to the processes and products in such a way as to reduce the risk to humanity and environment. If we speak about the technologies we mean that this strategy provides for the rational use of raw materials and energy, exclusion of toxic raw materials, and decrease of the amount and degree of toxicity for all wastes and discharges formed in the process of production. Pure production is reached by means of improving the technology, application of know-how, and changing management of the production and its organization.

It is noteworthy that the organization of zero-waste production frequently requires measures of economic support from the state such as tax concessions, preferential crediting, and investment allowance. The legislation of the Russian Federation allows for these measures in clause 24 of the Law of Russian Federation about Protection of the Environment: "Stimulation of the rational nature management and protection of the environment in the Russian Federation is carried out by means of:

- tax concessions and other preferences for the state agencies and other enterprises and organizations including those responsible for nature protection, if they develop zero-waste technologies of production, use secondary resources of raw materials and perform other activities providing nature protecting effects;
- introduction of special taxes for ecologically harmful production and production produced with the application of ecologically dangerous technologies".

3. Carbonate and cement production from nepheline

One of the examples of almost zero-waste technology is the production of sodium carbonate, potassium carbonate, and cement from nepheline concentrate of alumina by the joint stock company "Glinozem" in Pikalevo located in the Leningrad region. Implementation of the technology of alumina production from nepheline raw material was carried out by soviet specialists from 1949 to 1959. Limestone and nepheline concentrate (partly enriched wastes of apatite-nepheline ores of the Kola Peninsula) are used as raw material. The main product in this area is the apatite concentrate for phosphate fertilizer production.

The technological scheme of the reprocessing of nepheline concentrate is shown in Figure 2.

This process needs 3.9 to 4.3 tons of the nepheline concentrate and 11 to 13 tons of limestone ($CaCO_3$) to produce 1 ton of alumina (Al_2O_3).

In addition to the alumina we get:

0.62 to 0.78 tons of sodium carbonate (Na_2CO_3);
0.18 to 0.28 tons of potash (K_2CO_3);
9 to 11 tons of portland cement.

In addition to the ecological effect (zero waste), the technology implemented is characterized by high technical and economical index, which can be seen from Table 1.

Product obtained	Cost of the product obtained during integrated use of nepheline in % (100% of the traditional raw material)
Alumina	65

Soda ash	45-90
Cement	62

Table 1. Economic index of integrated reprocessing of nepheline concentrate

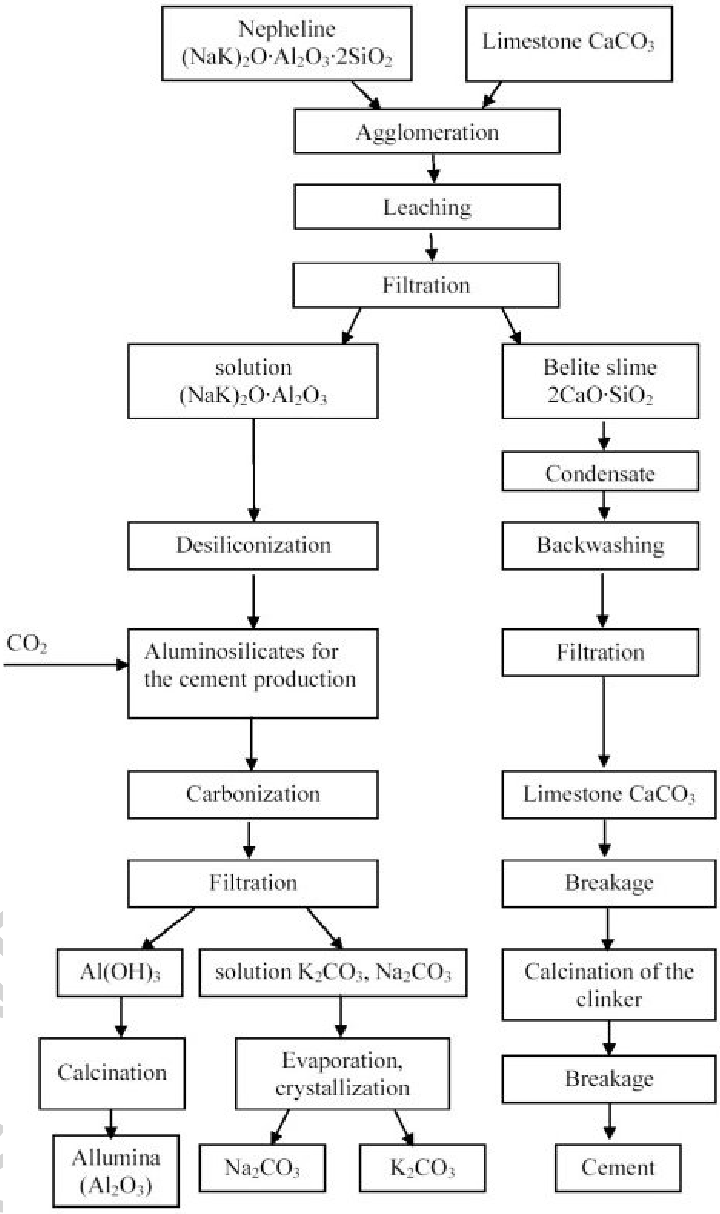

Figure 2. Integrated reprocessing of the nepheline concentrate by Glinozem, in Pikalevo

The ecological and economic advantages of this technology are not limited, however, by the region where this enterprise is located. In reality, the advantages are wider. During the reprocessing of the nepheline concentrate, which is related to the waste from the apatite production, the need for reprocessing the bauxite ore and rock salt is reduced. The production of calcine salt is ecologically harmless, while its production by traditional methods from limestone and common salt is one of the most ecologically unfavorable industrial processes because it is accompanied by formation of large amounts of extremely toxic waste, the distillate liquid. It is well known that the ecological situation in areas where soda manufacturing plants are located is extremely unfavorable (e.g. the Perm region and Bashkirtostan republic in Russia).

4. Galvanic production

It is not always possible, however, to develop a closed zero waste (or low waste) production within a single enterprise. Sometimes the solution can be found by solving the problem at the regional scale. This can be illustrated by the example of wastes from galvanic production.

It is well known that galvanic production is a major source of heavy metal pollution of the environment in industrial centers. Their prejudicial influence on the health of people and other life forms has been well studied. In this case it is possible to develop the methods of galvanic production with low or zero waste by means of regional programs, which include:

- reconstruction of the galvanic production with the objective of reducing the toxicity and amount of waste;
- development of an effective scheme for cleaning the drain water;
- development of specialized centers for reprocessing the spent electrolytes and other concentrated solutions (from solution recovery pools or by removing the coating) to return the metals back into galvanic production, or acquisition of their concentrates;
- development of centers for reprocessing the electrolytic slimes, formed in the process of cleaning the drain water including ceramic materials (brick, tile, claydite, etc.) with guaranteed ecological safety both of the processes and products obtained.

Realization of this program is extremely difficult even for large enterprises, while for medium and small ones, which are the majority, it is just impossible. The only realistic technical and economically effective way of developing ecologically safe low or zero waste galvanic production can be realized in a geographical region through a regional program, i.e. through a regional approach to develop zero waste production, including cleaning the waste waters and gas discharges, and reprocessing the wastes.

This problem is relatively simply solved theoretically, but its realization is possible only with the support of the governing organs.

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Biographical Sketch

Permyakov Rudolf Sergeyevich, is a professor and a doctor of engineering science. He was born in 1932, and in 1955 he graduated from the Leningrad mining institute.

1955 to 1968: worked on mines (center "Apatite" and Olenegorsky mining and-processing combine).

1968 to 1981: headed All-Union Research and Project Institute of Talurgy (Leningrad), investigating problems of mining of natural salts and affects of potash fertilizers.

1981 to 1986: Deputy Minister on Affects of Mineral Fertilizers, Ministry of USSR.

1986 to the present: teaching activity in Academy of National Economy under Government of USSR, now in the Russian Academy of Civil Service for the President of the Russian Federation.