230.

Russian ElectroKhimPribor Integrated Plant - Producer and Supplier of Enriched Stable Isotopes

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The report represents a short review of status of Russian Electrokhimpribor Integrated Plant in production and distribution of enriched stable isotopes.

1. Introduction

Russian ElectroKhimPribor Integrated Plant, as well as ORNL, is a leading production which manufacture and supply to the world market such specific products as stable isotopes. More than 200 isotopes of 44 elements can be obtained at its electromagnetic separator.

Changes being underway for a few last years in Russia affected production and distribution of stable isotopes. There arose a necessity in a new approach to handling work in this field so as to create favourable conditions for both producers and customers. In this connection at EKP a whole complex of organizing and technical steps have been implemented aimed at enhancing efficiency of its activity in this field.

2. Separation facilities

SU-20, powerful electromagnetic separator started in 1951 as a part of Soviet nuclear arms program is now used in industrial stable isotope separation at ElectroKhimPribor Integrated Plant. Initially it was intended to be used for obtaining large quantities of U-235, but due to successful application of gas-diffusion technique to this end this idea was abandoned. Separation of Li isotopes had been carried out at the separator up to 1955, and after the middle of 1955 it has been used on a regular basis in enriched stable isotope production of various elements except for radioactive, gases and precious metals. Today the production has technologies for separation of 44 elements from lithium to lead.

Su-20 is the only industrial stable isotope electromagnetic separator in the former Soviet Union and, apparently the world's largest together with ORNL electromagnetic facility. One can estimate the dimensions of the construction when he knows the weight

of electromagnet only, and it is several thousand tons. Electromagnet incorporates twenty separation chambers, each can accommodate up to three ion sources and the same number of ion receivers. Due to equal magnetic field intensity in all chambers it is possible to separate some two-three various elements simultaneously given their masses do not differ very much. Separator structure and performances were shown earlier in [1, 2].

All twenty chambers, power, vacuum and control equipment are ready for use, however, a smaller number of chambers are in operation simultaneously. This number is determined by separation program and by need to keep some reserve which would allow to maintain productivity in case of some chambers being urgently put out of action.

E-7, separator of small productivity, was put into operation in 1996 for experimenting and obtaining small quantities (0.1-10 g) of various isotopes of improved quality. Small separator E-7 allow to work through a design of ion sources and receivers, components of charge materials and separation technology without interfering with the SU-20 operation, which allow to reduce significantly transition time between separation campaigns of different elements. A minimal duration of separation campaign on the big separator SU-20 is 2-3 months.

Development and use of automation control system allow to rule out subjective factor and improve reliability and operational efficiency of separation process. That is particularly effective when obtaining isotopes with low natural abundance.

Engineers and specialists working on SU-20 not only control separation process, but also carry our researches aimed at improving separator performance.

As a result of their work, SU-20 output of Sr-88, Tl-203, Yb-168 was increased by 40-50% without fall in enrichment and enrichment of some other isotopes was significantly higher keeping the output constant. Enrichment of isotopes obtained during the last campaigns is higher (sometimes - substantially) than that of the previous ones.

3. Chemical facilities

Facilities for chemical processing of various materials are an inseparable part of isotope production. Natural materials, as a rule, should undergo processing in order to acquire a chemical form acceptable for their use in ion sources, while enriched isotopes after extraction from receiver pockets should be chemically cleaned and transferred into a more stable form before dispatching to the stock. Besides certain reagents used for processing isotopes undergo additional purification.

Chemical part of the production is provided with necessary equipment, employs highly skilled personnel enabling to carry out simultaneously processing of isotopes of several elements and obtain products possessing high chemical purity.

Next year will see reconstruction of production premises and placing of modern equipment for various kinds of chemical treatment of materials; it will essentially improve labour conditions and production efficiency. Following the reconstruction the major part of chemical production will be moved into the new premises. Arranging of chemical departments, facilities for packaging of products and their storage in the same building will positively influence the terms of shipment.

4. Isotope stock

It so happened that there were a little more then 30 various stable isotopes in the inventory at Electrokhimpribor plant in the beginning of the 90'ties, while most of them were not in demand with the customers. The Russia's State stock of stable isotopes was abolished and in fact they put an end to the State control over the production and deliveries of this specific product . A great number of trading intermediary firms have come to existence, and all of them were offering the customers products of doubtful pedigree and quality; the "black market" became active, causing much concern of the customers.

Having faced the situation, Electrokhimpribor Plant authorities made a decision to create a separate inventory of stable isotopes, which availability would enable to maximally meet buyers' requests. For solving the task the separation of isotopes of 17 chemical elements have been carried out. As a result, 104 various isotopes have become available from EKP inventory. Thus the stock of basic isotopes for radiopharmaceutical production has been raised up to a level guaranteeing their deliveries for a period of 3-4 years without renewal of separation campaigns.

The products stored have different state of preparedness ranging from ready-made forms to semifinished products as solutions. It enables within the shortest time to make deliveries in the form needed by the customer. Using the technique of differential isotope extraction from the receiver pockets helps keeping in stock batches of the very same isotope with different enrichment level. This is particularity attractive for customers conducting research works.

When creating the inventory separation campaigns were being planned and oriented to meet perspective scientific developments in the field of stable isotopes applications. It helped within a year and a half enlarge the list of products on sale up to 27 isotopes instead of 3-4 products usually sold until 1996. It supposed to increase the

number of isotopes kept in stock at EKP to 150 (one hundred fifty) within the period of 1998-1999.

5. Quality control

The question of providing for high quality of isotopically enriched products has enjoyed a highest priority for the previous four years. The reason for this may be explained by the following circumstances:

- ever-encreasing requirements placed by customers with regard to quality of isotopes (especially for radiopharmaceutical production);
- the necessity of receiving products surpassing by their qualitative characteristics (enrichment and chemical purity) products manufactured earlier.

For tackling the problem a quality management system has been reorganized to cover all stages of obtaining product - from input check-ups of raw materials and reagents used to quality certification of finished products.

Special importance is attached to technological checking of products quality throughout different stages of their preparation thus making possible timely corrections to separating procedure and processing of isotopes.

Five analytical laboratories, not belonging to isotope production shop, provide for carrying out of the procedure mentioned. These laboratories are responsible for finished product quality verification against Russian standards as well.

At customers request detailed analyses are made at an independent regional laboratory. Such analyses are aimed at defining the contents of several dozens of chemical elements which may be present in products. The laboratory is equipped with ISP spectrometers and awarded with international certificate. For many years of operation of isotope production at EKP there were no customers' claims with regard to product quality.

6. Busineces issues

Till the middle of 1993 EKP practically had not been selling its isotope products independently. Though due to certain changes that took place in Russia early in the decade EKP has to tackle on his own all questions of business-activity relating to distribution of enriched stable isotopes. Much has been done to analyze isotope market situation, a great number of meetings and talks held with major customers purchasing isotope products either for own use or for resale to the end users. Also pricing conception has been revised and business philosophy has been adopted to maximally meet customer requests. In addition to creation of inventory, which qualitative and

quantitative status should be attractive for the customer, a conception of long term contract has been worked out providing for considerable (substantial) price discount depending upon volume and duration of obligations. Besides, long-term contracts allow to low product price and also to plan effectively the producer's operation schedule and to guarantee reliability of deliveries and thus are attractive for the parties concerned.

Upon signing such contracts, on customer's wish, a batch of a product is accumulated which volume enables to cover all deliveries without changing of the batch.

Obviously it helps save time and material expenses of the customers to make control checking of product received.

Rather often the buyer of isotopically enriched product wishes to have it not in the form of a chemical compound, but as products having given parameters (say wire, foil, ingots etc.). EKP has implemented certain measures to meet such requests. As a result in 1966 for the first time the buyer obtained not simply an isotopically enriched substance but an article made out it having a definite geometrical form and precise dimensions. Measures are underway to further enlarge the possibilities of fulfilling such orders.

It is rather significant that having implemented a number of practical steps EKP from 1996 began making shipments of products within 7-10 days after receiving customers purchase order (the procedure of contract preparation is included here). Further reduction of shipment terms is limited by the time necessary for preparing custom and bank documents, envisaged by legislation of Russia.

In order to provide for a more wider distribution of enriched stable isotopes and raise volume of sales EKP in 1996 concluded a long-term agreement on partnership with Canadian Company "TRACE SCIENCES" within the framework of the agreement a successful joint work is being carried out.

As a result, within eighteen months period several dozen of contracts have been struck for supplying isotopically enriched products practically to all world major consumers. So it is once more confirmed the expediency of multilateral interest of the alliance between of a producer, possessing a large production and material potential, and an experienced, dependable distributor.

The understanding of the obvious truth acquires a special significance in conditions of ill-disposed competition, coming first all from certain Russian suppliers.

EKP guarantees reliable deliveries and for the last 5 years has had no claim from customers as to implementing contracts.

7. Summary

Due to changes being underway for a few years in Russia it is necessary for successful activity of the producer to work out a new approach to organizing production and distribution of enriched stable isotopes.

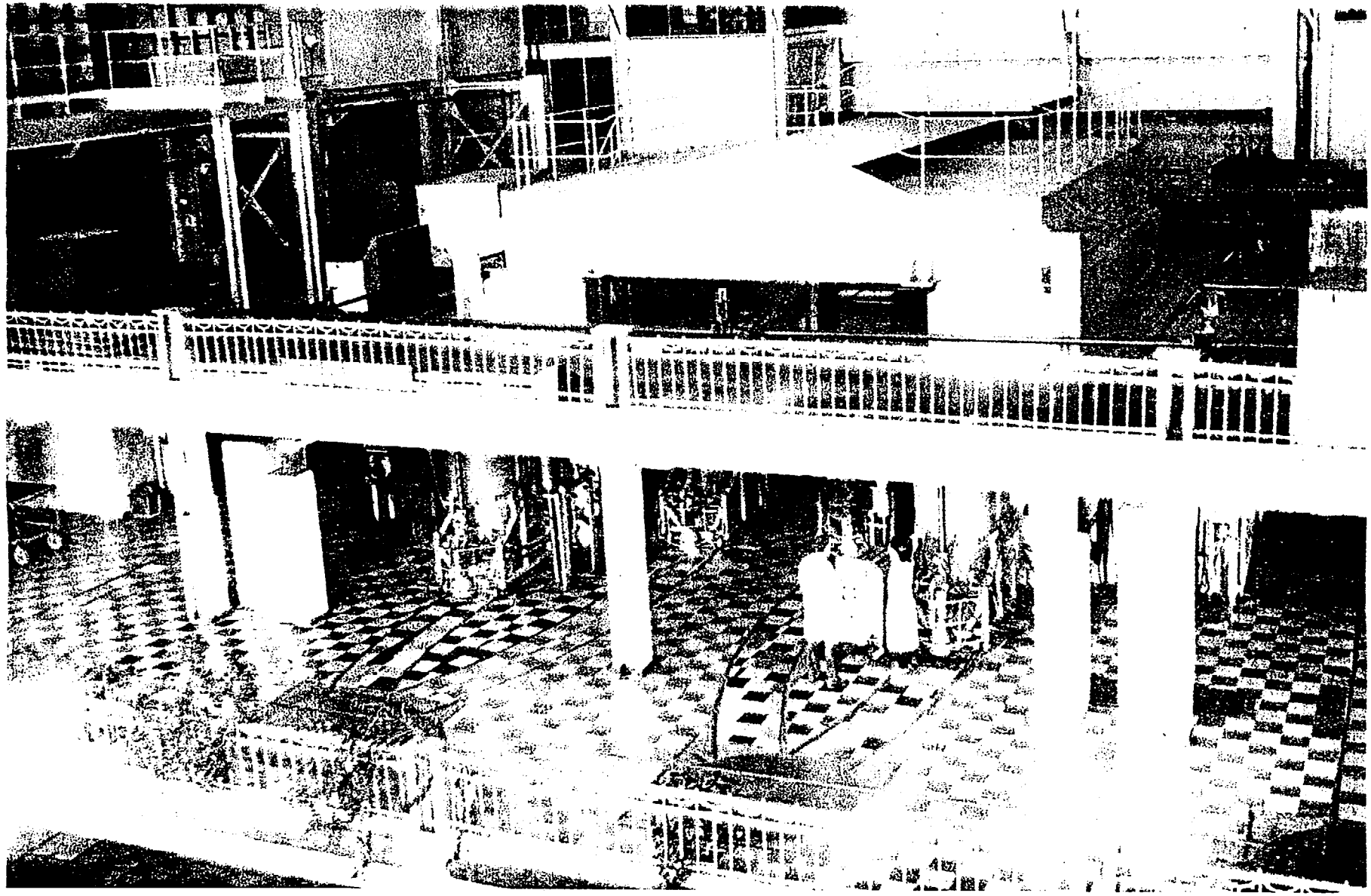
In order to solve the task at the Russian EKP within the last four years they have enhanced efficiency of Calutron operation, improved the work of large capacities for chemical processing of materials, reviewed the quality management system covering all stages of production process, created an inventory having a fairly large and ever-growing stock of various isotopes, introduced a new pricing policy, adopted a business philosophy oriented to meet maximum of customer needs.

All mentioned above plus consolidation of activity in production and distribution of isotopically enriched products on one place have currently enabled EKP to be in a perfect position to meet needs of stable isotope customers in industry, medicine and science all over the world.

References

[1] N. A. Kashchejev and V. A. Dergachev, Electromagnetic Isotope Separation and Isotope Analysis (Energoizdat, Moscow, 1989)

[2] N. A. Kascheyev, L. A. Polyakov and V. V. Tunin, Nuclear Instruments and Methods in Physics Research A 334, North Holland, 1993, pp. 27-32



The russian electromagnetic separator SU-20

Integrated Plant "Elektrochimpribor"