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Nicolae Sfetcu
nicolae@sfetcu.com

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Nicolae Sfetcu

Abstract

The heavy water plant was established under the name of Combinatul Chimic Drobeta, by Decree 400/16.11.1979, under the Inorganic Products Industrial Center (CIPA) Râmnicu Vâlcea. The thermo-electric plant for supplying the heavy water factory with steam was decided to be located in Halânga village, three kilometers from the factory. The process water required for the factory was brought from the Danube, and the hydrogen sulphide used in the process was produced in the plant, through a specific technology, and then compressed, liquefied and stored in special tanks. The works on the heavy water factory at Drobeta Turnu Severin started in 1979, based on a derogatory HCM. The equipment for the heavy water plant was purchased through the Industrial Center for Chemical and Refinery Equipment (CIUTCR). All equipment and facilities that transported hydrogen sulphide had to meet strict quality assurance conditions.

Keywords: heavy water plant, Drobeta Turnu Severin, construction

Fabrica de apă grea Drobeta Turnu Severin: Construcția

Rezumat

Fabrica de apă grea s-a înființat sub numele de Combinatul Chimic Drobeta, prin Decretul 400/16.11.1979, în subordinea Centralei Industriale de Produse Anorganice (CIPA) Râmnicu Vâlcea. Centrala termo-electrică pentru aprovizionarea fabricii de apă grea cu abur, s-a decis să se amplaseze în comuna Halânga, la trei kilometri de fabrică. Apa de proces necesară fabricii a fost adusă din Dunăre, iar hidrogenul sulfurat utilizat în proces s-a produs în combinat, printr-o tehnologie specifică, fiind apoi comprimat, lichefiat, și depozitat în rezervoare speciale. Lucrările

la fabrica de apă grea de la Drobeta Turnu Severin încep în anul 1979, în baza unui HCM derogatoriu. Utilajele pentru fabrica de apă grea au fost achiziționate prin Centrala Industrială de Utilaj Chimic și Rafinărie (CIUTCR). Toate echipamentele și instalațiile care vehiculau hidrogen sulfurat trebuiau să respecte condiții stricte de asigurarea calității.

Cuvinte cheie: fabrica de apă grea, Drobeta Turnu Severin, construcția

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Heavy Water Plant

The location of the heavy water factory was originally thought of in Malaia on the Lotru Valley, the water of the Lotru River being considered very pure. After checking this location, Turtureanu concluded that a well-ventilated area is needed and, based on the Canadian standard IAEA-SM-188.4, about means by which a plant is integrated into a Canadian community, developed by Atomic Energy Control Board of Canada, which mentioned the specific conditions for the siting of heavy water plants (low population density, special geographical and meteorological conditions, etc.). A second area near Francești, also in Vâlcea county, was considered, then an area in Bărăgan. Mircea Turtureanu proposed the location in Cernavodă but, although approved by Decree no. 419/25 October 1978, in the end it was decided to build the factory near the hydroelectric power plant Iron Gates 2. After a proposal for the exact location in

Rogova in Mehedinți county, and another in Cerneți, on the outskirts of Drobeta Turnu Severin, the final location was decided to be in Răscolești, at approx. 6 kilometers from Drobeta Turnu Severin. (Turtureanu 2016)

The heavy water factory was established under the name of Combinatul Chimic Drobeta (Chemical Plant Drobeta), by Decree 400/16.11.1979, under the Inorganic Products Industrial Center (CIPA) Râmnicu Vâlcea. The thermo-electric plant for supplying the heavy water factory with steam was decided to be located in Halânga village, three kilometers from the factory.

Later, the name of the factory was changed over time as Regia Autonomă ROMAG (until 1992), ROMAG (until 1998) and ROMAG Prod (until 2015, when it was closed).

The process water required for the factory was brought from the Danube, with a content of approx. 144 ppm D_2, being subjected to a purification treatment process before being used. The hydrogen sulphide used in the process, since it is not consumed during the process (it circulates in a closed loop, having rather the role of a "carrier", taking the light hydrogen (protium) from the process water and giving it deuterium), was produced in the plant, through a specific technology, being then compressed, liquefied, and stored in special tanks.

The water was enriched in deuterium in two steps: by isotopic exchange, and finally by distillation. Four manufacturing lines (modules) were planned for the isotopic exchange, which were to operate in parallel. Each module included four sets of columns (bitherms), each with one hot and one cold column, the first three using a G52/28 special steel with diameters greater than 5.3 m and height of 60 m forming Floor 1, and the fourth set (Floor 2) which took the enriched water from the 1st floor consisting of a hot column and a cold column, with a diameter of 2.8 m and a height of 80 m. The distillation columns contained phosphor bronze filling made at Uzina G The final product was stored in special barrels under a nitrogen cushion. (Turtureanu 2016)

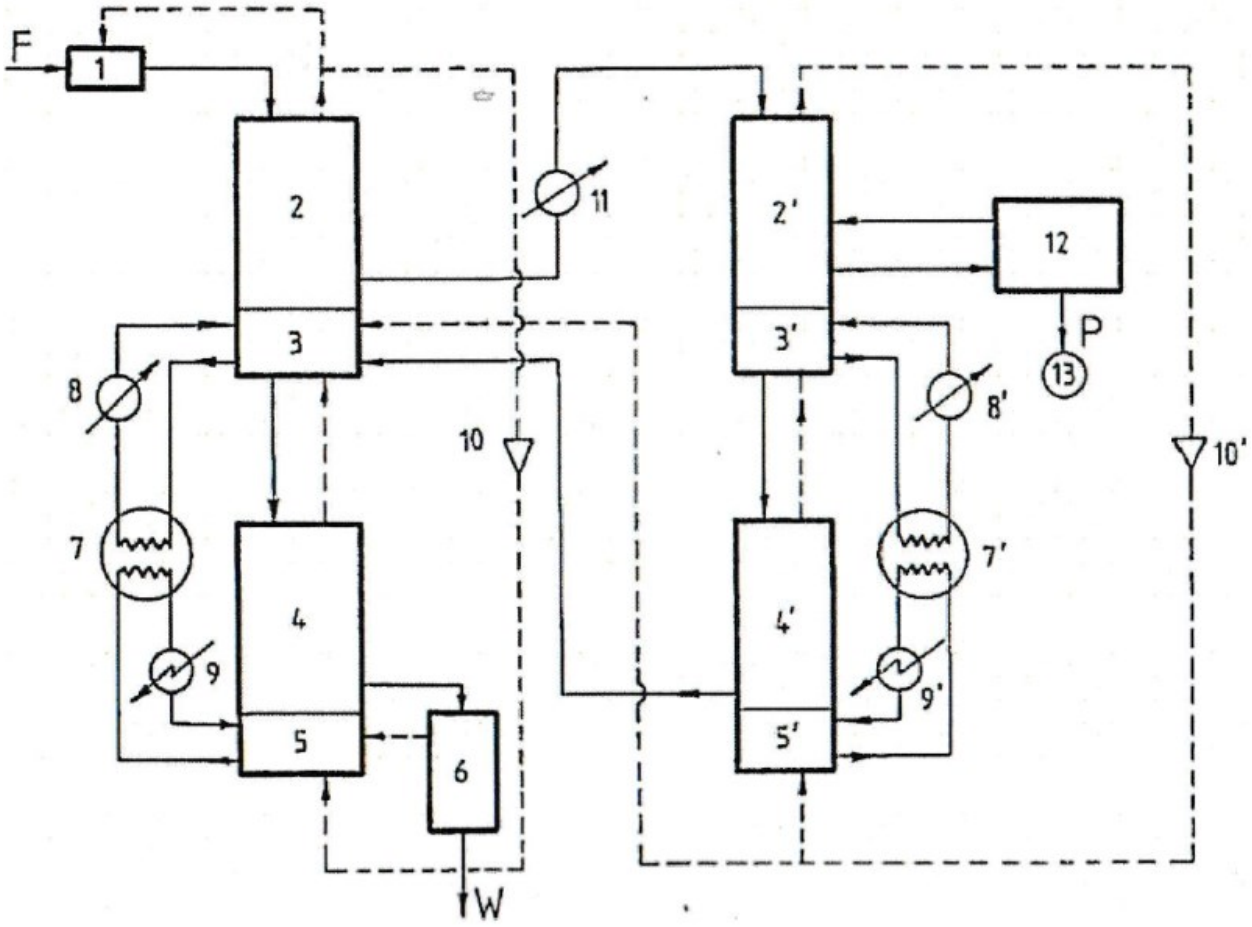

Figure 2. Scheme of the isotopic separation module according to patent 74088/1980
1 = absorber, 2, 2′ = cold columns, 3, 3′ = dehumidifier, 4, 4′ = warm columns, 5, 5′ = humidifier, 6 - striper, 7, 7′ = heat recovery, 8, 8 ', 11 = cooler, 9, 9′ = heater, 10, 10′ = compressor, 12 = distillation, 13 = storage of finished product
_____ = H2O, _ _ _ _ _ = H2S
Source: (Turtureanu 2016)

All equipment was manufactured in the country, in the best and most efficient specialized factories.

Heavy water for nuclear use must have a concentration of min. 99.75 D_2O. During the exploitation of the heavy water plant, it was found that there is an oversizing of the distillation plant which allowed to obtain a more concentrated heavy water than necessary (super heavy water). Also, during the production of heavy water, a secondary product was obtained, water

depleted in deuterium, with values of the percentage of deuterium much lower than in normal water, with uses in the field of health. (Turtureanu 2016)

Construction

The works at the heavy water plant at Drobeta Turnu Severin, subordinated to MICh (Ministry of Chemical Industry), began in 1979, based on a derogatory HCM. (Glodeanu 2007)

The equipment for the heavy water plant was purchased through the Industrial Center for Chemical and Refinery Equipment (CIUTCR). The main suppliers were: (Turtureanu 2016)

- Întreprinderea de Mașini Grele Bucharest (IMGB): sections of G52/28 steel columns from Combinatul Siderurgic Galați developed in the 80s at the Uzina de Oțel Galați based on the National Technical Normative NTR 440/83, installed by the Trustul de Montaj Utilaj Chimic (TMUCB), and centrifugal compressors for the recirculation of hydrogen sulphide (ICSITEE Bucharest);
- Uzina Grivița Roșie in Bucharest: the isotopic exchange columns on the 2nd Floor and part of the heat exchangers;
- IUC Ploiești: part of the heat exchangers in the isotopic exchange plant, the plates for the isotopic exchange columns and all the equipment in the distillation plant;
- Enterprise 23 August Bucharest: piston compressors for hydrogen sulfide designed by ICSIT FAUR Bucharest, spherical tanks for air and propane, and Diesel groups for isotopic exchange installations, all designed in the Plant's own design center;
- Aversa pump factory Bucharest: special pumps for hydrogen sulphide water designed by the design center within the factory (CCITPV Bucharest designer);
- Întreprinderea de Utilaj Petrolier Târgoviște: special fittings from the exchange facility;
- Electroputere Craiova: Diesel group;
- Unio Satu Mare: spirometallic gaskets;
- Uzina G: phosphor bronze fillers for distillation columns

Other providers: (Nica 2016)

- IAIFO Zalău: fittings;
- IMF Odorheiul Secuiesc: special faucets;
- Întreprinderea Mecanică Fină Sinaia: Norton mechanisms, reducers;
- Enterprise 1 Mai Ploiesti;
- Pipe factory Republica Bucharest;

The assembly works, with Trustul de Construcții Industriale (TCInd) Bucharest (TCInd Craiova and TCInd Drobeta Turnu Severin sites) as general contractor, were executed by: (Turtureanu 2016)

- Trustul de Montaj Utilaj Chimic (TMUCB) Bucharest through branches in Pitesti, Bacău, Craiova, Arad and Iași: installation of equipment and pipelines;
- IAMSAT Bucharest through the Turnu Severin construction site: automation works;
- TIEA Bucharest: electrical installations;
- TIAB Bucharest: high voltage electrical installations;
- TLSIT Bucharest: thermal insulation and waterproofing.

Other construction-assembly enterprises: (Nică 2016)

- Teleconstrucţia Bucharest (Drobeta Turnu Severin construction site): installation of low current installations;
- Hidroconstrucția Drobeta Turnu Severin.
- TCMRIC (Trustul de Construcții Montaj şi Reparații în Industria Chimică) Bucharest.

Since all equipment and facilities that transported hydrogen sulphide had to comply with strict quality assurance conditions, IITPIC developed its own Quality Assurance Manual and General Standards for Quality Assurance Manual on the basis of which all enterprises had to develop their own quality assurance manuals, with execution procedures and mandatory inspection and testing points attended by representatives of the beneficiary (future heavy water plant). The experience of the quality assurance system obtained for the heavy water plant helped equipment factories and builders when they moved on to the execution of nuclear equipment and the construction of the Cernavodă nuclear power plant. Overall, the introduction of the Quality Assurance System led to an unprecedented technological discipline and to the qualitative increase in the level of execution in the Romanian industry, thus becoming competitive on the international market.

During the construction of the heavy water factory, at the national level it was decided to double the number of CANDU type reactors, requiring double the amount of heavy water.

Consequently, it was planned to expand the plant from its current designed stage (Stage 1) with a new adjoining plant (Stage 2). The design was the same, and some units (such as sheds, part of the installations, etc.) were to be shared. Orders for Stage 2 have begun, however, considered by the designers as a big mistake. (Turtureanu 2016)

In 1979, by Decree 400/16.11.1979, it was decided to establish the "Drobeta" Chemical Plant for the production of heavy water, located in the village of Răscoleşti. M.E.E., as the plan holder, will ensure, until June 30, 1982, the steam and electricity requirements and divert the high voltage lines until March 30, 1980. (Fako et al. 2019)

The first employees of the factory were eight people, led by the first director, the chemist Gheorghe Florea. The foundations for the isotopic exchange columns, the water adduction works from the Danube have started to be poured. (Nică 2016)

In the spring of 1983, facility trials began and process water quality testing was completed.

The construction-assembly works started at the beginning of 1985.

In 1986 CET Halânga can supply steam. It is decided to expand Stage 2 with three isotopic exchange modules.

In May 1987, the first pyritization begins in the first module for the protection of carbon steel from the corrosive attack of hydrogen sulphide, by forming a micron layer of pyrite on the surface, finishing it in the autumn of the same year.

In September 1987, the first loading with hydrogen sulphide is done at Module 1.

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