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Water Chemistries at Thermal and Nuclear Power Stations: A New Level of Information Support

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Abstract—Methods used by the Moscow Power Engineering Institute's Department for Technologies of Water and Fuel in providing information support to the chemical departments of power stations in the field of organizing water chemistry of power units are described. Information is given on a new handbook on water chemistries at thermal and nuclear power stations and on the site supplementing this handbook.

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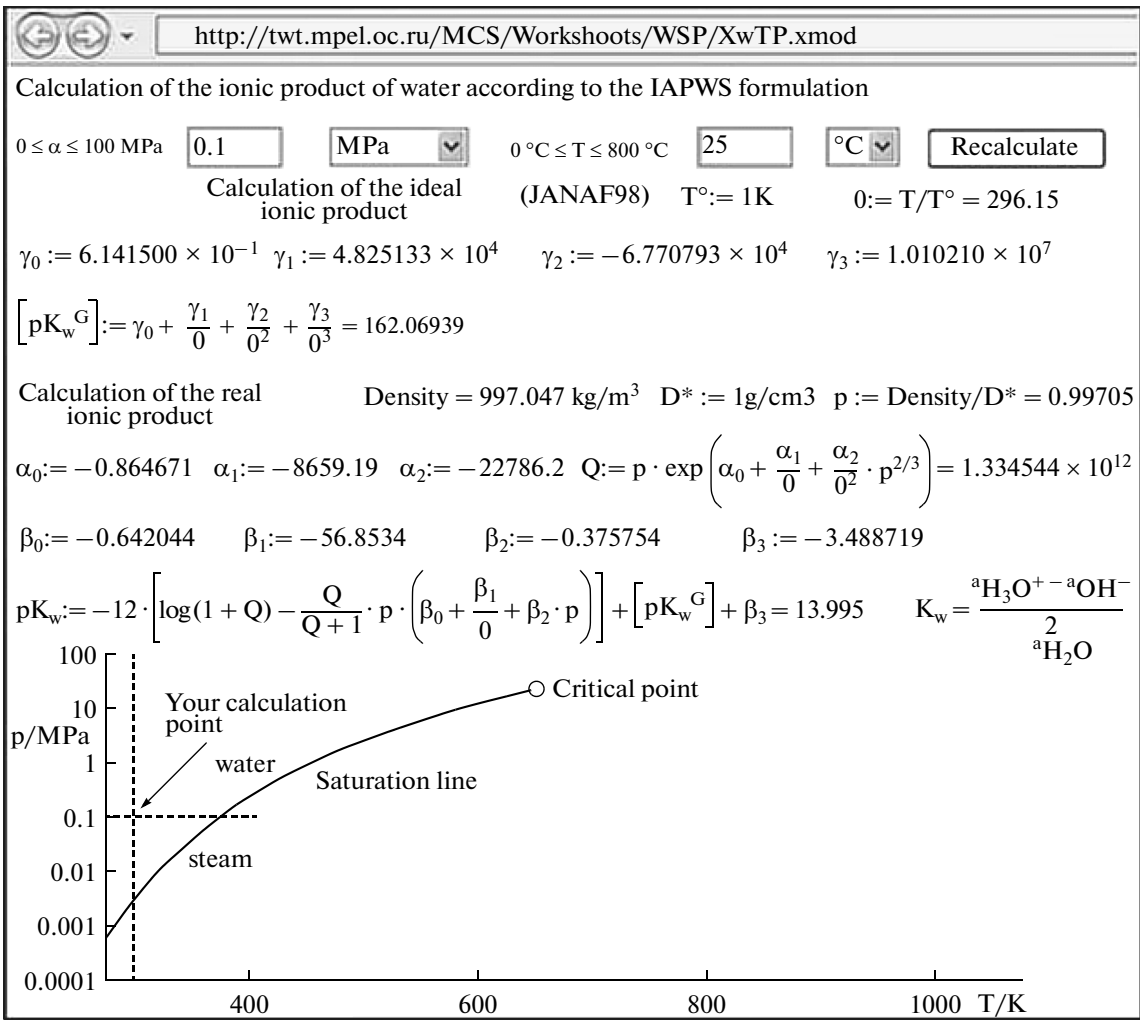
In the late 2009, the Publishing House of the Moscow Power Engineering Institute (MEI) issued the handbook Water Chemistries of Thermal and Nuclear Power Stations written by the Professors of MEI Department for Technologies of Water and Fuel, V.N. Voronov and T.I. Petrova. The discipline under the same name is delivered in different degrees of detail to students educated to a few certain specialties at MEI and other higher schools, as well as to students of specialized secondary schools. Since this book contains the results of research works that have been carried out at Russian (MEI, All-Russia Thermal Engineering Institute, Central Boiler-Turbine Institute, and others) and foreign (EPRI, the United States) institutions in recent years, the book may be of interest not only for students, but also for scientific and technical workers dealing with problems on this topic. It should also be pointed out that information on the water chemistries used at thermal and nuclear power stations (TPSs and NPSs) is regularly published in the journal *Teploenergetika*.

Unfortunately, the last fundamental works on the above-mentioned topic were published quite long ago due to certain circumstances [1–4]. Since the time these books were published, the need of carrying out detailed studies of steam generation processes has become still more topical in view of making equipment for increased working parameters and using new technologies for producing electricity, in particular, in combined-cycle power plants.

Apart from the traditional sections (physicochemical fundamentals related to corrosion of structural materials, carryover of impurities with steam, standard parameters of water chemistries used at TPSs and NPSs), the handbook contains a detailed description of the problems that have become important in recent years, including the behavior of organic impurities in the steam–water paths of TPSs and NPSs and the water chemistries of TPSs equipped with combined-cycle plants. As it regards the behavior of organic impurities, the handbook considers the influence of organic substances on the operation of equipment, thermolysis of organic impurities, and their behavior in the phase transition zone of steam turbines. The publications mentioned above did not consider these questions almost at all (these problems have become acute in the last two decades). The same can be said about combined-cycle plants, the development of which has commenced in a relatively recent time. It is not by chance that Voronov and Petrova's handbook describes first the thermal process diagrams of these installations, and only after that it considers the water chemistry parameters of heat-recovery boilers and gives concrete examples of these water chemistries.

It should also be noted that the handbook contains sections that formally go beyond the framework of its title, which, however, are necessary for students and may be of interest for specialists. In the last two decades, matters relating to preservation of power-generating equipment have become extremely important in Russia due to the well-known factors (the decay of industrial production and, accordingly, the drop of energy consumption). Quite a large experience has been gained at MEI and other organizations in preserving boilers and steam turbines, which has been reflected in the handbook. Knowledge of the water chemistries used in heat networks, turbine condenser cooling systems, and alternator cooling systems is of equal importance for students and specialists. These sections of the handbook reflect the authors' own experience and experience gained by other specialists; therefore, the book can be regarded not only as a handbook but also as a monograph, which makes it attractive for a wide range of readers.

In conclusion, I would suggest that in issuing the second edition, the authors supplemented the hard copy with an electronic version that would include the necessary calculations, concrete example problems (assignments), and other procedures the execution of



Interactive network calculation of the ionic product of water.

which is possible just in electronic format. This work has already been started [5–7].

A few specialized Internet sites for calculating and graphically representing thermal power processes have been developed at MEI (www.mpei.ru) within the framework of activities on implementing an innovative education program (http://inedu.mpei.ru) and development of the Electronic Encyclopedia of Power Engineering (www.trie.ru) under support of the Russian Foundation for Basic Research (www.rffi.ru) and under the aegis of the National Committee for the Properties of Water and Steam (http://twt.mpei.ru/rnc). The following innovation developments of MEI have been laid at the heart of these sites:

—The set of certified computer programs WaterSteamPro™ (www.wsp.ru) for calculating the thermophysical and physicochemical properties of water, steam, gases, and gas mixtures. The functions of this set can be made visible in all popular computation environments used by thermal power engineers in programming languages (FORTRAN, C, BASIC, and Pascal), spreadsheets (Excel), mathematical computer programs (Matlab, Mathcad, and Maple), etc.;

—A set of computation documents developed in the Mathcad software environment, which has powerful tools for solving mathematical problems and graphically representing the obtained solutions;

—A technology for publishing on the Internet of thermal engineering and other calculations created in the environment of the Mathcad software with the functions of the WaterSteamPro™ software package connected to it. It is important to note that the user can vary the initial data in the published problems and obtain new answers illustrated by the appropriate diagrams.

As an example, the figure shows the open interactive network calculation of the ionic product of water from this site, which frequently appears in calculations of water chemistries.

REFERENCES

1 1. M. A. Styrikovich, O. I. Martynova, and Z. L. Miropol'skii, *Steam Generation Processes at Power Stations* (Energiya, Moscow, 1969) [in Russian].

2 2. P. A. Akol'zin, T. Kh. Margulova, and O. I. Martynova, *Water Chemistry Used in Steam Turbine Units for Supercritical Parameters* (Energiya, Moscow, 1972) [in Russian].

2 3. T. Kh. Margulova and O. I. Martynova, *Water Chemistries Used at Thermal and Nuclear Power Stations: A Handbook for Higher Schools* (Vysshaya Shkola, Moscow, 1981) [in Russian].

4. O. I. Martynova, A. V. Nikitin, and V. F. Ochkov, *Water Treatment: Calculations on a Personal Computer* (Energoatomizdat, Moscow, 1990) [in Russian].

5. V. F. Ochkov, Yu. V. Chudova, and E. A. Minaeva, 3 "Cloud Computations" for Chemical Departments of Power Stations," Teploenergetika, No. 7, 19–24 (2009) [Therm. Eng., No. 7 (2009)] (http://twt.mpei.ac.ru/ochkov/TE-7-2009/Cloud-Calc-Therm-Eng.pdf).

6. A. S. Kopylov, V. F. Ochkov, and Yu. V. Chudova, *Pro-* 3 *cesses and Apparatuses Used in Advanced Technologies of Water Treatment and Their Programmed Calculations* (MEI, Moscow, 2009) (www.vpu.ru) [in Russian].

7. A. A. Aleksandrov, K. A. Orlov, and V. F. Ochkov, *Thermophysical Properties of Working Substances Used in Thermal Power Engineering: An Internet Handbook* (MEI, Moscow, 2009) [in Russian].

SPELL: 1. Styrikovich, 2. Margulova, 3. Chudova