Experience acquired with use of geosynthetic materials is analyzed in Russia and abroad. The advantages of these material when used in hydrotechnical construction is demonstrated.

Keywords: geosynthetic material; hydrotechnical construction; standard base.
Use of GSM in anti-filtration structures: (a) 1, geomembrane/bentomat; 2, protective layer; 3, cover layer; (b) 1, geomembrane/bentomat; 2, protective layer; 3, surcharge; 4, cover layer; 5, stabilization of edges of insulation.

for nature preservation — collectors of industrial and domestic wastes, ash dumps, tailing ponds, etc., where the waterproofing properties of GSM are utilized. This is explained, for example, by lack of development of a regulatory base and corresponding experience with their use in large-scale hydraulic engineering.

Historically, it has been told that initially, geosynthetic materials had come into use in the railroad industry; existing regulatory documents on their use had been oriented toward railroad construction [6, 7]. One of the first regulatory documents standardizing use of geosynthetic materials as anti-filtration elements for WDW was “Instructions for design and construction of anti-filtration installations formed from polyethylene film for artificial water bodies” [8]. This instruction contained materials required for design of anti-filtration installations formed from polyethylene films, which are used in elements of earthen structures for reservoirs, tailing ponds, and various collectors of industrial waste water, and which afford protection from contamination of ground and surface waters.

Recommendations [9] developed by specialists of the JSC “VNIIG im. B. E. Vedeneeva,” wherein results of multi-year investigations in the field of construction and design of anti-filtration curtains formed from a polyethylene films, and also requirements of international standards and norms, primarily in the “Standard procedure for quality assurance during installation of geomembranes” developed by the International Association of Geosynthetic Installers (IAGI), are generalized, has been an off-shoot of the instructions.

Application of geosynthetic materials in hydrotechnical construction is defined in Section 5.32 and Section 5.50 of Building Code 39.13330.2012 [10], especially use of geotextiles as reverse filters in the construction of anti-filtration installations formed from polymeric materials, for example, polyethylene, polyvinyl chloride, and butyl-rubber films, etc.), respectively. From the standpoint of modern development of geotechnics, these documents contain very little information, and encompass only the initiation of GSM implementation in components of water-power structures.

It is understood that the existing status of the regulatory base defines the level of implementation of GSM in the design of water-power structures. On such large-scale construction projects over the past 10 years as the Bureya HPP, and the new spillway at the Sayano-Shushenskaya HPP, and on the Lower Bureya, Boguchanskaya, Gotsatlinskaya, Zaramagskaya, and Ust’-Sredneekanskaya HPP and the Zagorsk No. 2 pumped-storage power plant, which are currently under construction, for example, unique design- and builder-specific solutions have been implemented; however, the potentials of new geosynthetic materials have yet to been utilized in practice.

Analysis of use of GSM in Russia has indicated that geosynthetic materials are used very little in today’s water-power construction, primarily for installation of filtering and insulating components of earthen dams; and, no practical use has been made of the reinforcing, draining, and protective functions of GSM in designs.

The largest water-development work constructed in the USSR with an anti-filtration element formed from polyethylene film is the dam at the At-Bashi HPP in Kirgizia [11, 12]. A geosynthetic protective filtering material (geotextile) was first used in Russian hydrotechnical construction in the design of the earthen dam at the Surgut No. 2 State Regional Plant to prevent silting-up of drainage pipes.

The universal technical characteristics of geosynthetic materials and experience acquired with their use in branches of railroad, industrial, and civil construction are opening broad prospects for use of these materials in hydrotechnical construction both in our country and abroad. Using modern GSM, therefore, it is possible to stabilize soft beds of structures and areas embodying infrastructure.

Procedures employed for GSM production ensure the required technical characteristics and their uniformity; this improves the quality of the construction based on high personnel qualifications and use of the latest equipment, and shortens the installation time of the structures.

Specialists of the JSC “VNIIG im. B. E. Vedeneeva” have developed an album of technical solutions and designs for subassemblies with use of GSM. Let us cite several examples.

Creation of anti-filtration installations (AFI) with use of impermeable geosynthetic materials as curtains, diaphragms, and AFI in the bed makes it possible to ensure extinguishment of pressure within the body of the dam, and a reduction in filtration flow rate with assurance of the filtration process in earthen dams (Fig. 1).

When the designs shown in Fig. 1, a are used, for example, it is possible, in addition to the above-cited advantages, to dispense with costly earthen cores, and clay-cement and bituminous-concrete AFI, reducing the cost and shortening the construction time. In cases when bentomats are used,