THE FOREST RESOURCES FLOODING IN THE SIBERIAN HYDRO POWER STATIONS (HPS) RESERVOIRS BOTTOMS

Korpachev V.P., Perezhilin A.E., Andriyas A.A., Korpachev K.E.
STM ARPA – The State Management of the All–Russian Production Association «The Siberian State Technological University»
Krasnoyarsk, Russia

The hydro power station (HPS) building has the great significance in the energy provision structure of Russia. For all this, the larger part of the economically efficient hydro power potential has been concentrated in the Siberia.
So, such complex naturally – technical objects building, as the hydro power stations (HPSs), is being conjugated with the whole series of the challenges advent, the basis of which is the wood's considerable volumes flooding, having exerted its influence upon the aqueous medium.
The wood pulp pollution prognoses of the Boguchansky and the Motyginsky hydro power stations (HPSs) reservoirs, having presented in the present paper, are being given the possibility to evaluate the environmental impacts of the submerged and the floating wood upon the water quality.

The part of the hydro power stations (HPS) is being made up 22 %, the thermo–electric power stations (TEPS) – 67 %, the atomic electric power stations (AEPS) – 11 % in the energy provision structure of Russia. So, the economically – efficient hydro power potential is being related to the five river basins, such as: the Yeniseisky one – 34 %; the Lensky one – 27 %; the Obsky one – 11 %; the Amursky one – 7 %; the Volzhsky one – 7 %.

The Nizhneboguchansky and the Motyginsky hydro power stations on the Angara river, the Evenkiysky hydro power station on the Nizhyaya Tunguska river, and also the Nizhnekureisky hydro power station on the Kureika river, except the building Boguchansky hydro power station (HPS) now are being related to the number of the most perspective HPSs in the Krasnoyarsk Region [1].

The complex naturally – technical objects building, as the hydro power stations (HPSs), should be conducted, with due regard for the incipient challenges complex.

Thus, it is quite possible to be divided into the initial ones, the foreseen ones at the projecting stage, and also the second ones, having advented, as the hydraulic works and the reservoirs construction consequences, the challenges, having advented at the hydro power stations (HPSs) reservoirs designing, the projecting, the construction and the maintenance.

Thus, we shall single out the main challenges just from the primary and the initial ones:

1) the water resources usage master plan choice;

2) the hydro electric generating complexes and the reservoirs optimal parameters validation;

3) the water, the land, and also the forest resources monitoring in the hydro electric generating complex construction zone;

4) the reservoir bottom preparation economically – ecological validation;

5) the engineering protection from the towns and cities, the human settlements, the separate enterprises flooding and the underflooding;

6) the agricultural holdings, instead of the submerged ones by the reservoir, restoration on the new place;

7) the reservoir fish economic activity mastering;

8) making the reservoir navigable;

9) the bottom sanitary preparation just before the flooding;

10) the hydro technical arrangements on the aqueous and the wind erosions prevention within the reservoirs zone;

11) the bottom forest report and the cleaning – forest just before the flooding, the afforestation planting on the new place.

The second challenges are more complex and interconnected, the consequences of which would be revealed throughout many years after the construction completion, in many cases, it is very difficult to predict them with the sufficient scientific validity and the soundness. So, many of all these challenges are being left quite unsolvable in the foreseeable future.

So, it is quite possible to subdivide the second challenges into, as the ecological, well as the social ones.

Thus, we shall mark out the main ecological challenges:

- the reservoirs coastline erosion, the banks and the shores, the bottom, the estuarine reaches of the rivers reforming, having fallen into the reservoirs, the sandbars formation;
- the drifting peat islands advent;
- the floating wood supply advent on the defined area of the reservoirs, owing to the bank erosion and the shore man – induced erosion;
- the wood, having received from the rivers, falling into the reservoir;
- the groundwater level changes;
- the body of water and the ambient environment temperature regime changes, the increased moisture, the intensive and the prolonged by their time mists advent;
- the additional water loss for the evaporation;
- the water qualitative composition changes in the reservoir;
- the vegetable and the animal worlds changes;
- the fish spawning grounds conditions violations;
- the Earth's crust vibrations provocations danger, in connection with the large hydro electric dams and the reservoirs construction;
- the contamination by the organic substances.

The reservoirs maintenance experience has been shown, that it is not enough to consider the denoted and the specified challenges at their designing and the maintenance, and also their consequences only from the economic point of view. So, it is quite necessary the complex economically – ecological and the social assessment of the reservoirs construction consequences.

The Siberian hydro power stations (HPSs) reservoirs are being located in the forested – covering zones, having had the damp – growing forest average stock at the riverside edge up to 200 m^3 per the forested – covering area hectare. There has not been the forest report conducting case in the complete scheduled volume at the stage of the reservoirs bottoms preparation. The refusal from the forest report and the cleaning – forest conducting in the Siberian hydro power stations (HPS) reservoirs bottoms in the scheduled volumes has been the flooding reason more than 22,69 mln. m^3 wood [2].

The wood flooding reasons in the reservoirs bottoms are the following:

1. The large labor – intensiveness and, as the result of this, the works high value on the forest report and the cleaning – forest;
2. The wood – roads absence in the flooding zone, as the result of this, the wood removal high value to the consumers;
3. The forest – processing enterprises absence in the flooding zones and on the territories, which are adjacent to the reservoirs;
4. The local working human resources absence;
5. The non – overflow dams' construction, not having permitted to be passed the rafts and the floats by the transit into the downstream.

It is necessary to be mentioned, that more, than 4 mln. m^3 wood pulp are being located at the Angara and Yeniseisky Region hydro power stations (HPSs) defined areas of the reservoirs water. Annually, about 300 thousand. m^3 wood have been removed from the Bratsk defined area of the reservoir water, and, moreover, more, than 6 mln. m^3 wood have been given to the Bratsk Forest – Processing Complex (FPC). But, the whole volume at its defined area of the reservoir water is not being decreased. The wood

stocks recovery non – stop process is being on.

The Ust – Ilimsky, Bratsky, Sayano – Shushensky, Krasnoyarsky hydro – power station (HPSs) reservoirs flooding zones investigations on the location have been permitted to determine the anthropogenic and the natural sources of the reservoirs contamination and their pollution by the wood pulp, and also their criterion, and the quantitative indicators and measures.

To the natural sources of the reservoirs contamination and their pollution are being related to the following ones:

- the trees falling into the water from the reservoirs waterside and the riverside, as a result of the banks washing out, the erosion and the banks falling;
- the partially or the completely falling away and breaking – away of the submerged forest and wood standing from the waves influence and the ice motions impact;
- the wood pulp removal from the rivers, having fallen into the reservoir;
- the natural disasters (e.g. the intensive wind – falling and the wind – blowing down, the flooding, the accidents at the wood – floating enterprises);
- the organic substances (e.g. the peat, the humus, the forest trees waste);
- the young undergrowth, having grown after the forest report and the cleaning – forest conducting.

For today, there are not the theoretical dependences, having defined the wood pulp total entering volumes into the reservoir, so, they are able to be defined only at the specific object in the process of the observation for it during the sufficiently large time of period.

The investigations, having conducted in the flooding zones, have been permitted to be worked out the main Methods of the hydro power stations (HPSs) reservoirs pollution and the contamination, and also the pollution prediction by the wood pulp and the organic substances [2].

These main Methods have been permitted to be worked out the pollution and the contamination prognosis by the wood pulp and the organic substances of the Boguchansky hydro power station (HPS) (Bo HPS), and also the designing Motyginsky hydro power station (HPS).

The pollution and the contamination prognosis by the wood pulp and the organic substances of the Boguchansky hydro power station (HPS) (Bo HPS) has been presented in the table 1.

Table 1. The shruberily – wood vegetation stock in the Bo HPS reservoir bottom after the flooding first year, under the forest report and the cleaning – forest conducting:

The Pollution & Contamination Sources	Volume, thnd. m^3
The systematic flooding volume	1431,1
The cutting remains from the forest report & the cleaning-forest conducting.	1534,8
The young undergrowth	1897,2
The dead wood and the fallen trees	552,0
The spreading wood pulp along the water's edge, the utility structures remains	19,2
The wood entering from the rivers	0,7
The wood losses from the forest floating and the timber enterprises activity	7,8
The natural and the unrecorded factors	11,0
Total: the wood resources	5453,8

The pollution and the contamination prognosis by the wood pulp of the Motyginsky hydro power station (HPS) (Mo HPS) has been presented in the table 2.

Table 2. The shruberily – wood vegetation stock in the Mo HPS reservoir bottom after the flooding first year, under the forest report and the cleaning – forest conducting:

The Pollution & Contamination Sources	Volume, thnd.m ^{3}
The cutting remains from the forest report & the cleaning-forest conducting	317,1
The dead wood and the fallen trees	175,9
The wood removal from the rivers, having unused for the purpose of the timber - rafting	0,2
The spreading wood pulp along the water's edge	20,5
The losses from the natural factors	8,0
The unrecorded losses	3,0
The wood losses from the forest floating and the timber enterprises activity	7,3
The banks washing out and the erosion	47,0
Total: the wood resources	579,0

Without due regard for the root system and, having assumed, that the cutting remains from the forest report and the cleaning – forest conducting, as this the Sanitary – and – Epidemiological Inspection (SanEpinIn 3907–85) is demanding [4], will be utilized in the Boguchansky hydro power station (HPS) reservoir bottom, not less, than 4 mln. m^3 the shruberily – wood vegetation will be submerged, in the Motyginsky hydro power station (HPS) reservoir bottom – not less, than 500,0 thousand m^3.

In conclusion, it is quite possible to be noted the following. The Siberian hydro power stations (HPS) construction experience has been shown, that such construction is being resulted in the wood large volumes flooding. The prognoses of the Bo HPS and Mo HPS reservoirs contamination and their pollution by the wood pulp, having presented in the present paper, are given the possibility to evaluate the submerged and the floating wood influence upon the waters quality.

References

1. Lapin G.G., “On the Situation and the Development Perspectives of the Russian Hydropower Engineering” / G.G. Lapin, V.V. Smirnov, E.E. Vaksova // “The Hydraulic Engineering Construction”, № 6, 2007, – p.p. 9 – 15;

2. Korpachjev, V.P., “The Wood Pulp Entering Prediction Methods at the Angara – Yeniseisky Region HPS Reservoirs Flooding and the Maintenance”/ V.P. Korpachjev, L.E. Malinin, M.M. Chebykh // “The Angara – Yeniseisky Region Resources Use and the Restoration: the Scientific Papers Collection of the All – Union and the Theoretical and Practical Conference”, vol. II. – Krasnoyarsk, Lesosimbirsk, 1991. – p.p. 107 – 113;

3. Savchenko, E.F., “The Far Eastern Reservoirs Ecology: the Organic Contamination Challenges” / E.F. Savchenko, M.N. Savchenko, // “The Russian Ecology and Industry”. – 1999. – p.p. 19 – 23;

4. SanEpinIn 3907–85 “The Designing, Construction and the Reservoirs Maintenance Sanitary Rules” – It has been confirmed by the Deputy of the Chief State Doctor of the USSR, dated from 01.07.1985.