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Procedia Environmental Sciences 2 (2010) 1979–1982

Procedia Environmental Sciences

International Society for Environmental Information Sciences 2010 Annual Conference (ISEIS)

Technology Review System of Water-Temperature Prediction for Reservoir Construction Project

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Abstract

It is the important technical support for technology appraisal to establish technology review system of water-temperature prediction for reservoir construction project. In this study, the technical route, implementation method and process, the required basic data, and key issues were proposed for the water-temperature technology review. The realization of water-temperature technology review can provide technical guarantee for regulating the technical requirements on water temperature prediction in environment impact assessment (EIA) report. Technology review can also prevent arbitrariness in some EIA reports. Moreover technology review could resolve some experts' doubts on the prediction result during the process of technology appraisal.

Key words: Reservoir construction project; Water-temperature prediction; Technology review

1. Introduction

In recent years, the construction speed of reservoir engineering has increased rapidly. After completion of the reservoir construction, the hydrological conditions of the original river are generally changed[1-2]. A lot of water is accumulated in the reservoir area, which makes a significant increase of thermal capacity in reservoir. And it can lead to water temperature distribution structure quite different to natural river temperature. Especially when the water level is very high in front of dam, it will form significant water temperature stratification [3-7]. Reservoir operation will lead to the phenomenon of cold water discharge, and change water temperature environment in the downstream. And it thereby will affect fish breeding in the downstream and agricultural production in some areas [8-9]. Therefore, water temperature distribution in the reservoir area and cold water discharge have been attached much more attention by the relevant parties. With increasing construction of dam reservoirs, the influences of cold water discharge became more and more serious. Water temperature forecast of reservoir project became the important parts of environmental impact assessment and its technology appraisal. In order to control strictly the reservoir influence of cold water discharge, technology review on environmental impact prediction needs to be carried out for water reservoir construction project. It is helpful to improve technology support for technology appraisal and environment management agents. And it contributes to evaluating forecast methods and results of water temperature

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doi:10.1016/j.proenv.2010.10.212

in the EIA report objectively and impartially. Technology review on water temperature prediction can provide technical support for better protecting the water environment.

2. Technology Review System of Water-Temperature Prediction for Reservoir Construction Project

Technology review of EIA is based on the study of environmental impact prediction models. There is a set of models on water temperature prediction in "Technical Guidelines for Environmental Impact Assessment of Surface water Environment". But with the development of numerical computation and high-performance computer, environmental impact prediction model can provide more and more accurate simulation. EIA forecast model is changing from general mathematical formula to the numerical solution. Therefore, for the technology review of environmental impact prediction, advanced numerical model software will be utilized to review water temperature prediction. Numerical model software which is mature and authoritative, is used to compute and simulate water flow and temperature, based on data provided by EIA agent. The results of technical review will be compared with the results of the EIA forecast. Analysis result will be given about if the result of EIA is scientific and reasonable. The purpose of technical review of EIA report is to analyze and evaluate technical methods, prediction parameters and prediction conclusions of water-temperature environment prediction. The conclusion will be drawn whether the result of water environment impact prediction is correct and credible.

The realization process about technology review of wate-temperature prediction is briefly described as follows: At first, there may be problems of the reservoir project to be selected to technical review; and then we read the EIA report, mainly water temperature prediction part, and give the preliminary judge whether prediction method and prediction parameters are reasonable. According to hydrological conditions, we determine modeling software used by the technical review, make technical review program, and obtain the basic data for technical review. After that we set model parameters and proceed numerical simulation. The prediction results of water temperature simulation will be obtained. The technical review prediction result will be compared with EIA prediction result. If both prediction results are consistent with each other or within the error range, we submit review report. If both prediction results differ significantly, we again contact EIA agent and verify the prediction model and prediction parameters used in the process of EIA. If necessary, EIA agent will be required to provide some materials about calculating process of water temperature prediction in order to further examine the differences between both prediction results. Finally, we analyze data error causes, submit technology review report to technology appraisal agent and finish EIA technology review. The technique routine of EIA technology review is shown in Figure 1.

The raw data for technology review of water temperature prediction include: underwater terrain data, discharge outlet location, discharge, water level, water temperature, air temperature, wind speed, solar radiation, total cloud amount, and sunshine hours etc. Model parameters include roughness and heat balance parameters. Different model software need the original data with slight difference, based on the model calculation conditions.

Water surface heat exchange is the main influencing factor of surface water temperature. Water surface heat exchange includes four parts: net solar radiation, net long wave radiation, evaporation and conduction. Heat flux into the water through water surface is calculated by formula 1.

$$\Phi n=\Phi sn+\Phi an-\Phi br-\Phi e-\Phi c \quad (1)$$

Φsn is net absorption of solar radiation; Φan is atmospheric long-wave radiation; Φbr is water long-wave radiation; Φe is evaporation heat loss; Φc is heat conduction flux.

Among prediction models of water environmental impact, there are some authoritative numerical model software packages, such as MIKE, Delft 3D, SMS, EFDC, and so on.

The department of Appraisal Center for Environment and Engineering, Ministry of Environmental Protection, which do technology appraisal of EIA for construction projects, has been carried out technology review for environmental impact of hot water discharged by power plant by MIKE 11. And now reservoir construction project is being undertaken technology review for water temperature affect.

The technology review focuses on whether it is reasonable of model used, whether it is reasonable of model parameter value, and whether it is right of water flow field to be simulated. Flow field is the base of temperature field. Only when flow field simulated is correct, we can ensure the correct temperature field to be simulate. Then the water temperature prediction result will be reliable.

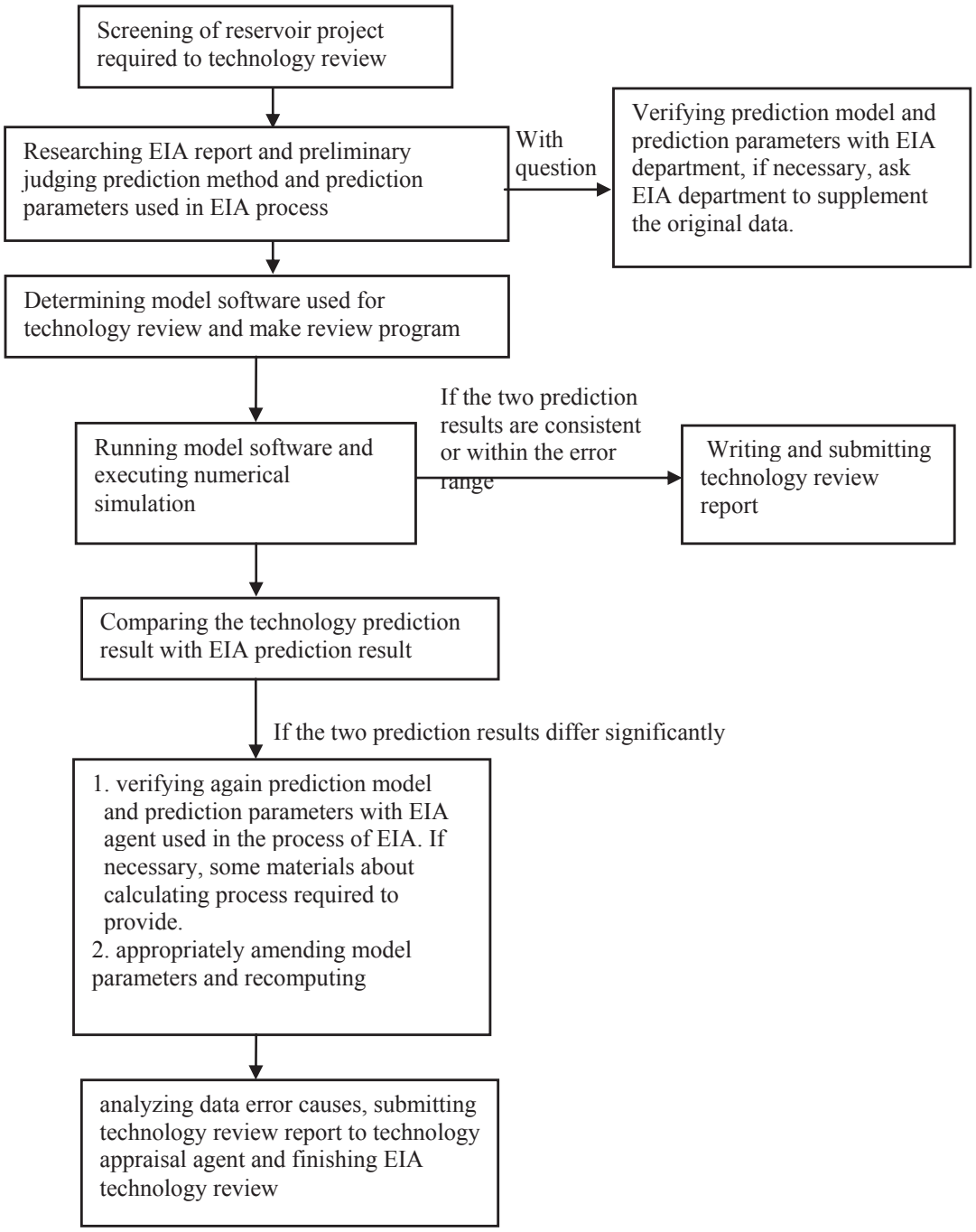

Fig1 The technique routine of EIA technology review

3. Conclusions

It will provide important technology support for technology appraisal of reservoir construction project when technology review of water temperature prediction is realized. In this study, the technical route, implementation method, basic data and key issues on technology review of water-temperature prediction for reservoir construction project are given. The realization on technology review of water-temperature prediction contributes to regulating the relevant technical requirements of water- temperature prediction in EIA report and preventing data selected arbitrary and untrue in some EIA report. And at the same time, technology review can resolve some experts' doubts on EIA prediction results. Moreover, technology review will improve technology appraisal scientific of EIA.

Acknowledgements

This work was financially supported by National Basic Research Program of China (No. 2010CB951102) and National Science and Technology Major Water Project (2009ZX07209-008-03).

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