Momentum and Vitality for Social Sustainable Development Resulted From Existing Hydropower Dams

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Abstract: This paper briefly describes the achievements gained from nearly 20 years by hard working for hydropower dam safety management in China. It discusses the necessity to build a dam safety management system that is friendly with ecological environment and suitable for modern social development under the guidance of scientific development view, as well as the importance of sustaining development of hydropower dam safety management. It further discusses the key issues on dam safety responsibility, emergency acting plan, dam safety on-line management system and so on, in order to develop sustaining and progressive dam safety management ability, so that the existing hydropower dams can provide ample momentum and vitality for social sustainable development, to promote the harmonious development in society, economy and ecological environment.
Keywords: dam safety, management, sustainable development, momentum

1. Importance for sustainable development of dam safety management

A large dam that retains huge energy in reservoir has its own life cycle from survey, design, construction, operation until being abandoned. Therefore, the dam performance after its naissance is dynamically changed along with the variation of geological and hydrological condition, time, environment and ageing of construction material, etc. The hydropower station dams in China widely distributed at every corner of China, vary from each other in climate, geology and construction condition, dam types and complexity, operation period, safety state and managerial focus, therefore, the safety management of large dams is a complex and technical job and should be planned with the view of sustainable development and scientific development.

The dam safety is one aspect of public safety closely relating the people's life and property, social development and stability downstream the dam, “the responsibility for safeguarding social safety weighed as heavy as Mount Tai”. Therefore, effort should be made to do better the dam safety management with the attitude of taking the responsibility for the people. Especially, today at the moment of deepening power institution system reform, Large Dam Safety Supervision Center will offer relative technical consulting service, raise sustainable development ability for dam safety management, serve sincerely to enterprises, society and the people while carrying out conventional dam safety management, along with the situation of reform to meet the needs for social development and market development.

2. Strengthen fundamental work for dam safety management [1]

Reviewing the establishment and development course of Large Dam Safety Supervision Center (LDSSC) in the past some 20 years, we have actively performed and established a sound foundation for dam safety regulations, standards, dam safety plans, periodic inspection, reinforcement and consolidation, ill and dangerous dam treatment, dam safety management training, and dam safety assessment, etc.

2.1 Establish and perfect regulations system and relative technical standards for dam safety management step by step

In 1987, the “Hydropower dam safety management method” was first promulgated by the Ministry of Power Industry, which was drafted by LDSSC, and soon afterwards, “Detailed regulations for

implementation of hydropower dam safety inspection", "Regulations for hydropower dam safety registration", "Management method for hydropower dam safety monitoring", etc. were enacted successively. LDSSC realizes the technical management and technical supervision according to the regulations above and make the safety management work of large dams be standardized and legalized step by step.

Along with the national power sectors reform and times development, the "Management method for hydropower dam safety monitoring" is urgent to revise to meet new situation and requirement of new institutions for dam safety management. Now, the Sate Electricity Regulatory Commission has completed the revision of this regulation, and to be issued recently for enforcement. LDSSC will offer technical support as before to revise and perfect the safety regulations, and at the same time will complete revision of related technical standards and specifications step by step such as "Technical rules for concrete dam monitoring", "Compilation rules for monitor information", "Technical specification for dam safety monitoring automation" and so on.

2.2 Do better planning of dam safety management and ensure performance of dam safety management by orders

The plan is the head of all work and only grab it be able to realize each work by order. Now, LDSSC will prepare four plans: The periodic inspection plan, the renovation and updating plan for monitoring facilities, the enforcement and consolidation plan and dam safety management training plan, LDSSC will realize actively these plans to ensure the implementation of each work for dam safety management by orders.

2.3 Realize periodic inspection, prevent and eliminate dam safety hidden trouble in time

The dam safety periodic inspection is one of most direct effective means of grasping safety state of large dams. The dam safety periodic inspection system was started in the power sector in 1987, 96 dams in the first round was completed in 1998, in which 9 dams were assessed as ill and dangerous dams, the safety situation of large dams of hydropower stations was basically grasped by the first round inspection, which had promoted development of enforcement and consolidation work for large dams. The second round inspection was started in 1997, it was planned to inspect 130 dams, at present 117 dams completed, and 17 dams to be started in this year. The second round inspection stressed the inspection and review of gate metal structure, underwater inspection, flood check and field inspection. Through the second round inspection, the safety condition of large dams of hydropower station has grasped and checked out a batch of hidden trouble that affected the safety of large dams, which is promoted the practice of enforcement and consolidation, elimination of defect and renovation of monitoring facilities. Now, planning for the third round inspection is under way.

2.4 Do better dam enforcement, consolidation and ill dam handling

By the incomplete statistics of 130 dams, more than 250 major dam rehabilitation projects were completed with total a total investment of 300 million Yuan. By the end of 2002, among 11 ill and dangerous dams were assessed by the periodic inspection, except Tianqiao dam and Foziling dam which were shifted for local management, 3 (Qingtongxia, Xiuwen, Lushuihe dam) of other 9 dams had been removed the label of ill and dangerous dam after rehabilitation, one dam (Yilihe-IV dam) approved as the normal dam after decreasing flood control grade, rehabilitation of 4 dams (Baiyutan, Majitang, Luodong, Liguan dam) passed the completion acceptance, and only one dam (Shuidong dam in Fujiang province) is still in rehabilitation. LDSSC will stress on the supervision and guidance of rehabilitation of ill and dangerous dams while offering technical support to the large dam management organs.

2.5 Perfect and update dam monitoring system

Dam monitoring could be able to discover in time the hidden trouble of dams, and it likes ear for safe operation of dam. From the 80's of last century, the monitoring facility for more than 130 dams in the power system was updated. By the end of 2002, excluding 7 small sized dams, others had installed certain monitoring items and most of them realized monitoring automation. The actual operation state

of dam was mastered through the data acquisition by monitoring instrument and data analysis, therefore the layout of dam monitoring instrument and intact level is very important. In the dam safety monitoring aspect, we shall stress the dam monitoring automation and practical equipment setup, for instance, compilation of relative technical specifications, development of dam safety management system, research of dam monitoring parameters and acceptance standard of monitoring automation system, except the management of assessment of monitoring system, stop, reject and storage of monitoring instrument.

2.6 Continue dam safety registration

The dam safety registration is a forced system to strengthen trade safety normalization management, the management of hydropower station will be more standardized and scientifically through the registration. According to the stipulations of "Detailed regulations for implementation of hydropower dam safety registration", the 5-year-interval registration is based on the conclusion of periodic inspection and actual situation of dam safety management, combining the registration qualification, safety grade, the random check and review management will be carried by dynamical way. According to the present situation of multiple investment channels, the registration shall stress the supervision of the management institution, staff setup, regulation establishment, etc. In 2004, LDSSC has the dam safety registration check on-the-spot and the result is notable. The suggestion and problem put out by the expert during the inspection on-the-spot greatly impacted the technical management engineers in the hydropower station.

2.7 Develop actively scientific research, raise technical level for dam safety management

The progress and innovation of science and technology is the soul and key power to raise dam safety management level. Via the practice of dam safety management for near 20 years, LDSSC has accumulated rich experiences, but the scientific research is still to grabed firmly. Up to 2002, two research tasks have been completed: The dam safety performance analysis and research(under the State Economic and Trade Commission) and Fengman dam safety assessment and research(under Sino-Canada cooperation); Now, the preliminary research of concrete dam operation safety assessment, application of risk assessment technology for hydropower dams in China and dam safety training under Sino-Canada cooperation is under way； The research item for dam safety management system was normally approved by the State Power Co.. Besides, we will engaged in study of dam monitoring index, crucial technology for repairing dam defects, estimation of dam risk and emergent acting plan, dam safety risk assessment and dam demolition technical research, etc. to offer fully technical services.

2.8 Strengthen dam safety training intensity, raise safety consciousness and business level of management people

The principle of "who is in charge of hydropower station, who undertakes the responsibility of dam safety" will be insisted. The document of "Stipulations of administrative responsibilities for specially huge safety accidents" was promulgated by the State Council in April 2001, which is very important to strengthen the legal responsibility and dam safety consciousness of dam owner and management persons at different levels, the dam safety and safe level is greatly depended on the safety consciousness and business level of dam management people, therefore, the dam safety training work shall be grabed frequently. During 1999 – 2001, we have conducted successfully 7 training classes of power plant directors and chief engineers, a training class for safety management of managers at power grid and province level, all have gotten a good effect. According to the long and middle-term working schedule of LDSSC, we are ready to conduct publicity training, monitoring post training, technical training for each type for safety management based on revised "Stipulations of hydropower dam safety management" at different trainees and different demands. Through increasing training intensity, train with great efforts a dam safety management troop that has high quality and high sense of responsibility and mission.

2.9 Realize safety assessment, better linking with construction period and operation period of dam

The hydropower project safety assessment was started at Daguangba project in 1995. By the "Provisional stipulations for hydropower project safety assessment" issued by the former Ministry of Power Industry in 1997, it was clearly ruled to have safety assessment before the acceptance of reservoir impounding and project completion. The project safety assessment is an effective link between the construction period and operation period. The practice of this work can discover project quality defect, eliminate safety hidden trouble, distinguish the responsibility limit between the construction period and operation period, accumulate valuable files information and establish the foundation of safe operation of hydropower station. The LDSSC will do the hydropower project safety assessment better as before and extend forward the duty of the dam safety management.

2.10 Realize technical exchange and cooperation at home and abroad, play platform role of periodical and website to conform with international level

The Dam Safety Management Professional Committee and Dam Safety Supervision Professional Committee of China Hydropower Generation Engineering Commission are attached with LDSSC and the Dam Safety Supervision Technical Standardization Committee also attached with LDSSC. The committee and commission joint famous scholar and experts in domestic dam safety profession to have regularly or irregularly domestic and international academic exchange, profession technical management and service, which has promoted the technical development and technical progress of dam safety management. After the magazine of "Dam and Safety" distributing openly at home and abroad, it plays a positive role to report the development state of dam safety and promote technical exchanges, it has now certain influence domestically and also published with international articles. The website and remote control system of LDSSC is under construction, which can become the information express of dam safety management and technical development exchange. We will adjust and perfect the website construction continuously according to the actual condition, play the exchange and spreading role of the periodical and website greatly to conform to world standard.

2.11 Harden foundation of dam safety files, realize sustainable development strategy

Through the first round, second round periodic inspection, safety assessment, general survey and safety registration, LDSSC has accumulated many very valuable safety files information, which will be valuable resource and wealth for future development. We will use modern technical means to store, keep and use, and at the same time update and perfect the database continuously. Establish solid foundation of dam safety management of hydropower station and reserve strength for sustainable development.

3. Existing hydropower dams offered huge momentum and vitality for national economy and social development

The main function of hydropower station dams is to store water for power generation. In 2002, the power output in China is 1.6540 trillion kW.h by the second position in the world, in which the waterpower production is 2280 hundred million kW.h by the 4th position in the world [2]， but our country has now become the second largest energy consumer country in the world, the power supply can not follow the step of economic development, and even outage event often occurs in peak hour in summer time. Power industry is the basic part for the national economy; therefore, the power industry should be developed in advance to meet the requirement of national economy and social development. The waterpower is revival energy and is in preference position for development. The coming 15 years will be the fast development period for waterpower.

In China, there are more than 70% fixed assets, 44% population, 1/3 farmland, above 620 cities located in middle and lower reaches of major rivers [2], which is facing seriously the threat of flood calamity, the contribution of dams in flood control period is huge and not be neglected. For the catastrophic flood in Changjiang River basin in 1998, 763 large and medium-sized reservoirs on the main steam and tributaries of Changjiang River had stored 340 hundred million cubic meter water,

resulting the water level lowered apparently, 7 million local resident exempting flood calamity, 3.30 million km2 farmland and more than 30 cities and counties exempting inundation, important traffic facilities protected, with flood control benefit of 500 hundred million Yuan. Therefore, the dam is important composition of national flood control system.

Excluding the power generation and flood control benefit above-mentioned, the dam has also notable benefit for industrial, water supply, agricultural irrigation, navigation, fishery and sightseeing, which has played important role for promoting the local development and economic increase of industry and agriculture. The construction of Three Gorges Project has improved the navigation condition of upper reaches of Changjiang River and is helpful for communication between the southwest region and mid-east region. Construction of major waterpower projects in Mid-China has improved the navigation condition for more than 2500km channels and shipping capacity increased by several times compared with the condition before the construction of Gezhouba, Danjiangkou, Wuqiangxi and Wan'an power station [2]. Really, the existing hydropower dams offered huge momentum and vitality for national economy and social development.

4. Necessity of establishing friendly ecological environment suitable for sustainable development of modern society

The existing dams as the infrastructure have made outstanding contributions for sustainable development and fast increase of power generation, flood control, water supply, irrigation and navigation and so on. As the manager of dams, he must remember the prerequisite of above-mentioned benefit is to ensure safety, the safety is just the biggest benefit, the safety is prerequisite of creation all benefit, and overlooking safety may bring disaster. Therefore, for today, well modernized with high civilization, it is very necessary to establish friendly ecological environment suitable for sustainable development of modern society for the dam safety management system. It shall be regarded strategically for the economic development and social progress by harmonious unification of human being and nature, and then can reach as a whole for harmonious and sustainable development.

China is a developing country, the water conservancy and water power project is the important infrastructure, the function for power generation, flood control, water supply and irrigation, etc. have a significant support role for social and economic development, therefore, under the guidance of scientific development view, it is very important to establish friendly ecological environment suitable for sustainable development for the hydropower construction and management system.

5. Work out and implement sustainable development strategy for dam safety management

Based on the original historical accumulation and considered fully the requirement of long-term development, LDSSC adjusted the strategic disposition in time and prepared the dam safety strategy suitable for the situation development required by the market demand, which is serviced as the link between past and future, and it is our sacred mission given by the history. Now, we will face each power grid company, generation company and basin development company, our service range will be more wide, the responsibility of the dam safety management will be more heavy, therefore, under new situation, we shall have both long-term program and the consciousness of sincere service for the market, thus the sustainable development strategy could be realized, developed and perfected, and our management ability could be cultivated and increased.

5.1 Promote establishment and enforcement of dam safety responsibility system under laws large dams

Via the effort of near 20 years, the regulatory system for dam safety management has been established and improved step by step, according to the change of management institutions, requirement of technical development as well as cognitive development, the related management regulations shall be revised and perfected at the right moment, and missing items or blank items shall be replenished. In the random check of dam safety registration on-the-spot in 2004 LDSSC discovered that considerable power plant still lacked the dam safety responsibility system, only flood control

responsibility system, the flood control responsibility system is insufficient, the flood control responsibility system can not replace the dam safety responsibility system. Through the daily management of registration, LDSSC actively pushed the establishment and enforcement of dam safety responsibility and promoted the management from the government to the power generation enterprise to manage the dam according to the laws.

5.2 Dam safety management alarming system and emergency response plan

Perfect dam safety management system should stress the safety of dam and its entire valley of lower reaches. Two principles of dam safety management should be insisted: “prevent accident to occur and reduce the loss once accident occurs”. The purpose of establishment of dam safety management alarming system is to reduce the loss of accident. The laws and regulations of some Europe and America countries such as United States, France and Canada, rule clearly the alarming system, emergence plan and evacuate plan. In recent years, some projects in developing countries have installed the alarming system [3]. Some Chinese large dams are preparing the dam safety management alarming system and emergence plan. This is also an important measure to ensure social stability, harmonious and sustainable development.

5.3 Dam safety remote management system

For the enforcement of sustainable development strategy, its key goal is to establish remote management system. This is an integrated and modern dam safety management system formed by measurement and remote control technology, computer technology and network communication technology. The purpose is to grasp in time the safety state and operation state of dams in power sector to offer dam safety information service and policy-making support for related authorities and generation enterprises to realize scientific decision of dam safety operation management [4]. If this goal is realized, the dam safety management level will step up a new stage, now this work is developing actively, but the platform for the dam safety remote control has been now set up, it still has plenty of work to be done and perfected.

6. Create new setup for dam safety management

The dam safety management regards to public safety and social stability, and is a formidable and glory undertaking. Under the situation of fast economic development, people's living level raised step-by-step, rigorous safety state from the production sectors, the Chinese government and entire society pay more attention to public security, and the requirement for dam safety management from the government is high. As a unit engaging in dam safety management specially, we shoulder significant responsibility of dam safety management. By the 20-years effort in the past, LDSSC makes plenty of basic and initiative work for dam safety management to form the present setup for dam safety management, but viewing the overall situation along with the development of science and technology, the dam safety management shall be more scientific, systematical and standardized. Therefore, LDSSC shall, under the leadership of State Safe Operation Supervision Administration and Sate Electricity Regulatory Commission, perform continuously the duty of “planning, guidance, supervision and service” to occupy high position technically through persevering efforts, and to form a new setup of management combining with remote management and periodic inspection by modern computer, website and information communication technology.

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