Annexure F

TEMPLATE FOR PREPARATION OF THE STUDY REPORT

The following template shall be followed to have uniformity in the preparation of the study report on site-specific design parameters by different organizations and experts.

1. Introduction

Description on the location (state, district, city, and village), exact latitude and longitude, seismic zone as per IS: 1893 (Part 1), project layout plan with details of the project components, type of dam with height and length, reservoir storage capacity, power generation capacity, objective of the study, methodology followed, and the output of the study.

2. Regional Tectonic and Geological Settings

Detailed description on geological evolution of the region and the major tectonic features along with a map depicting major tectonic features in an area of about 6°× 6° in latitudes and longitudes around the project site as per Section 4.0.

3. Local Geology and Site Soil Condition

a. Concise description on geological conditions at the sites of all important components of the project along with geological section along the dam axis indicating faults and shear zones, if present any.

b. Concise description on of the site investigations carried out to obtain the V_{S30} value and the basis for arriving at the thickness of sedimentary deposits at the project site as required in the GMPEs.

4. Earthquake Catalog and Analysis of Past Seismicity

a. Details on the earthquake catalog compiled as per section 6.1 and homogenized and declustered as per section 6.2 should be described in the study report and the list of the events in the catalog should be given in an Appendix to the report. If the number of events in the catalog is very large, only the events above a suitably selected threshold magnitude may be listed in the Appendix.

b. An analysis of the past seismicity as per section 6.3 be presented in the report with reference to the events in the compiled catalog, which should include a critical analysis on the association of past earthquakes with known faults with the help of a map showing correlation of epicenters of past earthquakes with tectonic features and the depth sections through the dam and across the major tectonic features in the region.

5. Identification and Parametrization of Seismic Source Zones

a. All possible Seismic Source Zones (SSZ) including area type as well as specific fault type where possible should be delineated following the guidelines and principles enunciated in section 7.1 and described in sufficient details in the study report. Major faults and significant past earthquakes shall also be indicated in each source zone.

b. Complete details on the development of the recurrence model for each source zone should be described as per sections 7.2 to 7.4, including the method used for completeness analysis and the completeness periods obtained, method used for fitting the G-R relationship and the recurrence parameters *a* and *b* obtained and the methods used and the value of $M_{\max}$ obtained. The values of parameters *a* and *b* along with their standard deviations and the value of $M_{\max}$ for all the source zones should be tabulated in the report. The form of the recurrence model selected should be described in the report along with typical plots of the recurrence model along with the observed data with error bars for the source zone in which the project is located and at least one more source zone with the largest $M_{\max}$ value.

c. The report should describe in details the database used and the analysis carried out for each source zone to arrive at the focal mechanism parameters as per the guidelines given in section 7.5 and to arrive at the focal depth as per section 7.6. The values of the focal mechanism parameters and the focal depth used for all the source zones should be tabulated in the report.

6. Ground Motion Prediction Equations (GMPEs)

The study report shall indicate the GMPEs used and the basis for their selection as per section 8.0 describing in brief for each equation the functional forms for estimation of the mean spectral amplitudes and the associated standard deviations, database used in developing the equation along with magnitude and distance ranges of applicability, and the input parameters involved in the equation.

7. Development of Target Response Spectra (TRSs)

a. The study report shall review briefly the PSHA methodology as per section 9.1, and describe in sufficient details of how the seismicity has been distributed over each source zone as per section 9.2 and with what assumptions and idealizations the various distance parameters required in the GMPEs have been estimated as per section 9.3 for estimation of the probabilities of exceeding the various spectral amplitudes. These will form the basis for computation of the DBE and MCE levels of TRSs of both horizontal and vertical components of motion by PSHA method as per section for return periods of 475, which will be described in the report along with plots of the spectra.

b. The report shall also present the details on the estimation of the MCE level of TRSs by the DSHA method as per section 10.0 including technical basis for estimation of the MCE magnitudes for the various faults around the project sites and the details of the faults used to estimate the various distance parameters.

c. The study report shall include the details on finalization of the four TRSs, viz. MCE and DBE levels of target spectra of horizontal and vertical motions, by comparison of the MCE levels of TRSs obtained by PSHA and DSHA methods. In case the PSHA estimates are revised on the basis of this comparison by including a line or dipping fault source, the complete details of the same shall also be recorded in the report.

8. Design Accelerograms and Response Spectra

a. Uncorrelated sets of horizontal and vertical components of design accelerograms shall be generated for both MCE and DBE conditions to be compatible with the respective finalized TRS using the guidelines given in section 12.1. The study report shall provide the details like the method used for generation of these accelerogramsin brief, strong motion duration used and the basis for its estimation, typical compatibility plots showing comparison between target and the time-history response spectra, plots of all the four accelerograms with the PGA values indicated, and provide the digital values of the accelerograms in soft form.

b. Four sets of smoothed design response spectra shall be computed for damping ratios of 1%, 2%, 3%, 5%, 10% and 15% from the four design accelerogram at sufficiently large number of natural periods between 0.01 s and 5.0 s or more and the study report shall provide the plots of all the four sets of design response spectra and provide their actual amplitudes at all the natural periods in soft form without using any normalization or approximating the spectra by the amplitudes at limited number of natural periods.

9. Input Parameters

The tool/software used for PSHA need to be stated and all the associated input parameters to be tabulated in the respective section of the report and be summarized in this section.

10. Design Seismic Coefficient

The report shall not recommend any site-specific estimates of the design seismic coefficient and the values of the seismic coefficients recommended in section 13 for dams may be used for the preliminary design using pseudstatic method of analysis.