Use of mechanical code and standard in Chinese nuclear power plants

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1.Status of mechanical code and standard used in Chinese NPPs

(1)Qinshan Nuclear power plant:

GB150 that is for chemical industry and fossil power plant was used due to no Chinese code or standard for safety-classified component in China at that time.

Some equipments, for example, reactor coolant pump that was from Germany, used German code. Reactor pressure vessel that was from Japan, used ASME code.

ASME Code was used for reevaluation and check after NNSA was established.

(2)Qinshan phase II Nuclear power plant

French RCC-M is used for Qinshan phase II nuclear power plant.

Some equipments, for example, steam generator, that was from Spain, and reactor coolant pump that was from Japan, use ASME code.

(3)Qinshan phase III Nuclear power plant:

CANDU type reactor, ASME code is used for Qinshan phase III nuclear power plant.

(4)Tianwan nuclear power plant:

Russian standard, known as Gost, is used for Tianwan nuclear power plant.

(5)Daya Bay, LingAo phase I and LingAo phase II Nuclear power plant:

RCC-M is used for Daya Bay, LingAo phase I and LingAo phase II nuclear power plant.

(6)CPR-1000 nuclear power plant:

CPR-1000 is designed refer to Daya Bay and LingAo nuclear power plants, is now under large scale construction (about 20 units) in China. Basically CPR-1000 use French RCC-M code.

Because likely global purchasing, other mechanical code or standard is possibly used in some CPR-1000 nuclear power plants.

(7)AP-1000 nuclear power plant:

Now 4 AP-1000 units are under construction in Sanmen and Haiyang site of China, ASME is used for them.

(8)EPR nuclear power plant:

Now 2 EPR units are under construction in Taishan site of China, RCC-M is used for them.

2. Treatment of some issues due to different code and standard used in one nuclear power plant:

Due to design, purchasing, repair, replacement, etc, different code or standard may be used in one plant or system, so that some special issues must be treated carefully.

(1)Welding:

As described above, there is the situation of different code used in one plant or system in China. For example, reactor coolant system basically follow RCC-M, but reactor coolant pump and steam generator follow ASME in Qinshan phase II NPP.

Welding procedure for interface part must be qualified carefully and completely.

Code or standard of welding should be identified so that it is consistent with code or standard that pre-service inspection and in-service inspection will follow.

(2)Pre-service and in-service test:

There may be some different requirements in different code or standard. For example, RCC-M is developed based ASME, but hydraulic test pressure of reactor coolant system for pre-service and in-service is 1.33 design pressure and 1.2 design pressure separately according to RSEM.

Correspondingly, hydraulic test pressure of reactor coolant system for pre-service and in-service is 1.25 design pressure and 1.1 operating pressure separately according to ASME.

Resolution is, first, identifying the code or standard followed by system. Second, identifying

test requirements for pre-service and in-service test according to the code or standard. Then, performing evaluation, such as stress analysis, fatigue assessment, etc. according the test requirements.

(3) Pre-service and in-service inspection:

Generally, it is required to meet code or standard used, but it must be carefully evaluated in interface part that different code or standard is used. Because there may be different inspection method is adopted for different code or standard.

For example, some welding defect happened on safety end of reactor pressure vessel in unit2 of Qinshan phase II. Initial welding procedure followed RCC-M, but Westinghouse was responsible for repair according to ASME.

Ultrasonic and γ ray examine is used for whole thickness of wall of safety end according to RSEM,

but only ultrasonic examine is required for 1/3thickness of wall of safety end according supplement8, ASME volume11.

final decision was according to ASME to conduct inspection.

Recently NNSA is establishing a national verification system for pre-service and in-service inspection.

(4)Water chemistry:

Water chemistry specification must be evaluated carefully so that it is compatible with all materials for one system.

(5)Special issue for AP1000:

As a unit, feet or inch is used in ASME, After AP1000 is localized, for example wall thickness and

diameter of pipe, will be changed, because international unit is used in china. Thus mass, elastic, etc. will change for pipe. Especially for rotate equipment and component, problem is how to choose tolerance.

So reevaluation and reanalysis must be conducted for localized AP1000. It is possible that necessary prototype test or

Qualification will be performed.

3.Chinese code and standard in future

Due to large nuclear power development program in China, it is impossible to import everything from other country. Therefore China must develop Chinese mechnacial code or standard for safety-classified components.

Several years ago, NNSA, National Energy Agency, National Defense Technology and Industry Agency, and National Standard Committee organized a leadership group to develop Chinese code and standard for nuclear power industry.

Now work is progressing.

Thank You