# Nuclear Safety Authority (ASN) opinion n° 2012-AV-0143 of 31st January 2012 concerning safety options for the ATMEA1 reactor project

The French Nuclear Safety Authority,

Having regard to the environmental code, in particular title IX of book V ;

Having regard to decree n°2007-1557 of 2nd November 2007 as amended, concerning basic nuclear installations and the regulation of the nuclear safety of the transport of radioactive materials, in particular its article 6;

Having regard to the Technical guidelines for the design and construction of the next generation of nuclear power plants with pressurized water reactors adopted by the Ministers responsible for nuclear safety on 28th September 2004;

Having regard to the safety objectives defined in November 2010 by the Western European Nuclear Regulators' Association (WENRA) for new nuclear power plants ;

Having regard to letter ATMEA D-GE-09-0132 of 3rd July 2009 requesting the review by the French Nuclear Safety Authority of the safety options of the ATMEA1 reactor and the successive updates of the safety options dossier, the final documents of which being summarised in letter ATMEA P-11-0090 of 29th November 2011;

Having regard to the agreement of 26th May 2010 and its amendment of 16th June 2011 between the ATMEA company and the consortium consisting of the French Nuclear Safety Authority and the Institute of Radiation Protection and Nuclear Safety (IRSN) representing the French State and relating to the assessment of the safety options of the ATMEA1 reactor;

Having regard to the opinion of the Advisory Committee for nuclear pressure equipment of 14th September 2011 relating to the design options for the main pressure retaining equipment of the main primary system and the main secondary systems sent by letter ASN-CODEP-MEA2011-053303 of 20th September 2011;

Having regard to the opinion of the Advisory Committee for nuclear reactors of 28th October 2011 sent by letter ASN-CODEP-MEA-2011-063143 of 18th November 2011;

Having regard to the opinion n°2012-AV-0139 of the French Nuclear Safety Authority of 3rd January 2012 concerning the complementary safety assessments of the priority nuclear facilities in the light of the accident that occurred on the nuclear power plant at Fukushima Daiichi;

Having regard to the ASN report on the review of safety options of the ATMEA1 reactor with reference CODEP-DCN-2011-n°070548 of 24th January 2012;

After having heard the ATMEA company on 12th January 2012;

Issues the following opinion:

**1. Safety objectives**

**ASN considers the safety objectives adopted by the ATMEA company for the ATMEA1 reactor to be satisfactory.** These objectives relate to five main points :

1) taking into account the experience feedback regarding pressurised water reactors and the use of state-of-the-art technologies and methods;
2) the radiation protection of the workers and the public under normal operating conditions in all operational states;
3) enhanced accident prevention;
4) enhanced prevention of core melt risks;
5) taking into account accidents with core melt.

**2. Safety options**

**Given the files provided by ATMEA, ASN considers that the safety options and design choices adopted for the main equipments of the ATMEA1 reactor are globally satisfactory in particular** with regard to:

- the French statutory texts and associated regulatory guidance in force;
- the above-mentioned "Technical guidelines for the design and construction of the next generation of nuclear power plants with pressurised water reactors".

In particular, given the initial proposals submitted by the ATMEA company and the changes that it incorporated during the assessment, ASN considers that the safety options selected for the ATMEA1 reactor do not warrant any observation in so far as concerns:

- the design choices of the main nuclear pressure retaining equipment (ESPN), in particular steam generators, the reactor vessel, the pressuriser and the main primary and secondary pipes;
- the design principles and design basis definition principles adopted for the reactor containment, including in the event of an aircraft crash;
- the equipment classification approach;
- the list of internal and external hazards and the approach for combination of hazards;
- the seismic spectrum used for the overall design of the installation;
- the safety approach for identifying the reference plant conditions and the multiple failures conditions;
- the safety approach for managing severe accidents.

Safety options will have to be adapted, where applicable, to take into account the national regulations in force when the building of an ATMEA1 reactor is considered.

**3. Detailed design**

ASN points out that, if an operator applies for an authorisation to create an ATMEA1 reactor in France, an analysis will be carried out to check that the detailed design of the reactor ensures effective compliance with the above-mentioned safety options and design choices. Similarly, the safety demonstration of the plant

will have to be done in accordance with the provisions outlined in these safety options. **In such a prospect, ASN considers that the ATMEA company should pay particular attention to the topics listed in the appendix to this opinion.**

In addition, the above-mentioned ASN report CODEP-DCN-2011-n°070548 of 24th January 2012 identifies issues which will need to be dealt with assuming an authorisation to create an ATMEA1 reactor is applied for. ASN stresses that there must be close collaboration between the designer, the manufacturers of the nuclear pressure equipments and the future licensee to resolve these issues.

**4. Lessons learned from the accident at the Fukushima Daiichi nuclear power plant in Japan**

ASN notes the approach developed by the ATMEA company to incorporate the first lessons learned from the accident that occurred on the Fukushima Daiichi japanese nuclear power plant in the spring of 2011. ASN further notes ATMEA's commitment to review the impact on the design of the ATMEA1 reactor of the decisions taken by ASN concerning reactors in operation or under construction following the complementary safety assessments carried out in 2011.

**Beyond the conclusions currently available, ASN considers that the safety options for the ATMEA1 reactor will have to take account of all the lessons learned from this accident and, if necessary, be modified accordingly.**

Paris, 31st January 2012.

The Nuclear Safety Authority Commission,[1]

**Marie-Pierre COMETS** **Philippe JAMET**

**Michel BOURGUIGNON** **Jean-Jacques DUMONT**

[1] Commissioners present at the meeting

**APPENDIX TO NUCLEAR SAFETY AUTHORITY OPINION N° 2012-AV-0143 OF 31ST JANUARY 2012 CONCERNING SAFETY OPTIONS FOR THE ATMEA1 REACTOR PROJECT**

## 1. Radiation protection objectives

ASN considers that, even if the approach presented by the ATMEA company with regard to the radiation protection of workers is satisfactory, the collective dose objective set out during the detailed design stage must be an improvement compared to the best operating experience feedback observed in France.

## 2. Accidents to be "practically eliminated" in the meaning of the Technical guidelines

To consolidate the safety options of the ATMEA1 reactor, ASN considers that the ATMEA company must specify the design, manufacture and operating requirements and the design basis criteria that it associates with all the provisions dealing with accidents that would result in large early releases, accidents which are to be "practically eliminated".

## 3. Application of the hypothesis of the break preclusion to the main primary and secondary pipes

ASN considers that the application of the hypothesis of break preclusion to the main primary and secondary pipes requires the reinforcement of the lines of defence which enable to substantiate that the loss of integrity of these pipes is highly unlikely. The ATMEA company must provide a description of all the additional provisions with regard to:

- quality of the design;
- verification of the design, including the accessibility and inspectability of the equipment;
- quality of the manufacture, including the qualification of the processes implemented and more precise specifications of the materials;
- manufacturing inspection, including the controllability of the manufactured equipment;
- in-service inspection.

The manufacturers will have to demonstrate how they ensure compliance with the above principles.

ASN considers that the ATMEA company will have to provide evidence that all these provisions render highly unlikely:

- the occurrence of any deterioration to the equipment which would jeopardise the ability to prevent the various types of damage ;
- the absence of early detection of such deterioration.

## 4. Extreme situations

Following the accident in 2011 at the Fukushima Daiichi nuclear power plant in Japan, and consistent with its above-mentioned opinion of 3rd January 2012, ASN considers it is necessary that the ATMEA company, in line with its commitments, defines a "hard core" of material and organisational provisions that will ensure control of basic safety functions in extreme situations (combination of natural phenomena of an exceptional scale, prolonged loss of electrical power or cooling systems, need to manage a severe accident under extreme radiation conditions).

## 5. Confinement of the annulus

At the top of the peripheral buildings (safeguard building, fuel building) around the reactor containment , a seal ensures the closure of the annulus in order to maintain the tightness of the "annulus" zone both in normal operation and accident conditions.

ASN stresses the need to demonstrate the effectiveness and robustness of the annulus closing system, on which the collection of any leakage outside the reactor containment would rely in the event of an accident or hazard which could lead to internal overpressures or significant relative movements between structures.

ASN considers that the ATMEA company shall detail the provisions used to test the performance of this system in order to identify, in normal operation, any deterioration which would impair its performance in an accident condition or during a severe accident.

## 6. Classification of the pressurized mechanical equipment of the steam generator emergency feedwater system

The general approach for classifying equipment appears to be acceptable. However, ASN considers that the pressurised mechanical equipment of the steam generator emergency feedwater system must be of a quality equivalent to RCCM level 2.

## 7. Breaks in high energy pipes

To analyse breaks in high energy pipes, ASN notes that the ATMEA company intends to apply the US approach (ASME code). If an ATMEA1 reactor were to be built in France, ASN considers that it ought to incorporate French safety approach, complemented by the above-mentioned Technical guidelines for the design and construction of the next generation of nuclear power plants with pressurised water reactors, recommending in particular that:

- the decoupling value between the large and small pipes corresponds to a nominal diameter of 50 mm ;
- for each room through which high or medium energy pipes pass, the designer must, during the detailed design, take into account any effects which may result from local failures in points chosen to maximize the consequences of the hazard ;
- longitudinal breaks are postulated on pipes with a nominal diameter greater than or equal to 100 mm which have no mechanical classification and which are not designed to resist earthquakes.

## 8. Combination of hazards

The options selected by the ATMEA company with regard to hazards combination incorporate the lessons learned from recent operating experience and go beyond the Technical guidelines. ASN considers that, among these combinations, ATMEA must consider the concomitance of a fire and extreme cold or hot outside temperature. The availability of the means for detecting and fighting a fire must, therefore, be guaranteed for the extreme weather conditions taken into account in the design basis (excluding peaks of less than 2 hours).