

Paris, 1 July 2009

Ref.: DEP-PRES-0077-2009

To the President
of Électricité de France

**Subject: EDF's pressurised-water nuclear reactors (PWR)
ASN's position on the generic aspects for the extension of the operating lifetime
of 900-MWe reactors after the third decennial visit**

Dear Sir:

According to Article 29 of the *Law of 13 June 2006 on Transparency and Safety in the Nuclear Field (TSN Law)* all operators of a basic nuclear installation, such as a nuclear reactor, are required to re-assess its safety every 10 years. Such re-assessment offers a sound opportunity to examine in depth the state of the facility in order to verify that it complies with all applicable safety requirements. It also offers a chance to improve its safety level, notably by comparing the applicable requirements with those being enforced in more recent facilities and by taking into account national as well as international feedbacks.

The standardisation of your facilities has led you to adopt a re-assessment approach for the safety of 900-MWe reactors, which includes an initial generic phase dealing with common aspects to all reactors and a second phase, specific to every facility.

This letter describes the position that the ASN Commission has adopted, upon the recommendation of its relevant services, regarding the generic studies EDF has undertaken in the framework of the safety re-assessment process and the generic aspects of extending the operating lifetime of 900-MWe reactors up to 40 years after their first criticality. ASN has taken special note that, in the case of certain reactors, there may be a gap of several years between the 40 years of operation and the scheduled date for the next decennial visits. The potential extension of the operating lifetime of reactors up to that date will be examined later on the basis of the updated aptitude files concerning the extension of operations, which EDF is required to submit to ASN by 2010.

For every 900-MWe reactor it operates, EDF is required to submit to the government, pursuant to the *TSN Law*, a report demonstrating the sufficiency of the safety re-assessment and of all contemplated changes to correct potential anomalies and to improve the safety level. **ASN is herewith requesting EDF to forward that re-assessment report no later than six months after the end of the decennial visit to the reactor concerned. The report shall contain the items mentioned in Annex 1. After analysing the report, ASN will decide whether to extend the operating lifetime of the reactor or not.**

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In a previous letter to EDF [Reference 1], ASN had requested that safety re-assessment studies deal with the following major factors:

- severe accidents;
- Level-1 and Level-2 probabilistic safety studies;
- the containment envelope of reactors;
- all fire hazards and explosion risks within the sites;
- internal and external aggressions;
- accident studies and their radiological impact;
- the design of civil-engineering systems and structures, and
- the management of facility ageing.

EDF has already submitted a report to ASN [References 2 and 3] demonstrating the sufficiency of the studies it performed and of the changes it plans to implement in order to comply with ASN objectives regarding safety re-assessment.

As mentioned in another letter [Reference 4], ASN sought the opinion of the Advisory Expert Group on Nuclear Reactors (*Groupe permanent d'experts pour les réacteurs nucléaires – GPR*) concerning the conclusions of the conformity and re-assessment studies that EDF had conducted, and on the sufficiency of the planned changes on the basis of the above-mentioned report [References 2 and 3]. Following its meeting of 20 November 2008, the GPR sent its formal opinion to ASN [Reference 5].

Some of the issues raised during the review carried out by ASN and its technical support, the Institute for Radiation Protection and Nuclear Safety (*Institut de radioprotection et de sûreté nucléaire – IRSN*), led to specific stands and proposed actions on EDF's part.

In addition, following the partial flooding of the Blayais Site in 1999, EDF has developed a special methodology to protect sites against the impact of external flooding. After reviewing it, ASN estimated that such methodology was generally satisfactory and that the related measures, whether already implemented or planned, represent a significant advance. Furthermore, in line with the experience feedbacks on the heat waves that marred the summers of 2003 and 2006, EDF is committed to reinforce the protection of all 900-MWe reactors against heat-related risks before the last of the decennial visits of such reactors.

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ASN recognises the significant work achieved by EDF in the framework of the safety re-assessment of its 900-MWe reactors during the third decennial visits, the objectives of which were quite ambitious.

ASN considers that the new safety reference system, as described in the safety report edition (VD3-900) for the third decennial visit of 900-MWe reactors will be able to maintain and to improve the overall safety level of such reactors. Among other things, the results of the Level-1 probabilistic studies were helpful in determining appropriate design or operational changes, which, once integrated in the reactors, will reduce even further any potential core meltdown.

ASN also feels that, at this stage of the review, none of the safety re-assessment studies has detected any element that would raise safety-related or generic issues concerning the capability of 900-MWe reactors to remain in service. In addition, ASN believes that the perimeter and the nature of the controls proposed by EDF are acceptable for the purposes of the conformity review.

Subject to EDF's observance of its commitments and to the integration of the requests referred to in Annex 2 concerning the generic studies of the safety re-assessment associated with the third decennial visits of such reactors, ASN considers that the intended changes for maintaining and improving the safety level of 900-MWe reactors and the new reference system of safety requirements applicable to them are satisfactory and consistent with ASN objectives.

Beyond the safety re-assessment, ASN considers that extending the operating lifetime of reactors may only be envisaged for a nuclear fleet that is correctly maintained and operated responsibly with a view to anticipating any potential anomalies. Consequently, it is your duty to take all necessary measures to maintain the capability of your facilities to comply with the re-assessed safety requirements.

With regard to the phenomena that may jeopardise such capability over the years, ASN requests EDF to maintain and even to amplify its efforts in a certain number of areas referred to in Annex 3.

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In conclusion:

1. based on the elements brought to the attention of ASN and the IRSN, as its technical support, especially with regard to completed generic studies and proposed changes, with due account of the opinions formulated by the GPR, ASN has not identified any element that would challenge EDF's capability to ensure the safety of 900-MWe reactors up to 40 years after their initial criticality, and
2. such generic judgement does not account for any potential reactor specificities. On the basis of that generic judgement, ASN shall decide at a later date on the potential extension of the operating lifetime of every reactor to be maintained in service by relying notably on the review of the re-assessment report of the reactor involved and on the results of the controls performed during its third decennial visit.

Yours sincerely,

André-Claude LACOSTE

REFERENCES

- [1] Letter of DGSNR/SD2 No. 760/2003, 9 October 2003..
- [2] Letter of EDF EMESN080033, 15 January 2008 and note of EDF EMESN 070479 Index A.
- [3] Letter of EDF EMESN080205, 8 July 2008 and note of EDF EMESN 070479 Index B.
- [4] Official request GP DEP-DCN-0458-2008, 6 October 2008.
- [5] Opinion and recommendations of the GPR DEP-MJO-0167-2008, 19 December 2008.
- [6] Letter of ASN DEP-SD2-0502-2005, 21 October 2005.
- [7] Letter of ASN DEP-SD2-0500-2005, 21 October 2005.
- [8] Letter of ASN DEP-DCN-0392-2008, 23 October 2008.
- [9] Letter of EDF EMESN060170, 28 December 2006.
- [10] Letter of EDF EMESN070232/TRD/MCB, 11 June 2007.
- [11] Letter of DGSNR DEP/SD2 No. 497/2004, 25 June 2004.
- [12] Letter of DGSNR DEP/SD2 No. 424/2006, 1 September 2006.
- [13] Letter of ASN DEP-DEP-0179-2009, 28 April 2009.
- [14] Letter of EDF D.4550.32-08/2573, 4 July 2008.
- [15] Letter of DGSNR DEP/SD2/No. 0361/2006, 5 July 2006.

Annex 1

Content of the safety re-assessment report

In accordance with Article 29-III of the *TSN Law*, ASN will issue a decision in order to prescribe the detailed procedure for conducting safety re-assessments. More particularly, the decision will specify the content of safety re-assessment reports. Pending the publication of that decision and without prejudice to any resulting requirement, ASN is already notifying EDF about certain observations on the content and format of the re-assessment report the utility has to submit for the third decennial visit of every 900-MWe reactor.

The safety re-assessment report of any reactor shall be submitted to ASN no later than six months after the restart of the reactor following its shutdown for the decennial visit.

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In accordance with Article 29-III of the *TSN Law* and in the framework of the safety re-assessment, EDF shall update its evaluation of the risks or inconveniences of the facility involved in the interests referred to in Article 28-I of the said law and with due account of the following factors:

- the state of the facility;
- the experience acquired during its operating lifetime;
- the evolution of knowledge, and
- all rules applicable to similar facilities.

Request 1 While taking into account the fact that those safety re-assessments were committed before the Decree of 2 November 2007, ASN requests EDF to integrate the environmental effects referred to the *TSN Law* in the actual description of the facilities in order for the monitoring and test results concerning the structures, systems and components not to be restricted to those involved in the nuclear-safety demonstration.

Request 2 ASN requests EDF to ensure that the re-assessment report include a justification of the sufficiency of the planned changes regarding the overall interests mentioned in I of Article 28 of the *TSN Law*. For that purpose, as complementary information concerning the nuclear-safety-related changes, the re-assessment report shall describe the major design and operating changes that were made since the last decennial visit with a view to reducing the impact of the operation of facilities on the public and the environment.

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Due to the standardisation of EDF's nuclear fleet, certain topics of the safety re-assessment are addressed in a framework that encompasses all power levels (900-MWe, 1,300 MWe and 1,450 MWe). ASN considers that the results of those reviews must be taken into account as much as possible in re-assessment reports.

More particularly, the conclusions of the review made by the advisory expert groups on topics such as floods, reactor maintenance, equipment qualification or organisational and human factors, for which studies have covered the overall nuclear fleet, shall be recalled in the re-assessment reports.

Request 3 ASN requests EDF to include in its re-assessment reports the main conclusions of any analyses that were performed in other frameworks on the overall operating reactors.

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The standardisation of EDF's fleet has led the utility to adopt a safety re-assessment approach for 900-MWe facilities, including a first generic phase and a specific second phase for every facility. The generic phase ends with the generic sufficiency file [References 2 and 3] and this letter from ASN. The VD-3 changes are currently being defined and shall be integrated during the third decennial visit of every 900-MWe reactor between 2009 and 2018.

However, the *TSN Act* specifies that the safety re-assessment shall allow for the updating of the risk assessment. It is therefore appropriate to ensure, notably in the case of 900-MWe reactors with a decennial visit scheduled over the medium term, that the evolution of knowledge and experience feedbacks shall not challenge the conclusions of the generic sufficiency file.

Request 4 For every reactor scheduled to undergo its decennial visit after 2013, ASN requests that EDF maintain the applicability of the generic sufficiency file, with due account of the evolution of knowledge and of experience feedback. Otherwise, EDF shall adapt its change and monitoring programme. In order for ASN to review such potential evolutions, EDF is requested to submit an updated sufficiency file between two and three years before the beginning the decennial visit.

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Certain specific risks to sites are not addressed in the generic sufficiency file, but shall be included nevertheless in the re-assessment report. As a complement, it is also necessary to review the relevant reference systems.

Request 5 For every reactor scheduled to undergo its decennial visit after 2013, ASN requests that EDF submit all reference systems relating to local risks that would not be addressed in the generic sufficiency file (particularly in the case of specific site studies concerning industrial environment and traffic, whether by air, road, rail, waterway or sea) in order to allow them to be reviewed. EDF is requested to send those documents to ASN between two and three years before the beginning of the decennial visit.

Generic conformity and safety re-assessment studies

I. Internal and external aggressions

EDF re-examined the risks of internal and external aggressions as well as the modalities to take such risks into account in the safety demonstration in order to determine potential changes for improving reactor safety.

The following main aggressions were taken into account in the studies:

- internal floods;
- explosions due to internal causes;
- fires;
- earthquakes;
- climatic aggressions, notably high winds, tornadoes, forest fires, snow, the depletion of the cold source, frazil ice, high temperatures of the cold source, high temperatures of air, and lightning;
- the drift of petroleum patches, and
- external aggressions likely to induce the simultaneous loss of the cold source and of power supply.

The review of those generic studies by ASN and its technical support, the IRSN, generated the following questions and comments concerning the self-sufficiency of every reactor unit and site against external common-mode aggressions and explosions due to internal causes.

I.1. Unit and site self-sufficiency against common-mode external aggressions

External aggressions of natural origin may generate losses of the cold source (H1-type situations) or of external power supplies. The purpose of the studies is particularly to ensure the robustness of the sites against aggressions, including their capability to maintain the safety of reactors during a representative period of likely loss scenarios.

After reviewing the case, ASN considers that EDF has justified the capability of its sites to manage H1-type situations or losses of external power supplies in all reactors and especially to have at hand enough water, fuel oil or oil reserves to ensure safety under such conditions. However, since those justifications are based on the use of operational means, ASN feels that requirements must be associated with such means in order to ensure their availability, operability and resistance to aggressions.

Request 6 ASN considers that studies on incident or accident situations induced by an external aggression or a combination of aggressions form an integral part of the safety demonstration. Those studies take notably into account the use of operational means to ensure the self-sufficiency of the sites in order to manage those situations correctly. Consequently, ASN requests EDF to prescribe specific requirements within its *General Operating Rules (Règles générales d'exploitation – RGE)* in order to ensure the sound operation of such means.

Request 7 ASN requests EDF to prescribe in its operating technical specifications (*RGE*, Ch. III), the specific quantities of water to be contained in the tanks of the distribution circuit of demineralised water in order to manage any situation involving the total loss of the on-site cold source induced by a non-foreseeable external aggression.

I.2. Explosions due to internal causes

Since there was no sufficiently thorough reference system to address explosion risks due to internal causes, ASN requested EDF [1] to describe in the safety report the relevant principles and method being used to

identify and to deal with such risks by taking into account the potential explosion sources and by implementing a suitable approach to verify that the selected measures are sufficient.

In a letter [Reference 6], ASN considered that the development of the “explosion” reference system by EDF would allow for a satisfactory integration of explosion risks due to internal causes. However, the experience feedback concerning the operating nuclear fleet detected corrosion problems on hydrogen ducts and the need to reinforce the analysis of explosion risks within the buildings of the nuclear island.

Corrosion and vibration-fatigue risks

Corrosion is an alteration likely to generate leaks in such equipment. In addition, the analysis of past events in operating reactors shows the existence of vibration-fatigue problems on hydrogen ducts.

Request 8 ASN requests EDF to take all necessary design, construction or operating measures in order to prevent the risk of corrosion and vibration fatigue in hydrogen ducts. The safety report shall contain clear indications on how such risks will be addressed.

Risk-analysis approach within the buildings of the nuclear island

In the methodology developed by EDF, the first analytical level consists in identifying the premises where an explosive atmosphere is likely to form. Once those premises are classified as “explosion hazards”, EDF shall investigate the potential safety-related consequences of an explosion in them and specify a relevant treatment to eliminate or to limit the risks involved by discarding the explosion source, installing automatic detector-driven isolating valves, displacing or protecting targets and implementing 2G equipment . ASN considers it necessary to reinforce that approach.

Request 9 Regarding the analytical approach for explosion risks within the buildings of the nuclear island, ASN requests EDF to submit a specific analytical report on any premises where an explosion would have unacceptable safety-related consequences, in order to justify the sufficiency of the sole measures EDF has taken and to reinforce them, if necessary.

II. Accident studies and their radiological impact

The objective of the approach was to examine suitable changes to enhance reactor safety by improving the prevention and management of accidents, as well as the mitigation of their impact.

The work focuses especially on the following items:

- the integration of the cold-overpressure risk;
- the integration of the boron-dilution risk in the primary circuit;
- the rupture of a steam-generator tube;
- severe accidents and their radiological impact;
- containment issues under post-accident conditions;
- the operability of hydrogen and uranium equipment, and
- the instruments used to enforce approach procedures per state and monitoring data after accidents.

The review of those generic studies by ASN and its technical support, the IRSN, generated the following requests and comments.

II.1. Integration of cold-overpressure risk

ASN’s objective was to verify that the risk of reactor-vessel rupture due to cold overpressure in all likely scenarios when the shutdown cooling system (SCS) is connected, was “practically excluded”. In that context, EDF has explored the possibility to modify 900-MWe reactors in order to improve safety in case of overpressure. The change would consist in lowering the taring setpoint of the protection valves of the primary circuit.

When the SCS is connected, the reactor may be in various “standard” states as described in the RGEs Such change is not implemented by EDF in all standard states, especially in the state of “intermediate shutdown =closed primary circuit”.

In order to justify that such protection is not necessary in that state, EDF relies on probabilistic studies assuming that the running period of a reactor in the state of “intermediate shutdown– closed primary circuit” is equal to 37 h (average observed throughout the nuclear fleet). Experience feedback shows that such state is often selected to perform certain unscheduled interventions and that it is not unusual for a reactor to remain in that state for more than 37 h. Consequently, the cold-overpressure risk during such unscheduled interventions may be more significant than the risk postulated in the reference probabilistic safety study.

Request 10 ASN requests EDF to prescribe in its technical operating specifications for 900-MWe reactors (RGE, Ch. III) that protective means be available against any cold-overpressure risk of the primary circuit in the state of “intermediate shutdown – closed_primary circuit”.

II.2. Severe accidents and their radiological impact

In order to facilitate the diagnosis under severe-accident conditions and to detect the potential release of the corium in the reactor-vessel pit in the hypothesis of a core meltdown, ASN requested EDF [7] to install a corium-detection device in the vessel pit of all 900-MWe reactors by their third decennial visit at the latest.

In a letter [Reference 7], ASN considered that it was important, in case of severe accidents, to rely on the availability of the relevant instruments to assess in real time the evolution of the hydrogen risk and to update the knowledge about the progression of the accident. ASN also requested that the implementation of such instrumentation be investigated.

In order to reply to ASN’s requests, EDF developed Modification PNXX0/1746 concerning the detection of vessel punctures and the assessment of the hydrogen risk.

ASN feels that the principle of the solutions adopted by EDF is relevant, but that their actual description is insufficient.

Request 11 ASN requests EDF to provide clear indications on the necessary means to ensure the availability of relevant instruments to detect any puncture of the reactor vessel (thermocouple) and on the measures to be taken if the instruments are unavailable.

Request 12 ASN requests EDF to equip several passive hydrogen autocatalytic recombiners with relevant instruments in order to assess in real time the evolution of the hydrogen risk on the base of a justification of their selected locations.

Request 13 ASN requests EDF to develop a support system in the use of measuring instruments to detect any puncture of the reactor vessel and to assess the hydrogen risk in order to guide crisis teams as efficiently as possible.

II.3. Containment envelope under post-accident conditions

In the framework of the safety reassessment, ASN conducted a comprehensive analysis of the accident sequences likely to induce breaching accidents with containment by-pass. The rupture scenario of the thermal barrier of a primary pump was analysed more closely.

EDF’s method to control the rupture sequence of the thermal barrier relies mostly on the capability of the pneumatic isolating valve of the component cooling system (CCS) to close after rupture. ASN considers that the demonstration of the capability of the valve to close in case the thermal barrier of a primary pump was ruptured was not conclusive. In fact, EDF’s study elements relating to that valve do not allow for a satisfactory decision to be made on either the operability or the continuous internal tightness of the valve during the accidental transient under study.

ASN considers that EDF must implement proper modifications from now on in order to guarantee the availability of at least one CCS line for the cooling of the SCS.

Request 14 Within nine months, ASN requests EDF to propose a design change with a view to reducing any core-meltdown risk with bypass of the containment envelope in case of rupture of the cooling circuit of the thermal barrier of any primary group of motor-driven pumps and to submit an implementation schedule.

In a letter [Reference 1], ASN requested EDF to examine the behaviour of the third containment barrier under post-accident conditions and, more particularly, to study the limitation of likely releases through the water-treatment and cooling tank of the pools in the case of an accident involving a loss of primary coolant.

In fact, ASN stresses the fact that, in case of a breach in the primary circuit requiring the operation of the safety injection system (SIS) and of the containment spray system (CSS) in recirculation by the sumps of the containment system, a leak of the isolating valves of the connections between the SIS and the CSS systems toward the pool tank would induce a release in the environment through the tank vent. The calculations of the radiological impact reassessed by EDF in 2007 show that iodine-131 releases after 30 days through the pool tank are estimated respectively for the CPY and CP0 series, at close to 19% and 11% of the total release of iodine-131 in the case of loss-of-coolant accidents.

During its analysis, EDF studied various solutions to reduce releases from the pool tank. However, EDF is indicating that it will not proceed with any modification designed to reduce such releases, because it considers that, besides the implementation and operational problems involved, such modifications provide only a small improvement of the safety level and are not reasonably cost-efficient in relation to safety.

Request 15 ASN requests EDF to implement a change in order to limit direct radioactive releases in the environment through the vent of the pool-water treatment and cooling tank under accidental conditions requiring a recirculation phase by the sumps of the containment envelope of the backup systems. EDF's reassessment report shall also provide clear indications on the deadline for the implementation of such change.

II.4. Boron-dilution risk in the primary circuit

The boron dilution induced by a leak from the exchanger of the tightness system of primary-circuit joints may lead to the formation of a plug of a few cubic metres of clear water in the U-shaped branches of the primary circuit in certain reactor states. When the primary pump is activated, the plug is directed towards the reactor core. In a letter [Reference 6], ASN requested EDF to demonstrate that an internal leak from the exchanger of the tightness system of primary-circuit joints will not lead to any unacceptable dilution accident during the activation of the primary pump and, if need be, to propose appropriate design or operational modifications to eliminate that risk.

EDF presented ASN with sufficient analyses to conclude to the non-toxicity of that accident scenario. Those elements are being analysed by ASN and its technical support. **ASN will issue at a later date its position on the sufficiency of the studies relating to the control of heterogeneous-dilution scenarios due to an internal leak from the exchanger of the tightness system of primary-circuit joints and, if need be, will request that such risk be eliminated.**

III. System design

In a letter [Reference 1] based on French and foreign experience feedbacks, ASN selected civil-engineering systems and structures, the design of which was supposed to be re-examined by EDF with due account of the corresponding safety stake, including the cooling system of the pool in the fuel building.

The purpose of the studies conducted on reference accidents relating to the safety of fuel disposal in the cooling pool was to examine scenarios involving the fast dump of the pool in relation to the risk of exposing fuel assemblies during maintenance or when stored at the bottom of the pool.

In a letter [Reference 6], ASN had noted that EDF was going to reinforce the operating measures of the reactors in order to reduce the risk relating to the accidental dumping of the pool. ASN had requested that, over and above the additional preventive measures proposed by EDF, other technical and organisational measures be investigated for limiting the consequences of such an event in accordance with an approach to improve defence in depth.

The review by ASN and its technical support of the latter response elements of that request are under way. **ASN will issue at a later date its position on the sufficiency of the studies relating to the control of the scenarios involving the fast dump of the pools.**

Generic framework of the extension of the reactor's operating lifetime

I. In-service monitoring and maintenance

I.1. Maintenance policy

ASN considers that in-service maintenance and monitoring constitute an essential line of defence to avoid anomalies, to prevent deficiencies from inducing equipment failures and to maintain the conformity of a nuclear facility with its safety reference system. In-service maintenance and monitoring of facilities represent crucial factors for reactor safety. In the context of facility ageing, ASN carried out a comprehensive review of EDF's maintenance policy and of its enforcement in NPPs. ASN reviewed also basic preventive maintenance programmes, notably those concerning the main primary and secondary systems, and requested EDF to provide additional information in accordance with Article 6 of the Order of 10 November 1999. On the basis of those reviews, ASN considers that EDF's maintenance policy is adapted [Reference 8], including the methods being implemented for optimising the maintenance programmes for the major safety-related equipment, the upgrading of which is significant and must be applied on the actual process to enhance experience feedback.

I.2. Programme of complementary investigations

EDF intends to complete its maintenance programmes by implementing a complementary investigation programme (*Programme d'investigations complémentaires* – PIC) in the framework of the safety re-examination associated with the third decennial visits of 900-MWe reactors in order to verify the absence of alterations on the areas where no alteration mechanism is feared. ASN feels that such approach is essential in order to confirm the validity of the ageing-maintenance and management programmes. In such framework, the selection of the areas to be monitored for preventive-maintenance purposes is particularly important.

With the support of the IRSN, its technical support, ASN has completed the review of the programmes [References 9 and 10] that EDF intends to implement, and issued its opinion [Reference 8] on the following items:

- pipes that are not part of the primary-circuit and secondary-circuit pressure boundaries ;
- tanks and exchangers, and
- automatisms.

In addition, ASN reviewed the programmes relating to the main primary and secondary systems of reactors and considers them to be acceptable.

With regard to the PIC concerning civil engineering and the containment envelope, ASN takes note that no investigation on pathologies induced by internal sulphate attacks (ISA) is scheduled.

Request 16 Within the framework of the PIC for the third decennial visit of 900-MWe reactors, ASN requests EDF to detect the presence of any potential internal sulphate reaction on both the containment envelope and the other civil-engineering structures, and to analyse their impact on the safety of the reactors.

The exhaust stacks of nuclear auxiliary buildings are controlled in accordance with the in-service maintenance and monitoring programme. Pursuant to the PIC for the third decennial visit of 900-MWe reactors, EDF intends to conduct an investigation on the state of the composite material of those stacks. EDF plans notably to assess the sensitivity of the composite material to ultraviolet radiation and its behaviour under tension and shearing conditions.

ASN feels that the analysis of the behaviour under tension and shearing conditions is not sufficient to assess the resistance of the composite material under alternating solicitations.

Request 17 ASN requests EDF to complete its programme by assessing the behaviour of the composite material used for building stacks within the auxiliary nuclear areas.

ASN considers that the investigations proposed in the framework of the PIC are sufficient, provided that they be completed in order to take into account the previous requests.

II. Ageing management

During the preparation for the third decennial visits of 900-MWe reactors, ASN requested EDF in 2001 to present an accurate account of the ageing status of each of the reactors concerned and to demonstrate the possibility of continuing their operation under satisfactory safety conditions beyond the third decennial visit. In response to that request, EDF developed a management programme on the ageing of 900-MWe reactors. The new safety reference system presented in the VD3-900 edition provides the details of that methodology.

ASN feels that the ageing-management approach is appropriate. However, with due account of the new alterations having been observed over the last few years, especially on steam generators, ASN feels that it is essential for EDF to continue its studies and to develop relevant means in order to manage better the knowledge of alteration mechanisms and, thus, to prevent them satisfactorily.

Moreover, in the framework of the ageing-management policy, EDF intends to replace certain mechanical components, with due account of the impossibility of justifying their mechanical strength in service because of the alteration mechanisms involved. **ASN reminds EDF the need to comply with the set deadlines for the replacement of such equipment.**

Lastly, in two letters [References 11 and 12], ASN requested EDF to provide certain complements to the ageing-management programme, particularly with regard to heavy R&D means.

ASN will complete its position on those elements at a later date.

III. Capability to extend the operating lifetime of the equipment of main primary systems (MPS) and of main secondary systems (MSS) in 900-MWe-reactors

In parallel with the ageing-management programme, various reports on the alteration mechanisms affecting the MPS and MSS components of reactors were examined.

III.1. Guaranteed ongoing operation of 900-MWe reactor vessels

Since the reactor vessel constitutes a non-replaceable component the rupture of which is not postulated in safety studies, it must be given special attention. In 1999 and 2005, the Standing Nuclear Section (*Section permanente nucléaire – SPN*) of the Central Commission on Pressure Vessels (*Commission centrale des appareils à pression – CCAP*) inspected the mechanical strength of the vessel of 900-MWe reactors while in service.

Following SPN conclusions, EDF resumed its studies on creep forecasts, thermohydraulic transients, likely irradiation effects and the mechanical behaviour of the reactor vessel, notably in cases of “cold-shock” transients. Those results were presented to ASN in October 2008 and their review is under way.

Without anticipating on the results of the IRSN analysis, ASN takes notes that the maximum design neutron creep concerning the vessel of 900-MWe reactors ($6.5 \cdot 10^{19}$ neutrons/cm²) will not be reached over the next few years, but that guarantees will need to be provided in order to ensure the compliance with that limit at all times until the fourth decennial visits.

Request 18 ASN requests EDF to develop a specific programme to provide data relating to the creep of 900-MWe reactor vessels in order for the envelope character of the creep to be taken into account from the design stage until the fourth decennial visit.

III.2. Steam generators

New generic alterations have appeared over the last four years on steam generators in various French nuclear reactors. EDF has implemented relevant treatment strategies to reduce safety-related risks, which, however, are not well under control in certain cases. Consequently, ASN considers that further investigations concerning those

phenomena and their treatment must be undertaken with a view to preventing other generic alterations likely to affect steam generators.

EDF has already the means to re-establish the conformity of steam generators involved, especially their chemical cleaning and tube plugging. The consequences of those operations on the safety of the reactors may lead to revisions in the safety reports for steam generators. The plug installation must be also monitored with special care after the anomalies detected in 2008 and 2009.

In that context, ASN requested EDF [Reference 13] to review the overall design of steam generators by addressing all aspects relating to safety, design, manufacturing and in-service monitoring.

Request 19 As a general rule, ASN requests EDF not only to continue its investigations concerning the alteration mechanisms likely to affect steam generators, but also to increase its efforts to anticipate anomalies.

III.3. Situation accounting

Transient bookkeeping and the projections made until the fourth decennial visits constitute a major element in monitoring the ageing factor, because it helps in assessing the fatigue on the MPS and on certain areas of the MSS.

That topic is the subject of regular inspections, which helped ASN observe that the organisation set in place for monitoring the accounting of situations is generally satisfactory. ASN takes note also that EDF is developing new methods to improve the assessment of fatigue in certain areas.

Following EDF's letter [Reference 14], ASN stresses the importance of the relevant justifications to be provided in case the number of certain design situations is exceeded, but did not challenge the individual demonstrations that EDF is scheduling. Nevertheless, that strategy is only reasonably applicable, if the number of excess situations remains limited, as shown by the projections made until the fourth decennial visits, but will need to be reviewed, if the operating lifetime of the reactors is extended over a longer term.

III.4. Areas in Type-600 Inconel alloy

Areas made of Type-600 Inconel are sensitive to stress corrosion. EDF has already developed a semi-empirical method based on the relative knowledge on that material, on stresses and on in-service temperatures in order to assess the risk of triggering stress corrosion in each Inconel-600 area. The purpose of that method is to classify areas in relation to each other in terms of an index risk concerning the triggering of stress corrosion. The areas involved include mostly the following:

- adapters of the reactor-vessel cover;
- the weld of the partition plate on the steam-generator partition stub;
- vessel-bottom penetrations, and
- vessel "M" supports.

Among those components, the replacement of reactor-vessel covers is scheduled in a programme ending in 2009. Consequently, the mechanical strength of the covers does not raise particular issues relating to the alteration mechanisms in Inconel-600 areas.

The other files and the management strategy that EDF has set in place will be subject to a review based especially on the summary file concerning Inconel-600 areas, which ASN requests EDF to submit by the end of 2009 at the latest. ASN will base its position on the sufficient level of in-service monitoring of the relevant equipment.

However, ASN considers that EDF's demonstration based on the estimated time to trigger potential deficiencies is not sufficient to defer certain monitoring operations.

Request 20 Consequently, ASN requests EDF, before the partial requalification of any MPS between the third and fourth decennial visits, to verify the overall vessel-bottom penetrations of 900-MWe reactors, if it is impossible to install a detection system for small perpendicular leaks to vessel-bottom penetrations.

With regard to the weld of the partition plate on the steam-generator partition stub, ASN's final position will only be made public after the review of the report concerning the "Behaviour Analysis Without Partition plate" (*dossier d'analyse du comportement sans plaque de partition*) justifying the sound mechanical strength of the MPS without considering the presence of the partition plate.

Pending the announcement of ASN's final position on the case, ASN requests EDF to continue its in-service monitoring in the areas involved and to address every observed discrepancy on a case-by-case basis.

IV. Skill management

In 2006, ASN examined EDF's skill-management process and **considered that EDF's system for managing skills and the certification of the operating staff of pressurised-water reactors was satisfactory [Reference 15]**. ASN took note that EDF's skill-management system is equipped with significant means and incorporates an approach not only to identify precisely the skills to be acquired by agents and services, but also to develop and to implement the relevant professionalisation initiatives.

ASN wishes more particularly for EDF to continue and to reinforce its current actions to ensure the perennity of sensitive safety-related skills, with due account of the severance prospects of many agents.