

## Safety Management in a competitiveness context

Jean-Marie ROUSSEAU

Institut de Radioprotection et de Sûreté Nucléaire  
31, avenue de la division Leclerc - 92262 Fontenay-aux-Roses Cedex - France

### Abstract:

This paper summarizes the first assessment performed by the IRSN related to the management of French power water reactors (PWR) safety. The conclusions of this assessment were submitted to the “advisory committee” (Groupe Permanent) in April 2008.

After an introduction reminding the French industrial and regulatory context as well as the way the assessment has been conducted, the relationship between safety and competitiveness is briefly discussed. Then the main issues and recommendations pointed out by the IRSN assessment are presented. These concern in particular: the balance between the shift operation team and the outage project team; the real-time decision-making capabilities of plant managers; the lessons learnt from the analyses of decision-making processes; the management of cultural changes.

Finally, a conclusion presents a global diagnosis in terms of strengths and weaknesses of the EDF safety management system and proposes some lightings regarding the “priority given to safety”, the meaning of safety used by operative people and the continuous improvement approach. Lastly, methodological lessons are pointed out.

## 1 INTRODUCTION

### 1.1 French civil nuclear industrial and regulatory context

In France, three main licensees are involved in the civil nuclear industry: the AREVA group is the main constructor of nuclear reactors, possesses a full mastering of the fuel cycle and has a major share of the fuel supply market; the CEA (Commissariat à l’Energie Atomique) is in charge of fundamental R&D, operates research facilities, designs new reactor concepts, fuels and components; EDF (Electricité de France) presently is the sole power reactor utility operating in the country.

EDF operates 58 reactors located on 19 nuclear power plants (NPPs) which are coordinated by a central department comprising engineering units as well as management support (definition of policies, industrial strategies, management principles, etc.).

In 2005, the electricity market has been deregulated and EDF became a private company, although more than 80% of the shares remain owned by the French government. France is currently organizing the arrival of a new operator for the next years, and thus EDF has to prepare the loss of its monopolistic position.



In the same time, the regulatory structures are evolving and new regulatory texts are being elaborated.

As a fundamental principle, the licensees remain responsible for insuring nuclear safety of their facilities. External control is carried out by the French Nuclear Safety Authority (ASN) supported by the Institut de Radioprotection et de Sûreté Nucléaire (IRSN).

Two main complementary processes of control, involving ASN and the IRSN are implemented as shown in Figure 1 below.

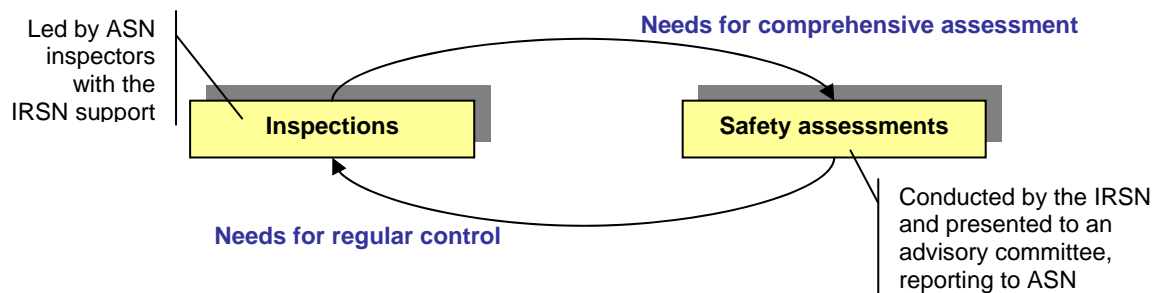


Figure 1: The complementarities of the main French control means

## 1.2 Assessment of the EDF safety management system performed by the IRSN

The elements presented here have been collected during the safety assessment performed by the IRSN, related to the examination of “**safety management of EDF reactors in a competitiveness context**”.

The assessment has focused on three main questions:

- How real is the "priority given to safety" in the daily arbitrations made at all nuclear power plants, particularly with respect to the other operating requirements such as costs, production, and radiation protection or environmental constraints?
- Knowing that the managerial and organizational contexts are submitted to frequent evolutions, is safety still meaningful to human operators?
- Do the organizational measures set up to manage safety (in order to counterbalance competitiveness oriented measures) allow EDF to maintain a “continuous improvement” of safety?

As safety management can be viewed as an organizational framework for taking into account safety requirements in day-to-day decisions (at strategic or operational levels), these three questions have led the IRSN to focus the assessment strategy on “decision-making processes”.

Thus, several safety analyses involving the national level (headquarter and central support department) and the on-site level (plants) have been conducted to evaluate decision-making practices in different situations:

- Real time decision-making during unit outage;
- Decision-helping provided by the headquarter to the plants in order to solve technical problems;
- Definition and use of indicators (considered as decision-support tools for managers) for managing safety;
- Processes for internal safety assessment and use of assessment results for improving safety;
- A *posteriori* analyses of decision-making processes implemented by the licensee as an experience feedback tool;

- Another transversal study was dedicated to identification of safety representations constructed and used by plant personnel. Its goal was to determine the influence of the organizational and managerial context on these representations.

The scheduling of the assessment is presented in Figure 2 below:

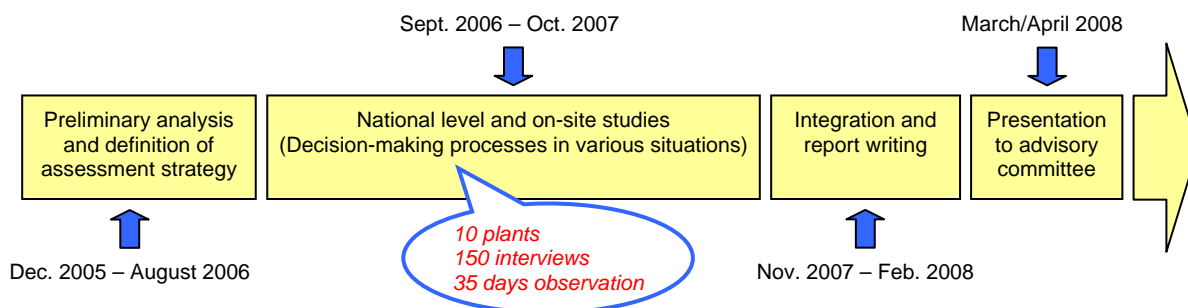


Figure 2: The assessment of EDF Safety Management System performed by the IRSN

The main results coming from this assessment process are presented in the following.

## 2 SAFETY AND COMPETITIVENESS: A STORMY RELATIONSHIP

### 2.1 Lessons learnt from organizational analyses

Some noteworthy accidents (or near-accidents) illustrate the negative impacts on safety of the production pressures that result from a search for competitiveness. Thus, the Paddington rail crash in England (1999), the corrosion of the reactor vessel head at the Davis-Besse nuclear power plant (2002), and the in-flight explosion of the U.S. space shuttle Columbia (2003) provide such examples.

They show that the search for competitiveness, through the organizational, managerial and cultural changes it induces, raises common issues: a long “incubating period” during which degraded situations appear without being detected or without being managed has often preceded the accident occurrence, the safety related instructions have lost their original sense for operators (phenomenon of normalization of deviance), some organizational vulnerabilities appear in particular due to reductions in personnel and the consecutive increase in operator workload, the “weight” given to the alerts related to safety purposes has gradually decreased as well as the budget dedicated to improve safety, etc.

Specific countermeasures must be implemented to manage these phenomena. They must be oriented towards finding the “best compromise” between competitiveness and safety. Although the assurance of safety is an absolute necessity, competitiveness is also necessary, and it is only an unreasonable and poorly managed search for competitiveness that is really questioning.

Human and social sciences literature enhances some performance factors of organizations regarding safety management. The research trend relative to high reliability organizations (HROs) identifies such factors as well as the studies and guides produced by the national or international agencies (NRC, IAEA and OECD in particular). Starting from the risks identified in specific case studies or accident analyses, they propose recommendations regarding the organizational arrangements to put in place (such as experience feedback management, competences management, reduction of organizational barriers, clarification of roles and responsibilities, etc.) and managerial arrangements regarding the motivation of personnel,

the degree of centralization for decision making processes, the management of cultural aspects, etc.

Nevertheless, these various works conclude that there is a non-deterministic and non-systematic relationship between the search for competitiveness and the maintaining of an acceptable level of safety.

To summarize, it appears that the search for competitiveness finally represents a risk that has to be managed at organizational and managerial levels. In this context, the commitment of corporate management of companies as well as the role played by the regulatory authorities is an essential factor for the effectiveness of the management of this risk.

## 2.2 The position of Electricité de France

In the framework of the IRSN assessment, EDF has proposed a description of its safety management system (defined as a set of managerial and organizational principles, roles and mechanisms). It has been built progressively in four stages: the “quality assurance” period (from the 80s), the implementation of “safety management levers” (specific human factors oriented practices set up from 1996), the “quality management” organization (from 1999) and recently (2006) a specific huge project relative to “human performance”, oriented towards the reliability of operatives’ practices and the “on-the-field” presence of managers.

The principal competitiveness levers put in place over the last few years by EDF are related to: the optimization of maintenance programs and volumes, the reduction of outages duration, the purchase of external services (80% of maintenance operations are outsourced), the extended fuel cycles, and some initiatives to optimize financial costs and human resources.

EDF establishes a strong link between safety management and “human factors” approaches arguing that *“safety participates in the global industrial performance by the means used to maintain it”*. In other words, the assumption made by EDF is that the rigor put in maintaining safety benefits to the other challenges of the company including security, radiation protection, protection of the environment, production efficiency, financial costs, etc.

In that sense, maintenance of safety appears to serve the search for competitiveness.

## 3 MAIN ISSUES AND SOME RECOMMENDATIONS

### 3.1 Preserving decision making responsibility of the shift operation team from the outage project

#### 3.1.1 Assessment context

One of the studies performed by the IRSN was related to refuelling outage. Such outages are managed in “project mode” and involve the interventions of many actors; it is a period in which many decisions have to be made; it fits into an overall strategy of “optimization” thereby satisfying economic requirements.

The analysis performed by the IRSN addresses the following issues: outage preparation; outage planning; information circulation and traceability; management of the outage project; relations within the outage dedicated structure; relations between the outage project, operation teams and maintenance teams (including sub-contractors); the place of the instructions within the activities; the question of material and human resources.

### 3.1.2 Some observed issues

Regarding decision making, favourable factors were identified through the observations:

- The cohesion of the management team favours serene exchanges of viewpoints and the collective agreement on the decision taken further to these discussions.
- The presence within the project of an organized diversity of views makes possible an overall understanding of the problems to solve and guarantees that all the information potentially relevant to the decision will be taken into consideration.
- The redundancy of the information channels and the formal means of discussion (“institutional” meetings, audio conferences, etc.) as well as informal (favoured by the maintaining of good interpersonal relations) also guarantee the accessibility of the information necessary for decision making.
- The decision-making processes benefit from the fact that all the people involved are truly concerned about questions of safety. Although this concern can take different forms and sometimes leads to mutual lack of understanding, it guarantees that safety is taken into account in the decisions for which the safety issues are identified.

Likewise, disturbing factors were also observed:

- The importance placed in the preparation and planning must not minimize the need to maintain the ability to react to unforeseen situations. From the decision-making aspect, this attachment to preparation brings in itself the risk of restricting the individuals’ decision-making capacity in situations that do not fit into the previously devised plan of actions.
- Time-factor pressure, whether real or simply felt by the protagonists, can be detrimental to decision making. Indeed, it is likely to disturb the serenity of the “last barrier” that the shift operation team represents.
- The difficulty in tracking events when they occur, with a view to capitalizing on experience can be prejudicial to decision making. Consequently, decision making can sometimes suffer from a lack of experience feedback.
- Although the risk of some actors - normally positioned at distance from the action – getting “absorbed by the real-time” is identified, it remains a problem because of the need to stand back from the events when making a decision.
- The increased use of service providers and the place given to contractual aspects can lead to a loss of decision-making flexibility in hazard management situations.
- The existence of different stakes among the various actors and the risk of division within the general organization of the outage can act as a damper to information sharing, communication and interactions, and the commitment to the pursued aims.
- The complexity of the instructions sometimes leads individuals to adopt a “bureaucratic” point of view, using the rules to protect themselves (against sanctions) as much as to guide them in their decision making.

To face up to the highly complex socio-technical system and ensure that the actors are capable of deciding and acting in compliance with the safety requirements, the organization implements numerous measures. These measures contribute to the robustness of the outage project but they also create an imbalance between the outage project and the operation team.

### 3.1.3 What could be done?

In a simplified view, the outage project brings the “competitiveness objectives” underlined by the optimization of maintenance operations (with respect to safety related constraints), while the shift operation team remains responsible for the plant safety (the “last barrier”).

The role played by the outage planning and some other “pressure” means available for the outage project represent a potential hazard regarding the place for safety requirements in decision making.

The confirmed or potential vulnerabilities revealed by the IRSN's study give rise to a set of recommendations oriented towards a reinforcement of the position of the shift operation team to face to the increasing power of the outage project in the decision making process.

### **3.2 Preserving the integration capabilities of plant managers against the pressure induced by their environment**

#### *3.2.1 Assessment context*

The question of the pressure exerted on the managers at different hierarchical levels (head of departments, proximity managers, team leaders) has appeared with different aspects at each study performed by the IRSN.

#### *3.2.2 Some observed issues*

This question of “pressure on managers” is partly linked with the role they play in the “requirements integration process” induced by the fact that all the requirements fields are “aligned”. Thus, managers have to consider simultaneously the different objectives and constraints of the company, i.e. safety, security, protection against radiations, protection of the environment, production objectives, cost optimization, etc. As they are “aligned” in many discourses and policy documents, it is difficult for managers faced to daily decisions, to establish a hierarchy between these requirements, although the “*priority on safety*” is claimed within the same discourses and the same documents.

Moreover, they have to explain their decisions to their teams, which are often unaware about the strategic constraints taken into account for deciding. For example, a manager will make the decision to postpone an activity because of the lack of the spare material required to perform it. Its decision takes into account a new modality for managing spare parts, ignored by the end-operator, but does not impact a safety requirement at that time. The operator will think that his manager “*does not care about safety*” judging the reparation of the given material as essential from a safety point of view. If communication does not take place between the manager and the operator, the ambiguity will stay and the message brought by the manager's decision will be misinterpreted by the operator, thinking that “*the cost of the reparation is more important than safety*”.

This kind of cases is quite frequent in operational situations and contributes to make difficult the integration process by the managers and to make ambiguous its communication to the operators' teams. As the managers have to give the “*right example*”, the claimed message about “*the priority given to safety*” is sometimes counter-productive.

Other causes are at the origin of the pressure exerted on the managers. The most obvious is the pressure coming from the industrial continuous process. It is difficult for managers to escape from the real-time imposed by the production rhythm itself.

Another source of pressure is the mode of management adopted by EDF and in particular the “perpetual movement” generating by the continuous improvement strategy. Most of the new measures set by EDF over the last 10 years (to improve safety, but also security, radiation protection, protection of the environment, and finally competitiveness) have strongly impacted the managers' workload, multiplying the objectives and constraints they have to deal with.

In addition, the variety of monitoring dispositions implemented in the nuclear domain, both internal (from national level, in-site safety control, etc.) and external (safety authority regulation, WANO, IAEA), represents a source of pressure, by the fact that control reveals potential management errors. One verbatim collected from a manager during an interview is particularly illustrative of this phenomenon: “*Be careful, control maintains the managers’ failures*”.

Lastly, the current external conjuncture brings also its part of pressure. For example, at the moment in France, recruitment of “nuclear competences” is becoming very difficult whereas experienced people retire and plant ageing is generating new technical problems to cope with.

### 3.2.3 What could be done?

First of all, the issue of pressure must be considered and analyzed regarding both its origins and its effects on people. The trend to ignore or to deny this phenomenon is frequently observed in modern companies. The first step is to go through this “reflex”.

In the assessment performed by the IRSN at EDF, some originated factors have been identified: the potential gap between the claimed slogans and the ground reality, the real-time and continuous industrial process, the multiplication effect on managers’ tasks produced by the continuous improvement strategy, the control processes revealing managers’ errors and the socio-economic contextual situation.

In terms of effects on managers, we have observed various difficulties in decision-making situations, but also connected effects such as fatigue, frustration, worry, and rarely loss of motivation.

The IRSN report concludes on the necessity to introduce some “breathing spaces” in the improvement strategy in order to lighten the pressure and to set means able to “qualify” this pressure. Then it would be possible for EDF to take provisions to prevent its impacts on people and their capabilities for deciding and explaining their decisions.

## 3.3 Learning from decision-making processes analyses

### 3.3.1 Assessment context

The OSD (Observatory for Safety/Availability) is one of the “safety management levers” implemented by EDF in 1997. Its objective is to perform retrospective analyses of high-stake decisions, in order to improve decision-making processes. This defines the OSD as an experience feedback tool.

The study performed by the IRSN has concerned the national (central services) and local (NPP) levels, and has involved a documentary analysis (organization memos, situation assessments, OSD reports, etc.) and a series of interviews.

At local level, it was decided to focus on the OSD analyses of two different NPPs. Information was thus collected on both the local implementation of the OSD (procedure, organization, quantitative data, decisions analyzed, etc.) and on a particular event examined by the OSD following an historical approach (criteria for choosing events, analysis procedure and persons involved, resulting recommendations and their monitoring, etc.).

### 3.3.2 Some observed issues

The first and general statement concerns the highly contrasting situations that exist regarding the local functioning of the OSD and the way it is used (differences in management, objectives, analysis means and procedures, etc.).

Otherwise, some limitations have been detected on the achievement of the objectives assigned to the OSD:

- The analysis is limited to the decision-making process (*"we do not judge the decision, but the process only"*);
- The prescribed analysis procedure (see Figure 3 below) is constructive but too restrictive and does not always bring into play the necessary HOF (Human and Organizational Factors) skills;
- A participatory approach is not always applied (no debate with the actors of the decision);
- A "bureaucratic position" underlines the formulation of some recommendations;
- There is a poor capitalization of lessons learnt;
- Some difficulties remain in monitoring the effectiveness of the OSD;
- The assistance given by the national level to the sites is quite limited.

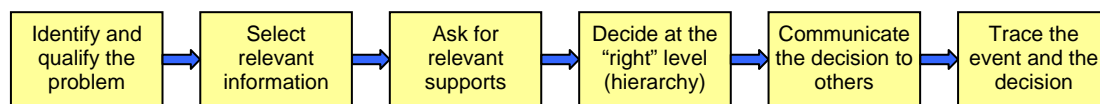


Figure 3: The OSD prescribed procedure for making "good" decisions

Lastly, the case studies revealed factors that overshadow safety stakes in the decisions: lack of mastery of the technical baselines, safety considerations overridden by the complexity of actions to undertake, excessive self-assurance of actors, workload and fatigue of involved actors, individuals too concerned about preserving the targeted outage duration.

### 3.3.3 What could be done?

The study has pointed out that the OSD, as a feedback experience tool, provides *a priori* a strong pedagogic framework for the licensee. It offers a context to organize debates about safety and to share safety representations between actors, illustrated by a real problematic situation. It has to be noticed that it is the only tool dedicated to "monitor" the safety/competitiveness relationship.

But the fundamental position of this tool (*"not to make judgment about the decision-maker"*) is too restrictive and often becomes *"not to analyze the decision"*, in terms of results and effects on the given situation.

As the existence of such a tool is judged positively, it is necessary to improve it towards two main directions:

- To understand the factors favouring the quality of a decision-making process. To this end, it is necessary to take into account the decision context elements such as time pressure, fatigue of actors, availability of supports, difficulties in identifying safety requirements, etc.
- To understand why a "qualitative decision-making process" does not always produce a "right decision". To this end, it is necessary to analyze the decision itself with the results it produces and the effects it has on the situation.

A last point concerns the competences required to increase the efficiency of the implementation of such a tool. Involving HOF competences is absolutely necessary to progress in this kind of analysis tool.

### 3.4 Anticipating and managing the cultural changes

#### 3.4.1 Assessment context

This point is transversal to the different studies performed by the IRSN. It arises from the particular French situation relative to the ageing of NPPs population and from the fact that EDF – faced to the opening of the electricity business market – tends to increase its search for competitiveness by reinforcing the economical aspects in its discourses and practices.

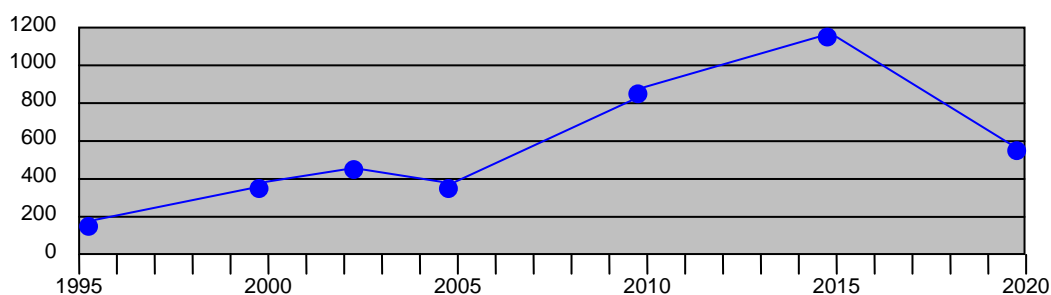


Figure 4: The foreseen renewal of EDF population (approximation)

#### 3.4.2 Some observed issues

From the “principles point of view”, the current efficiency of the EDF Safety Management System (SMS) relies on the implementation of operational dispositions such as: quality insurance approaches, operation experience feedback management, internal independent control organization, integration of human factors. Moreover, the SMS takes benefit from its integration within the global management system of EDF, including competences management organization.

From the “real-life perspective”, the current efficiency of the EDF SMS relies on the actors’ commitment to the values progressively constructed. The cultural characteristics (values, norms, beliefs, practices, etc.) carried on by the SMS are shared by the current staff of the licensee.

Then, the question of the continuity of such adequacy is raised, in the context of an important cultural change. Two main sources of change are currently threatening the “cultural balance”:

- An important renewal of the current EDF population (see Figure 4 above);
- A reinforcement of the “technico-economical values”, likely to modify the existing culture of people.

This foreseen evolution is often mentioned by the operational actors met during the assessment, but it is often minored or sometimes ignored. Consequently, the phenomenon is not explicitly managed and poorly taken into account for defining new dispositions.

At least, some questions have to be asked and monitored: What will be the impact of population renewal on safety culture? What will be the impact of the integration of “technico-economical” aspects on safety culture? What will happen during the transition period before

the change is completed? What will be the consequences of these changes in terms of adaptation of the SMS?

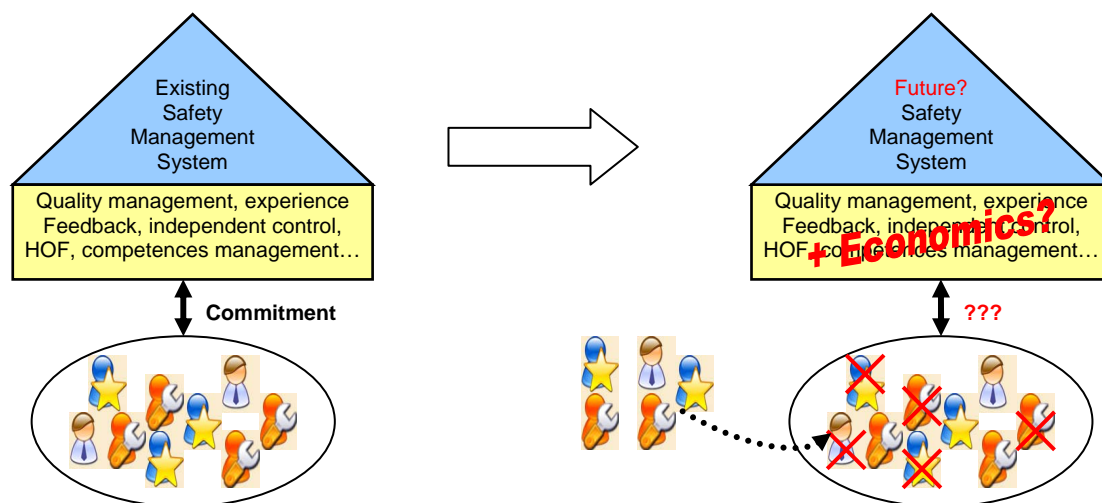


Figure 5: The foreseen cultural changes and the question of its effects

### 3.4.3 What could be done?

In 2001, the NRC (see NUREG CR-6735) pointed out the effects of deregulation in terms of cultural changes.

The IAEA (see INSAG-18) emphasized the same conclusions in 2003: *"In times of change, there is significant pressure on the approach to safety and on the safety culture of both organizations and individuals. The key mission for the leaders of an organization should therefore be to hold as their top priority the need to remain focused on maintaining and enhancing the overall safety culture of the organization. An appreciation of the key elements which support a strong safety culture and, in particular, the need to visibly reinforce the corporate commitment to safety in a way which is credible to the workforce and to continue to communicate honestly and openly about safety matters is vital. The effect of change on the individual's commitment and the impact that this can have on the maintenance of a good safety culture must be recognized. Thus, all actions taken by the leaders in planning and implementing change are to be tested in terms of the effect they will have on the perceptions of individuals about these key elements as beacons of stability within periods of inevitable uncertainty"*.

In addition, theoretical (social and human sciences) and practical works (management consultancy) dealing with change management put the cultural factors at the centre of their findings. Some of these works stress the particularities concerning the way these factors must be taken into account: *"[...] the tools classically used by management, seems to be insufficient when cultural factors or symbolic factors are placed at the heart of the stakes. That is always the case in situations of change"*.

Those tracks could provide practical means to anticipate and manage cultural changes, and at least demonstrate that valuable studies can be conducted on this field to improve the understanding of cultural phenomena.

### 3.5 Other issues to be deepened

Some other issues have been identified during the assessment performed by the IRSN:

- Managing the complexity of rules and their effects on decision making;
- Organizational data collection for using feedback from experience of unit outages;
- Management of spare part stock;
- Position and power of internal independent control;
- Operational implementation of INSAG 18 for managing organizational changes;
- Implementation of the EDF "human performance project".

These topics – all of them connected to particular decision making issues - will be examined later by the IRSN in the frame of further safety assessments.

## 4 CONCLUSIONS

### 4.1 A global diagnosis

A first finding pointed out from the assessment performed by the IRSN between 2006 and 2007 at EDF concerns the variability of the situations that comes out of the local investigation of 10 different NPPs. That generates some difficulties for generalizing the findings and implies to consider the worst case. A question is still to be solved: should homogeneity be sought among the numerous NPPs of a given licensee? It is not so obvious that safety culture is really impacted by this variability.

Anyway, some strengths and weaknesses have been identified by examining decision-making processes.

The identified strengths are: the dynamic attitude concerning questions of safety (safety that is managed, and is considered central to nuclear fleet performance); the genuine commitment of people to safety; the capability of EDF to adopt a "project mode" in order to de-compartmentalize its organization for a specific purpose; the complementarities of the verification and control systems and structures; the organized multiplicity of viewpoints, bringing diversity into the decision-making process.

The main vulnerabilities mentioned are: the complexity of the rules (technical, organizational and managerial instructions); the multiplication of the procedures and the accumulation effect for people; the difficulties in collecting and using organizational experience feedback; the weakness (on certain sites) of the internal quality and safety assessment practices.

### 4.2 A response to the 3 directing questions

Regarding the "priority given to safety", the IRSN has noted the clear and determined position displayed at all levels of EDF, from the Chairman to the operative. Nevertheless, it seems that the notion of arbitration - implied by the expression "*priority on safety*" - needs to be reformulated to take on its full sense in the operational context. The various observations made by the IRSN reveal an "integration process" that allows safety and other requirements (availability in particular) to be taken into account simultaneously. They also show that the rationality of the daily arbitrations between the safety stakes and the other requirements can be compromised in certain situations. For the IRSN, the operational implementation of "priority on safety" cannot come without a sharp analysis of these phenomena.

It appears that the “alignment of stakes” (to be safe, clean, competitive, etc. all at once) disturbs the orienting of decisions (those that require arbitration in particular) and generates pressure that is felt essentially by the local management players. In the IRSN's opinion, the risk needs to be analyzed in order to improve control over it.

The IRSN's field studies have identified cultural changes in the meaning that the operational actors give to safety. According to the IRSN, safety still has an operational meaning for operative people. This meaning is the result of a construction that anchors itself in the activity of the actors (managers or agents) and in the role that this activity plays in plant operation. It is therefore variable, sometimes complementary and sometimes a source of conflicting goals between those involved.

Regarding the ability of EDF to improve safety, the response is more reserved. The interacting of varied vulnerabilities (time-related pressure, strong external economic constraints, structural and social constraints, lack of medium and long-term visibility over the cultural changes) in a context characterized by the increasing complexity of the technical and organizational baselines and increasing search for competitiveness threatens the efficiency of the EDF SMS. It seems that the arrangements recently set up by EDF are responses to deal with these “aggressions” and are not really directed by a strategy to improve the level of safety.

The last conclusion addresses the question of the robustness of the safety management system. Here the word robustness means the capability of the system to resolve the difficulties it encounters and to anticipate those to come, and adapt accordingly.

For the IRSN, the reinforcement of the robustness of the EDF SMS, consistently with the objectives of increasing the company's competitiveness, requires the introduction of “breathing times”. These should be used to strengthen the weakened lines of defence and to clarify the doctrine with respect to the safety/competitiveness relationship.

The strength of the EDF safety management system relies on the fact that it is carried in the field by men and women who are able of understanding, innovating and, when necessary, resisting. In the opinion of the IRSN, this strength must be fostered.

### **4.3 Methodological lessons learnt**

The assessment performed by the IRSN has shown that it is possible to examine decision-making processes as they implemented in “real life” and not only as they are described formally within the organizational documents. These documents propose a rational view of how the decisions are taken. This view is sometimes far from the daily reality.

From a methodological point of view, the main lesson learnt is that examining decision-making processes constitutes a valuable approach to:

- Go further than quality insurance approaches based on compliance verification principles;
- Assess the efficiency and the relevance of the SMS components on operational safety management in real-time situations;
- Get relevant traces of beliefs, values, representations and more generally all “hidden faces” composing safety culture.

Safety culture is not only a convenient concept – used in a “black box” mode without need for explicating it – to explain the errors committed by individuals. Safety culture can be examined from the organizational and managerial context participating in its construction, and from the effects it produces, in particular on daily decisions.

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