REPORT

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INSTITUT
DE RADIOPROTECTION
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Faire avancer la sûreté nucléaire

Addressing Cultural Aspects of Organisations in High Risk Industries

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ASTRACT

The concept of Safety Culture is a key element of many initiatives aimed at improving the safety of nuclear facilities. In particular, the IAEA has focused its development strategy on taking into account human and organisational factors. In this context, the IRSN has mainly devoted its evaluations and research to theoretical lines arising from ergonomics and the sociology of organisations. Although this orientation has helped to formulate documented assessments, it is necessary to better take into account cultural aspects, because some of these contribute to risk management. They can, for example, be an important part of provisions to promote cooperation between different professions (maintenance and operation, operation and decommissioning, operation and research, etc.), between project organisation and daily organisation (outage management, change implementation, dismantling worksitess, etc.), between companies (relations between customers and service providers).

The IRSN thus conducted a study aimed at defining guidelines for the use of the "culture" and "safety culture" concepts in safety assessments of nuclear facilities. First, the contributions and limitations of the safety culture concept are identified, leading as a second stage to a review of the main works on culture that have been conducted in anthropology, sociology, management science and ergonomics. These studies show that taking into account cultural aspects can give access to phenomena that are difficult to deal with using other organisation analytical frameworks. On this basis, four analysis plans were defined, which provide a breakdown of the overall "culture" topic: organisational cultures, professional cultures, social cultures and relations, and national cultures. In the fourth part of the document, these analysis plans are used to revisit safety assessments performed in the past. In doing so, the relationship between cultural aspects and safety are specified and the interest in taking them

into account is confirmed.

RESUME

La notion de Culture de sûreté est au cœur de nombreuses démarches visant à améliorer la sûreté des installations nucléaires. En particulier, l'AIEA en a fait un élément central de sa stratégie de développement de la prise en compte des facteurs organisationnels et humains. Dans ce cadre, l'IRSN a principalement inscrit ses évaluations et ses recherches dans des courants théoriques issus de l'ergonomie et de la sociologie des organisations. Si cette orientation a permis de formuler des avis documentés, il apparaît nécessaire de mieux prendre en compte les dimensions culturelles, car certaines d'entre elles contribuent à la maîtrise des risques. Elles peuvent par exemple être partie prenante de dispositions destinées à favoriser la coopération entre métiers différents (maintenance et conduite, exploitation et démantèlement, exploitation et recherche, etc.), entre structure projet et organisation pérenne (management des arrêts de tranche, implantation de modifications, chantiers de démantèlement, etc.), entre entreprises (relations entre donneur d'ordre et prestataires).

L'IRSN a donc réalisé une étude visant à définir des orientations concernant l'usage des notions de « culture » et de « culture de sûreté » dans les évaluations de sûreté des installations nucléaires. Dans un premier temps, les apports et limites de la notion de culture de sûreté sont identifiés, ce qui conduit dans un deuxième temps, à relire les principaux travaux concernant la culture qui ont été menés en anthropologie, sociologie, sciences de gestion et ergonomie. Ces recherches montrent que la prise en compte des dimensions culturelles peut donner accès à des phénomènes peu saisissables par d'autres grilles d'analyse des organisations. Sur cette base, quatre plans d'analyse ont été définis qui proposent une décomposition de l'objet global « culture » : cultures organisationnelles, cultures professionnelles, cultures et relations sociales, cultures nationales. Dans la quatrième partie du document, ces plans d'analyse sont mobilisés pour revisiter des évaluations de sûreté réalisées dans le passé. Ce faisant, les rapports entre les dimensions culturelles et la sûreté sont précisés et l'intérêt de leur prise en compte est confirmé.

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INTRODUCTION

The concept of Safety Culture was used for the first time in the Chernobyl accident analysis report published by the IAEA in 1987 (INSAG-1 revised in INSAG-7) explaining that the lack of a safety culture had contributed to the occurrence of the accident. The concept was then widely used in other risk sectors: aerospace, chemical and oil industries, and health. It has been the subject of many studies producing new definitions, ways to assess it, and ways to enhance or maintain it. Safety culture has also resulted in requirements, particularly from the IAEA, on which nuclear operators have based their development of managerial tools aimed at promoting-steering-controlling-evaluating the consideration of safety within their organisations.

In risk management assessments carried out by the IRSN, the area covered by the "safety culture" concept has mainly been addressed using concepts developed in ergonomics (work activities, work situations, skills, etc.) or in sociology of organisations (organisational structure, decision-making processes, role playing, etc.). It should be noted that the IRSN has not explicitly used the culture concept as it was developed in the humanities and social sciences.

The discussions presented in this report strive to determine to what extent the culture concept could enrich the assessments conducted by the IRSN. The following issues are specifically addressed:

- What specific aspects of the cultural approach in sociology and anthropology could be incorporated into the analysis of organisations with high reliability requirements?
- What link(s) can be made between the identified cultural aspects and risk management?
- How should aspects be actually addressed during a safety assessment? What are the conceptual analytical frameworks and methods used?

In Chapter 1, the contributions of the safety culture concept to the development of nuclear risk management are presented, as well as its limitations and the criticism directed at it. This criticism relates particularly to the vagueness of the concept, the inadequacy of its scientific basis, and the "simplistic" view of the ability to act on the culture involved. The IRSN concludes this chapter by noting that striving to influence the culture within the organisations of nuclear operators to make it evolve in a direction favourable to risk management requires relying on scientific work in order to understand culture characteristics and their dynamic evolution precisely.

Chapter 2 provides a review of the main scientific work relating to culture that has been conducted in anthropology, sociology, management science and ergonomics. This review enables the different characteristics related to culture to be identified, especially its collective aspect, its emerging nature over time, and its place in formal and informal systems. It seems like this concept could enable access to phenomena that are difficult to deal with using other organisation analytical frameworks. It also appears possible to implement technical and organisational measures whose effect on the culture of the players and work collectives may, to a certain extent and with caution, be anticipated.

In Chapter 3, four analysis plans are presented, which outline a scientifically based perspective of action on the culture, i.e., based on the results of research work in sociology and anthropology. These analysis plans are a way of breaking down the overall "culture" topic, which is considered too complex to be addressed directly. The chapter successively addresses: organisational cultures, professional cultures, cultures and social relations, and national cultures. The following are presented for each analysis plan: conceptual references, the perspective for risk management, and the data to be gathered to perform the analysis.

Chapter 4 presents a "cultural review" of some topics that have been the subject of evaluations by IRSN specialists in organisational and human factors. This review has been performed through the approaches to culture presented in Chapter 3 and opens perspectives for deepening assessments by the IRSN.

1. "SAFETY CULTURE:" A CONTROVERSIAL CONCEPT

1.1 INTRODUCTION TO THE "SAFETY CULTURE" CONCEPT

The concept of Safety Culture was used for the first time in the Chernobyl accident analysis report published by the IAEA in 1987 (INSAG-1 revised in INSAG-7). The IAEA explained that the lack of a safety culture had contributed to the occurrence of the accident. The concept was subsequently clarified in 1990 in INSAG-3 (Revised in INSAG-12), and finally precisely defined in INSAG-4, which remains the reference text on the subject today. In the latter document safety culture is defined as *"the set of characteristics and attitudes which, both in organisations and in individuals, cause nuclear power plant safety related issues to be given the priority attention warranted by their significance*".

Initially deployed in the nuclear field, the concept was then widely used in other risk sectors: aerospace, chemical and oil industries, and health. It has been the subject of many studies producing new definitions, ways to evaluate it, and ways to enhance or maintain it. Safety culture has also resulted in requirements, particularly from the IAEA, whose operators have based the development of managerial tools aimed at promoting-monitoring-controlling-evaluating the consideration of risks within their organisations. Thus defined, culture has become integrated into an operational approach aimed at the guidance and supervision of the behaviour of the players, particularly through the development, dissemination and sharing of rules and values relating to risk management.

1.2 CONTRIBUTIONS OF THE "SAFETY CULTURE" CONCEPT

The introduction of the safety culture concept was an important contribution to risk management, like that of the "total quality" concept was in the 80s as a managerial tool for on-going improvement.

In particular, it emphasises the fact that risk management is built at all levels of the organisation, whereas previously the focus was on the operators, especially from the point of view of human error. INSAG-4 thus presents requirements directed to those in charge of the risk management policy (regulatory authorities, nuclear operator management structures, etc.), to those in charge of management of risk management and to the staff in charge of the operation.

The concept also emphasises the more informal aspects of the organisation, in addition to the technological and procedural aspects that had dominated until then. The values, habits, business standards, and local contexts, etc., now appear as elements to be considered when studying the risk management construction methods within an organisation.

Moreover, the safety culture concept, in its various developments, had the merit of promoting a " systemic approach" to risk management issues. For example, the work of the Foundation for Industrial Safety Culture (*Fondation pour une Culture de Sécurité Industrielle*, FonCSI, 2010) combines 4 levels in a same approach: organisation/management; work collectives; work situation; and individuals. FonCSI emphasises that each of these levels helps to structure (influences) human activity and thus contributes to industrial safety, which is the product of factors relating to anticipation and rules (regulated safety) and factors relating to the real-time adaptation (managed safety).

Similarly, the safety culture concept introduced the idea that it is possible to influence the culture of a group, making it evolve by acting on the characteristics of the organisation. The role played by the explanation of the strategic objectives assigned to the Group and the associated values and

criteria, that of feedback and the discussion of the implementation of work practices have also been emphasised.

Finally, the safety culture concept has served the "*human factor*" approach more broadly, both among operators (Lagrange, 2011) and within safety authorities. The concept has been used to position the organisational and human factors, giving them legitimacy at a time when organisational and human factors were still emerging in the field of risk management. The IAEA, through the various INSAG documents and "*safety standards*" that refer to them, has helped to give it the status of a standard in the world of high risk industries.

1.3 LIMITATIONS OF THE "SAFETY CULTURE" CONCEPT

Despite this progress, the criticism directed against the concept is recurrent.

This criticism relates to the vagueness of the safety culture concept. This term is often used in a negative form (lack of safety culture), particularly in incident reports made by nuclear operators, thereby indicating a lack, a void that remains difficult to fully define.

This vagueness concerns the concept of culture itself. Indeed, INSAG-4 associates safety culture with a number of attitudes and expected behaviours that players should develop to ensure the safe management of the facilities. However, the way in which they can be linked and combined to form a culture is not defined. We find, for example, the expectation of adherence of individuals to the common safety objective", which raises more questions than it answers: What does it mean to have a common objective? Can the safety objective be the same for all of the staff, whether they are in charge of maintenance, control, or management? How can staff adherence to this general objective be designed, when at the same time INSAG stresses the need for a possible "systematic questioning" of the rules? Shouldn't divergent objectives be, on the contrary, allowed to intersect and compete to foster debate and cause a clarification of the values and criteria for each, including those concerning safety?

This vagueness also concerns the safety concept. INSAG-4 frequently uses this concept, without ever defining its meaning (safety appears as a "data item") and without ever indicating that this concept is precisely and continuously at the core of staff activities: Is it safer to complete a work project with sub-optimal organisation or suspend it? Is it safer to involve a pair of two first workers or to postpone the intervention? Is it safer to devote resources to the thorough analysis of an event or to another task?

In add, focus on safety may lead to neglect other issues that an organisation needs to integrate. Philippe Lorino[1] argues that "managing safety" as a separate process from the rest of the organisation presents risks: excessive formalism at the expense of managerial and organisational aspects (ways of cooperation between players, relation style, distribution of roles and responsibilities, etc.), an excess of rules that ultimately makes them inapplicable, a bureaucratic approach to safety (compliance) rather than the development of practices favourable to risk management, possible conflict with other interests (particularly economic) placing operators in paradoxical situations. In order to prevent safety from therefore becoming an OBJECT to be managed, but rather an aspect of the individual and collective activity, Lorino proposes an integrated approach and paying attention to other processes that may affect safety, such as: skill management, wage policy, career management, social climate, budget management, supplier and subcontractor management, external communication and relations with the community/residents, and relations with supervisory bodies.

[1] Interviews conducted by the IRSN to write this report

Criticism also concerns the ways of knowing the culture of a group. Safety culture encompasses highly complex cognitive and social phenomena. For example, while the behaviour of individuals can be observed, accessing the underlying values behind their behaviour is far from a trivial task. Similarly, the collective and shared aspect of culture, and the fact that it develops and changes over long periods, present formidable theoretical and methodological challenges. However, most studies regarding safety culture are conducted through questionnaires and interviews (Cole *et al*, 2013). Many authors emphasise that they produce insufficient data to understand the cultural aspects of organisations.

Finally, this criticism concerns the "simplistic" view of action on culture. INSAG-4 presents an almost mechanistic view of human behaviour. Thus, the motivation of individuals is achieved "through issuing orders, establishing objectives and reward and sanction systems, and thanks to the attitudes adopted by the people themselves." Similarly, many studies concerning safety culture define factors contributing to its development. In their literature review, Cole *et al* (2013) for example mention the Geller "model" (1994), which identifies 10 principles that form the basis of a "total safety culture": *"1) employee driven safety rules and procedures, 2) a behavior-based approach, 3) a focus on safety processes not outcomes, 4) a view of behavior being directed by activators and motivated by consequences, 5) focus on achieving success, not on avoiding failure, 6) observation and feedback on work practices, 7) effective feedback through behavior-based coaching, 8) observation and coaching as key activities, 9) the importance of self-esteem, belonging and empowerment and 10) safety as a priority rather than a value"*. Although the authors who define these principles emphasise that most often it is their interaction that influences the culture of an organisation, it is clear that these principles are often transformed into "safety culture assessment criteria" and considered independently. This view ignores the complexity of the work and processes that develop within work collectives and organisations and that contribute to the emergence of a culture over a time span that is necessarily long (Fucks, 2012; Theureau, 2010). An organisation is a system in which each component is the site of relentless development (procedures change, people change jobs, their skills evolve, etc.), each component interacts with other components in an environment that is continuously evolving. This makes it particularly difficult to "steer" the effects of an organisation and of a management system on the medium-term. In this regard, Mathilde Bourrier[2] considers that focusing on player culture masked for a long time the issue of the "design" of high-risk organisations. Discussions on safety culture focused on teams and their performance and made it possible to not "*open the organisation box, which would in particular have forced international comparison*."

In general, most critics argue that this concept of safety culture is a form of "*response*" aimed, on the one hand, at dealing with informal aspects of organisations without really dealing with them ("*calming down the uncertainty related to the lack of control of organisational and human factors*"), a "*clever metaphor*" to describe the problems associated with Soviet culture without naming them in the Chernobyl accident, "*another scapegoat*", and on the other hand, it leaves aside the "real" organizational issues, which nevertheless have a strong impact on risk management: industrial policy, inventory management policy, HR policy (incentive systems, goals, career management, etc.), budget management, etc. (P. Lorino, M. Bourrier[3]).

[2] Interviews conducted by the IRSN to write this report

[3] Interviews conducted by the IRSN to write this report

1.4 INTERIM CONCLUSION: THE NEED TO REVISIT THE SCIENTIFIC WORK ON CULTURE

Given these criticisms of the safety culture concept, should we abandon or reject any attempt to take into account the cultural aspects associated with organisations and their influence on risk management? Should we also abandon any idea of influencing the culture to make it evolve in a direction favourable to risk management?

Some researchers favour this option since, according to them, safety culture would be "*a thinking* obstacle", a commodity that does not enable the right questions to be asked. They also believe that any action on safety culture is impossible, or at least, that it is not really possible to predict the effects.

This is not the position of the IRSN which, while remaining cautious, hypothesises that understanding cultural aspects can enrich the analysis of high-risk organisations because they contribute positively or negatively to the development of risk management.

Cultural aspects appear to be an important topic to study, because they indicate patterns, habits forged within a group or organisation, which emerge and are in the end likely to produce an organisational equilibrium that may or may not be favourable to the safe operation of a basic nuclear facility (INB). The safety thus designed is a process (more than a stock to be renewed), it is the product of collective construction (Journé 1999).

Similarly, culture contributes to the identity and cohesion of a group and allows it to exist by distinguishing itself from those outside the group. Given that inter-organisational aspects are increasingly present in research on risk management, it is interesting to examine intergroup relations by including cultural aspects, whether these are relationships between contractors and service providers, between the project organisation and day-to-day organisation, or between operators and inspection authorities, etc.

In order to open perspectives of overcoming the limitations of the safety culture concept in its current formulation, the IRSN conducted a review of the scientific work conducted in anthropology and sociology, with regard to culture and its study. Indeed, any attempt to perform any action on the culture of a group requires science to accurately understand its characteristics and those of its dynamic evolution.

2. LESSONS LEARNED FROM RESEARCH ON CULTURE

2.1 ORIGINS

"Culture" is a concept from anthropology and sociology, developed through the study of communities in which patterns in terms of habits, beliefs, rites, and "symbolic systems" bringing together the members of that community or distinguishing them from other communities, have been observed.

In this research, two main concepts of culture emerge:

- **A universal concept** (mostly developed in France) that defines culture as proprietary to the human species, distinguishing it from the "nature state". The culture that can be associated with the concept of "*Paideia*" here includes education as well as the influence of the group on individuals. It is dynamic and is associated with the idea of progress and civilisation.
- **A particularistic concept** (mainly of German origin). The word "*Kultur*" in German is associated with the aristocracy, a class that stands out through its superiority from the bourgeoisie. Culture is thus associated with the intellect, spirituality, science, the arts, etc. It is what distinguishes one social class from another. Anthropologists like Ruth Benedict (1934) follow this line. Her work is aimed at reasoning the difference between cultures. For her, what distinguishes human groups is cultural in nature and not racial. In other words, there is no difference in nature, but rather of culture.

These two concepts mark two major routes: one that favours unity (see E. Tylor, 1871): culture is a multidimensional "complex whole" that includes knowledge, beliefs, art, morals, law, customs, etc.). These are shared traits, which are collective and largely unconscious, that structure human society. The other concept, on the contrary, assigns all importance to diversity. It is thus a case of studying cultures, emphasising what distinguishes one human group from another (see Boas, 1940): a "cultural area" (a convergence of traits in a space), "cultural traits "(the smallest components of a culture), etc.

2.2 DEFINITIONS

There are numerous definitions of Culture. In his work, M. Thevenet (1993), based on an analysis of the literature, points out the abundance of definitions and attempts to identify common features in these definitions. Some definitions, from the field of cultural anthropology (G. Rock, E. Tylor, C. Geertz), and from the field of high-risk industries (S. Antonsen, E. Schein) are presented below:

- **G. Rocher**: "*A system of behaviours (visible), standards (implicit or explicit collective rules); of values (symbolic level) giving meaning to the whole* " (Rocher, 1968),
- **E.Tylor** : "*A complex whole that includes knowledge, beliefs, arts, morals, law, customs, and any other capabilities and habits acquired by man as a member of society* " (Tylor, 1871),
- **C. Geertz** : "*Culture is a network of meanings, consisting of recurring variables that men create and depend on themselves; it is comparable to a set of commands that IT professionals call programs; it is an organising element of the social field, determining the social relations, values and attitudes necessary to maintain the group* "(Geertz, 1973); He proposes to distinguish "global" Culture (an orderly system of meanings and symbols) from "local" culture, which is a product of social interaction,

- **E. Schein: "***Basic shared certainties that the group has learned as it solved problems, which have worked well enough to be considered valid and consequently to be taught to new members as the correct way to perceive, think and feel about those problems"* (Shein, 1992),
- **S. Antonsen:** "*The reference frame through which information, symbols and behaviours are interpreted, and through which the conventions regarding behaviour, interactions and communication are generated*" (Antonsen, 2009).

These definitions are not contradictory, they focus on different elements. The IRSN retains here many elements common to these definitions:

- **The collective and shared aspect of culture within** a social group: this collective aspect unifies within the unit considered, and at the same time distinguishes this unit from other units. This group unification may not be consistent with organisation boundaries; thus, in his thesis, Ponnet (2011) shows that the links between people intervening on road and ballast renovation mobile worksites (who in particular share specific living conditions) transcend the boundaries between the SNCF and service providing companies,
- **Persistence over time:** for there to be "culture", the elements identified must be repeated, and have a given permanence and recurrence proving that they have become habits for that group,
- It is a **reference frame** (beliefs, symbolic order, meaning, values, etc.), partly unconscious and implicit, that is reflected and developed in practices/attitudes/behaviours, habits, customs, etc.,
- **It is as much the product of informal aspects** (shared habits, good practices, rituals, etc.) as of formal aspects (organisational arrangements, processes, delegation rules, management tools, technical procedures, etc.),
- **It refers to a "whole",** an integral and relatively consistent view greater than the sum of its parts, **as much as to one part** (an element of the system on which it is possible to act, thereby affecting all of the system); In other words, we can understand the culture from a global perspective (e.g., the culture of a company) as well as from that of a specific local element (e.g., the culture of maintenance occupations),
- It is both a **social construction that emerges from the interactions** within a community, from interactions between social groups, and from experience, as well as **a being an educational/ cultural trait,** which can be disseminated and influenced to some degree. The notion of "learning" is thus at the core of the definition by E. Schein.

2.3 DIFFERENT APPROACHES TO CULTURE

It would be irrelevant and too ambitious to present here all of the literature on the concept of culture. We simply propose here a classification and a general positioning of the main approaches[4].

There are four main streams/disciplines that have shaped the concept of culture according to quite different perspectives, aims and methods: anthropology, sociology, management sciences and cognitive sciences (psychology, ergonomics). The table below gives a summary of these approaches:

	Anthropology	**Sociology**	**Management Sciences**	**Psychology/ ergonomics**
Subjects	Human communities and their mode of operation: patterns, beliefs, rites, etc.	Social groups and their identities, which are a source of unity and/or difference. Power relationships, or even domination relationships between groups. Socialization	The company values and their diffusion in behaviours, in particular through the design of management tools.	Behaviours and underlying cognitive processes. The construction of meaning, reasoning, interpretation of situations.
Perspective	Comprehensive	Policy	Economic performance	Comprehensive and engineering
Methods	Ethnography, direct observation, diary	Surveys: observations, interviews	Questionnaire, interviews.	Analysis of activity through observation and interviews
General overview of culture	A function and an indivisible whole; a personal and located internalization (types, configurations); symbolic systems, patterns	A social construction and/or heritage The product of interactions	A body of standards, rules and values that it is possible to define, monitor and disseminate	A sense constructed by the players, a network of shared meanings
key authors	B. Malinowski, E. Tylor R. Benedict, F. Boas, I. Geertz, E. Schein	P. Bourdieu, C. Dubar, F. Osty	J. Kotter et J. Heskett, W. Ouchi, G. Hofstede	E. Schein, E. Hutchins, G. Bateson, K. Weick, J. Theureau

[4] This part is based more particularly on the work by D. Cuche (1996), M. Thévenet (1993) and a study by J. Theureau carried out for the IRSN in 2010 (not published).

Although this type of classification serves as a reference in a quite abundant field, it is nevertheless reducing: on the one hand because many authors often structure their approach around several disciplines and, on the other hand, because of the plurality of perspectives developed in each of these currents. In the next part, these nuances are considered more thoroughly.

Several results from the work in cultural anthropology seem relevant to the analysis of the cultural aspects in high-risk industries:

- Culture has various components (knowledge, beliefs, customs, habits, tastes, etc.); it is necessary to connect them (systemic view - a whole, a consistent and indivisible entity),
- Culture may have one or more functions (giving meaning, ensuring group cohesion, etc., see § 2.4),
- A local practice may be representative of the whole (according to a systemic view), but at the same time, one must avoid overgeneralization. There are thus always simultaneously two study levels to be considered, the local culture and global culture,
- Cultural phenomena occur over a long period of time, which requires learning (socialisation, training, etc.) and they are unstable (reinterpreted by each person, influenced by external elements, etc.).

In terms of sociological approaches, several elements can also be identified:

- Rather than speaking of "culture" in singular, it seems more relevant to focus on "cultures" in plural within the same organisation (site culture, team culture, occupation culture, etc.),
- Culture is constantly redefined in social relations because of tensions, conflicts, cooperation, etc. Culture is thus alive and the subject of negotiations,
- The environment (the industrial fabric of a region, the political/institutional/economic context, the state of regulations, etc.) influences the cultural dynamics within an organisation, at a site, or in a company. It should be taken into account,
- Individuals are members of several groups or communities and import their cultures to the organisation concerned. These individuals are simultaneously influenced by the organisational culture within which they evolve, and by the cultures of groups to which they belong (professional, corporate, non-professional groups). In other words, there is a mutual influence between the members of an organisation (individual and collective) and the organisation itself (its history, its operating modes, routines, etc.).

In terms of cognitive science, the concepts of "meaning" and “learning" are key:

- The activity is thus connected to the way in which the players put it into words (what people say about what they do and what they say about the reasons that led them to do what they do). K. Weick (1987) thus emphasises the construction of meaning ("sense-making"), which is rooted both in individual and collective activity,
- E. Hutchins (Hutchins, 1995) who has in particular worked on operating an aircraft emphasises the situated, collective and cultural aspects of this activity. The activity is thus the result of interactions between individuals and the material world, in a given context. Hutchins emphasises the influence of the material conditions under which the activities are carried out on the development of the culture. Given that "cognition is socially distributed" between collective and artefacts, it is necessary to observe the collective work situation in order to explore how business is built collectively. Cognitive Anthropology thus campaigns for a work

analysis taking into account the culture of the players, which is more or less shared collectively,

- Finally, it emphasises the different levels of appropriation of culture (through training in the activity, through educating individuals or through broader cultural movements at the social level). At the micro level, it is thus a question of the ownership processes.

Finally, as regards management science, it is the "corporate culture" that constitutes the flagship concept. The latter is the product of both formal frameworks (rules, ways of dividing work - horizontal and vertical, processes, management tools, etc.), history and activity of the organisation in question, as well as social relations and how they are developed (management style, existence of counter-powers, debate and discussion places, etc.).

2.4 THE INFLUENCE OF CULTURE ON GROUP PERFORMANCE

According to Fucks and Lemaître (1984), various functions can be assigned to "culture":

- Culture gives "meaning"; it provides individuals with a framework for interpreting reality: myths, symbols and metaphors are ways of giving meaning to a lived reality. Culture also contributes to the sharing of interpretations within a group,
- Culture is a motivation, mobilisation, and action element for individuals, because it offers an interpretation of reality and associates a value with it,
- Culture ensures the maintenance and the reproduction of social order, it is a control tool due to the social norms that it disseminates. From this point of view, it also provides some safety for people; it protects them from choices or dilemmas that might be difficult to solve. It thus provides protection and transmission, offering a safe environment,
- Finally, culture is an identifying factor; it promotes feelings of belonging to the group and also enables access to a definition of self and "us."

Due to the existence of the functions of culture, some authors have attempted to identify the links between group culture and performance. This is the perspective from which the works on safety culture was carried out. Considering that risk management is a performance element, they have sought to identify and define influence relations between culture and safety. INSAG-4 stipulates for example that a "questioning attitude" or "near field" of managers are favourable to risk management.

Some authors have even gone further, since they defend the idea that it is possible to act on the culture and thus improve performance by enhancing culture. Acting on culture and, what is more, on "safety culture" (culture on safety matters) would increase the overall performance of the company; particularly its performance in terms of risk management. It is this assumption that led many companies in the 80s to develop "management through culture". Developing the corporate culture (values, behaviours, common objectives, etc.) thus allowing a significant staff mobilisation, would also be an informal control mechanism, and would thereby have a positive influence on performance, including economic performance. This is at least the theory developed by Kotter and Heskett (1992) and others, based on the analysis of correlations between culture and results in more than 200 companies (growth, return on capital, share price). It is also the premise of Ouchi (1981) who, in his "Z Theory", provides organisational forms (Toyota type) based on trust relationships and a "clan" culture that would serve performance. The strength of these successful companies lies in

the commitment of employees to the core values of the latter. Further cultural change conditions can be deduced from these theories, particularly in the event of a merger/acquisition.

Although after the wave of the 80s this cultural view of management lost its attractiveness, it has recently experienced a resurgence of interest. Indeed, in times of crisis, it appears as an employee engagement lever, enabling at the same time both savings on the supervision and control costs and a way to retain talent[5]. This managerial perspective of culture has been the target of ample criticism from sociologists, who consider that this view is simplistic; it does not take the complexity of the organisation and its social dynamics sufficiently into account and, above all, it ignores the time aspect linked to the emerging nature of culture. It should also be noted (Cole *et al*, 2013) that studies on safety culture mostly offer the diagnosis of an existing situation and do not really offer a forecast of the performance that can be expected from organisational changes.

In the field of risk management, however, several authors appear to be relevant from the perspective of the links that can be established between "Organisation", "Culture" and "Safety":

- M. BOURRIER (1999) makes a comparison between organisations in nuclear power plants in France and in the US, in order to determine whether the differences in their observed behaviour may be related to national cultures. While she does not altogether rule out the influence of national culture on risk management, she shows that theorganisation in the plant, which she describes as "meso" level, plays an essential role. She introduces the concept of ***organisational reliability plans*** (organisational characteristics of each of the plants studied) to name this collective operation. She stresses that if the rules are circumvented at the Bugey plant, it is not primarily due to being in France, but rather because the players cannot change the procedures. Meanwhile, at Diablo Canyon, or North Anna, there are powerful (and different) mechanisms to take into account the reality of current work and a real possibility of adapting the rules. "Just getting it done" is not necessarily a "French trait". It arises from the fact that if expertise and scant possibility of formally intervening on the rules are combined, we are moving towards a model of opaque and stressed autonomy... which has its advantages (autonomy can promote adaptability) and its limitations (opacity prevents sharing and debate regarding practices),
- K. WEICK (1987) combines culture and reliability directly through the notion of Sense-making: individuals make sense of events by extracting meaningful patterns from their experiences and life situations, but the interactions between members of the organisation also produce meaning enabling them to establish and share priorities and preferences for actions to be taken,
- D. VAUGHAN (2001), makes a historical and ethnographic investigation following the Challenger shuttle accident and focuses on the decision making methods. She raises the hypothesis that the bureaucratic structure of NASA's organisation, the corporate cultures (technical culture, engineering culture, secrecy culture) and the difficult economic climate affected the world view, the interpretation of the information and the choices made by those involved in the shuttle launch decision, resulting in a "standardisation of deviations",
- S. ANTONSEN (2009) developed a theory that strives to link organisational culture and safety. It is a case of shedding light on the way in which the informal aspects of the work and organisation are linked to the structures of organisations, where the correspondence between

[5] Les Echos, 17/10/2013, "when faced with the crisis, reinforcing corporate culture to generate performance", www.lesechos.fr

formal and informal organisation can influence risk management. Antonsen is also interested in the concept of power. "*A culture that influences safety positively is not necessarily a homogeneous culture without conflict, but rather a culture in which there is enough space to manage opposing views in a constructive way*".

In all of these works, it is clear that culture influences risk management; that is, if the levels at which it is addressed are specified (work organisation, industry, social group, etc.) and if the issues are addressed systemically and not in a causalist manner: in other words, if we seek to examine the role of culture in safe organisations without however deducing a mechanical relationship between a given individual element of the culture and safety. **Culture should thus rather be understood as a set of organisational and social criterions that influence risk management**, which nevertheless remains partly unpredictable insofar as each situation offers a new combination of players and processes. Moreover, these **criterions** are inherently unstable because they are living, and moving at the whim of constant changes in organisations (whether technical, organisational or human). In the following part of the report, four major aspects of culture are identified as potential points of support for better risk management, with the precautions mentioned above.

2.5 INTEGRATING CULTURAL ASPECTS OF ORGANISATIONS

From this overview of the research on culture, the IRSN notes that this concept allows access to phenomena of a sociological and anthropological nature that are difficult to address by other organisational approaches, enabling a better understanding of the fundamental principles of perception, interpretation and action of individuals and groups in organisations.

However, this culture concept must be used with caution, with some clarifications/precautions/ conditions:

- Separating "Culture" and "Safety": namely, considering that culture has a role to play in risk management, but that it is more generally related to the organisation performance which is global,
- Not considering that "culture" is only on the informal side, but rather that there is also "culture" in the formal organisation, particularly in the various procedures and tools used in technical processes, which are "carriers" of a world view, values, etc.,
- Taking into account two aspects of culture: on the one hand produced by the organisational and technical provisions, but also the production and construction of a group that emerges in the long term,
- Referring to 'cultures' in the plural and not to ‘culture’ in the singular: in fact, the organisation hosts and structures different groups with various cultures. Individuals are also likely to move from one group to another in the medium term (change of site, change of job, etc.) as well as in the short term depending on the characteristics of the work situations, including the conditions of the interactions between groups and between individuals (the values shared by service providers relative to the employees of a customer - the values shared by control engineers relative to planners),
- At the same time, specifying which "culture" we are interested in: in the approaches mentioned above, the "corporate" culture is implicitly and essentially referred to. Further on in this report, other aspects will be discussed, especially the "professional culture" (occupations),

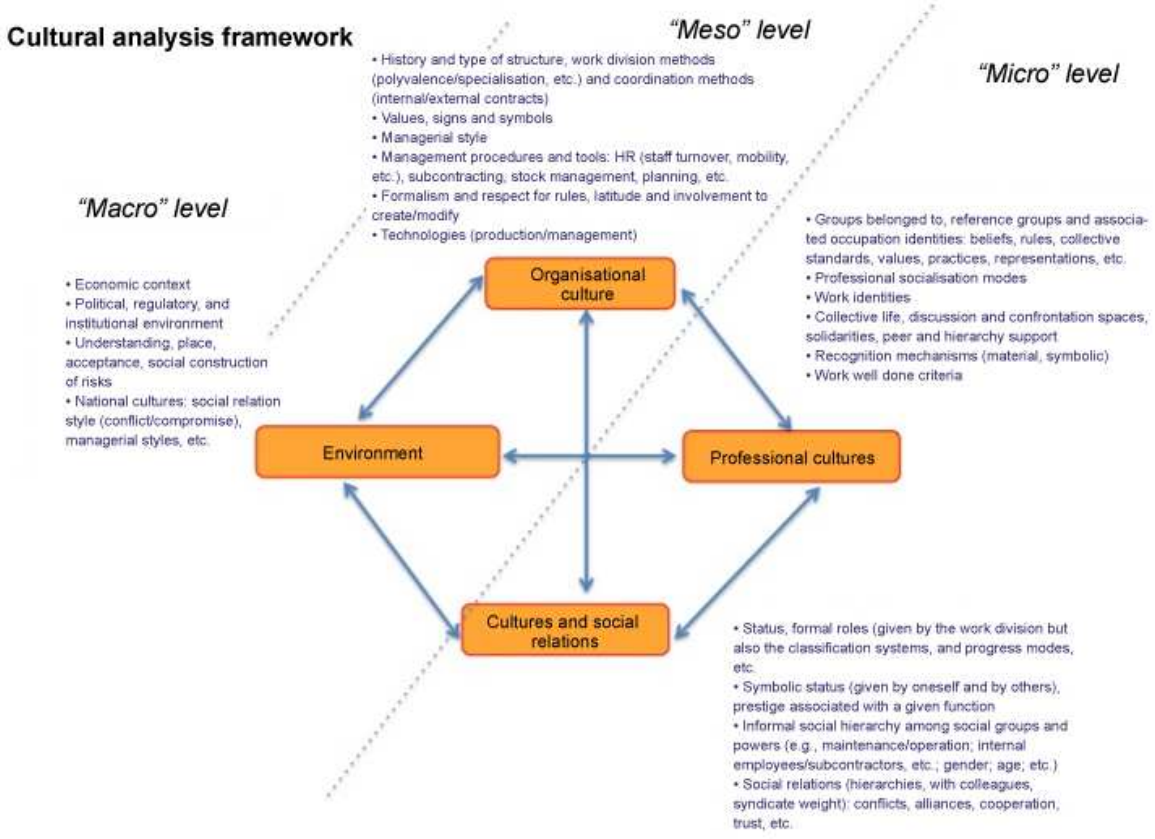
- Considering that there is no direct causal relationship between managerial and organisational arrangements and the development of a culture within groups. However, it appears possible to establish organisational arrangements whose effect on player cultures and work groups can be, to some extent, anticipated or expected. Given that culture is a complex whole, only influence effects can be sought. Given that culture develops in the long term and that industrial situations are eminently evolving situations, the "cultural impact" provisions implemented must also be considered with caution.

3. UNDERSTANDING AND ACTING ON THE CULTURAL ASPECTS OF ORGANISATIONS

3.1 A FRAMEWORK FOR ANALYSING THE CULTURAL ASPECTS OF ORGANISATIONS

From the literature review above, four analysis plans were selected to understand cultural aspects (plural) having an impact on risk management in high reliability requirement organisations. These analysis plans strive to outline a scientifically based perspective of action on the culture, thus closely linked to research in sociology and anthropology. These analysis plans are a way of breaking down the global topic "culture", which appears to be too complex to be addressed directly. They are intended to complement each other and to enable a comprehensive understanding of the cultural aspects of an organisation and the impact of these on risk management. However, each of these plans is understood in a specific way, with their associated concepts and methods that will be detailed in the following paragraphs.

First, we will present some transversal methodological principles to all "cultural" inputs (§ 3.2); then, each of these will be detailed in a common plan: conceptual references, application to the field of risk management, data to be gathered, and bibliographical references.



3.2 METHODS

Although culture is an emerging entity, and thus socially constructed, in line with works in ergonomics, sociology and anthropology, the methods to be adopted for its study have in general been traditionally considered as ethnographic "field work". In other words, it is a case of gathering facts, behaviours, points of view regarding these facts and behaviours (interpretations), representations, discussions, etc., striving to reveal the meaning and value systems underlying the activity of the players and the group cohesion. The data gathering methods are related to this perspective. They are opposed to the traditional hypothetical-deductive approach that builds hypotheses and then in an orderly way gathers items of information that will enable a response to these. Here, the analyst is rather in the position of being surprised by what emerges; he listens, watches and then puts in order the information and interpretations gathered to make sense of them.

Addressing cultural issues in this perspective means adopting:

- A comprehensive position,
- An inductive approach,
- Methods for gathering qualitative ethnographic data (through observations and interviews rather than with questionnaires)[6].

Based on ethnography, Antonsen (2009) formalised in this regard several characteristics concerning this way of working. They are summarized here:

- Preferably conducting the study in a natural working environment: in other words, the observation of the activity in a natural working situation and "*in situ*" interviews are preferable to conducting interviews in researcher's office, disconnected from the action,
- Giving full attention to the interpretation by the persons concerned: that is, to the sense made by the players of what they do,
- Using induction: the interaction to make sense of the behaviours and beliefs studied: that is, understanding comes from reading and interpreting the data related to the analytical frameworks or models, cross analysed against the views of the players, following an iterative system. The analyst contrasts his view and his interpretation with those of the players,
- Cross-referencing the data sources or "triangulating data": in order to limit the risk of arbitrariness and to increase the reliability, the analyst must use several methods to cross-check data and must also vary the gathering situations in order to gain access to the differences and patterns. The various data sources can include the following: interviews, observations, documentary collection of all kinds, and gathering traces of activity,
- Taking into account the context, the situation in which the observed phenomena occur ("*in situ*" action): an activity is always connected to a specific context.

To these generic principles, we can also add that proposed by D. Vaughan (2001):

- For this, insofar as culture is not visible, it is necessary to focus on the "events" that will lead to discussions, conflicts of interpretation, decision making modes, arbitration, etc. All of these observables will help us to learn about the culture. The events act somewhat as an indicator of normal operations.

[6] The criticism of questionnaire methods are known: the questions generally guide perceptions, they cause those answering them to ask themselves questions that they would not otherwise have done. A questionnaire enables "the external layers of cultural phenomena" to be analysed, those that are directly accessible (Antonsen, 2009), namely the artefacts, the behaviours, the standards and conventions, but not the deep layers (values, beliefs, identities, etc.).

This last important point here concerns the relationship between the analyst and his field of study and the manner of involvement of the latter. Anthropologists and sociologists have long emphasised the effects of the presence of an outside observer on the behaviour of players in the field, and the influence that it can have on the data gathered. Thus, anthropology advocates long term immersion in the field and sociologists advocate a scientific approach ("taking social facts as objects", as Durkheim proposes) to "neutralise" as much as possible the effects of observation. From another perspective, assuming that these effects are never completely reducible, another customary research method instead proposes to make the field-researcher relationship an object of study. As part of the assessments carried out by the IRSN in the field of organisational and human factors, this effect is even more significant if the organisational and human factor specialist is perceived as a member of the regulatory body.

Although these limitations are real and difficult to circumvent, it is only possible here to offer a perspective from which to approach the maximum. It is that of the involvement of the analyst[7]: the relationships of trust that he is likely to develop with local players make it possible both to limit the position of externality that only increases the risk of truncated data (fabricated solely for the purposes of the study and not a reflection of reality), while allowing immersion in work collectives.

The involvement of the analyst involves the active negotiation of the choice of fields and the access to data, by establishing clear rules on data use (including privacy policies), by becoming immersed for a certain period to encourage the establishment of dialogue and trust with all players in the field and, finally, by the flow of data (iterative dialogue on the data gathered in order to also obtain the interpretations of the data by the players).

Having recalled these generic principles, each analysis plan is now detailed conceptually and practically.

3.3 ANALYSING ORGANISATIONAL CULTURES

3.3.1 CONCEPTUAL REFERENCES

Generaly "organisational culture" refers to the "corporate culture". This view is part of a managerial trend from the early 80s that considers culture as a performance lever: by acting on the loyalty, commitment and identification of employees with their company, its performance is increased. The Japanese model (Toyota) was thus seen as a virtuous model based both on process optimisation (total quality) and on the way in which people become involved in on-going improvement efforts (participation). French companies have tried to import what had made it successful (quality circles, zero defects, etc.), but the implementation soon showed its limitations: the Japanese model worked because it was deployed in Japan, in a favourable cultural universe. The link was thus made between "corporate culture" and "national culture", thereby limiting management model imports.

The idea remains that it is possible to steer performance through culture: that explicit values broken down into principles and rules could guide the behaviour and values of company employees. Corporate culture translated into values, rules of behaviour and management principles, and monitored by management, is used to guide behaviours so that they contribute to the performance. Culture is understood here as an organisational product likely to change and to impose on members of the organisation.

In a more sociological sense, organisational culture is not a variable among others in the organisation, but rather a social construction, historically situated, emerging from interactions and confrontations between different social groups within the company. Culture is thus no longer a part, but rather a

[7] Cf. “Embedded Sociology” recommended by Bourrier (2010) who refers to war reporters; it consists in being involved in various events without divulging important information concerning localizations or names of people concerned.

"whole". The organisation IS a culture (Thevenet, 2013) and therefore deserves to be studied in the manner that an anthropologist would to the extent that an organisation is a human society, with its codes, rituals, values, and patterns, etc. Sociologists focus in particular on highlighting a heterogeneous cultural world, in relation to the social heterogeneity of the various staff categories. Individuals arrive in organisations with their cultures: professional and class cultures, etc. The "corporate culture" is the result of these cultural confrontations between social groups and is constantly being rebuilt through these interactions.

In this perspective, we try to reveal what is both shared (in terms of beliefs, representations, knowledge, sense) within the organisation, the consistency points in collective functioning, as well as the differences opposing social groups, for it is here considered that the organisation does not support a single culture, but rather consists of as many cultures as there are units or work groups (e.g., project groups). This approach differs from a survey on the "social climate", which focuses on what people think at a given time. It involves, on the contrary, focusing on what people do and say about what they do (the sense that they make of their actions) and on how the work framework elements (organisation, technology) exert an influence on those views.

3.3.2 PERSPECTIVE FOR RISK MANAGEMENT

Although the managerial approach to corporate culture presented above may appear too simplistic, a strictly comprehensive approach to culture that does not seek to identify "reasonable" means of action on the culture would be of little interest to anyone wanting to improve risk management.

According to Schein (1992), "Culture is a set of basic assumptions about how the world is and that determines their perceptions, thoughts, feelings and to some degree their other behaviour". From this point of view, there is no deterministic relationship between the "assumptions" (hypotheses), the "artefacts" and the behaviours, but they are nevertheless related. Management defines values and disseminates them into and throughout the organisation, expecting to thereby shape culture as a basis for the commitment and motivation of individuals, and ultimately to guide their work practices. This design of the links between culture and organisation has led to studies of organisations that do not consider the latter only in terms of the functional requirements and of the related processes, or in terms of power relations. These studies seek to understand how the organisation "holds together" the various players and promotes the inclusion of their actions in a shared and consistent framework. Such studies have especially been developed by D. Vaughan (1996) and M. Bourrier (1999, 2005), mentioned in Paragraph 2.4.

We can find this approach to organisational culture in the perspective proposed by I. Fucks (2012), which speaks of "organisational configuration", of a "structure" within which "safety culture" evolves and is built. This configuration consists of five interacting fields: the social group, the work and the players, the organisation, technology and risk, and the organisation's environment. From his comprehensive position, I. Fucks also stresses the importance of the sense made by the players of the events and elements relating to the situation.

In the same perspective, P. Lorino[8] proposes considering safety as being at the core of the organisation, and not as an aspect or a specific quality that could be managed independently. "*Neither safety nor quality can be significantly improved by establishing a specific and isolated management device. It is part of the organisation*."

Finally, M. Bourrier (2005a, 2005b), like P. Lorino, emphasises organizational variables that affect the construction of reliability: planning, cooperation with maintenance, choice of subcontractors (the procurement process), HR processes, the degree of involvement of the players in the process of creating rules, etc.

[8] Interviews carried out by the IRSN for this report

Dealing with the "corporate culture" means addressing these various aspects bearing in mind that the organisation, in its specific configuration, is more or less fertile ground for the development of reliability.

3.3.3 DATA TO BE GATHERED

Thus defined, the study of "corporate culture" therefore has a certain complexity. To deal with it, "traces", "hallmarks", facts and interpretations must be gathered. This assumes focusing both on the identifiable and describable organisational and technical component formal frameworks (to the extent that it is possible to access these data) and on the meaning that they have for the players, that is to say, the way in which these frameworks influence the actions of the latter and make sense to them. This, maintaining a certain distance with regard to possible projections, hunches, impressions and opinions (of the analyst). Being interested in the meaning given means gathering facts and the interpretation of those facts by the players themselves. "*In the symbolic approach, it is not a case of finding what is (...), but rather what the social body retained* of it" (M. Thevenet).

Based on the methods formalised by M. Thevenet, the IRSN proposes to retain the following aspects to fuel the study of organisational culture:

- **Historical elements**: the circumstances of its creation, founders and history of the founders, milestones, stages of its development (with regard to the activities, technologies, structures, scope of the organisation, strategies, etc.). All of this contributes to structuring myths of the beginning that often persist long after the founding and evolution of the organisation.
- **Activity**: the core business, specific and distinctive know-how, and technologies.
- **Values**: generic values of the organisation (distinguishing "declared values": those in the texts, institutional discourses and "operating" values, those that are found in the management systems, decision making methods, procedures in general - recruitment, budget, etc.); safety-related values (what is considered "good" risk management/"bad" risk management, etc.).
- **Signs and Symbols**: behaviour codes, space planning, captions, etc.
- **Structure type** (entrepreneurial, professional, bureaucratic, mechanistic, innovative, missionary, or politicised organisation), work division arrangements (versatility/specialisation, etc.) and coordination (internal/external contracts), see Mintzberg (1989).
- **Management style**: see R. Likert (1961) (authoritarian/directive style, paternalistic/benevolent style, consultative style, or participative style).
- **Management tools and processes**: distinguishing management tools (action oriented) and assessment tools (reporting); identifying the tools as such, as well as the discussions and the underlying value systems (Boussard, 2008). Discussions give meaning to the tool.
  Among the devices, the following can be distinguished: processes aimed at optimisation, rationalisation (operating procedures, quality processes, etc.); managerial arrangements aimed at regulating social relations, commitment and motivation of players (performance contracts, HR systems in general); measuring devices and the reporting of results (charts, etc.); procurement processes.
- **Rapport with the rules**: latitude to change the rules, degree of involvement of the players in the process of creating rules.
- **Event management arrangements**: decision making process, arbitration criteria and methods, etc.. (see D. Vaughan).

It is not a question, of course, of exploring all of these aspects, but rather of identifying those that are relevant to the context and the problems to be dealt with. It should be stressed that taking into account historic aspects enables applications for improving the organisation and management system to be guided along a path (e.g., between a more centralised and a decentralised movement).

3.4 PROFESSIONAL CULTURES AND IDENTITIES AT WORK

3.4.1 CONCEPTUAL REFERENCES

It is in sociology, clinical sociology and work psychodynamics that most work can be found on these subjects. Culture is closely associated with the notion of identity here. Thus, the cultural identity of a group or of an individual is defined by a set of affiliations (gender, age, social class, occupation, nationality, etc.). It is what distinguishes a group, or an individual, from others. Thus, “the identity enables the individual to get his bearings in the social system and to become socially identified himself" (Cuche, 1996). It is the same for groups. **Identity means both "inclusion" (meaning membership) and “exclusion” (what differentiates one group from another).**

Depending on the approach (functionalist, interactionist, or clinical), this culture is "inherited" from the group(s) to which one belongs, resulting from a "socialization" process (within the family, by institutions, by education, by work, etc.) or is on the contrary the product of social and individual building (rapport with the Other, relationships, social exchanges, the result of personal choices, etc.). Therefore, it fluctuates, undergoing continuous redefinition. For those who consider that "culture" is "second nature", identity is a "legacy" of the original group belonged to. In other words, the group’s identity pre-dates the individual who can only adhere to it. The identity creates a "sense of belonging", it enables the identification of a more or less imaginary community. Faced with this objective conception of identity, subjective design argues that identity is the product of a located social construction. It can therefore be the subject of strategies, emerge in given situations and not be permanently fixed. In other words, there is no identity in itself, there is only that which exists in social relations (that which one gives oneself and that others give us - self-identity and hetero-identity).

These two approaches can be found in the works on the concept of "socialisation". It is a case of understanding the processes by which individual and collective identities are forged, generating debates to try to define the extent to which identities are "taught" by a form of social conditioning (Parsons, 1954), are incorporated gradually by individuals[9], are learned along the long stages of child development (psychologist Jean Piaget's work), and/or are constructed from social interactions (Mead, 1928). In his book, C. Dubar (2010) proposes an ambitious retrospective starting from Piaget's psychology to reach a sociological theory of identity in which the subjective trajectories of individuals are as essential as the cultural context. Two ideas throughout these works can be used:

- **A distinction is made between two socialisation methods: primary socialisation,** corresponding essentially to that which occurs during early childhood within the family, enabling the acquisition of basic skills such as language; and **secondary socialisation**, corresponding to that made by the institutions – particularly schools – and within the workplace, which is never finished. It is more particularly the latter that appears interesting here, insofar as it contributes to the development of a "professional" identity,
- In a more interactional design, social reality is not a whole and cannot be "incorporated" as such: it is the subject of representations and interpretations, a structure still in the making. **Social identity cannot be fixed once and for all. It is a balance between identity for itself** (the one

[9] R. Benedict, from a comparative study of 3 different societies, shows the way in which the individual personalities are forged by the progressive incorporation of the culture of the society that they belong to; P. Bourdieu with the concept of *habitus* focuses on the incorporation (reproduction) of the social systems into which the individuals are integrated, as well as on the way in which they construct and disseminate new ones (Benedict, 1934).

you want, that one that you believe you have and the one that you wish to assert within a group – the I), **and the identity for others** (that attributed by others, for which we are recognised, which may be built upon - the ME). Here we find a duality between the "reference group" - that to which one aspires, and the "home group" – that from which we come (see H. Hyman, 1942). This fundamental duality can lead to internal tensions, negotiations, and therefore to strategies on the part of a player trying to reduce the gap. In this view, identity is thus basically a rapport between each other and the work (hence the typology proposed by R. Sainsaulieu, 1985)[10].

Building identity through work and its impact on work commitment

Clinician sociologists are particularly interested in the role of the professional sphere in identity construction. Similarly, according to the psychodynamics of work, work cannot be reduced to a production activity in the objective world. *"Working is not just to produce, it is also to transform oneself"* (Dejours, 1993). **Work is thus understood as an experience** that engages the body, emotions, and affectivity. **It is in itself a source of identity, a meaning provider** or even a source of health, that is, if margins for autonomy and creativity exist, if there is a possibility of leaving one's mark, i.e., if the prescription and/or constraints do not stifle autonomy and responsibility, which are sources of commitment to work. G. Canguilhem said: *"I am healthy if I am responsible for my actions, if I can contribute things to life, and if I can create things that would not be there without me"*.

Although this part of work sociology and psychodynamics research seems more difficult to use within the context of safety assessments by the IRSN, it may however be appropriate to address the issue of **the balance between contributions and compensation (both in material and symbolic terms) on a social group level**: contributions to the activity, to safety, etc.; material remuneration (salary, bonuses, overtime, etc.) and symbolic remunerations (status, time, signs of recognition, etc.). In this respect, the example of the study of nuclear power plants managers conducted carried out by G. Jobert can be an interesting point of support. This analysis makes it possible to understand the possible sources of discomfort that may produce disengagement, or even conflicts between professional groups, and to have an impact on risk management.

Occupation and profession as a source of common standards

The terms "occupation" and "profession" are sometimes used interchangeably, although referring to different concepts. These differences, as analysed by professional sociologists, occur on two main levels: the type of knowledge involved and the mode of acquisition of such knowledge. Thus, the term, "occupation," generally refers to manual, technical or mechanical work associated with a set of knowledge that is acquired through experience, repetition, routine. The term, "profession," refers to activities involving academic knowledge (e.g., doctors) requiring a capacity for abstraction. A profession is transmitted by teaching, that is, the oral and written explanation of knowledge. The profession is "professed" in training. A prestigious label is also attached to the notion of profession. In other words, a profession has a statutory existence (which can be as far as an "order" or "occupation association"). This statutory existence makes access to it necessarily more difficult; it is controlled by its members, in fact a relatively closed social group. In the end, a profession is socially organised and recognised.

[10] In his work, R. Sainsaulieu distinguishes 4 types of work identities, notably as a function of players' access to power and of their individual trajectories bringing work values (symbiotic identity, withdrawal identity, negotiation identity and affinity identity). These identities coincide in part with the groups belonged to and with the status within the organisation (self-taught supervisory staff, non-qualified workers, technicians, qualified professionals, etc.). Thus the enterprise is the site of group micro-cultures and the latter are defined both by the internal work organisation and by the groups to which each belongs. Given that each individual is in fact a member of several groups, the interactions between social groups within the company are complex.

Sociology has made professions a field of study since the 20s: it is divided into two approaches (Champy, 2011). One, a functionalist approach, has focused on the study of professions considered as such pursuant to two criteria: a high level of expertise and a "service-based" aspect. In this perspective, the study particularly concerns the favoured unit traits (values, knowledge, etc.). In the second interactionist approach, sociologists have, on the contrary, described the specific features that distinguish professional groups. The new sociology of professions advocated by F. Champy offers an articulation of these two aspects. Taking the example of architects, it highlights the "professional culture" imposed on all architects, which is based on shared knowledge and values. Mastery of the same culture integrating common values gives unity to the profession. Then, based on the analysis of professional activities characterized by the complexity and singularity of the situations to be dealt with, he highlights the deliberative part of these activities. These deliberations result in trade-offs that reveal hierarchies of values at some point, enabling various "professional exercises" to be distinguished, that is to say, local professional cultures. This allows him to question autonomy and more generally the conditions that are essential for prudential deliberations: time for reflection, etc.

Identifying these professional or occupational cultures within the same organisation is valuable both to update resources and standards that could constitute benchmarks to conduct its business, and to understand potential conflicts/tensions between social groups and explain action strategies. This is particularly noticeable when changes move the identity boundaries of both people and professional groups.

3.4.2 PERSPECTIVES FOR RISK MANAGEMENT

The consideration of cultural aspects can enrich risk management system assessments, in particular:

- **The professionalisation process:** these can be addressed through the consideration of the organisational provisions implemented (training, tutoring, retraining, etc.) and in terms of the technical skills acquired. However, this process goes beyond just these aspects if we take into account the fact that professionalisation also enables the sharing of professional knowledge specific to a given community, thereby fostering a common "culture" for this community and contributing to its cohesion. This secondary type of socialisation is particularly important insofar as it helps to understand how work standards are built, transmitted and made sustainable. Professional "culture" constitutes here a method for integrating young entrants, as well as building skills,
- **Inter-group cooperation:** this can be addressed from the perspective of the different places and coordination support tools considered purely on a "functional" level for performing the tasks. However, the quality of cooperation also depends on the way in which these sites and tools take into account the pivotal role of the social group recognised as being of the same occupation or same profession, as well as shared values (e.g., operation, maintenance, logistics, dismantling, etc.). The group imposes standards, rules, ways of doing things, and values of its own, and thus plays a role of leadership and control over its members that will affect cooperation.

With regard to professional identities and cultures, the work of Guy Jobert (2014) can be mentioned, which refers to a study carried out in the early 90s aimed at understanding the discomfort of the operation staff of nuclear power plants, despite apparently favourable working conditions. The author in particular emphasises the important part of "hidden work" performed by these, generating a psychic load, an emotional commitment to action that the reward system does not recognise. This "blocked" recognition generates discomfort and counter acts on the commitment of the staff. If this commitment remains intact despite everything, it is thanks to their patent "gift", their sense of Duty to the Nation and to the company to which they owe their position in society.

With regard to the occupational culture, the work of F. Osty (2003) is particularly fruitful. Based on the observation of a relative failure of new forms of work organisation, F. Osty believes the occupation "is back". It has a triple virtue: the creation of a know-how and skill development area, participation in the development of an individual and collective identity, and that of making rules (behavioural standards within a given professional group, and work quality standards, as well as exchange rules between professional groups). The understanding of the construction methods for professional know-how are in particular applied to nuclear power reactor operation teams. In this particularly complex world, it is in particular shown that reliability cannot be based solely on the application of rules and procedures, but rather that effectiveness is also based on the empirical knowledge held by staff. However, this empirical knowledge, this "knowledge in action" is notably based both on professional socialisation modalities that are at the same time formal (training), and also on forms of sponsorship, tutoring, team exchanges, etc., and on opportunities that allow the construction and transmission of knowledge and values, as well as on the cooperation/adjustment skills needed to cope with contingencies. In addition, this peer enabled socialisation enables the building of trust within teams, trust in the professional actions of others, and mutual recognition, which facilitate the development of common standards. Finally, the conviviality that develops, the rituals and meals, etc., are also a way of collectively managing the emotional load related to this risk universe. Thus, informal professional socialisation conditions are seen as a resource both for individual know-how and skill building and for building a work collective within in which cooperative practices can be carried out, which are also essential for risk management.

3.4.3 DATA TO BE GATHERED

Dealing with professional or occupational cultures within a given organisation is difficult, insofar as they consist both of formal elements that are immediately accessible (e.g., professional socialisation modes), but mostly less immediate elements ("veiled variables", or "buried" variables according to the terms used by I. Fucks) that can only be analysed through work observations (particularly the cooperation and coordination phases) and interview about these observations, allowing access to the sense made by the players of the professional practices identified.

Based on the work of F. Osty (2003), the IRSN proposes to retain the following aspects to study the professional and occupational cultures:

- **The social groups belonged to**: a formal professional line (referring to the officially used nomenclature), as well as a reference group (the one that makes sense to the player). The study may involve various levels: the company; the plant or site, and the related features (values, operating modes, atmosphere, etc.); the professional line (operation, maintenance, etc.); the occupation (electromechanic, valve repairman, etc.); etc. The goal is not to carry out an exhaustive exploration, but rather to identify and prioritise the 2/3 reference groups to which an individual, or a community refers, on which it relies to the extent that it is both an identity resource and also a knowledge resource and a milestone for work standards.
- **Professional socialisation modes provided** by the company (training, career paths, etc.), peers (tutoring practices, buddy system, rotating implications), hierarchy (training sessions, tutored simulations).
- **Collective life and exchange spaces** for trust and cooperation, and ways to regulate potential tensions or conflicts: collective life (rituals, meals, etc.), solidarity/cohesion within a professional group (degree of cohesion, support modes, hierarchical role in collective life in general), for exchanges (meetings, informal exchange times, time spent on them, etc.) method for managing tensions and conflicts (arbitration modes).

- **Skill recognition mechanisms** (in the classification system, as well as peers), and more generally (salary, classification, compensation, bonuses, various benefits, overtime pay, participation in projects, autonomy, room to manoeuvre, etc.).
- **Work "well done" criteria** and the quality of work, which may in particular emerge from events to be managed, uncertainties and dilemmas, sparking debates that enable the implementation of these criteria to be observed. At this time, different professional practices may also emerge within a same occupational family.

The consideration of the cultural aspects that contribute to the cohesion of professional groups is especially important when work is increasingly performed by players associated with various organisations, e.g., working in project mode in relation to sustainable entities, resorting to subcontracting.

3.5 CULTURES AND SOCIAL RELATIONS

3.5.1 CONCEPTUAL REFERENCES

Sociology considers the organisation as a social system, i.e., a meeting place, a place of confrontation between social groups among which there is a social hierarchy, roughly covering the formal hierarchy (vertical direction on the organisational chart). Therefore, like any social system, it is a hierarchical system in which **power relationships** are at play; struggles, strategies and domination. In this "game", no group, even the "weakest, is completely powerless in relationships. Each has strategic resources.

For some sociologists, culture is thus addressed in terms of social relations that determine a social and cultural hierarchy. *"Cultures do not exist independently from social relations, which are always unequal relations. Thus, there is a hierarchy between cultures resulting from the social hierarchy"* (Cuche, 1996). Many studies have thus focused on these "cultures" to try to define and analyse their respective social positions. This is the case for example, of the work of Lewis (1983) on the "culture of poverty": a way of "being in the world" for people who feel excluded from an economic system that values economic success. Populations that develop a distrust of state institutions, practice purchasing on a day by day basis, identify strongly with a territory (district), etc. O. Lewis also shows that this culture is a real resource, a form of active "resistance", a way to rehabilitate themselves as social players. Along the same line, work on "class culture" can be found (identification of cultural traits that are specific to particular social class - workers, bourgeois, capitalist entrepreneurs and their Protestant inspiration, etc.), as well as on "mass culture" , "popular culture", etc. Each time, the approach is the same, it is a case of identifying traits developed by a segment of the population, traits that at the same time serve to characterise own behaviours, which are identity elements, but that also define a position of this segment in a social hierarchy.

This approach to culture can be described as "political" in so far as it refers to the relationships between social groups, seen as relations of domination. From this point of view, the notion of habitus developed by Pierre Bourdieu (1979) can be compared to that of culture. It refers to durable and transposable provisions; it characterises a social group, is deeply internalised, and constitutes unconscious patterns that result from a socialisation work to which the individual is subject. The habitus is also an embodiment of the collective memory. What appears to be natural (behaviours, habits, etc.) actually comes from a habitus. Personal styles are merely variations that reveal the uniqueness of the position and trajectory of an individual within the class. The habitus is thus subject to change throughout life (social mobility).

Sainsaulieu (1985) also in a "political" approach to the world of work, proposes a strategic reading of identities: he thus identifies the types of behaviour with social-professional categories and with the conditions of access to power related to these categories: thus, for example, a symbiotic identity would

be characteristic of specialised workers and would result in collective struggles, strong solidarity among peers, strong identification with a charismatic leader, etc.

Work carried out on gender or age has been along the same line. In the 70s, many studies were conducted to show how sexual relationships reinforce social relationships. Women would thus occupy jobs that reflect the social division of roles within the family. There would be skills that are specifically more "feminine" and thus occupations that are "naturally" more feminine than others.

Similarly, a number of studies attempt to show the specifics related to age (seniors, Generation Y). For example, the studies conducted by Delay (2008) focus on revealing new modes of involvement of young people with regard to work (cooperative individualism, autonomy, negotiated reciprocity, better work/life balance, strong IT familiarity, etc.).

This social division of work and organisation is another possible reading angle for cultural issues. It leads not only to identifying social categories with their own characteristics, but also to better understanding the sources of tensions, or even the conflicts between social groups and the strategies that these groups may need to deploy to maximise their resources.

3.5.2 PERSPECTIVES FOR RISK MANAGEMENT

The work in sociology of organisations conducted in the nuclear field are scarce. Mathilde Bourrier appears to be a key author from this point of view. She provides a strategic approach to reliability: *"Reliability should be analysed as the product of choice, decisions and successive, parallel and concurrent regulations, congruent or conflicting as appropriate"*, and thus proposes to analyse high-risk organisations *"from the point of view of the players, of their strategies and of how they negotiate their participation in a very demanding organisation"*. She is particularly interested in strategic games, in the player games that take place around the "prescription", the rules and the procedures, and deduces "reliability plans" from them (specific organisational configurations). Indeed, these are particularly determined by each other's social place within the organisation; places that are different for different plants. Comparing the operation of four nuclear power plants (2 in France and 2 in the US) during the 90s, she identifies various "regimes". For example, in Bugey, circumventing rules would be relatively common and can be explained by the fact that technicians would not participate either in the development or in the changes to the rules and, similarly, would not forward information up the command chain with a view to improving them. This would be accompanied by a specific socialisation, belonging to a particular community that defines "how far one can go too far". This model, which would promote "DIY", is effective from a certain point of view, but by increasing the gap between what is prescribed and what is real it risks stretching limits of acceptability and would promote opacity, encouraging partitioning and turfs.

Another example of a reliability scheme, is that of Diablo Canyon in the USA: a form of bureaucracy (division of tasks, long hierarchy line, excess of procedures, etc.) that nevertheless "would work." The unexpected would be limited, through planning, to the support that technicians would benefit from, to a lack of appreciation of initiative, etc. In other words, M. Bourrier demolishes the idea of "too much" or "not enough" procedures, and supports the idea that reliability is built upon the quality of the social relationships and interactions that develop in relation to these rules and procedures. However, the latter is determined by the relative positions of the various social groups, the opportunities to exchange and negotiate where applicable, the absence of sterile power games that would lead to hiding information or to not cooperate, etc.

She thus makes the connection between a social reading of the organisation and reliability, which then becomes the product of interactions. This social reading can partially cover "occupation" reading, but adds new aspects. Thus, for example, beyond the traditional division between "operation" and "maintenance", there may be rivalries between maintenance teams related to their different histories. Similarly, the manner of exercising the supervising function can be different for different plants,

depending on whether it is embodied by a technical expert who draws his legitimacy from his knowledge of the field, or by a "manager" who has a distinctive way of leading the collectives. She also shows how organisational reforms jostle alliances between social groups, transforming social regulation methods.

The approach proposed by M. Bourrier thus appears particularly fruitful for understanding what is at stake in social balances, which may constitute barriers or, on the contrary, levers in the cooperation and co-construction of risk management.

3.5.3 DATA TO BE GATHERED

Specifically, it is a case of accessing the fine balances that develop between social groups within work organisations, beyond the formal aspects. In methodological terms, it may be useful to build upon the work carried out in classical sociology of organisations (see Bernoux, 2014) which gather data on the following aspects:

- **Formal elements relating to the ways of exercising power and to the division of work:** hierarchical strata, classification and recognition system, horizontal division of work, social data (age, gender, seniority, etc.),
- **Symbolic aspects related to the roles and places within the organisation.** It is particularly a case of identifying: the prestige associated with a particular function, how to participate in the development/modification of rules and procedures, autonomy, decision latitude and control of areas of uncertainty[11]. These aspects can be understood from the analysis of work meetings; for example, the decision-making modes (who decides what and by what process - see in particular the issue of developing and changing rules), the autonomy margins associated with a particular function, respecting the rules, etc,
- **Elements related to the interactions between players and groups of players**: analysis of player games, alliances, cooperation, and the conflicts that are forged.

This strategic reading of the organisation and the players helps to understand both the levers and the potential bottlenecks, for example, in the implementation of a reorganisation, since any change indeed modifies the grey areas controlled by the players, resulting in a change in the power balances.

3.6 INFLUENCE OF NATIONAL CULTURE

3.6.1 CONCEPTUAL REFERENCES

A number of studies seek to identify managerial modes, or types of social relations, which are specific to certain countries and could be associated with national cultures. P. D'Iribarne (1989, 2005) in particular emphasises the impact of national culture on corporate culture from a comparative study between 3 countries (France, USA and the Netherlands). For him, it is not a case of a simple "cultural veneer" but rather of real traditions that are rooted in the texture of our social relations throughout collective life (inside and outside of organisations). Thus, an honour system would be at work in France, according to a principle derived from the codes of medieval knights, while a contract system would prevail in the US and a consensus system would be needed in the Netherlands. Similarly, according to T. Philippon (2007), there would be a French specificity in work relations, described as traditionally conflicting relations between employees and employers (a winner/loser type of relationship), generating a foul social climate that is hardly favourable to employment and productivity. These relations are rooted in the history of

[11] Strategic analysis distinguishes 5 main uncertainty areas. Power is related to the control of one of these faults of the organization. The 5 uncertainty areas are the following: economic uncertainties (cash, investments, customers, contracts, etc.) environmental uncertainty (technical change, etc.), technology-related uncertainties; organisational uncertainties (work division, distribution of powers, etc.) and social-cultural uncertainties (player motivation, learning abilities, etc.)

the countries: the union construction history and also the family capitalism history that characterises French society, where power is held by "legacy".

Although there is necessarily a reciprocal influence between the traditions of a country and the modes of organisation of companies, it is however difficult to characterise this link and the work by Bourrier (1999 and 2005b) calls for caution with regard to a cultural interpretation that would neglect the influence of the role of local organisations having a "meso" level of analysis.

3.6.2 DATA TO BE GATHERED

As part of the safety assessments performed by the IRSN, the identification of the traits of national culture and the study of their influence on the organisation of operators appears to be irrelevant: it requires investigation means that are not on a par with instructions, it presents the pitfall of stumbling into the obvious or into clichés about national or regional behaviour, and may not allow ways for improvement to be identified.

However, it is necessary to identify the cyclical and contextual variables that can permeate the global culture of the organisations of operators, and explain the strategic choices involving the players:

- Environment, institutional and regulatory policy: type of risk governance, regulatory changes and prescriptive force of the latter, etc.,
- Economic environment that may influence the strategic choices: restructuring,
- Social construction of risks: place of risks in the company, consideration for the nuclear industry, etc. (coupled with the mobilisation of civil society players),
- National/regional traditions in social relationships (employer-employee relations) and hierarchical relationships (management design),
- Regional industrial fabric, and its ability to meet the needs of established sites.

4. CULTURAL ASPECTS OF SOME CURRENT ISSUES

This section presents a "cultural review" of some topics that have been the subject of evaluations by IRSN specialists in human and organisational factors and have been identified as common to numerous safety assessments. It has been carried out using expert assessments that have already been performed, and discussed by a panel of organisational and human factor experts. The meetings with the experts[12] made it possible to identify how these expert assessments addressed issues related to cultural aspects and to appreciate how the cultural approaches presented in Chapter 3 opened prospects of enrichment for expert assessments. This is a later analysis, whose main limitation is not being able to enrich the data gathered.

4.1 CULTURAL ASPECTS OF ORGANISATIONAL CHANGE: THE OUTAGE ORGANISATION MODIFICATION PROJECT

The evaluations within the scope of this section are those in which analysing the impact management of an organisational change, and its potential consequences for risk management, is explicitly required.

An analysis of the cultural aspects The evaluations within the scope of this section are those in which analysing the impact management of an organisational change, and its potential consequences for risk management, is explicitly required. Evaluations **of an organisational change can explore the following:**

- ⇨ **"Macro" level: foundations (sense) of the organisational change and its inclusion within the existing organisational culture** (global - at a company level for example, and local, at a site).
- ⇨ **"Meso" level**
  - o **collective aspect of the activity**: role distribution, cooperation/conflicts, etc., player games (uncertainties, strategic resources, etc.), balances of power (strong players, etc.),
  - o **collective life** : socialization methods, their impact on trust and practice sharing,
  - o **symbolic and identity aspects** contributing to giving meaning, to motivating staff, to unifying practices and to creating adhesion: standards, values, rituals, representations, myths, symbols, identification spaces (status, enterprise, occupation, etc.), recognition arrangements (by hierarchy, by structure).
- ⇨ **"Micro" level**
  - o **Cooperation and coordination modes:** evolution of cooperation dynamics, decision making processes and arbitration,
  - o **collective life**: recounting experiences.

For each aspect, it is a case of identifying the 'before' and 'after' of the modification, in order to emphasise the difficulties, the tensions produced, and also the adjustments that may be favourable to risk management.

[12] 3 meetings were held, on each of the subjects studied, between March and June 2015.

Illustration by an example: In the late 2000s, EDF deployed new outage management provisions (COPAT). These provisions were the subject of a risk study and their deployment was phased with the support of national engineering units. The IRSN conducted an assessment of the radiation protection safety management during the outage, following these organisational changes. The topics for which clarification through the concept of culture could help to complement and deepen a strictly organisational approach are presented below.

4.1.1 INCLUSION OF THE NEW OUTAGE MANAGEMENT PROVISIONS IN THE EXISTING ORGANISATIONAL CULTURE (NATIONAL, SITE)

The COPAT proposes a new way to organise outages, in order to improve the effectiveness of their management and to reduce their duration. The project, based on the Outage Control Centre (OCC) developed in the USA, in particular includes innovations that introduce significant changes in the ways of carrying them out.

- "Managerial style" associated with the new outage management provisions: the new outage management provisions are based on function and power transversality principles. Both features are a breakthrough in the management style of this company and in the management of outages, which has traditionally been centralised, pyramidal, and used to operating within a highly concentrated core. By spreading the roles and responsibilities over a larger number of players, the idea of a collaborative operation is introduced. Within this organisation perceived as more "diluted", employees may feel less assured of a good risk management, raising the question of the arrangements to be made to engender the necessary trust between players;
- Consideration of the variability of "site cultures": the outage management device was deployed on 19 sites on French territory. The diversity of the deployment and ownership dynamics observed revealed relatively varied "Site Cultures", related to the history of each site to the profiles of the staff, to social relation modes, etc. The identification and consideration of these local characteristics deserve to be taken into account in the organisation and evaluation of the site deployment provisions defined nationwide.

4.1.2 COLLECTIVE ASPECT OF THE ACTIVITY

An outage is a specific period in the operation of a nuclear power plant. It is a time away from the activities and therefore has a specific organisation, in charge of carrying out a series of maintenance operations in the shortest time possible (given that a plant outage generates a significant cost/loss of income). This organisation in "project mode" involves many employees from different professions, who come together for a short period of time to steer and implement this activity program. The questions of coordination between these players and of the management of their activities are essential. However, the COPAT mode modifies the distribution of roles and responsibilities while at the same time raising activity coordination questions, but also with regard to cooperation between different occupations. The following aspects could be the subject of a cultural approach:

- Development of a common adjustment: conducting an outage and managing the associated risks are a collective matter and each player in the chain has a defined role. It is important to assess to what extent the new provisions include formal and informal exchange , likely to promote coordination as well as different points of view and the development of a shared repository;
- Legitimacy of the project manager: the legitimacy of the outage project manager relates, on the one hand, to his/her technical expertise (trajectory within the company), and on the other hand to his/her managerial skills. Although these positions were previously held by experienced engineers, EDF has tried to make a trampoline job for young entrants, which has created tension to the extent that this conflicted with how legitimacy was usually forged. A cultural approach to

this question should better take into account the construction dynamics of the "competence perceived by others" and the reputation, which are essential aspects of management.

The study of these aspects enables the understanding of what organisational balances the trust and the work of players were based upon and how the introduction of COPAT changing these references can cause difficulties.

4.1.3 SYMBOLIC AND IDENTITY ASPECTS

The establishment of a new organisation necessarily upsets the symbolic and identity references of the teams. In particular, it questions the place of everyone in the system:

- Social hierarchy: continuous functioning is common in the world of operation, but not in that of outage steering, which was previously carried out only during the day. These working hours, the associated remuneration systems (overtime, bonuses, etc.) and the status given to the members of the operating team make them a class "apart", conferring to them a place in the social hierarchy. It could be interesting to investigate whether the introduction of continuous steering of the maintenance activities performed during an outage can affect the positioning of the players within this social hierarchy;
- Inter-occupational tensions related to systems specific to each occupation: each occupation has its objectives to meet, its deadlines, its constraints to minimise and its representations of work well done (professional values). These occupational systems unite members of the same group and thereby also contribute to safety and to radiation protection. Working together within the COPAT organisation, these various systems may be different, leading to tensions, conflicts and finally to difficulty in carrying out the operations. It seems interesting to better understand how the project system (project culture) and occupational system (occupational culture) are different and how spaces for exchange and confrontation of their underlying values can promote their articulation.

4.1.4 COLLECTIVE LIFE

The aim here is to question how a new organisation can evolve, or even undermine, informal spaces for meetings and exchanges, socialisation modes of new entrants, etc. These contribute to creating conditions of trust and cooperation, while not being recognised by the organisation, therefore potentially becoming "forgotten" reorganisation projects.

- Physical Locations: COPAT members have a dedicated place in new buildings, away from the rest of the plant. Although belonging to the project group can be reinforced for those who are involved, through the particular collective life that may be deployed within it, it can also increase the separation from the others: at the time of an outage but also *a posteriori*, when staff members return to their original post. This separation can be addressed from a strictly functional communication and coordination point of view, or it could also be addressed from the perspective of the cohesion of the overall organisation of the plant.

4.2 CULTURAL ASPECTS OF THE INTRODUCTION OF A MANAGEMENT TOOL: RISK ANALYSIS IN RADIOTHERAPY

This is a classic topic in safety assessments by the IRSN, whether it is its main theme, as in the example that will be detailed below, or whether it is simply part of the field to be explored.

In the end, the analysis of the cultural aspects of a management tool assumes that various different levels are articulated:

- Speeches,
- The tools themselves, as "technical" tools,
- The appropriations, use and social constructions of the tools.

Applied to management tools, the analysis of cultural aspects can thus address the following aspects:

- ⇨ **the intention behind the tool,** its intrinsic logic, the principles and values that underpin it and its inclusion in the existing organisational culture,
- ⇨ **the construction of the tool,** its mechanics, the lessons that it provides and its articulation with professional cultures**,**
- ⇨ **the impact of introducing the tool on the work of players and on social relations,** the changes that it causes in the modes of cooperation, and the relations between social groups and between individuals, etc.

This results in a reading of the uses and practices, from which it is possible to understand the barriers to appropriation and distribution, as well as the identification of the levers.

Illustration by an example : Following the Epinal and Toulouse accidents, a decision by the Nuclear Safety Authority has forced radiotherapy units to implement various measures to improve patient safety, including the completion of "preliminary risk studies" (risk mapping). At the request of the ASN, the IRSN conducted a diagnosis of the application of this regulatory requirement. The objective was to evaluate the appropriation of the risk analysis tools by institutions, the difficulties encountered, and ultimately the contribution of this analysis to improving risk management. The topics for which clarification through the concept of culture could help to complement and deepen a strictly organisational analysis are presented below.

4.2.1 INCLUSION OF THE TOOL FOR THE ANALYSIS OF THE RISKS INCURRED BY PATIENTS IN THE EXISTING ORGANISATIONAL CULTURE

The tool was designed to be part of a comprehensive approach to risk control/management in a given organisation.

- Relations between the intrinsic logic of the tool and the normal operation of the structure: the tool has shaken the usual modes of operation. Indeed, there is a gap between what the tool brings (transversality) and the functioning of the structure (compartmentalisation of occupations), which causes difficulties with the implementation of the analysis. Overcoming these challenges involves taking into account the global organisation of radiotherapy units and even of the structures in which they are inserted (National Centre for the Fight against Cancer, hospitals, clinics, etc.). An approach in terms of organisational culture, a "reliability plan", could prove fruitful.

4.2.2 INTRINSIC LOGIC OF THE TOOL

The tool itself has a "technical" aspect, a table consisting of columns and rows, whose workings must be understood in order to use it properly. This structure interacts with the existing occupational systems.

- A view of the healthcare activity: The tool is oriented towards "treatment production" (dose delivery) more than towards "healthcare". The tool thus fuels a certain view of the risks, which may contradict that of some professionals, who are more sensitive to a healthcare approach. It can thus fuel tensions between professionals who are more or less close to the patient (physicists/dosimetrists on the one hand, handlers and doctors on the other). These "views" of healthcare (the healthcare culture), the way in which they are built in the daily work activities, should be studied more precisely,
- A view of risk management: This is a tool designed to break down activities in order to try to achieve risk control at each stage exhaustively. This approach could impact the view of the occupation itself and of what makes up its professionalism, its value: knowing how to identify risks, and making trade-offs based on the experience and skills accumulated over the years, themselves being a source of pride, recognition and appreciation. In other words, the work approach proposed by the tool can be experienced by these professionals as an amputation of an essential aspect of their profession. This interaction between the tool and the "views of the occupation" could also be explored more in depth.

4.2.3 THE SOCIAL RELATIONS GAME

As in any management activity, the tool is likely to alter the social balances, and the relations between individuals and between social-professional groups.

- Explaining and rendering visible work practices: the tool is likely to strengthen - in defence - professional identity or solidarities that exist for each occupation, and ultimately overlook potentially risky individual practices (e.g., not signing a folder, incomplete prescriptions, pseudo-validation of circumventing, etc.),
- Power relations: within the work groups on risks, all participants in discussions do not have the same weight. The authority of doctors can sometimes curb expression, and their positioning can make some subjects non-addressable.

4.3 CULTURAL ASPECTS OF A BUSINESS TRANSFER BETWEEN TWO COMPANIES

Culture can simultaneously promote and also hinder a business transfer operation between entities. This situation has points in common with mergers and acquisitions that have been studied by several authors (Kotter and Heskett, 1992). They particularly showed the failures in these operations (estimated at 1 of 2) when cultural aspects are not taken sufficiently into account. Considering that the identity of employees and their commitment are built around the organisation to which they are attached (sense of belonging), a transfer or merger with another organisation can potentially have withdrawal, demobilisation, or disengagement effects, which can degrade performance. Also, working on these aspects appears essential, when a transfer of activities between the two entities is looming.

Analysis of the cultural aspects of a business transfer between two entities:

- ⇨ **Professional socialisation** modes: it is not a case of merely transmitting knowledge here, but rather also of empirical knowledge, knacks, tips and tricks known by staff members who have forged a living experience of work in a given context.
- ⇨ **Social Pact**: the transfer of skills between social groups requires an understanding of the implicit "social pact" existing within a social group, or between social groups, which will facilitate such transfers or, on the contrary, act as a brake, triggering information withholding phenomena, etc. (Le Roux, 2006).
- ⇨ **Meaning of Work, as an identity aspect of the activity**: the meaning attached to the work, which is an identity resource for individuals engaged in a given organisation, is necessarily affected in case of a business transfer, and even then, it is likely to cause blockages or, on the contrary, establish levers.
- ⇨ **Collective skill, beyond individual skills**: If safety and safe operation are considered to be a collective construction, i.e., a performance resulting from a way of cooperating and working together, it is not enough to understand the transmission of individual skills (by occupation, by strata, etc.). It is also important to identify interactions, the way in which roles are distributed in a collective, the individual contributions, etc., which also constitute the value of a team, or of a transferred activity.

Illustration through an example: Two facilities of the CEA Cadarache site, of which the CEA is the nuclear operator but that are managed by AREVA, were shut down in 2009. An agreement between CEA and AREVA defines the respective roles and responsibilities for the implementation of the decommissioning operations underway. The CEA must take charge of the entire management of the facilities for the final stages of the decommissioning. The IRSN assessed the provisions implemented to ensure the transfer of activities between AREVA and the CEA, and the arrangements aimed at ensuring the sustainability of the skills within the facilities. A number of topics are presented here, for which the analysis of cultural aspects could prove to be interesting.

4.3.1 PROFESSIONAL SOCIALISATION MODES

As mentioned several times, within the context of the transfer/sharing of expertise, the question arises of what has been implemented to ensure the transfer of the "empirical" knowledge of the staff members, beyond codified knowledge contained in skill tables. However, this knowledge in action is particularly based on formal learning modalities (training, career paths, career management, etc.), as well as more informal ones, provided by peers and by the hierarchy, for example during co-interventions, briefing or debriefing meetings, and various exchanges, etc.

Furthermore, the operation of a production unit, whatever it may be, is certainly based on the implementation of skills held by individuals as well as on the skills forged by the group members as a work collective. The collective expertise arises from interactions within the collective and from routines constituted through experiences, and therefore depends on the quality of the interactions and the ability of the players to share and exchange their knowledge and expertise. Identifying the characteristics of this collective skill in view of its transfer pose real difficulties. This skill is by definition mobile, and depends on the management as well as on the individuals who compose the collective. However, it can be supported by actions aimed at developing cooperation, communication, exchange of practices, etc. It is for example what civil aviation did through the CRM (Crew Resource

Management), which is aimed at developing an understanding of group phenomena in the cockpit and thus at better controlling it.

4.3.2 THE IMPLICIT SOCIAL PACT

A transfer of skill cannot be based on a desire to transmit, on the will of everyone to participate, or a desire to cooperate. According to Le Roux (2006), in general *"there is a strong will of the older staff members to transmit all of their knowledge"*.

More fundamentally, **the transfer or sharing of expertise can be analysed as a social exchange based on gifts/counter-gifts**. In cases where the exchanges are perceived as unbalanced, the transmitters may be reluctant to do so: for financial reasons, for example *("it hurts me to think that the guy that I am training and is twenty years younger is being paid almost as much as I am"*) or on a more symbolic level. In the case of older staff members asked to transmit their skills to younger people, they can for example be hampered by the negative image of early retirement policies that convey premature aging or can be hampered by the competition they may perceive from younger better educated staff members with more career development prospects.

In other words, for there to be a transfer or sharing of expertise, it is necessary for there to be a reciprocal relationship benefiting everyone. **The quality of social relationships will thus be critical.** Understanding what develops between the groups involved in the transfer (trust, competition), how each is situated with regard to this potential transfer, the mechanisms envisaged to support and motivate the transfer, etc., are some of the many aspects to be studied in order to evaluate the bottlenecks and levers likely to support this process.

4.3.3 THE SYMBOLIC AND IDENTITY ASPECTS

In any business transfer operation, the perception of the "value" of the transferred business undeniably plays a role. In the example mentioned, the transfer concerns the decommissioning activities that do not seem to have a strong appeal for employees. The fact of working on the decommissioning of a plant (end of life) can generate, from a symbolic point of view, rejection to the extent that the activity can be perceived as "deadly." Operators could feel and be perceived by others as performing a "dirty job", which is a scarcely rewarding and somewhat uninspiring picture for these. The symbolic aspects of the new activity must be watched closely in the case of transfer/sharing, because they act on the meaning of the work for each person, their mobilisation, and their commitment.

Cultural analysis thus appears particularly fruitful in the case of a transfer of activity, to the extent that it requires going beyond the technical and organisational (formal) aspects of the transfer, but allows implicit functions, knowledge in action, solidarity and forms of social links, etc., to be included, which also contribute to the success of an activity that could hamper the functioning of the new activity, transported into a new context.

5. CONCLUSION

The safety culture concept is at the core of many approaches to improve risk management. In particular, the IAEA has made it a key component of its development strategy for taking into account human and organisational factors in risk management.

The IRSN has mainly conducted its assessments along theoretical lines coming from ergonomics and sociology of organisations (including the line known as 'High Reliability Organisation "HRO). Although this orientation has helped to formulate documented expert assessments, it is necessary to evolve in order to better take into account the cultural aspects. These can, for example, be a decisive part of provisions to promote cooperation between different occupations (maintenance and operation, operation and decommissioning, operation and research, etc.), between the project organisation and day to day organisation (outage management, change implementation, decommissioning sites, etc.), and between companies (relations between customers and service providers).

The IRSN has conducted a study to define the guidelines concerning the use of the concepts of "culture" and "safety culture" in safety assessments of nuclear facilities. This work, whose results are presented in this report, is the first step towards a discussion that is worth pursuing.

Research should be conducted to clarify what is meant by the concept of culture in a high reliability requirement organisation. Several avenues could be worth exploring: a study of the cooperation between players from different occupational areas and with different skills and value systems, a study of the medium-term evolution of the modes of cooperation within a given group, focusing on the development of group cohesion mechanisms, a study on the professionalisation-socialisation process, etc. Such research should also help to propose methods for the empirical study of culture, enabling its dynamic and largely implicit collective aspects to be taken into account.

It would also be necessary to clarify the relations to be developed between "approaches centred on safety management" and "approaches focused on the safety culture". A number of authors indeed argue in favour of a global or integrated approach to safety management. Thus, Rollenhagen (2010) emphasises that an approach centred on the safety culture could lead to assigning excessive weight to the beliefs, values, attitudes and behaviour of staff, at the risk of not paying sufficient attention to the design principles of the systems within which this personnel must work. Guldenmund (2010) proposes that safety be considered as the product of an interaction between three characteristics of an organisation: its structure (formal framework), its culture (value system), and its processes (the procedures, and ways of doing things within the organisation). Similarly, Cole *et al* (2013) conclude their literature review on the safety culture by advocating "*a balanced approach that addresses individual and organisational, as well as the engineered aspects of the system.*"

Finally, it appears necessary to clarify the conditions, modalities and limitations of an action on culture. Although organisational arrangements and management can contribute to the development of an organisational culture that promotes safety, the way in which these provisions combine their effects to influence culture remains largely unknown. This discussion should particularly specify the analytical approaches that could be implemented as part of a safety assessment and the types of conclusions that could be formulated.

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