STUDIECENTRUM VOOR KERNENERGIE
CENTRE D'ETUDE DE L'ENERGIE NUCLEAIRE

BOOK OF ABSTRACTS
SCK•CEN-BA-28

Topical Day

The enhancement of safety culture

Mol, 15 October 2009

SCK•CEN
Boeretang 200
BE-2400 MOL
Belgium
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Status: Unclassified

Contents

Introduction

Safety culture has been recognised as one of the paramount factors in guaranteeing a safe operation of complex facilities. Indeed, analysis of many events in several industries including aviation, space exploration, the chemical and nuclear industries, has shown that - besides technical factors - organisational and human factors largely contribute to the prevention of incidents and accidents. As such, it is vital that the prevention and safety policy of an organisation is not only focussing on technical solutions for risk reduction, but is also paying attention to less tangible factors such as an effective communication, trust, overall priority to safety, a questioning attitude of the workforce etc. In a world reigned by engineers and physicists it is not trivial to achieve this switch of attention.

The objective of this Topical Day is to bring together a number of actors that contribute actively to the enhancement of safety culture, each with their own role and responsibility. These actors include international organisations providing guidance and tools to assess and enhance safety culture, regulators imposing programs to stimulate safety culture policies, technical safety organisations controlling and supervising nuclear operators, and of course people responsible for coordination of the safety policy within organisations. Key note speakers will present their point of view and sufficient time for discussion with the audience is foreseen for debate and exchange.

Programme

Morning Session: chair: Fernand Vermeersch

08.45 - 9.30 h	Registration and welcome coffee
09.30 - 10.10 h	Welcome - introduction - overview of the programme Safety Culture Enhancement: Some challenges ***Frank Hardeman, SCK•CEN***
10.10 - 10.40 h	Concepts of Safety Culture ***Frank Guldenmund, TU Delft***
10.40 - 11.10 h	How to enhance the level of Safety Culture and to monitor its evolution ***Anne Kerhoas, IAEA***
11.10 - 11.30 h	Coffee break
11.30 - 12.00 h	Comment juger le niveau de sûreté ? Limites des statistiques et conduite d'un diagnostic organisationnel ***Michel Llory, Institut du Travail Humain*** *(in French)*
12.00 - 12.30 h	Safety Culture Enhancement policy and issues in a nuclear power plant ***Serge Powis, Suez - Electrabel***

12.30 - 13.45 h	Lunch

Afternoon Session: chair: Frank Hardeman

13.45 - 14.15 h	The role of the regulator in enhancing Safety Culture ***An Wertelaers, Federal Agency for Nuclear Control (FANC)***
14.15 - 14.45 h	The role of the Technical Safety Organisation in enhancing Safety Culture ***Yves Van Den Berghe, Bel V***
14.45 - 15.15 h	Safety Culture in a research environment ***Fernand Vermeersch, SCK•CEN***
15.15 - 15.45 h	Coffee break
15.45 - 16.45 h	Panel discussion
16.45 - 17.00 h	Concluding remarks ***Prof. Em. Michel Giot, UCLouvain***
17.00 h	Drink

The enhancement of Safety Culture: Some Challenges

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Abstract

The enhancement of Safety Culture is an issue for many actors working in fields related to the safety management of complex facilities. Very often, there are more questions than answers to these questions. Some basic problems are given below:

- A fundamental issue is that the Safe Culture concept in itself is difficult: it has many attributes, it is hard to assess, it often remains hidden in the language used. It also includes human and organisational aspects that can hardly be put in checklists or reference guides. Therefore, it is hard to tell whether the level of safety culture is sufficient, excellent of lacking.
- The main focus of safety culture enhancement programs is often laid on nuclear safety, which refers to low probability - high consequence events. For the workforce, the safety culture issues relating to radiation protection (the dose per operation, the risk of contamination) is much more visible. In terms of probabilities of getting lethal or permanent injuries, the industrial safety related issues clearly are predominant. Therefore, many people in the organisation may assess the focus is not put in the right place.
- An other issue is that safety culture often gets in as a negative aspect of some incident analysis, which is partly explained as being due to 'a weak safety culture'; the inverse relation (a good safety culture which leads to less incidents) is much less often made.
- For the moment, international guidance leads to an inflation of culture issues: radiation protection culture, safety culture, security culture,… Some of the 'optimal' behaviour related to each of these cultures may be opposite, leading to cognitive dissonances with the workforce. As a solution, they may just reject 'culture' and fold back on the technical issues they are feeling much more comfortable with.
- Each complex organisation has a large number of in-house and external stakeholders that should all be working into the same direction of enhancing the safety culture. International guidance clearly points to the role of the upper management here, but there is much less guidance on the roles of other actors (middle management, prevention workers, trade unions, Board members, inspectory bodies, regulators, contractors, clients,…).

The considerations mentioned above lead to a large number of practical questions:

- The balance between formal (e.g. procedures) and informal (e.g. social activities); the balance between written instructions and oral advice or discussion.
- The time needed to create some change (in mentality, spirit, culture of the people on the various levels and functions mentioned above): How fast can one go?
- The value of tradition versus the need for change (technical, organisational, conceptual).
- The balance between stimulation and encouragement vs. control and sanction.
- Communication issues, especially with people working in shifts and contractors, or in cases of contradictory messages to be brought.

Concepts of safety culture

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Abstract

Interest for safety culture and safety climate has been gradually increasing ever since INSAG's introduction of the term in 1986. Researchers as well as consultants have put significant effort into the development and assessment of the concept, resulting in multiple approaches to capture and evaluate it. Interestingly, none of this seems to have led to a particularly heated debate on the nature of safety culture; each just went their own way.

Cultures are often modelled as consisting of a core surrounded by 2 or more layers. The core is invisible, and is assumed to contain the essence of a culture - e.g. norms, values, convictions, ideas; that is, the strongly held beliefs Schein calls 'basic assumptions'. Because it is covert and also largely unknown to its beholder, the basic assumptions have to be deciphered from the more tangible outer layers. Approaches to safety culture differ in where exactly the concept is situated in this model and, hence, how it should be assessed and changed. Or, put in other words, views differ on whether safety culture pertains to either a behavioural system, or a system of ideas (or both).

Overall, six approaches to safety culture can be discerned, each of which can be represented by an image:

1. the net: the scientific approach;
2. the castle in the air: safety culture as a religion;
3. the porcupine: safety culture as a sensitising concept;
4. the monkey wrench: safety culture as a thing;
5. the mirror: safety culture as a (developmental) hierarchy;
6. the work of art: safety culture as an essentially contested concept.

In the presentation important aspects of the culture concept will be discussed as well as the (onion) model of safety culture mentioned above. Furthermore, various images of safety culture will be outlined. The presentation ends with a description of how safety culture might be ideally explored.

How to enhance the level of Safety Culture and to monitor its evolution?

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Abstract

Introduction

Engineering issues related to safety have received close attention from the nuclear community over many years. However it is only in the last two decades, more specifically after the Chernobyl accident (1986) that organizational and cultural issues have been identified as vital in achieving safe operation. Safety culture is now a commonly used term. From INSAG 4 to the newly published Requirements GS-R-3 (Management System for Facilities and Activities) and Safety Guide GS-G-3.1 (Application of the Management System for Facilities activities), there is a common understanding on the attributes which are essential for achieving a strong safety culture. Nevertheless, there is still a need for developing common views on how to assess Safety Culture.

What does Safety Culture embrace?

Before addressing the main challenges facing Safety Culture assessment and the nuclear community response to them, let's remind what Safety Culture embraces.
First of all, what we mean by the term 'culture'. Culture is a deeply-rooted, rather than superficial, phenomenon and hence fairly stable over time. It is shared by people and relates primarily not to an individual but to a group, community or organization.

Besides, it is a broad concept and covers all aspects of external and internal relationships in a group, community or organization. The main differences of nuclear safety culture compared with general corporate culture touch on the concept of core hazards and the potential large effects associated with the dispersion of radioactive substances. It is this fact that makes nuclear power different and that demands a set of organizational values that place nuclear safety as the top priority of an organization.
Moreover, a broad agreement on the key characteristics of Safety Culture has gradually emerged in recent years and is documented in IAEA GS-G-3.1.

The framework identified in this IAEA safety standard consists of five key Safety Culture characteristics composed of a set of corresponding attributes. The attributes (37) are short descriptions of a specific organizational performance or attitude, which, if fulfilled, would characterize this performance or attitude as belonging to a strong Safety Culture. Those five characteristics being identified as essential for achieving a strong Safety Culture are the following:

- Safety is a clearly recognized value
- Leadership for Safety is clear
- Accountability for Safety is clear
- Safety is integrated into all activities
- Safety is learning driven

What are the challenges facing Safety Culture assessment?

Assessing Safety Culture is different from assessing technical areas. It relates to attitudes, values and behaviours and as such, assessing Safety Culture is still a challenging task. Among others, the main defies are the accessibility to perceptions and beliefs, the multifaceted nature of Safety Culture and the strong influence of leadership on Safety Culture.

To face those challenges, the majority of Member States which have already started implementing Safety Culture assessment programme, share the common views below:

- the IAEA Safety Culture characteristics constitute the basis for evaluations and evaluation criteria,
- a broad range of tools and methods such as observations, interviews, surveys is used to collect Safety Culture data,
- information accumulated from various origins such as routine inspections, event analysis, Safety Culture surveys, third party assessment is consolidated and analysed to develop the organization's Safety Culture picture.

SCART-The IAEA safety review assessing Safety Culture

In connection with the increasing need for assessing Safety Culture, the Agency has recently developed a safety review service centred on behaviours and attitudes, called SCART-Safety Culture Assessment Review Team.

The review process follows a systematic approach structured in several phases.
The initial phase is data gathering -The review team consists usually of 5 reviewers, a team leader, and a deputy team leader. Each reviewer evaluates all characteristics of safety culture with their corresponding attributes (all together 37 attributes) via interviews, observations and documentation analysis.

At the end of the data gathering, the reviewers analyse the data and come to conclusions concerning the attributes of all 5 Safety Culture characteristics. Their conclusions are individual and independent. We are here in the second step.

Afterwards, the reviewers share their individual opinion and develop a team opinion for each of the assessed Safety Culture attribute.

Finally, based on this team evaluation, the team identifies strengths and areas for improvement. Strengths are areas where the Safety Culture is strong and safety performance highly satisfactory. In areas identified for improvement, the organizational performance or attitude at the nuclear facility does not correspond to what is expected according to IAEA Safety Standards. It leads to recommendations concerning the area.

Up to this point in time two SCART missions have been accomplished. They allowed the Agency to validate the main principles of the SCART methodology. One mission is planned in South America for the end of this year.

It might be concluded that SCART as a Safety Review Service for Safety Culture is a new level of support for Member States. Being a promotion tool for Safety Culture, it is also a motor of motivation for the Member States to enhance the Safety Culture in their nuclear facilities. On the other hand, SCART missions will increasingly become opportunities to facilitate the application of IAEA Safety Standards.

Comment juger le niveau de sûreté? Limites des statistiques et conduite d'un diagnostic organisationnel

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Abstract

Les approches statistiques et probabilistes ne peuvent fournir que des données partielles pour juger de la sûreté d'une installation à risques et de l'organisation qui la gère.

La méthode de diagnostic organisationnel est une approche incontournable pour élaborer le niveau de sûreté d'un système complexe à risques, un point de passage obligé, car les accidents graves ou majeurs ont montré l'impact considérable des dysfonctionnements organisationnels. Mais comment développer cette pratique?

On expose dans cette communication les grands principes de cette démarche d'analyse organisationnelle qui peut s'appliquer aussi bien à des diagnostics partiels ou spécifiques qu'à un diagnostic général du système.

On présente également les caractéristiques principales de cette forme d'analyse : l'analyse de la demande, la nécessité d'un couplage entre une méthode d'entretiens « compréhensive » (prenant en compte les aspects subjectifs des FH et FO), et une méthode « explicative » (objectiviste), ainsi que les contraintes préalables déterminantes qui sont imposées à ce type d'analyse.

On discute également les caractéristiques importantes des enquêteurs eux-mêmes (le « profil » des enquêteurs) et ce que nous pouvons désigner comme les connaissances d'arrière-plan pour mener ces enquêtes. On présente en outre et on propose des dispositions intéressantes pour accroître la qualité du diagnostic, fiabiliser le processus de diagnostic, réduire au maximum les zones d'arbitraire ou d'incertitude.

Enfin, on montre à partir d'un exemple d'illustration (enquête sur la sécurité conventionnelle dans un Centre de Recherches Appliquées, menée après une série noire d'accidents graves ou mortels), le processus de construction du diagnostic.

Safety Culture Enhancement policy and issues in a nuclear power plant

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Abstract

1. Brief introduction of GDF-suez AND ELECTRABEL

One of the leading energy providers in the world, GDF SUEZ is active across the entire energy value chain, in electricity and natural gas, upstream to downstream. It develops its businesses (energy, energy services and environment) around a responsible-growth model to take up the great challenges: responding to energy needs, ensuring the security of supply, fighting against climate change and maximizing the use of resources.

The Group employs 198,200 people worldwide and achieved revenues of €83,1 billion in 2008.

Belonging to the Business line Energy Europe and International, Electrabel is a leading European energy company and number one on the Benelux market. Electrabel provides comprehensive and tailor-made energy solutions for industrial enterprises. Electrabel is strengthening its local geographical presence with generating activities in a number of regions of Europe. It manages diversified generating equipment totaling 31 187 MW. The company's main objectives are high-energy efficiency and the lowest possible impact on the environment. The European facilities are primarily made up of high-energy yield gas turbines, of extremely reliable nuclear facilities and of renewable energy generating facilities. The 7 Electrabel's nuclear units are located in Belgium on two sites: Doel with 4 units and Tihange with 3 units.

2. Nuclear safety: continuous evolution

The term 'Safety Culture' was first introduced in INSAG's Summary Report on the Post-Accident Review Meeting on the Chernobyl Accident, published by the IAEA in 1986 Ref [1]. It is fairly recent in the history of the nuclear industry and since that time, a large number of publications refer to this concept of "safety culture".
Obviously, there is an increasing awareness of the contribution that human behavioural sciences can make to developing good safety practices (IAEA documentation Ref [2] and [3]).
By using the operating experience, the operators have progressed in the understanding of the factors influencing nuclear safety:

- At the early stage of the nuclear industry, the nuclear plant organizations saw safety as an external requirement and not as an aspect of conduct that could help organizations to succeed. There was little awareness of behavioural and attitudinal aspects of safety performance. Safety was seen very much as a technical issue.
- With time and progress made in quality management, good safety performances became an organisational goal. An organization at this stage had a management, which perceived safety performance as important even in the absence of regulatory pressure. Although there was growing awareness of behavioural issues, this aspect was largely missing from safety management methods, which comprised technical and procedural solutions. Safety performance was dealt with, along with other aspects of the business, in terms of targets or goals. The organization concentrated primarily on day-to-day matters. There was little in the way of strategy. Management's response to mistakes was to put more controls in place via procedures and retraining. There was a little less blaming. Safety was thought to imply higher cost and reduced production. There was growing awareness of the impact of cultural issues in the workplace. It was not understood why added controls do not yield the expected results in safety performance.
- And now on, nuclear plants organisations have adopted the idea of continuous improvement and applied this concept to nuclear safety. There is a strong emphasis on communications,

training, leadership, and human performances. Everyone in the organization can contribute. Some behaviour is seen within the organization, which enables improvements to be made. The level of awareness of behavioural and attitudinal issues is high, and measures are being taken to improve behaviour. Progress is made one step at a time and never stops. The organization begins to act strategically with a focus on the longer term as well as awareness of the present. There is no goal conflict between safety and production performance. Safety and production are seen as interdependent. Management's role is seen as coaching people to improve business performance. People are aware of the impact of cultural issues, and these are factors considered in key decisions.

More than ever, human behaviour is considered as a central element for good safety performances.

3. ENHANCE safety culture

As regard to nuclear safety, the Electrabel approach used for its existing nuclear power plant fleet is based on four pillars:

Pillar 1: Values and Behaviors promoted by our Policy Declaration on Nuclear Safety

The top document in the Nuclear Generation Management System of GDF-SUEZ Electrabel is the Nuclear Safety Policy. The first principle stated in this Nuclear Safety Policy is "Safety = the first priority".

This Nuclear Policy is posted in many places on sites and at least at the entrance of each building. The document is also integrally copied in the management expectations booklets. During the initial training on nuclear safety, all employees receive the Nuclear Safety Policy document and a specific module is devoted to explain this policy. The policy is also available on the intranet.

The way to implement the principles defined in the Nuclear Safety Policy is described in the integrated management system.

Pillar 2: Organizational and individual behaviors implemented through the General Management System

The General Management System provides structure and direction to the organization in a way that permits and promotes the development of a strong safety culture together with the achievement of high levels of safety and excellent performance.

The organizational and individual behaviors described in the Nuclear Safety Management System are provided as guidance to staff. Process owners are in charge to integrate these behaviors into the processes they are responsible for.

Pillar 3: Human performance policy
On a third level, GDF-SUEZ Electrabel is also driving safety culture through the development of a human performance policy, which is based on two approaches:

- A bottom-up approach, that analyzes the root causes of events (including the human factor)
- A top-down approach, that relies on human performance tools, safety culture awareness, and activity observation

Bottom-up approach
Analyzing errors and deviations is a basis for continuous improvement. Root cause analysis should cover both technical aspects and human factors in order to reinforce defense barriers. It must therefore:

- Highlight and explain all deviations linked to an event
- Identify the real and potential consequences of these deviations
- Define corrective actions to be implemented to avoid recurrence of the event

Top-down approach
The top-down human performance approach gives the direction for improvement trough leadership, values, and organizational behavior.
The main focus is to ensure the integration of the human error reduction tools for appropriate human behaviour. A Management expectation booklet clearly describes the safety behaviours that must be adopted by every workers to reach excellence . Use of human errors reduction tools is also reinforced during task observations, training and through the different communication channels (posters, meetings, intranet…).
Especially, in the training field, the “human performance simulator”, is an efficient tool to train workers with practical exercises on safety behaviours.

Indicators and targets are used to monitor the number of task observations performed by managers and supervisors. These Task Observations are performed in order to:

- Identify and value good practices
- Identify and correct deviations
- Reinforce contacts of the management with the workforce on the field

Pillar 4: Global Nuclear Safety action plan

The Global Plan for nuclear safety lays down main objectives of GDF-SUEZ Electrabel in nuclear safety for the coming years (from 2006 to 2010). These are aimed in particular at continuously improving our performance and our safety culture.
With this Global Plan, GDF-SUEZ Electrabel formally expresses clear objectives to consolidate its safety approach and improve its safety culture.
These objectives are transposed in the annual action plan of power plants and those of offsite organizations that carry out activities with an impact on nuclear safety.

4. Safety culture ASSESSMENT

GDF SUEZ Electrabel monitors safety culture by different ways : key performance indicators, events, WANO Peer Reviews, OSART… For the next future, Electrabel will request to WANO a Technical Support mission dedicated to specifically assess safety culture. This mission will be used as a preparation to the SCART mission that will be requested to the IAEA. The experience gained from these two missions will be than used to implement a methodology of periodic self-assessment of the safety culture.

REFERENCES

[1] INSAG's Summary Report on the Post-Accident Review Meeting on the Chernobyl Accident, Safety Series No.75-INSAG-I, IAEA, Vienna 1986

[2] DEVELOPING SAFETY CULTURE IN NUCLEAR ACTIVITIES PRACTICAL SUGGESTIONS TO ASSIST PROGRESS, Safety Reports Series No. 11, IAEA, Vienna (1998)

[3] INTERNATIONAL NUCLEAR SAFETY ADVISORY GROUP, Safety Culture, Safety Series No. 75-INSAG-4, IAEA, Vienna (1991)

The role of the regulator in enhancing Safety Culture

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Abstract

The FANC and Bel V are, as the regulatory body for nuclear safety and radiation protection, concerned about and thus on a daily basis occupied with the safety and safety culture in our Belgian nuclear facilities. Together with a team of enthusiastic engineers and highly qualified technical staff, we put in every effort in order to stimulate and improve the safety and safety culture in the field. This is done by imposing additional operating conditions in the licences, by tightening the regulations, by inspections that should result in specific actions within a determined period of time,… The big challenge is being able to take effective and efficient actions as a competent authority. This is what the public expects us to do.

The FANC and Bel V expect our nuclear operators to take proactive initiatives in order to enhance the safety and safety culture, to react positively to all our actions and to be open to implement in their own installations the “good practices” which already exist elsewhere. And even if things might still go wrong, and an incident or accident might occur, we expect everybody to draw maximum lessons from it for future events. The intention is - and remains - to increase the global safety of our installations wherever possible.

This requires efforts in all fields, and not only from the people working in the safety branch and in the field, but also from the strategic, financial and even political decision makers. Safety and the safety culture do not arise by themselves. They need investment.

This presentation outlines the approach taken by the FANC and Bel V and gives a few practical examples.

The Role of Bel V as TSO in Enhancing Safety Culture

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Abstract

Inspections and assessment of the effectiveness of the licensee safety management systems in achieving acceptable radiation protection & nuclear safety performance and in fostering and supporting a strong safety culture is an essential part of the mission of the proximity surveillance of the Belgian nuclear installations, which Bel V has received as the Technical Support Organization of the Federal Agency of Nuclear Control (FANC).

When developing regulatory strategies to address safety culture it is important to recognize its strong link with the concept of safety management as well as the limitations that exist in the accessibility of safety culture to the regulator and its TSO. It is the task of Bel V to verify that appropriate processes are in place to manage safety and foster safety culture, without interfering with the licensee's responsibility for the safety of its plant. Direct observations of outward operational manifestations of safety culture through inspections of activities and facilities, through analysis of incidents and through regular contacts and discussions with licensee staff will complement this assessment by identifying areas of substandard or declining safety performance as well as specific safety culture issues that need improvement.

In addition to this assessment role the regulator and its TSO has also a role to promote safety culture. This is done by putting safety culture on the agenda when discussing with the highest organizational levels at the licensee, by encouraging good safety practices and promoting the use of safety culture self-assessments or independent assessments and by providing the outside influence that is ultimately needed for implementing comprehensive improvement plans when, despite preceding regulatory actions, safety performance is persistently declining.

A sound regulatory safety culture and appropriate regulatory strategies and attitudes when interacting with licensee staff as well as setting the right regulatory priorities will also contribute to the safety culture of the licensees. Safety culture cannot be regulated or prescribed and therefore a compliance based approach is inappropriate. Non-prescriptive strategies which favor a coaching, collaborative and interactive regulatory approach and encourage ownership of safety culture issues by licensee senior management have higher chances to enhance safety culture in the long term.

Safety Culture in a research environment

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Abstract

Many similarities exist between complex industrial facilities and research centres in the field of safety and safety culture. However the research environment represents specific challenges. First of all there is the broad spectrum of risks, nuclear and non-nuclear, and operations that can change rapidly over time as new experiments are designed, developed, performed and decommissioned. This life cycle is sometimes accompanied with a changing workforce of scientists bearing the responsibility for the experiments. Furthermore, many facilities and equipments are unique and innovative.

In order maintain a high level of safety culture the management of a research facility needs to implement a framework of different systems to insure that safety is maintained and kept in focus. This can be done by a clear structure, clear responsibilities, procedures, adequate training, high quality documentation and efficient feedback of experience and a social climate open to communication. It is important to audit this framework regularly to avoid the pitfall of overconfidence. This can be performed periodically or can be initiated through feedback analysis of minor events.

In this presentation we will sketch the research environment and highlight the particularities with respect to safety and give feedback on a self-assessment of the safety framework.

Biographies

Frank Hardeman

Frank Hardeman owns a master in physics and a Ph D in Sciences from the KU Leuven. After his military service, he joined the SCK•CEN in 1990. Since then, he obtained two extra masters: one in nuclear engineering and a second one called 'Prevention advisor level 1'.
At SCK•CEN he occupied several positions in the fields of safety and radiation protection: site inspector in the BR2 reactor; in house responsible for the emergency response plan; head of the laboratories for gamma spectrometry, antropogammametry and neutron activation analysis; project leader for the programs in support of the Belgian authorities for environmental monitoring or emergency response; head of the department of decision strategy research (dealing with social aspects of nuclear decision making, with decision support tools and off-site emergency response). He has been the head of the internal service of prevention and protection at work. At present, he is institute manager of the institute "Environment, health and safety". He is author/co-author of over 150 papers, reports or conference contributions in the fields mentioned above. He is invited lecturer at the Université Catholique de Louvain.
In the field of safety culture, he has been supporting in house doctoral research, he has contributed to several missions in support of the IAEA and he still is responsible for the implementation of an Action Plan to enhance safety culture within SCK•CEN.

Frank Guldenmund

Frank Guldenmund studied psychology at Leiden University in the Netherlands and majored in both cognitive psychology and methodology. Joining the Delft Safety Science Group in 1992 primarily as a methodologist his involvement subsequently enlarged to include the modelling and assessment of safety management systems and the role of organisational culture in relation to (occupational) safety. He has been involved in projects regarding both the modelling and the measurement of these variables. Being quantitative by education his interest gradually has become more qualitative and holistic. Recently, he finished his PhD thesis titled ‘Understanding and exploring safety culture’, which he will defend in public in January 2010.

Anne Kerhoas

Since 2006, Anne Kerhoas has taken a mandate in the International Atomic Energy Agency in Vienna. She has been appointed as Senior Safety Officer responsible for the development of Safety Culture and Management System areas. She is also in charge of managing and coordinating for the Nuclear Installation Safety Division, all Technical Cooperation projects regarding safety aspects.
Before joining the Agency, she worked at CERN as deputy Head of health and safety department for the planning and strategic matters. She was responsible for ensuring increased policy and financial commitments in the area of health and safety.

As consultant in international companies, she contributed in several international developments related to health and safety matters. More specifically, she took part in the drafting of the International Safety Management Standard (OHSAS 18001) as a member of the working group made up of the 6 major certification bodies.

She started 20 years ago, as a consultant in risk and RAMS (Reliability, Availability, Maintainability, and Safety) analysis in space and aircraft area; she worked at that time intensively on the European launcher Ariane V programme and implemented RAMS culture within several industrial designers' teams.

Her educational background includes a PhD in engineering and a Master of Business Administration.

Michel Llory

- Ingénieur-chercheur pendant 27 ans à Electricité de France, Recherche et Développement, dans le domaine nucléaire, avec une évolution prononcée des études probabilistes de sûreté (EPS) aux Facteurs Humains (FH) et Organisationnels (FO).
- Direction du département Etudes de Sûreté et de Fiabilité (devenu: Management des Risques Industriels) où s'est réalisée la première étude d'ensemble (EPS) d'une tranche nucléaire (80 Ingénieurs x ans environ). Initiateur de nombreux types d'études FH et FO: sur simulateurs, questionnaire de perception de la sûreté, approches organisationnelles de la sûreté, intégration des enseignements des accidents industriels, Veille sur ces sujets.
- Depuis 15 ans, consultant privé dans le domaine des risques et de la sûreté, en privilégiant les FO : développement entre autres du paradigme organisationnel, du diagnostic organisationnel et de formations aux FH et FO.
- Auteur de 2 ouvrages aux Editions l'Harmattan (Paris):
    - Accidents industriels: le coût du silence (1996)
    - L'accident de la centrale nucléaire de Three Mile Island (1999)

Serge Powis

I have started my carreer within Electrabel (previously Intercom) in 1988. I gained my first professional experience in different fossil plants in Belgium and after few years I joined the nuclear power plant of Tihange. During my stay In the Operation department, I followed the training on simulator to be licensed operator on Unit 2. Two years after, I was transferred to the Nuclear safety and training department. I was in charge of nuclear safety and operating experience activities. In 1999, I moved to Paris as detached engineer for 3 years to the World Association of Nuclear Operators; I was responsible of the peer review program. After this mission abroad, I came back to Brussels within our Marketing & Sales department as Product Manager. In 2003, I did a come back to Tihange and actively participated to the preparation of the OHSAS 18001 certification and to the preparation of the organization within the Training and Qualification area before the OSART mission in may 2007. Since three years, I joined the Headquarter and work within the Electrabel Corporate Nuclear Safety Department.

An Wertelaers

After having obtained the diploma of civil engineer (electro-mechanics) at the KU Leuven in 1989, An Wertelaers took her first professional steps in the (industrial) safety branch of the technical safety inspection.

In 1993, she obtained, at the same university, the diploma of nuclear engineering and the leap was made from industrial safety to the then regulatory body for nuclear safety (Service for the Technical Safety of Nuclear Installations of the Ministry of Employment and Work).

In 2001, the different public authorities competent in the field of nuclear safety, radiation protection and physical protection joined into one organisation: the Federal Agency for Nuclear Control (FANC).

Since 2004, An Wertelaers was in charge of the FANC's inspections in all nuclear facilities. Due to a reorganisation in the spring of 2009, she is now responsible for licences and inspections regarding the industrial nuclear facilities.

Yves Van den Berghe

Education:
Civil engineer degree in electromechanics, University Ghent 1980
Nuclear engineer degree, University Ghent 1981

Professional history:
1980-1981: assistant at laboratory of theoretical electricity (faculty of Applied Sciences University Ghent)
1981-1984: assistant at laboratory of physics (faculty of Medicine University University Ghent) – lectures and exercises in the fields of radioprotection, dosimetry, source term assessment and risk analysis
1984-2008: working with Nuclear safety department of Vinçotte later AVN (Association Vinçotte Nuclear) working consecutively as nuclear safety inspector at Doel NPP, nuclear safety consultant at Borssele NPP, national and international projects manager, technical support to inspections & operating experience feedback coordinator, area manager inspections class I installations
Since April 2008: working with Bel V as area manager inspections class I installations

Expertise:
Since 1987 expert class I
Since 1994 member of OECD/NEA/CSNI working group on human and organizational factors
Main fields of expertise: nuclear safety inspections, nuclear safety analysis, root cause analysis & operating experience feedback, periodic safety reviews, safety management & human factors.

Fernand Vermeersch

Fernand Vermeersch has a Phd in Physics from the Ghent University where he specialised in gas discharge and plasma physics. He investigated the propagation of resonance radiation in gaseous media and was involved in different research projects such as: image restitution, the physics of writing, incoherent Thomson scattering, neutral beam injection in the TEXTOR TOKAMAK, spectral characterisation of lamps...

Since more then 15 years he is working in the health physics and safety department of the SCK•CEN. He has followed supplementary courses in radiation protection, nuclear engineering specifically nuclear reactors and nuclear reactor safety. He is a safety advisor in radiation protection and nuclear reactor safety and involved in plant safety, emergency preparedness and issues concerning the application of the ALARA principle. He is also the Belgian representative to the European ALARA network and developer of the VISIPLAN 3D ALARA tool. He recently obtained a Masters in Safety Techniques at the Catholic University of Leuven and is at present head of the Internal Service for Prevention and Protection at Work.

Michel Giot

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Prof. Em. Michel Giot was full professor at the Université Catholique de Louvain (UCL-Louvain-la-Neuve) teaching Thermodynamics, single- and two-phase transport phenomena major technological hazards, nuclear thermalhydraulics.
Chairman of the Scientific Advisory Committee of SCK•CEN Ingénieur civil électricien (UCL,1964), Docteur en sciences appliquées (Mécanique, UCL, 1970) Research field: Multiphase fluid flow and heat transfer with applications to nuclear and chemical engineering Teaching duties in BNEN: Nuclear Thermal Hydraulics Editorial duties: Member of the Editorial Boards of International Journal of Multiphase Flow, Archives of Thermodynamics, and Multiphase Science and Technology Other duties: member of the “Conseil Scientifique of DEN (CEA-France), member of the Scientific Committee of the Department “Nuclear Energy and Safety” of the Paul Scherrer Institute (Switzerland), member of the Scientific Council of the Belgian Federal Agency for Nuclear Control (FANC-AFCN), member of the Scientific Council of Association Vinçotte Nucléaire (AVN),member of the Evaluation Committee of the "Ecole Polytechnique" of the University of Nantes, active member of the European Academy of Sciences and Arts.