TOP SAFE'98

Presentación

Organizada por la Sociedad Nuclear Española, con el patrocinio de la Sociedad Nuclear Europea, se celebró la Top Safe'98, entre los días 15 y 17 de Abril.

El éxito de la convocatoria se vio confirmado con la participación de 360 conferenciantes provenientes de treinta países, y la presencia de 21 empresas en la exposición comercial que tuvo lugar en paralelo con las sesiones técnicas.

Teniendo como centro de atención la seguridad, se hizo referencia en múltiples ocasiones a la necesidad de hacer compatible su aplicación con las nuevas exigencias de reducción de costes y competitividad que impone la apertura de los mercados en todo el mundo.

Debido a su extensión, nos es imposible publicar todos los trabajos presentados en esta reunión. Se reproducen seguidamente algunos de los más representativos, tanto en el ámbito nacional como en el internacional, en el idioma de exposición. Las ponencias completas han sido editadas en CD ROM, y pueden solicitarse a la SNE

TOP SAFE'98

La mesa presidencial en el acto de apertura contó con la presencia de: Mariano Gómez (Jefe de C.N. Cofrentes), José Domingo Pérez-Alonso (Vicepresidente de la SNE), Susan Fringen (Directora de la Comisión Europea de DG XI), Juan Manuel Kindelán (Presidente del CSN), Alfonso Grau (Teniente Alcalde del Ayuntamiento de Valencia), Antonio Gomis (Director General de la Energía), Pat Upson (Presidente de la ENS) y Javier de Pinedo (Co-presidente del Comité Organizador)

APERTURA / OPENING SESSION

PRESIDENTE DEL CONSEJO DE SEGURIDAD NUCLEAR (CSN)
Juan Manuel KINDELÁN

Es para mi un placer dirigirles unas palabras tanto en mi calidad de Presidente de Honor de la Conferencia como del organismo regulador de España en materia de seguridad nuclear y protección radiológica.

La seguridad nuclear ha tenido desde el inicio de los programas de construcción de centrales nucleares un importante componente internacional. El intercambio de prácticas reguladoras y experiencias operativas han sido objetivos prioritarios tanto de organizaciones internacionales gubernamentales, el OIEA, la NEA/OCDE o la Comisión Europea, como de asociaciones de operadores o profesionales del sector, por ejemplo el WANO o las Sociedades Nucleares.

España ha evolucionado en este contexto de un papel eminentemente receptor a ser en la actualidad un contribuyente importante en estos foros, dada la madurez alcanzada en su sistema de licenciamiento y la experiencia de sus operadores e ingenierías soporte.

Quisiera hoy referirme un momento a los problemas que plantea a la seguridad la liberalización del sector eléctrico que se está introduciendo en muchos países:

- La búsqueda de competitividad puede llevar a los productores a recortes de personal, lo que podría tener consecuencias negativas. Debe ser un objetivo irrenunciable mantener en todas las áreas técnicas de la organización el conocimiento y la experiencia necesarios para garantizar la seguridad operativa de las plantas.
- Las presiones de la competencia en el mercado conducen, por otra parte, a un predominio de la racionalidad económica sobre el conocimiento de los técnicos en la dirección de las plantas, y a fijar prioridades distintas de la seguridad nuclear.
- La programación a corto plazo por razones de rentabilidad puede poner en peligro programas de largo plazo como los de investigación en seguridad. Dejar la investigación en seguridad a los gobiernos o a los suministradores puede limitar la capacidad de evaluación del operador que es el principal responsable.
- Otra cuestión se refiere a las relaciones entre los operadores. Actualmente se da un amplio intercambio de información entre los operadores nucleares, tanto a nivel nacional como internacional. Una mayor competitividad puede crear obstáculos para estos intercambios. Por eso son muy importantes reuniones como ésta, que tienen precisamente como objetivo fomentarlos y que indican que las actitudes de colaboración entre operadores y profesionales del sector no se han visto de momento alteradas.
- En los aspectos técnicos, se pueden considerar alargamientos de la vida de las instalaciones movidos por criterios estrictamente económicos, con rechazo de acciones correctivas costosas, como las reparaciones de gran alcance o la sustitución de componentes fundamentales, que encontrarán fuerte resistencia si las razones de seguridad para hacerlas no son totalmente claras.
- Los operadores nucleares pueden estar tentados de posponer o de transferir al organismo regulador las actividades de revisión. Es fundamental mantener como principio básico que la responsabilidad de la seguridad reside, en primer lugar, en el operador responsable y que el organismo regulador tiene la obligación de imponer normas y controlar su respeto.
- La evolución de la industria hacia un marco menos regulado, plantea problemas respecto a la disponibilidad de fondos para una gestión

segura de los residuos radiactivos y del desmantelamiento. Es preciso garantizar que estén disponibles los recursos económicos necesarios para llevar a cabo estas operaciones.

La necesidad de organismos reguladores más efectivos y eficientes se hace mayor en un entorno competitivo. Es preciso centrarse en las cuestiones significativas para la seguridad sin imponer cargas innecesarias a los operadores. Desde este punto de vista, cabe esperar un uso más extenso de análisis coste/beneficio como elementos para valorar la seguridad. Además, la evolución hacia regulaciones basadas en el análisis de riesgos y la medida de resultados contribuirá a centrar la regulación en las cuestiones fundamentales. Todos estos cambios pueden provocar que las tradicionales relaciones entre los operadores de centrales nucleares y el organismo regulador se modifiquen de forma significativa.

En el caso de las centrales españolas, la seguridad se ha demostrado hasta ahora como suficiente. La preocupación por las mejoras de la seguridad y por el aumento de la calidad en la gestión de las instalaciones, ha ido acompañada por una baja en los costes de mantenimiento y por un aumento en la tasa de utilización de las centrales, factor fundamental de su economía, lo que reconcilia de algún modo la contradicción entre seguridad y economía.

Porque a pesar de los desafíos que un marco económico desregulado puede plantear, yo soy optimista. Es evidente que los responsables del sector son conscientes de que la pervivencia de la producción nuclear depende de que siga consiguiéndose y aún aumentándose el nivel de seguridad alcanzado, que es mayor que en casi todos los sectores industriales.

Me atrevo a afirmar que el futuro de la energía nuclear depende de dos factores esenciales y en cierto modo contradictorios: el aumento de la seguridad y la disminución de los costes de producción. Esa contradicción sólo podrá resolverla el progreso tecnológico. Sólo la tecnología puede garantizar la pervivencia del desarrollo de la producción nucleoeléctrica; esta afirmación debe condicionar también las decisiones que tomen los responsables económicos del sector.

Los organismos reguladores tienen la obligación de velar por la seguridad de las instalaciones y la protección de las personas. Es fundamental, para conseguirlo, no sólo reforzar el seguimiento de las instalaciones nucleares y radiactivas, sino fomentar la investigación en materia de seguridad nuclear.

Existe, por otra parte, una relación entre la calidad de la gestión y los niveles de seguridad; las causas últimas de una buena seguridad hay que buscarlas en la calidad de organización y gestión. En síntesis quiero insistir en que los viejos dilemas que oponen la seguridad a la economía o la eficacia reflejan una cierta falta de rigor.

La introducción de los análisis de la seguridad basados en el riesgo, pretenden enfocar los esfuerzos hacia aquellos aspectos de las operaciones que tienen especial significación para la seguridad, dejando de lado aquellos cuya repercusión en ésta es muy pequeña.

Al centrar los recursos en temas significativos y mantener expectativas altas en cuanto al cumplimiento de los requisitos existentes por parte los explotadores, aumentará la calidad de la supervisión y la confianza de los ciudadanos en la misma.

Es preciso, también, eliminar requisitos reguladores innecesarios y modificar las reglas ajenas a la seguridad, aunque los operadores deben tener claro que el continuo avance hacia una mayor flexibilidad en los requisitos reguladores se basa en la disciplina de su cumplimiento.

El debate sobre la influencia de la desregulación del sector eléctrico en la seguridad nuclear y, por tanto, en la actividad de los organismos reguladores, interesa a todos los países y una buena muestra de ello es la discusión en el marco de la INRA (Asociación Internacional de Reguladores Nucleares) compuesta por los Presidentes de los ocho Organismos Reguladores de EE.UU., Francia, Japón, Canadá, Reino Unido, Alemania, Suecia y España. Allí se ha reafirmado la importancia de la tecnología, del mantenimiento de la competencia técnica de los operadores y de la toma de conciencia de los reguladores acerca del desafío que se les plantea.

TOP SAFE 98 puede aportar un diálogo abierto entre los profesionales del sector, tanto reguladores como regulados. Este diálogo contribuirá sin duda a identificar aquellas áreas en las que se puede optimizar la situación actual.

Soy, por lo tanto, el primer interesado en el éxito de esta conferencia, y estoy convencido de que la audiencia tan cualificada aquí reunida es capaz de conseguirlo.

CO-PRESIDENTE DEL COMITÉ ORGANIZADOR
Javier de PINEDO

It is a great honor for me , as Executive Vice President of the Power Generation Group of IBERDROLA and Co-Chairman of the TOPSAFE Steering Committee, to share with you our recent experiences, ideas and some of my personal thoughts regarding Safety Management of Nuclear Plants in the new framework of the recently deregulated Spanish electricity market.

The nuclear power generation in Spain has evolved, like in many other countries, from the big effort carried out in the seventies and early eighties in the design and construction of our plants, to a new focus on a more efficient and safe operation during the last decade.

In the last few years a liberalization process of the electricity market is taking place in several countries. This process, together with a fast development of the technology worldwide, place the nuclear power generation bussiness in a competitive environment. Hence a new set of performances are demanded in our nuclear industry.

First of all our nuclear installations must produce in nowadays a more reliable, safer and cheaper electricity. Moreover, the new environment made us to acknowledge the obsolescence of some organization procedures and individual behaviours of the past, and forced us to introduce in our organizations and companies a transformation process which could guarantee a future to our nuclear industry.

These transformation processes, mainly dictated by the rules of free competitive markets, bring about a global "Cultural Change" with a particular impact in our management criteria and business methods. In consequence, our industry is involved, now and in the near future, in significant and deep transformation projects.

On the other hand, a general vision for a sustainable development of the society in the future, based upon a better quality of life, brought up in paralell, a sense of social and collective responsibility which call for an economic optimization of the most important industrial processes compatible at the same time with an strict care of the environment.

Furtheremore, the public of the societies we serve have an increasing demand for higher safety levels by diminishing potential risks, and to ask at the same time for production activities be made with duly attention to priorities, benefits and reduced costs.

We thus have been driven in nowadays to face those challanges for competitiveness and risk management, with a great deal of efforts which seems to be continue in the years to come. Even though the Nuclear Power Plants performance indicators clearly shown the high level of maturity reached by the nuclear industry, the new scenario we are facing call for more challenging mechanisms of continuos improvement and management of quality.

Therefore we ought to identify and achieve basic goals in areas such as:
- precise strategic planning
- strenghten safety culture and safety management
- human resources consideration and motivation
- reingineering of complex processes
- improvement of quality and plant efficency
- development and implementing self-assesment capabilities
- openness to professional collaboration and information exchange.

All these challanges have forced the companies, at a corporate level, to break with some traditional limitations and barriers which were well established in the old cultural behaviours. The "Cultural Change" we are for aiming for at present is based in higher levels in quality of the management, operational eficiency, higher professional skills, people motivation and participation, and the involvement of all members of the organization in the safety matters.

It is necessary at this point to recognize that the critical driven force in any dynamic and demanding change of a company is his human resources. The company productivity is fundamentally based upon the best utilization of knowledge, talent for creativity and quality of his people in his daily work. Moreover, in a possitive attitude of his personnel to accept new challanges.

The human dimension though present in any industrial activity, it is even more important in the nuclear industry. We may speak not only about human errors causing incidents to become accidents, but also on important sucesses by controlling accidents due to human intervention.

In a nuclear industry, where a good jairalquical structure and clear lines of responsibilities have always been established, the operational results will depend at the end on human performance according to the level of professionalism, knowledge, attitude toward safety, self-assesment, communications and goals.

Focusing our attention in the area of nuclear safety and safety culture, we consider that there is a need to support and push forward a better development of it. In a nuclear organization, all personnel at any level, should know, act and be responsible of any activity which can affect the safety of the installation.

An efficient management system should be founded on the cornerstones of people involvement, participation, team-work and good communications channels. I also believe that an urgent need exists to develop management models capables to measure those intangibles attributes through visible results, as it was pointed out in the IAEA-INSAG-04 report.

I personally think that by taking up people attention and participation in this creative process, we are going to get a great "added value" of their contributions as well as an increase of their professionalism and motivation, because of the cumulative experience acquired by them throughout many years.

The role of the management team in this matter is also a crucial point in the sucess, not only because its necessary support but most of it by its management style, cultural exemples, daily visibility and the adequate allocation of human resources.

In a competitive scenario we ought to reduce the operating, maintenance and fuel costs of our nuclear plants together with an enhancement of the plant performance and the nuclear operations quality, without jeopardizing safety. In every day activity of the nuclear power plants operation, we then have the challange to accomodate the two fundamental concepts of quality and safety with the economical one of cost reduction.

Our experiences already shown that going beyond this challange is possible by using any well-designed "Improvement Programme for Continuos Quality Management Systems" based on an open mentality which believe that any process can be further improved, bearing in mind a possitive self-critical attitude, and workers being more active and participatives.

"Safety Culture" needs to be involved in this new set of mental attitudes because its final deal is to maintain nuclear safety in the planning, execution, verification and optimization of all activities with any significance for plant operations.

Any future stage of nuclear energy development in a free competitive market will be conditioned by the results obtained from the operation of the present nuclear plants which, as I have just said depends on the efforts to run in parallel the programmes of Total Quality, Safety Culture, cost reduction and improvement of operational practices.

On the other hand, the nuclear industry also has to work together with the regulatory bodies, and since the begining of this decade has became more clear that a change in the "Regulatory Culture" is also needed.

Within the nuclear industry there is a general opinion that the regulatory bodies should change from deterministic rules and regulations towards rules based on the relative balance between risk and operational results, licensing processes more sistematics and efficients, and going from a rigid and prescriptible regulation to a more predictible and efficient one.

This new regulatory environment will reduce the burden on the final product avoiding undue extracosts, by appliying criteria of marginality to safety and technical obsolencence in the obtained results. In this sense the use of probabilistic safety analysis will increase as an integral tool in the rationalization of the decission making processes.

We are also continously improving the communications between the nuclear plants and the regulatory body. As a result a better coherence between the licensing and research and development programmes and the safety and cost/benefit perceptions from both sides will be achieved. In this way the actions of the regulatory body will be more predictibles to any responsible operator and owner of a nuclear plant. Nuclear energy still suffer a lack of confidence from the general public. Making clear to the public that the safety of the nuclear installations is our first and continuos priority will help to bring back some of this confidence.

The very competitive and demanding environment of the nuclear industry, forces us to demonstrate that the balance between the safety, the reliability and the profitability of our nuclear installations is also possible.

Statistical studies carried out in more than forty nuclear plants have already clearly shown that the best performance indicators were obtained in plants with the lower operational costs being the management operational quality strongly linked with the global safety of those plants. The higher the safety level and operational quality are the bigger are the profits and the public acceptence of the nuclear plants.

Even though the operational performances and safety parameters obtained in the nuclear industry have reached a fairly high value, still two main problems are making the nuclear option an issue of concern to the majority of the public : nuclear incidents and non programables outages and the generation and final disposal of radioactive wastes.

The communication and evaluation methods of nuclear incidents have improved in the course of the last decades. Today a transparent and understandable system, based on the international nuclear incident scale INES proposed by the IAEA, is available even for non nuclear specialists. The INES scale have improved the understanding between the nuclear industry, the public opinion and the mass media. However, I consider that a major effort is still needed in order to improve the communications of the results obteined in the operation of the nuclear plants, throughout their own information centres, but also in a clear and fast response to any wrong or misleading interpretation respect to any particular nuclear incident.

It is not possible in those remarks to deal with the subject of concern of the radioactive waste management, which could be the matter of a new entire conference. Just as a summary let me say that the special character of the management of the radioactive waste is based in the isolation of the wastes from the environment during long periods of time. This isolation is actually technological solved.

In Spain the scheme adopted in the case of low and medium radioactive wastes is giving excellent results, and we are working now on in order to have a feasible solution in the near future for the high activity level waste.

I wish to finish my words by trying to give you a clear message : nuclear energy, besides being safer, has to be more competitive. I believe the only way in the future for the survival of the nuclear industry is to produce electricity not only at higher safety and quality levels, but also at lower cost. However, many management and cultural changes are still needed within the nuclear organizations in order to achieve these goals, and to accomadate them to the new market challenges. Finally, I also believe that the nuclear industry human resources constitute the key of the success of the whole transformation process in which we are involved.

SESIÓN PLENARIA 1 / PLENARY SESSION 1

MANAGEMENT OF SAFETY, SAFETY CULTURE AND SELF ASSESSMENT

A. CARNINO - IAEA

Safety management is the term used for the measures required to ensure that an acceptable level of safety is maintained throughout the life of an installation, including decommissioning. The safety culture concept and its implementation are described in part one of the paper.

The principles of safety are now quite well known and are implemented worldwide. It leads to a situation where harmonization is being achieved as indicated by the entry into force of the Convention on Nuclear Safety. To go beyond the present nuclear safety levels, management of safety and safety culture will be the means for achieving progress.

Recent events which took place in major nuclear power countries have shown the importance of the management and the consequences on safety. At the same time, electricity deregulation is coming and will impact on safety through reductions in staffing and in operation and maintenance cost at nuclear installations. Management of safety as well as its control and monitoring by the safety authorities become a key to the future of nuclear energy.

SAFETY CULTURE CONCEPT

The concept of safety culture is defined in INSAG-4 as:

"Safety culture is that assembly of characteristics and attitudes in organizations and individuals which establishes that, as an overriding priority, nuclear plant safety issues receive the attention warranted by their significance."

Safety culture is also an amalgamation of values, standards, morals and norms of acceptable behaviour. These are aimed at maintaining a self-disciplined approach to the enhancement of safety beyond legislative and regulatory requirements. Therefore, safety culture has to be inherent in the thoughts and actions of all the individuals at every level in an organization. The leadership provided by top management is crucial.

The significance of nuclear safety issues will vary among organizations and reflect their particular needs. There will always be a necessity to choose which issues are to be addressed as a priority using resources available. The efforts made to enhance safety culture can have beneficial consequences for plant engineering, construction and performance through better organization, analyses, anticipation and ways of doing work such as better planning of outages.

Development of a strong safety culture can result in more effective conduct of work and a sense of accountability among managers and employees.

In promoting an improved safety culture there have been different emphasis, with some countries favouring an approach giving a high profile to the use of behavioural sciences while others have emphasized the quality management system approach to enhancing safety performance. There is consensus that account should be taken of both national and organizational culture in promoting an improved safety culture and an appropriate balance of behavioural sciences and quality management systems approaches should be pursued.

The characteristics and attitudes referred to in the definition of safety culture should be commonly held and relatively stable. "Commonly held" implies that there is a core of key attitudes and values that are acknowledged by the majority. "Relatively Stable" implies that any change tends to be evolutionary rather than revolutionary. Safety culture is important in that it is an influence on behaviours, attitudes and values which are important factors in achieving good safety performance. Organizations with mature safety cultures focus more on the overall goals and key points rather than only on compliance with procedures.

Developing and implementing the safety culture concept needs both a "top-down" and a "bottom-up" approaches. This change in culture must stem from all directions, however, consistent and visible leadership from the top is essential. For management led changes to be successful, it is essential that there is effective cooperation and two-way communication at all levels of the organization. Honest and open communications depend on the development of trust throughout the organization. Technical specialists, human factors specialists, operating personnel and management must work together to develop a common understanding across their various functions. This is in itself a learning process, and as such, a characteristic of a good safety culture. Continuous learning and improvement processes play a central role in the development and maintaining of a good safety culture.

An organization with a good safety culture relies on the close interdependence between technical safety and organizational processes. In practice, a high level of safety culture means the systematic organization and implementation of activities aimed at creating high quality technical, human, and organizational systems.

Irrespective of the level of technical sophistication a mature safety culture can defend in depth against the risk of accidents. An investment in improving safety culture can be beneficial in cases where nuclear facilities are designed to earlier standards.

When considering safety culture as practiced around the world, it is apparent that nearly all organizations involved in nuclear activities have in common a concern for safety and how to improve and maintain it. Yet there is substantial diversity among organizations in their understanding of "Safety Culture" and how to act to influence it in a positive way.

This variation is represented in different developmental stages. Three stages seem to emerge, each of which displays a different awareness and receptiveness to the effect of human behavioural and attitudinal matters on safety. The characteristics of each stage, identified below, provide a measure for organizations to use as a basis for self diagnosis. The characteristics may also be used by an organization to give direction to the development of safety culture, by identifying the current position and the position aspired to. It is possible for an organization at any time to exhibit any combination of the characteristics listed under each of one of these stages.

Stage I: Safety solely based on rules and regulations

At this stage, the organization sees safety as an external requirement and not as an aspect of conduct that will help the organization to succeed. The external requirements are those of national governments, regional authorities, or regulatory bodies. There is little awareness of behavioural and attitudinal aspects of safety performance, and no willingness to consider such issues. Safety is seen very much as a technical issue. Mere compliance with rules and regulations is considered adequate. For an organization which relies predominantly on rules, the following characteristics may be observed.

- Problems are not anticipated; the organization reacts to them as they occur.
- Communication between departments and functions is poor.
- Departments and functions behave as semi-autonomous units and there is little collaboration and shared decision-taking among them.
- The decisions taken by departments and functions concentrate upon little more than the need to comply with rules.
- People who make mistakes are simply blamed for their failure to comply with the rules.
- Conflicts are not resolved; departments and functions compete with one another.
- The role of management is seen as endorsing the rules, pushing employees and expecting results.
- There is not much listening or learning inside or outside the organization which adopts a defensive posture when criticized.
- Safety is viewed as a required nuisance.

- Regulators, customers, suppliers and contractors are treated cautiously or in an adversarial manner.
- Short term profits are seen as all important.
- People are viewed as 'system components'- they are defined and valued solely in terms of what they do.
- There is an adversarial relationship between management and employees.
- There is little or no awareness of work, or business, processes.
- People are rewarded for obedience and results, regardless of long term consequences.

Stage II: Good safety performance becomes an organizational goal

An organization at this stage has a management which perceives safety performance as important even in the absence of regulatory pressure. Although there is growing awareness of behavioural issues, this aspect is largely missing from safety management methods which comprise technical and procedural solutions. Safety performance is dealt with, along with other aspects of the business, in terms of targets or goals. The organization begins to look at the reasons why safety performance reaches a plateau and is willing to seek the advice of other organizations.

- The organization concentrates primarily on day to day matters; there is little in the way of strategy.
- Management encourages cross-departmental and cross-functional teams and communication.
- Senior managers function as a team and begin to co-ordinate departmental and functional decisions.
- Decisions are often centered around cost and function.
- Management's response to mistakes is to put more controls, via procedures and retraining, in place. There is a little less blaming.
- Conflict is disturbing and discouraged in the name of teamwork.
- The role of management is seen as applying management techniques, such as management by objectives.
- The organization is somewhat open about learning from other companies, especially techniques and best practices.
- Safety, cost and productivity are seen as detracting from one another. People think that safety means higher cost and reduced production.
- The organization's relationship with regulators, customers, suppliers and contractors is distant rather than close; this is a cautious approach where trust has to be earned.
- It is important to meet or exceed short-term profit goals. People are rewarded for exceeding goals regardless of the long-term results or consequences.
- The relationship between employees and management is adversarial, with little trust or respect demonstrated.
- There is growing awareness of the impact of cultural issues in the workplace. People do not understand why added controls do not yield the expected results in safety performance.

Stage III: Safety performance can always be improved

An organization at stage III has adopted the idea of continuous improvement and applied the concept to safety performance. There is a strong emphasis on communications, training, management style, and improving efficiency and effectiveness. Everyone in the organization can contribute. Some behaviours are seen within the organization which enable improvements to take place and, on the other hand, there are behaviours which act as a barrier to further improvement. Consequently, people also understand the impact of behavioural issues on safety. 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 asks how it might help other companies.

- The organization begins to act strategically with a focus on the longer term as well as an awareness of the present. It anticipates problems and deals with their causes before they happen.
- People recognize and state the need for collaboration among departments and functions. They receive management support, recognition and the resources they need for collaborative work.
- People are aware of work, or business, processes in the company and help managers to manage them.
- Decisions are made in the full knowledge of their safety impact on work, or business, processes as well as on departments and functions.
- There is no goal conflict between safety and production performance, so safety is not jeopardized in pursuit of production targets.
- Almost all mistakes are viewed in terms of work process variability. The important thing is to understand what has happened rather than find someone to blame. This understanding is used to modify the process.
- The existence of conflict is recognized and dealt with by trying to find mutually beneficial solutions.
- Management's role is seen as coaching people to improve business performance.
- Learning from others both inside and outside the organization is valued. Time is made available and devoted to adapting such knowledge to improve business performance.
- Safety and production are seen as inter-dependent.
- Collaborative relationships are developed between the organization and regulators, suppliers, customers and contractors.
- Short term performance is measured and analyzed so that changes can be made which improve long-term performance.
- People are respected and valued for their contribution.
- The relationship between management and employees is respectful and supportive.
- Aware of the impact of cultural issues, and these are factors considered in key decisions.
- The organization rewards not just those who 'produce' but also those who support the work of others. Also, people are rewarded for improving processes as well as results.

The above characteristics describing each of the three stages of evolution could serve as the basis for a survey to establish which stage an organization has reached. Different parts of the installation organizational structure can in fact be found at different stages of safety culture development.

The process for the development of safety culture can be assisted by the use of a learning process within an organization. There is a wide range of practices that are of potential value in the practical development of a progressive safety culture. The timescale required to progress through the various stages of development cannot be predicted. Much will depend upon the circumstance of an individual organization and the commitment and effort that it is prepared to devote to effect change. However, sufficient time must be taken in each stage to allow the benefits from changed practices to be realized and to mature. People must be prepared for such change. Too many new initiatives in a relatively short period of time can be organizationally destabilizing. The important point to note is that any organization interested in improving safety culture should start and not be deterred by the fact that the process will be gradual.

There is a possibility that certain practices may be more suitable to one of the three particular stages of development of safety culture, although the complexity of the cultural change process precludes any universal guidance. In developing an improved safety culture attention needs to be paid to the national culture. In some countries there may even be significant differences among regional cultures. The characteristics of a national culture can amplify or attenuate the factors associated with a good safety culture.

MANAGEMENT OF SAFETY AT OPERATING ORGANIZATIONS

The first requirement for safety management is a commitment to safety from the top management at both corporate and NPP level. It is demonstrated in different ways such as a yearly general declaration, fixing short term and long term safety objectives and including safety managers in the NPP structure who are accountable for the safety in operation. Safety advisory panels or groups are also important to monitor and assess the overall plant safety and to support the safety measures to be taken.

The second requirement is to develop the necessary work environment for developing a good safety culture through employee welfare, openness, communication, listening to staff problems and noticing on time the warnings indicating possible degradation of safety. Safety culture concept needs both a "top-down" and a "bottom-up" approach. Continuing learning and improvement processes play a central role. Although safety performance indicators have not yet been agreed upon on an international basis, each NPP management should set up its own in order to be able to detect progress or deterioration of performances.

The third requirement is a commitment to develop and maintain a good safety culture. It recognizes the close interdependence between technical safety and organizational processes. In practice, a high level of safety culture means the systematic organization and implementation of activities aimed at creating a high quality defense-in-depth against both technical, human and organizational failures that may cause accidents.

Irrespective of which stage of safety culture as defined in chapter 1 an organization is at, there is one fundamental requirement that is essential, namely the genuine and visible commitment of the top management of the organization to the improvement of safety. Top management should have knowledge about safety cultural issues so that they are in a position to undertake the leadership role to create and communicate the future safety vision for their organization. Managers should not only know how to motivate their team but also how to avoid demotivating them. The involvement and commitment of senior management in pursuing high standards of safety is essential. Without a visible and genuine demonstration of this commitment by personal behaviour and leadership example by senior managers, other workers in the organization will not be convinced of the importance of safety compared to other organizational issues. Words without deeds will create an illusion of safety that will result in the development of a superficial safety culture.

To support the development of a good safety culture and an appropriate safety management, senior managers can contribute by:

- Gaining understanding of safety culture concepts and practices by undergoing appropriate training;
- Demonstrating a leadership style that has an appropriate balance between caring and controlling;
- Being visibly interested in safety;
- Having safety as a priority item on the agenda at meetings;
- Encouraging employees to have a questioning attitude on safety issues;
- Ensuring that safety is addressed in the strategic plans of their organization;
- Having personal objectives for directly improving aspects of safety in their areas of responsibility;
- Regularly reviewing the safety policy of the organization to ensure its adequacy for current and anticipated circumstances;
- Monitoring safety trends to ensure that safety objectives are being achieved;
- Taking a genuine interest in safety improvements and giving recognition to those who achieve them, and not restricting their interest to situations where there is a safety problem.

Senior management should ensure that their organization has a safety management system that provides a structured systematic means of achieving and maintaining high standards of safety performance.

The last requirement on operating organizations is to stay "humble": don't take for granted that the good level of safety will stay for ever, especially in the field of safety culture, keep a questioning attitude. External peer reviews are useful for that purpose and are getting more and more popular through the IAEA OSART and ASSET services and through the WANO Peer reviews. The Convention on Nuclear Safety also relies on peer reviews. More and more efforts are dedicated to learning from experience and to the sharing of good practices worldwide through various mechanisms. It helps keeping the operating organizations "humble" and vigilant on the safety performance of their plants.

Examples of practices that help to maintain the operating organization humble and vigilant are given as an illustration:

- Use of "predictive risk analysis" or "risk assessment methodology" during the preparatory phase of an activity. This analysis of risk of errors and of their consequences is basic to quality. Performed by a multidisciplinary team, it should focus on quality requirements for the main safety-related issues, and thereby contribute to better understanding and communication between servicing and operating teams. It also improves the awareness of each member of the team on the key points and overall aim of the activity and its connection with other activities. If well applied, this predictive risk analysis is a learning process and is a good tool to spread safety culture by contributing to better understanding and adherence to safety requirements.

- Errors considered as a learning opportunity. Any event related to safety, and especially human or organizational errors, must be first considered as a valuable opportunity to improve operations through experience feedback and lessons learned. It is of the utmost importance to encourage the development of employee attitudes that give them confidence, without fear of blame, to report fully errors, particularly human errors, so that the opportunity can be taken to learn how to further improve the process. One consequence of this, as is shown by some experience, is that the number of events reported can actually increase. It indicates a higher safety awareness which will induce better detection and reporting.

- Systematic in-depth analysis of events. The first step is the detection of events by reporting against clear criteria including the analysis of human factors. The causes may be one or several of the following: technical, human behaviour, organizational culture, process, procedure, equipment, man-machine interface, environment or latent weaknesses in defence. The need for honesty, objectivity and comprehensive reporting of incidents and the use of this information must be stressed. One essential condition, especially in case of human error, is the participation of the personnel or the team involved in the event. They should be encouraged to propose corrective and preventive measures. It must be clearly stated by management that safety culture is not necessarily a "zero error" culture, but rather a learning process which relies on openness and experience feedback to get improvement.

- Ability to learn. The enhancement of nuclear safety relies on both actions taken in response to failures (reactive prevention) and the ability of organizations to identify the nature and causes of developing problems and to apply effective interventions to meet them (proactive prevention). A more proactive approach to safety management can be achieved through processes that will promote improved performance over time. Organizations of this kind have been characterized as "learning organizations".

- Employee contribution. Every employee has a primary responsibility for contributing to their personal safety and to that of their fellow employees.

Many organizations have found, by experience, that this contribution is best facilitated by encouraging employee involvement in safety. Individuals tend to take a personal interest in those matters related to their personal safety. Examples of employee involvement in safety include safety improvement teams, safety committee and safety meetings.

MANAGEMENT OF SAFETY FROM THE REGULATORY AUTHORITIES VIEW POINT

In addition to its regulatory functions in developing regulations, licensing and operating experience feedback analysis, a regulatory authority ensures that the operating organization is fulfilling its responsibility in terms of nuclear safety.

Regulatory inspection and enforcement is an essential tool for monitoring the safety level at installations. Since more and more non-prescriptive regulatory approaches are now taken in the world, inspections tend also to depart from pure compliance to performance and/or process checking. Such an orientation certainly reinforces the prime responsibility of the operating organization in safety.

Since safety culture cannot be "regulated", appraisal of the safety culture in operating organizations becomes a major challenge for regulatory authorities. Indicators of safety culture development and of deviations of usual performances become essential.

Traditionally most organizations have measured the number of accidents and safety-related events. Whilst providing important trend information, these indicators are of a passive nature and their exclusive use can be demotivating to the workforce. Some organizations have used indicators of a more positive nature to complement the traditional passive indicators. Examples of positive safety indicators include:

- Percentage of employees who have received safety refresher training during the previous month/quarter
- Percentage of safety improvement proposals implemented during previous month/quarter
- Percentage of improvement teams involved in determining solutions to safety related problems
- Percentage of employee communication briefs that include safety information
- Number of safety inspections conducted by senior managers/managers/supervisors during previous week/month (the inspection may be combined with a house keeping inspection)
- Percentage of employee suggestions that relate to safety improvement
- Percentage of organizational routine meeting with safety as an agenda item.

The value of positive safety indicators is that they serve as a mechanism for giving recognition to employees who are endeavouring to improve safety by thought, action or commitment. Recognition for achievement is a powerful motivating force to encourage continued improvement.

There is considerable international diversity in the regulatory approach to safety in terms of where emphasis should be placed. The regulator has options in dealing with the regulation of human and organizational factors. Options include compliance-based approaches, where there are very explicit standards and requirements that are applied uniformly to all nuclear facilities or activities and that result in a standard approach being taken. However, this approach may be less effective or even inappropriate for the area of organization and safety culture.

Another option is to focus on outcomes - to establish safety performance indicators and to devote regulatory energies to tracking indicators and launching investigations when the indicators show a level of performance that is deteriorating or not acceptable. The problem that has been discovered with this approach is that it is very difficult to develop predictive indicators, and that the indicators that can be developed are often either too easy to manipulate or are not sensitive enough to developing problems to allow early intervention.

An additional option, referred to as a process-based approach to regulation, takes specific account of the fact that the safe operation of nuclear facilities depends on the effectiveness of the organizational processes established to operate, maintain, modify and improve a facility. Briefly put, the process approach focuses on the organizational systems that the facility has developed to assure the ongoing safe operation from the perspective of the facility's internal logic. Process-based regulation recognizes that the design of organizational processes must remain flexible in order to allow the facility to create processes that are internally consistent, adapted to their history, culture and business strategy and that allocate resources in the most rational way. A process-based approach attempts to allow this flexibility while forcing the facility to think very carefully about the logic of their processes, to demonstrate to the regulator that they have taken a very rigorous approach to the design, implementation and ongoing evaluation of their key processes and that they are alert to opportunities to improve their systems. A combination of the above three approaches can be used as they are not mutually exclusive.

Effective processes can take many different forms, but they must stand the test of being explicit, predictable, logical, implementable and include a basis for self assessment. The advantage of process-based regulation for the areas of organization and safety culture is that assessments that focus on the logic of key organizational processes and the care that the utility or plant takes in implementing and self-assessing these processes allows a degree of flexibility but is just as rigorous as prescriptive approaches that concentrate on compliance.

Irrespective of which regulatory approach is adopted, organizations committed to continuous safety improvements will benefit from an open and frank dialogue with the regulatory body, especially when the dialogue focuses more on achieving fundamental safety objectives than on merely formal compliance with detailed rules and regulations. Experience has shown that this type of dialogue will promote an enquiring and learning attitude, a key element in enhancing safety culture. In other words, the regulatory approach adopted may significantly influence the possibilities to foster a continuous improvement approach on the part of the utility or plant. In practice, an optimal combination of all these suggested regulatory approaches may be the most effective. The optimum regulatory approach will depend upon the influence of the national culture.

In the interests of promoting safety culture in organizations under its jurisdiction, the regulatory body could consider :

- Within the constraints of national legislation, allowing some flexibility for organizations to manage for safety and develop aims and goals that exceed legal requirements;
- targeting inspection effort to areas of risk and recognizing that some plants may have effective safety management systems. At these plants, sufficient inspections of control processes and selective inspections of outcomes on the plant may be adequate as a regulatory tool;
- not seeking to have blame allocated in the investigation of incidents, and avoiding inappropriate punitive action on the reporting of incidents;
- making the reasoning behind regulatory controls visible, e.g. publish them;
- establishing predictability and stability in the regulatory process;
- trying to agree on appropriate technical ground rules for safety cases and for assessment methodologies;
- having regular dialogue with organizations and encouraging openness in dealings;
- training inspectors to deal with the public on nuclear safety issues in a way that is understood;
- training of inspectors in safety management (including safety culture) and human factors matters;

Peer reviews from external organizations or international ones represent also a good means for regulatory authorities to exchange experience on installations safety performance evaluation and to further enhance the monitoring of safety in operating organizations.

It is important that regulators be alert to incipient weaknesses in safety culture and this section provides some guidance on symptoms to look for when carrying out their regulatory duties. The operating organization should also pay attention to these symptoms. The symptoms have been categorized into organizational, regulatory, employee and technological issues.

Organizational issues

External environment pressure. Many organizations are subjected to increasing economic and business market pressures that are forcing them to reduce significantly their costbase, often through down-sizing of their workforce. In some regions of the world there has been major political and social change that has impacted organizations both directly and indirectly. These changes create uncertainty in organizations that inevitably affect the behaviour and attitude of people. Organizational goals and priorities can change significantly and there is the potential for safety standards and performance to be adversely affected. Attention should be paid by all involved, either in the management or regulation of safety, to how significant corporate change processes are being managed to ensure that the principles of good safety are not being jeopardized.

Inadequate problem resolution. Symptoms of inadequate problem resolution are repeated crises, significant accumulations of corrective actions, lack of effective managerial prioritization of remedial actions and failure to address the root causes of problems. Inadequate problem resolution can result in an increasingly overloaded and under-resourced situation that causes a highly ritualized response to problems.

Organizational insularity. Organizational insularity can cause safety culture to deteriorate simply because managers come to believe that safety performance is satisfactory and so become complacent. Managers have no benchmarks or learning opportunities. Insularity can be internal to an organization. It often occurs that plants and facilities belonging to the same utility create and display very different organizational and operational styles and identities. The regulators should determine on a regular basis that an 'open' and interactive organizational style prevails between the plants under their jurisdiction.

Openness. Open and honest communication between regulator and representatives of an organization is essential if the former is to be able to assess and evaluate the safety culture. Difficulties in obtaining information may be a sign that there is a weakness in the safety culture. An organization striving to improve and develop its safety culture should be willing to share its experience with others as well as using the experience to improve its own safety. This may also extend to the 'openness' of the organization to participate in and contribute to international exchanges and initiatives.

Regulatory issues

Corrective actions. When safety culture first starts to weaken one of the most obvious signs is evidence of a significant accumulation of corrective actions that have not been addressed. The existence of an effective self-assessment, root cause analysis and corrective action programme is a positive indication of a good safety culture.

Patterns of problems. Part of the ongoing monitoring of compliance and plant status checks normally carried out by the regulator is the collection of information from varied sources. By arranging this information in pre-determined categories it is possible to create a profile or pattern of similar situations from which preliminary conclusions can be drawn. Repetition of problems usually indicates that the root cause was not identified correctly and that whatever corrective action may have been implemented was not adequate. Whilst they are not true indicators of performance, trends are guides which can alert the regulator to areas of concern based on actual plant sourced information.

Procedural inadequacies. Documentation is the life blood of an organization and regulatory requirements demand that it be acceptable in quality and content. It is also required that safety documentation be complied with and, therefore, it must be up to date and reflect the actual situation. Normal quality assurance audits and checks should cover these requirements, however, these are usually not performed often enough to monitor the day to day status of review and revision. An important element of safety culture is that employees will have confidence in procedures and use them correctly. However, it is essential that the regulator has an indication of the situation pertaining to regular documentation reviews and that any deteriorating situation is detected at an early stage.

Quality of analysis of problems and changes. Regulators have to be sure that any analysis carried out at the plant follows a systematic, auditable system which will ensure that the correct methods are used, validation is performed and the correct solutions defined. Too often the process is circumvented due to inadequate identification of the problem, lack of resources and knowledge or time constraints and these can lead to inappropriate actions being taken. High quality in analysis usually also requires an integrated approach i.e. to have a broader view on safety and recognizing the need for integrated analyses with the involvement of different specialists. In order to be more proactive the analyses performed also need to include a long-term perspective.

Lack and failure of independent nuclear safety reviews. For all nuclear safety-critical proposals and modifications, independent nuclear safety assessments should be undertaken by persons other than those who have undertaken the original work. In a healthy safety culture, these assessments will always have been fully documented, and checked for methodological, calculational and technical accuracy and validity, using approved procedures.

Reality mismatch. A well developed safety culture will always be consistent with the nature of the safety case and the state of the plant. The plant state, configuration and condition must, at all times, be fully consistent with the claims that are being made in the safety case and that likewise the claims that are required in support of the safety case must never make demands on plant or personnel which are unrealistic or unreasonable.

Violations. Non-compliance (violations) tend to be recorded by most licensees in varying degrees, in relation to breaches of operating rules and operating instructions. Such reports can be of variable quality and detail but all should be notifiable to the relevant regulatory bodies.

Repeated requests for dispensation to regulatory requirements. Requests for dispensations to existing regulatory requirements can occur, particularly prior to restart after a planned outage. When requests are frequent this should trigger a review of the adequacy of the regulatory requirement, or of whether production priorities are being over-emphasized at a possible disadvantage to safety.

Employee issues

Excessive hours of work. A significant factor in the degradation of personal performance is fatigue. Safety culture relies on optimum output in the areas of attention, questioning attitude, diligence and fitness for duty, however, all these are adversely affected when a person is tired and stressed. Working hours must be formulated and regulated to allow individuals to perform their allotted duties within reasonable timescales without imposing undue pressures which can induce unsafe and undesirable consequences. Persistent abuse of overtime and the continued reuse of staff on call-outs or replacement work would indicate to the regulator that resource levels and planning of work require investigation.

Number of persons not completing adequate training. Training plays an integral role in the safety culture of an organization and the regulator would want to be assured that adequate attention was being paid to the quality and applicability of training programmes. These aspects are checked by submissions of the operating organization, examination and acceptance of the training required by the regulator, however, the attendance and performance of staff at training sessions needs on going attention.

Failure to use suitably qualified and experienced persons. A proactive approach includes identification of the principal duties and responsibilities of the job holder, the attributes required for the tasks to be performed and the preparation of a profile outlining the characteristics that would be required of the incumbent in order to carry out the duties effectively.

Understanding of job descriptions. Typically in poor safety cultures, some individuals are not fully aware of the full requirements, responsibilities and accountabilities of their job. The regulator should then require evidence that there is a one to one correspondence between the job holders' understanding of their respective job responsibilities, and the licensee should be able to produce evidence that the job holders actually understand the requirements of their jobs as defined by the licensee.

Contracting. An emerging trend in plant maintenance and support is the increased employment of contractors to replace traditionally plant based personnel. Whilst this has financial benefits for the utility it often comes at the expense of safety, either directly as a result of lower contractor standards or the indirect effects on permanent plant employees.

Technology issues

Plant conditions. Plant conditions provide a useful and valuable insight into the general health of an organization's safety culture. It has long been recognized that poor house keeping standards are an indicator of behaviour and attitudes that are not likely to be conducive to the development of a sound safety culture. Other indications are lack of attention to alarms or non-repair of mal-functioning equipment, overdue maintenance work or poor information recording and archiving systems.

SELF-ASSESSMENT

The nuclear industry in general is getting to a more and more mature stage and the future for continuing the safety enhancement will be with safety culture and especially self assessment which correspond to the stage 3 described above.

Ensuring operational safety is an obligation on the nuclear power plant operating organization. Characteristics of operational safety include: conservative decision making; operation of the plant within the safety analysis envelope; maintenance of defense-in-depth against unplanned events and their consequences through high levels of equipment reliability and human performance; and ensuring that all plant and procedure modifications are adequately considered for safety consequences. Self-assessment of operational safety has been identified as an important mechanism that organizations can use to improve safety. Independent external assessment, carried out by a body that is external to the utility, is not considered to be part of the self-assessment processes described here but should be used as confirmation of self assessments.

The purpose of self-assessment is to promote improved safety performance through the direct involvement of personnel in the critical examination and improvement of their own work activities and work results. It is designed to ensure that line management is effective and monitoring operational safety performance and takes timely corrective actions to improve performance. At lower levels of the organization potential weaknesses can be detected and often resolved well before they reduce any margin of safe operation. .Self-assessments are also designed to identify and overcome process weaknesses and obstacles to the achievement of safety performance objectives. As a result the allocation of resources can be prioritized.

Self-assessment is essentially a critical comparison of existing activities and results against a predetermined set of performance expectations. The full set of performance expectations can be the set of goals, targets and objectives, including those set by the organization management, that are to be followed and achieved by the staff as a whole and may include performance expectations other than safety. The performance expectations should be set by:

- taking into account regulatory requirements as a minimum level;
- considering attributes of the top performing plants in relevant areas;
- looking at best practices identified through information exchanges, international organizations and institutions.

Targets should be reviewed on a regular basis to ensure that performance continues to improve.

Experience of the application of self-assessment has shown that the following benefits can be gained from an effective programme. It maintains a continuous assessment of safety throughout the whole of the organization; this allows improvements to be made based on up-to-date factual knowledge and the objectives to be achieved.

Staff awareness of the self-assessment process can result in a better understanding of safety culture, of performance expectations and can broaden staff knowledge of the objectives to be achieved, and how they can be reached. Self-assessments can help to improve communication and working relationship across all levels of the organization.

A strong commitment to the self-assessment process can motivate staff to seek improvements in safety performance and in developing a greater sense of ownership and openness in which staff feel confident in bringing problems forward and in suggesting improvements.

The self-assessment process, in conjunction with other forms of internal and external assessments, is a major factor in reaching the desired overall performance expectations and maintaining and enhancing safety culture.

Although the primary beneficiary of strong self-assessments will be the plant and operating organization, the results of the self-assessments could be used, for example, to increase the confidence of the regulator in the safe operation of an installation

The commitment of the individuals and management at all levels is needed for the success of a self-assessment programme. This includes active involvement in developing and implementing the self-assessment plan.

Some organizations provide specific training for employees who have responsibilities for self-evaluation/assessment to ensure that the task is conducted to an acceptable standard. Some organizations are providing a wider range of their workforce with self-checking training to encourage employees to assume an individual responsibility for their personal safety and those of their colleagues. Such training can assist in identifying unsafe acts or unsafe conditions.

Independent evaluations and audits are conducted by competent people independent of the area or activities being audited. This can be achieved either by using external consultants or by using employees from different sections, departments or sites to audit their colleagues. Those with auditing responsibilities will generally require specific training in this task to ensure competence.

Review and audit activities in the nuclear industry are commonly used. Those which focus merely on compliance can create a negative image of audits in the eyes of employees and can create difficulties for auditors in their work. Some organizations have changed the role of audits from the exclusive identification of non-compliance to include the identification of improvement opportunities. Auditors, by the nature of their work, have the opportunity to observe "best practices" in the organization, and audits can be used as a means of disseminating information about best practices to all parts of the organization. Judgement of what constitutes "best practice" is subjective to a degree and the inclusion of this supplementary requirement may present difficulties for the traditional quality assurance audit.

A feature of many successful audits is that there is a pre-audit meeting between the auditors and the auditees to discuss and agree the scope and programme for the audit. This involvement by the auditees does much to ensure that the auditors' work is perceived positively.

Self assessment will soon become the key to continued safety management progress.

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SESIÓN PLENARIA 2 / PLENARY SESSION 2

MAINTAINING OPERATIONS EXCELLENCE IN A COMPETITIVE NEW OPERATING ENVIRONMENT

Marvin S. FERTEL- Senior Vicepresident
Nuclear Energy Institute

I'm pleased to be here to address this gathering of the international nuclear community. As you know, the United States relies on nuclear energy for one-fifth of its electricity (see Figure 1). Also, as you know, the electricity business in the United States is currently being transformed from a regulated monopoly to a competitive generation business. This transition represents a significant opportunity for nuclear energy in the United States. In fact, the outlook for nuclear energy in the United States may be the best it has been at any time in history. Of course, the foundation of any successful nuclear program is maintaining excellence in operation and safety performance, which is the theme of this plenary and a subject I will come back to throughout this presentation. But first, let me share with you why we believe the future for nuclear energy in the United States is so bright.

I want to discuss two key themes about the U.S. nuclear energy industry:

One, key policy issues are beginning to converge in a way that is very positive for our industry—and for society as a whole: and Two, the industry has worked hard to prepare for the future—and we are ready to make the most of these positive developments.

Let's talk about the convergence of key policy issues...Nuclear energy's future es linked to several major policy issues. Issues like the environment,

Electricity Generation in the United States

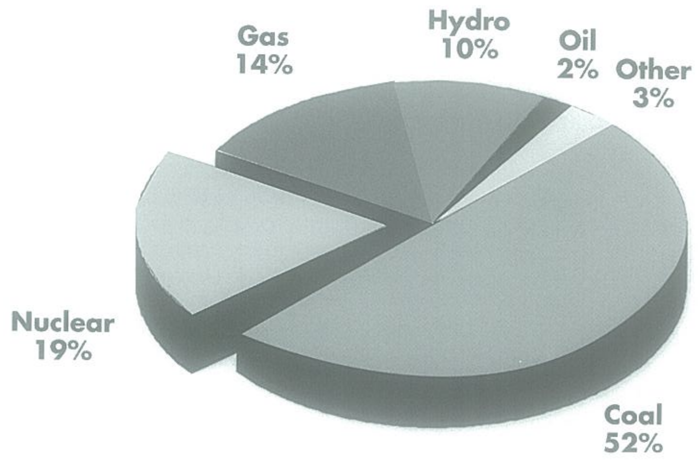


Figure 1

competition and the associated restructuring of the electric utility industry. Waste disposal. And public acceptance.

All these issues are moving in directions that are very positive. And what is even better, they are converging. Let me discuss the convergence.

Concern about the global environment is causing many people to take another look at the benefits of nuclear energy. We see growing support for nuclear energy in the administration, the U.S. Congress and among the American public. Even among some environmental groups that have been critics of the industry in years past.

December's meeting in Kyoto hammered home the message that nuclear energy is critical to curbing greenhouse gas emissions. Nuclear plants generate large amounts of electricity without emitting carbon dioxide –the most prevalent greenhouse gas– or other air pollutants, such as nitrogen oxide or sulfur dioxide.

Fossil fuels can't make that claim. And certainly in the United Stated non-emitting hydroelectric and renewables can't meet the demand.

Electricity producers in the United States particularly are under more and more pressure, to reduce emissions of air pollutants. In the context of global climate change, there has been a lot of discussion about carbon. But it isn't the only pollutant that electricity producers have to worry about. In the United States, utilities also have to contend with stringent limits on SOX and NOX emissions—sulfur dioxide and nitrogen oxide.

Nuclear plants are vital to reducing emissions of carbon, SOX and NOX (see Figure 2). This is part of the "hidden value" of a nuclear power plant. Anyone who thinks a balance sheet tells the whole story of a nuclear plant's value is just plain wrong.

The Clinton administration fully recognizes that the United States can't meet its targets for emission reductions without continued –and expanded– use of nuclear energy. Our government's chief negotiator in Kyoto, Stuart Eizenstat, said a recent congressional hearing that "nuclear power will have to play an increasingly important role, because it does not emit greenhouse gases".

The second reason we are optimistic about the outlook for nuclear energy is that we are closing in on a solution to the issue of spent fuel disposal.

Last November, the Federal Appeals Court –once again– affirmed the Energy Department's obligation to start accepting spent fuel from nuclear power plants. And in no uncertain terms, told DOE that not having a disposal site ready is no excuse for dodging its responsibility.

This action by the Court was in response to law suits filed by utilities, State Attorney Generals and State Public Utility Commissions. This strong coalition of industry, states and utility regulators is continuing to work together to pursue resolution to out waste disposal issues through both the Courts and the Congress.

Last year, both houses of Congress passed legislation requiring the Energy Department to establish an interim storage facility for spent fuel... and to get on with the business of building a permanent repository. Members of Congress are now working to prepare the bills for a vote in both houses... and to secure enough votes for this legislation to pass with a veto-proof margin. The need for and value of congressional leadership on addressing this federal government responsibility is fully recognized by our Congress. We expect passage later this year of the Bill.

The waste issue is so important that it's being pursued on more than one track. In addition to pursuing legislation, a number ot utilities are working to develop private interim storage facilities. But passing this legislation in the House and Senate this year is the industry's number one priority. It will do more than just safely remove spent fuel from the nation's nuclear plants, where it has been accumulating. It will remove a philosophical argument against future plant construction. And it will bolster support for license renewal of existing plants.

The third reason we are optimistic about the future of nuclear energy in the United States is really captured by the subject of this plenary –Operational Excellence. Through the efforts of the individual operators of our plants and those of our Institute of Nuclear Power Operations (INPO), our plants are performing exceptionally well and continuing to improve. From a safety standpoint, we are already meeting or exceeding the year 2000 goals for two key WANO Performance Indicators –nplanned automatic scrams (Figure 3) and safety system performance (Figure 4). From a capacity factor perspective, our operating plants continue to show marked improvements (Figure 5) –and with the onset of competition we see companies planning on sustained 3-year rolling capacity factors approaching 90 percent. The onset of competition, however, won't detract from the emphasis on safe, reliable operations. Clearly, you can't compete if you don't operate—and just as clear, you won't operate unless you do so safely and reliably. The commitment of the U.S. nuclear industry to operational excellence and to the sharing of information and experiences from a safety standpoint continues unabated as we enter the competitive marketplace. The commitment of the industry to improving the overall efficiency of operations has been strengthened as a result of competition—and that leads me to my fourth point concerning the future of nuclear energy in the United States.

NUCLEAR ENERGY: A Clean Alternative

- **In 1996, nuclear power plants prevented the emission of:**
  - **147 million metric tons of carbon**
  - **5.3 million short tons of sulfur dioxide**
  - **2.5 million short tons of nitrogen oxide**

Figure 2

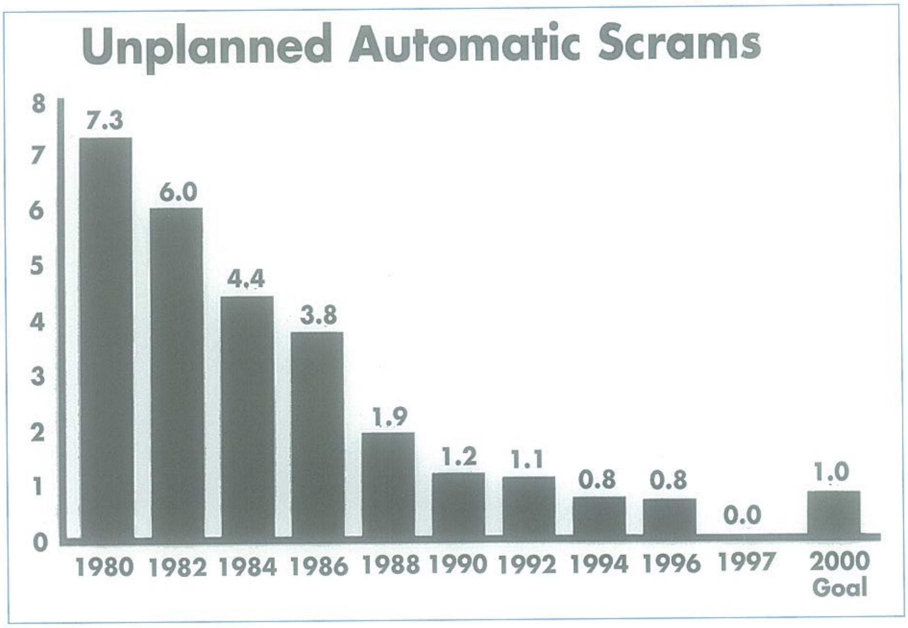


Figure 3

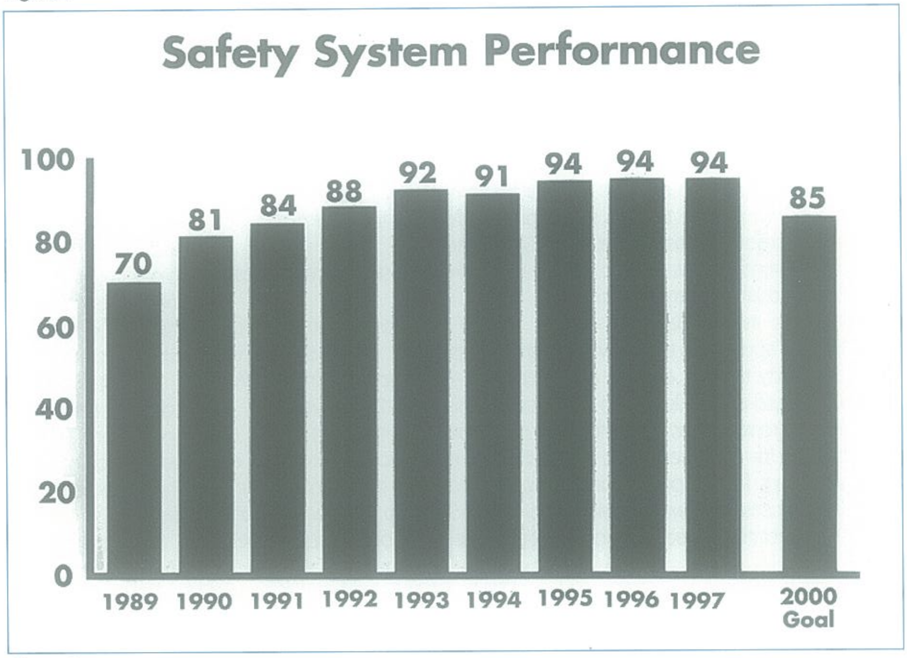


Figure 4

The shift toward open competition in the electric-generating industry—is good news for nuclear energy, with its comparatively low marginal operating costs (see Figure 6).

Average nuclear production costs –that's O&M plus fuel– have declined substantially since the late 1980s. In 1987, the average cost per kilovatt-hour was 3.01 cents, calculated in 1996 dollars. The 1996 figure was 1.91 cents—a 37 percent reduction in less than a decade.

The figures aren't all in yet for 1997. But we have seen a decrease in production, and we'll probably see an increase in costs. That's largely due to regulatory compliance issues the industry has faced during the past two years. In 1997, 10 units1 were shut down all year... and four others2 were down much of the year.

There is both good news and bad news.

The good news it that very few of the issues those plants are looking at affect the public health and safety.

Unfortunately, that's also the bad news—because it highlights inefficiencies in our regulatory system. There are lots of efforts under way by the NRC itself and the industry working with the NRC to correct these inefficiencies. But that's a subject for another speech.

Even with the difficulties we've had recently, the number of units with capacity factors of 80 percent or better actually went up last year! Fifty-six units performed at that level. Two more than the year before.

And nearly three-fourths of U.S. units had capacity factors of 70 percent or higher. So while some plant are struggling, the majority are doing well. And many of them will be highly, competitive in the years ahead.

From the perspective of safety and economic performance, we find that our least cost plants from the perspective of dollars spent on O&M are also among our safest plants, consistently receiving high ratings by both INPO and the Nuclear Regulatory Commission. We also find that those plants spend about on average $40 million per year less on operation and maintenance than the rest of the industry, and less than 50 percent of what the plants that are spending the most (see Figure 7). These data and other information leads to the clean conclusion that safety, regulatory performance and efficient-economic performance are not only in conflict, but in fact are complimentary. We can also conclude that there is significant opportunity for improved economic efficiencies by all of our plants, particularly those in the higher cost quartiles.

Let me know turn to the fifth reason we are so optimistic about nuclear energy's future is that the American public supports it. This support is quiet, and without fanfare. But it's there.

A recent NEI poll looked at the views of an influential sector of the American public—college graduates who are registered to vote. Nearly nine out of ten agree that we should renew the licenses of nuclear plants that continue to meet safety standards. Three out of four agree that we should keep the option to build more nuclear power plants in the future.

And listen to this: More than half of those surveyed said that the United States should build more of these plants in the future. The people surveyed influence public policy directly—at the ballot box.

But we continue to see a "perception gap" regarding public acceptance of nuclear energy. While this survey shows that a majority of Americans support nuclear energy, it also shows that those supporters think they are in the minority. The support nuclear energy personally, but view it as unpopular (see Figure 8).

We have seen the same perception gap in surveys of congressional staff. A majority of them say they support nuclear energy—but they believe their constituents do not.

A decade of public opinion surveys shows strong public support for nuclear energy in the United States—but the perception gap is a concern. In fact, NEI has launched a major new program aimed at closing that gap. And our industry is one of the target groups we have to reach. The attitudes we express publicly, as well as within our own industry, play a big role in how it is perceived by others. In the U.S. at least it's time to put aside the pessimism that has pervaded the industry. The outlook for nuclear energy is extremely bright—in the United States and we believe worldwide. So get the word out!

This brings me to my second theme: The U.S. nuclear industry is ready to make the most of the opportunities now presented to us.

In 1989, the industry created a strategic plan for building new nuclear power plants in the United States. The plan identified key elements that must be in place before utilities start building the next generation of nuclear plants. I've already discussed one of the key elements we wanted to improve the efficiency and reliability of our current nuclear plants, and while we will

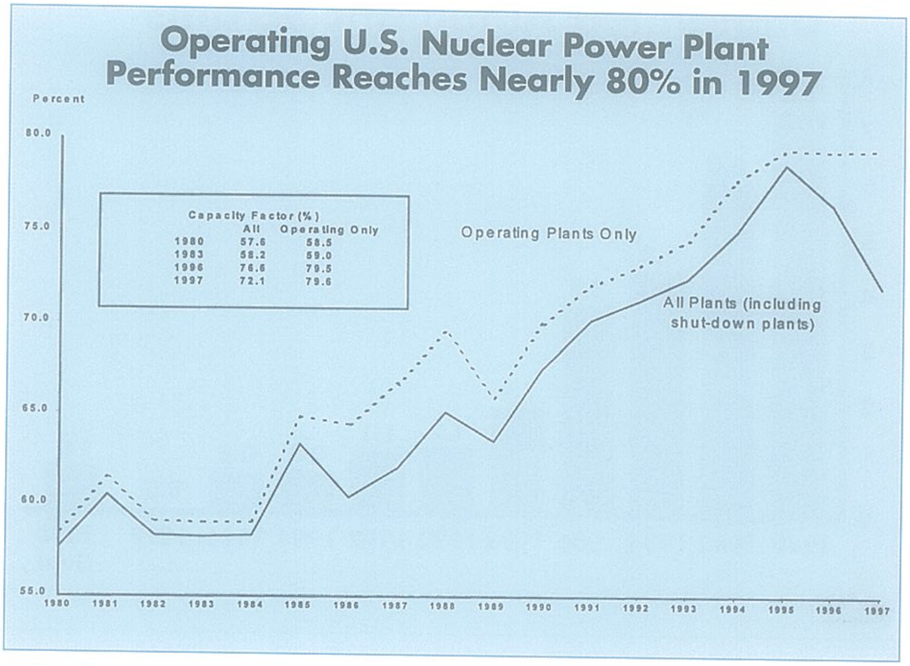


Figure 5

continue to see improvements, we believe the plants are already achieving exceptional levels of performance. Let me briefly touch on two other elements important to us and important to operational excellence.

One, we wanted to establish a regulatory framework for license renewal; and **Two**, we wanted to have standardized advanced light water reactor designs available to satisfy future capacity requirements.

License renewal is a realistic option for well-run, cost-effective nuclear plants, especially the larger units.

Just this month, Baltimore Gas & Electric Company submitted its preliminary application to renew the license for its Calvert Cliffs plant. BGE is the first utility to make a formal announcement—but others will follow. We expect several applications from other licenses this year and next year.

License renewal has a number of major benefits including laying a foundation for continued focus on operational excellence by providing a clearer future for people working or wanting to work in the industry. In addition, license renewal will allow the United States to maintain needed electric generating capacity that does not produce greenhouse gases or other pollutants, such as nitrogen oxide and particulates. As I said previously, emission controls are making it more and more expensive to operate fossil-fueled plants. Let's take a look at the first benefit of license renewal: It will maintain generating capacity that doesn't produce greenhouse gases.

In a 1997 report3, the Energy Department estimated that U.S. nuclear capacity will fall from 99,200 megawatts in 1995... to 88,900 megawatts in 2010—mainly because of the retirement of plants whose licenses expire between 1999 and 2010. If no nuclear plant licenses were renewed, nuclear capacity would decline even more sharply between 2010 and 2025. The DOE report recognized the vital importante of keeping emission-free nuclear power plants on line. Here's what it said:

Nuclear power is a carbon-free source of electricity. Retaining as much as possible of its current power generation would therefore be an important carbon mitigation strategy.

We agree wholeheartedly!

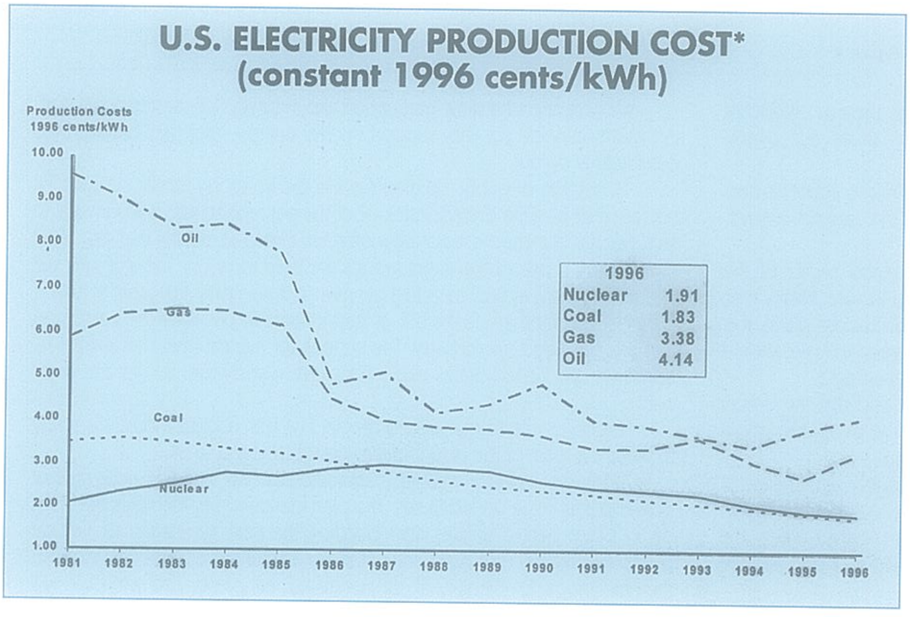
This brings me to the second benefit of license renewal: It is fas cheaper than building new generating plants.

By the time a nuclear plant is ready for license renewal, most of the initial capital costs will have been depreciated. We estimate that is will cost less than $10 million, on the average, to prepare a renewal application and cover the NRC review fees. Those costs probably will come down a bit with time and experience. There also are costs associated with the hearing that will take place after the application is submitted and there will be some costs related to the plant and/or its programs. Those costs are to difficult to estimate. But even taking into account these costs—where else is a utility going to get 1,000 or 2,000 megawatts of generating capacity for #10's of millions or anything close to that? The cost for license renewal is at least an order of magnitude below what it would cost to build a new plant—of any kind.

Look at these figures on new power plant construction4. The estimated cost of a new combined-cycle gas plant is $400 to $450 a kilowatt. For a conventional coal plant, the cost is approximately $1,100 a kilowatt for pulverized coal, $1,200 a kilowatt for integrated gasification combined cycle. The projected cost for a new advanced nuclear power plant is $1,550 a kilowatt.

The cost of building a fossil-fueled plant will probably go up somewhat because of pressure to reduce emissions. And operating costs may rise dramatically because of their sensitivity to changes in fuel prices.

Figure 6



Let me briefly touch on the new advanced light water reactors. Clearly, from an operational excellence perspective, the ALWR's represent the state-of-the-art design with operational focused enhancement built in from the start. These designs provide a solid basis for the next generation of reactors installed in the United States and worldwide. At our annual Nuclear Energy Assembly meeting next month in San Francisco, we will issue the final report on the Strategic Plan for Building New Nuclear Power Plants. In addition to documenting the new improved licensing process associated with these plants, it will highlight the following major achievements:

- ALWR design requirements were developed by utilities, reviewed and approved by the U.S. Nuclear Regulatory Commission, and applied by reactor designers as the bid specification for standardized ALWRs.
- General Electric's 1,350-megawatt Advanced Boiling Water Reactor and ABB Combustion Engineering's 1,350-megawatt System

80+ Standard Plant were approved and certified by the NRC. The NRC is expected to give final design approval to the Westinghouse 600-megawatt AP600 this year, with design certification to follow.

- First-of-a-kind engineering—funded jointly by the Department of Energy at $100 million and by industry at $175 million—has been completed for the ABWR and will be completed in 1998 for the AP600. This work achieves a high level of plant engineering design completion and provides critical data on the schudule and cost of construction, providing necessary certainty for improved project planning. The design and construction of the ABWRs for Taiwan Power Co.'s Lungmen project are making valuable use of this FOAKE work completed for the ABWR.
- Two General Electric ABWRs have been built be the Tokyo Electric Power Company and are operating in Japan.

In closing, we are confident that the 21st century will bring a renaissance for nuclear energy—in the United States and around the world. This renaissance will be built upon an unequivocal commitment to safety and operational excellence— and continued improvement in efficient operations. It will be driven by the growing recognition of nuclear energy as a major part of the solution to reducing the emissions of air pollutants and greenhouse gases. In the next decade, we'll see nuclear plant licenses renewed in the United States for the first time in history. We'll also see the first orders placed for new, advanced nuclear power plants in the United States.

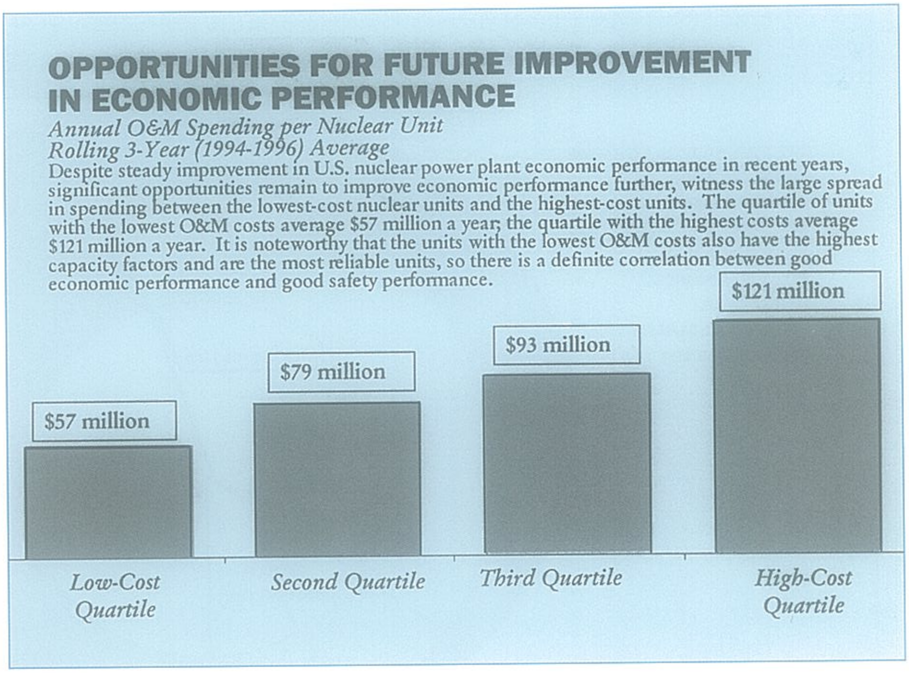


Figure 7

January 1998 Public Opinion Results*

	Own Opinion %	Perceived Community Opinion %
Favor Nuclear Energy	65	21
Oppose nuclear enegy	33	61
Don't know	2	18

* Nationally representative sample of 1000 college graduates, registered voters.

Figure 8

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SESIÓN ESPECIAL 3 / SPECIAL SESSION 3

PREDICTABILITY IN U.S. NUCLEAR REGULATION: THE ROLE OF RISK INFORMATION

N.DÍAZ - (NRC.)-USA

As the U.S. nuclear industry developed in the 1960's and 1970's, the nuclear regulatory oversight evolved reactively. Changes were made haphazardly, as new technological developments or newly discovered safety issues suggested the need for new regulations. The result was a patchwork quilt of regul.ations focused on individual issues, rather than integrated into a seamless whole. In 1979, just as the licensing and construction aspects of nuclear regulation were becoming stabilized, the Three Mile Island accident occurred, prompting the NRC to superimpose a new set of requirements on the existing process. The NRC's need to oversee licenseesl response to these new requirements diverted attention from the long needed comprehensive review of the regulatory process, and of the value added to nuclear safety by NRC regulatory oversight. Today, however, the NRC is engaged in a systematic and holistic review of its regulatory processes, designed to move the agency in the direction of more riskinformed, performance-based regulation. With a clearer focus on the distinction between safety and regulatory compliance, the Commission is moving to ensure that NRC regulations that do not contribuye value-added are amended or abolished.

For the future, the NRC's actions are designed to ensure that nuclear oversight will progressively enhance the safety of nuclear power, and will not place unnecessary obstacles in the way of its safe and economical use.

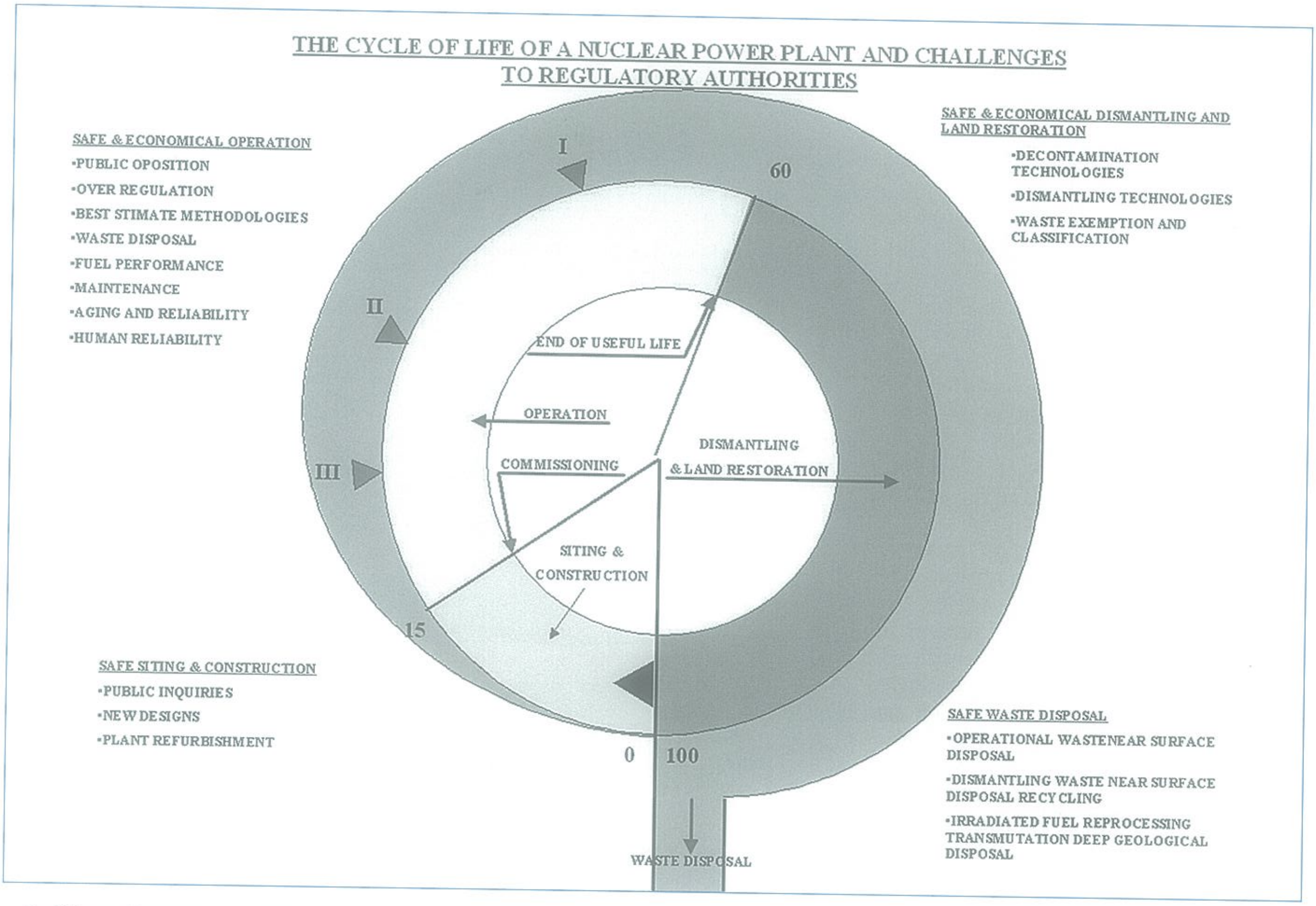
EUROPEAN PERSPECTIVES ON NUCLEAR SAFETY REGIMES: PAST, PRESENT AND FUTURE(*)

A. ALONSO - (CSN Counsellor)

PRESENTATION

The licensing of nuclear power plants in the Western European countries has now reached a considerable degree of maturity. A preliminary understanding of such diverse systems could be gained by dividing the different countries into groups in accordance with: the attained nuclear development, the constitutional nature of the State and the licensing tradition for other hazardous and energy producing installations.

(*) The opinions of the author do not neccesary represent those of The CSN.



The Western European countries could be divided into two major groups in accordance with the nuclear development attained: developers and now exporters of nuclear technology Clearly France, Germany and Sweden are within this group. There is a large number of countries which have developed their nuclear power system by importing reactors from European and American suppliers, but have also largely contributed to their design, construction and procurement within a high level of scientific and industrial background Belgium, Finland, Italy, Spain and Switzerland are among those. Those are called qualified importers.

There are countries of a Federal nature. In those countries it was first necessary to determine where nuclear licensing should be put, either in the hands of the Federation (Belgium and Switzerland) of under the responsibility of the States (Germany). Finally there are countries with central governments, notably France and Sweden, where also strong central regulatory authorities and technical bodies have been established.

There are also countries with a long tradition for the industry to control itself through private, industry supported, non-profit organizations, such as the Technical Inspection Agencies in Germany or the VinHotte Association in Belgium, which also participate heavily in the nuclear power plant licensing process as technical bodies. While in other countries, such as France or Spain, the tradition rests in the industry to be controlled by technical bodies depending from governmental ministries.

The presentation reveals a large variety of circumstances or models, many combinations have been possible, some of them forbidden. Nevertheless the overlying common objective is that of exploiting nuclear energy without undue risk to the health and safety of its workers and the population at large and, this is not frequently quoted, without endangering the financial investment into the plant.

THE PAST AND ITS DEVELOPMENT

The Western European countries were very prompt to recognize the potential advantages of nuclear power to produce electricity. To that effect, they created the basic legislation to control such power, which were promulgated in the 50's and early 60's. Nevertheless, in those days there was not a clear distinction between the promotional and the control activities related to nuclear, which later on became a necessity, what forced the revision of these first documents. The creation in Spain of the Nuclear Safety Council is an example at hand.

Even though nuclear and radioactive waste was considered in these early legal documents, there was not a clear evidence of the magnitude and social, political, technical and scientific importance of the problem. The recognition of this has more recently forced the countries to create technical bodies and regulatory procedures to cope with the matter. The 1991 French law on radioactive waste is a good example. In the same way, the basic regulations did not covered in sufficient detail such aspects as decommissioning of nuclear power plants, a subject of major attention today, which has been secured by amendments to the existing regulations and even by drafting new regulations.

Despite differences, there are many commonalities which I would like to express. These are being now reinforced by the Nuclear Safety Convention and other international regulatory activities. Although the clear desire for uniformity will probably never come to a full fruition. Nevertheless there will be a movement towards the worldwide acceptance of the most basic principles of independence between the regulators, the regulated and the promoters; well defined responsibilities of the operators and that of the regulators; effectiveness of the regulatory precess, which has to cover with competence all significant aspects while taking into account economical and social considerations; openness to public and political scrutiny. The way to cope with such principles nationally and internationally has always been, and will continue to be, a real challenge to regulators.

The licensing process itself varies among the different countries, but it always includes four basic steps:

1.- the filing of the application for license;

2.- the intervention of the local authorities and the public, mainly in the early stages;

3.- the evaluation of the proposal by the technical bodies, and

4.- the granting, or denial, of the license.

ATTAINED NUCLEAR DEVELOPMENT	CONSTITUTIONAL NATURE OF THE STATE	LICENSING TRADITION OF HAZARDOUS ACTIVITIES
EXPORTERS	FEDERAL	INDUSTRY´S SELF-REGULATION
QUALIFIED IMPORTERS	CENTRAL GOVERNMENT	CENTRALICED REGULATION

THE NEAR TERM FUTURE OF LICENSING GENERAL CONSIDERATIONS

Regulatory activities have a life of their own which is being shaped by the life of the regulated industry. The circle of life of a power plant is represented in fig.1. It last for about a century and includes three mayor phases:

1.- siting, design and construction,

2.- useful operating live and

3.- decommissioning and land restoration.

In the 50's and 60's the major preoccupation in the West was siting and site evaluation.

The main activities in the 70's and 80's were design, construction and commissioning of each time larger power plants.

In the 90's most of the actual nuclear power plants were already in operation, therefore safe operation is today the major activity of concern of regulatory authorities in Western Europe.

The largest future challenge will therefore be the safe decommissioning of the actual operating nuclear power plant. After that, it is expected that the cycle will repeat itself using better technologies and with much more experience.

The challenges, some of them indicated in the figure, through which regulatory authorities have past through, including the very first idea of creating such regulatory bodies and the corresponding regulations, have been much significant and formidable that the ones to come, as they required breaking new ground with less knowledge and poorer tools. Nevertheless, regulation came brilliantly through such hardships and there is no reason to believe it will not be so in what remains to close the cycle of life of the plants and its potential repetition, although such activities will correspond to the decision makers of the next century.

The challenges to regulation are mainly due to external influences although internal inputs are also at work. The two major external effects are due to the prevailing social attitude against nuclear technology, a subject which will not be discussed, and to the changing electricity market, which is being driven by de-regulation and competition. The internal inputs, in part also externally driven, are related to safety in aging power plants and the corresponding life extension, as every body would like the end of the useful life to move clockwise as much as possible in the circle of life of the plant. The solution of the yet unresolved issue of high level radioactive waste and irradiated fuel will not be discussed.

THE INTERNAL STIMULI

Ageing and its evaluation is possibly the most significant technical stimuli presented to regulatory authorities. Ageing of components and structures is well taken into account in the design of the plant. Nevertheless there could be unknown degradations mechanism not prevented in the design. The most recent example of that is the accelerated corrosion experienced by the zircalloy-4 in high burnup fuels or in case of changes in radiation flux. The major difficulty with aging rests in the fact that it has to be predicted and prevented on time while the cure is still possible.

Decommissioning and land restoration are real regulatory challenges for the years to come. There is not yet a complete and well tested set of regulations for safe decommissioning, which also requires the necessary funds and the appropriate technologies. In many countries, as it is the case in Spain, regulations have been enacted to collect the necessary funds from the operating nuclear power plants to be dismantled at the end of their final live, technology has also being under development taking advantage of the decommissioning of some old prototypic plants, but that will not be enough. Regulations will be necessary to determine the criteria for dismantling, the decommissioning levels to be reached, the way to handle and dispose of the many types of waste to be produced, the unconditional release thresholds and the traceability of the disposed wastes, including those of a very low level. The IAEA is really helping on all that through the activity on standards development.

THE EXTERNAL CHALLENGES

Much concern has been expressed in recent times on the tendency to de-regulate electricity production and to bring it into a competitive market driven activity with the corresponding effects on nuclear regulation and regulatory activities. It is believed that this competitiveness will force the plant owner/operator to reduce their investment in safety and radiological protection and to demaning the staff and operating teams with potential negative impacts on safety.

There is no doubt that such threats are real and measures should be taken by the regulatory organizations to prevent their materialization whenever they appear. But regulatory organizations have always been confronted, even in well regulated markets, with the desires of plant owner/operators to reduce cost. To cope with such pressures the regulators have enacted complete and coherent sets of regulations which are not going to change in the new market situation. There will be necessary, as it has already been recognized by the Spanish Nuclear Safety Council, to increase inspection and enforcement to make it sure that the present safety regulations will be complied with under all circumstances. Moreover, the introduction of the safety culture concept in a truly national and even international basis will make every managerial level aware of the importance of safety.

The real challenge to regulators will be in the fact that not all sources of electricity are treated equally from the regulatory point of view. The combustion of fossil materials has a considerable environmental impact, nevertheless strict regulations have not been enacted, in any country, to retain and store the noxious gases which are produced.

This unequal treatment may cause nuclear based electricity to be less competitive than other sources and force the utilities to close down their valid nuclear power plants. These potential situations force the nuclear regulatory agencies to review carefully their safety requirements and determine which ones go beyond a reasonable limit taking into account technical, economical and social implications. Many experts believe that such reevaluation exercise is needed to bring safety requirements into a proper perspective and limit and to avoid overregulation which may have been produced by social and political pressures.

A very distinguished scholar and specialist in nuclear law Dr. Pierre Strohl, for may years Deputy Director General of the NEA, has very recently written: "The Obligation to avoid risk must not be allowed to overshadow the need for economic competition". Of course, such dictum could also be read backwards to say: "Economic competition will never be achieved without the appropriate safety level"

This implies that there exist a very delicate and subtle equilibrium or balance between safety and economy and that this balance has to be defined in quantitative terms, as Prof. Krhger this morning wisely suggested. The finding of such equilibrium point in the balance is a common job between regulators and regulated, each one looking at the problem from its own point of view. This way of doing things jointly has also been stressed by Prof. Diaz in his presentation. That is the real challenge and I wish it will be solved.

SESIÓN TÉCNICA A2 / TECHNICAL SESSION A2

OECD/NEA HUMAN PERFORMANCE ACTIVITIES FOR OPERATIONAL SAFETY IN NUCLEAR POWER PLANTS

L. CARLSSON - NEA/OECD

The OECD/NEA constitutes a forum for the exchange of technical information and for eollaboration between organisations which can contribute, from their respective backgrounds in researeh, development, engineering or regulation, to these activities and to the definition of the programrne of work. A major part of the activities are carried out in working groups in principle areas such as operating experience and the human factor, reactor coolant system behavior, various aspects of reactor component integrity, the phenomenology of radioactive releases in reactor accidents and their confinement, risk assessment, and severe accidents. The importance of excellent human performance in the various phases of nuclear power plant is an element common to all activities.

Especially in two areas there are activities to promoted the present knowledge of human behavior. One working group on human factors is linked to the evaluation of operating experience and other activities are carried out in the probabilistic safety assessment group. Under the OECD umbrella Man Maehine Interface research are carried out at the Halden Reactor Project which is presuably the largest effort sofar worldwide.

This paper will explore the ongoing activities and some of the insights found in finalised projects. The working group on Human Factors contribute to operating experience analysis of incidents reported to identify human factors. It also provide a forum for human factor assessment methodologies. Projects reported concerns:

- The role of simulators in operating training
- Human Factor related Common Cause Failure
- Generic study on modifation and requalification problems following outages
- Human interaction in Probabilistic Safety Assessment
- Human reliability analysis: Errors of Commision

Member countries continue to have a high interest in understanding the human behaviour not only as individuals but also as groups, in cooperation of groups and in the decision-making process. The characteristics of human behaviour are more or less common. These behaviours highly depend on the context of the situation or the context of their activities. The shaping factors which influence their performance have to be well understood. Particular interest can be found for human behaviour during the gathering information or assessment process activities, in risky situations or activities, in stressful conditions or in plant disturbance situations. Understanding this could be helpful to enable better mastery of error mechanisms in such situations and to improve or develop cogrutive models for PSA. The data collection for such area should come from event analysis, observation of specific works, interview with operators, following methodologies which have to be defined. The programme to complete the research in these areas could be discussed with experts in a workshops or specialist meeting. The paragraphs in the paper summarize the discussions on a number of issues developed by the expert group and proposals for coordinated joint efforts.

SESIÓN TÉCNICA B1a / TECHNICAL SESSION B1a

IMPLEMENTING A SAFETY CULTURE AT FRENCH NUCLEAR POWER PLANTS

B. FOUREST - Electricitè de France (EDF)

INTRODUCTION

Electricité de France (EDF) currently operates 58 PWRs, which generate about 85% of the electricity produced in France. The design, construction, start-up and early operation of these plants on 20 different sites have left a strong legacy of centralization.

This was of course originally justified by more effective solutions of technical issues, as well as for recruitment and training, relationships with the grid operators, plant manufacturers, suppliers and safety authorities, and in terms of organization, plant outage management and experience feedback.

This initial phase resulted in strong leadership at the General Management level of the Nuclear Generation Division of EDF. Site management's role has long consisted in integrating the demands and requirements imposed by the corporate level, in terms of both labor-management and technical issues. Site management had no real power to question these demands, even though they were sometimes contradictory or in conflict with the site concerns or priorities.

In the 1980s, warning signs began to crop up, clearly indicating that the solutions which had been appropriate for the design, construction and start-up of some fifty PWRs in 10 years were no longer appropriate to achieve the required results in terms of safety, availability, radiation exposure control and cost controls, since major new challenges were arising: public acceptance of the nuclear industry (in relation to Chernobyl, nuclear waste processing and storage), competitiveness, opening of electricity markets, etc.

By then, it had become obvious that the centralized management structure seriously hindered the development of a safety culture based on both a strong line of management, down to the supervisory level, and the commitment of individuals. The result was:

- clarifying the two-level management of the Nuclear Generation Division;
- implementing this new management through six initiatives;
- clarifying safety management through requirements, objectives, a human factors approach and management control.

TWO-LEVEL MANAGEMENT

In terms of safety culture, the two-level management principle is designed to make the sites more responsible for achieving objectives and to encourage individuals to take full responsibility for their acts.

One major project has been set up for the Nuclear Generation Division and one for each nuclear site.

Each station manager reports to the Nuclear Generation Manager. He is fully in charge of developing methods to carry out changes and of managing the station.

The role assigned to the Central Engineering and Support Branch (CESB) of the Nuclear Generation Division is now completely different. Once in a position to impose standards in each area – organization, recruitment, training, operation, maintenance, experience feedback, etc. – it is now entitled to support the two aforementioned management levels: corporate and site.

This involves:

- providing support to the sites on request, to help them implement their project;
- providing support to the corporate level to develop strategies, and to manage relations with the safety authorities;

• assessing each station's management and performance to foster the development of effective site control at the corporate level;

• drawing the attention of site management or corporate management to specific areas, if needed.

In order to change the "balance of force", the resources devoted to write all the operational methods have been removed from the technical departments of the CESB. These operational methods comprise the technical specifications, periodic test procedures, normal and emergency operating procedures, maintenance procedures, modification design and planning.

SIX INITIATIVES FOR THE NUCLEAR GENERATION DIVISION

The six initiatives implemented by the Nuclear Generation Division are the six ribs ensuring a consistent decentralization process. These six "lines" are designed to make individuals aware that safety and quality depend on their attitude and commitment, as well as to foster the necessary changes, and to adapt the organization. These initiatives are:

- Operation and Safety
- Maintenance and Safety
- Engineering
- Cost-effectiveness
- Information Systems
- Communications.

We will focus on the three initiatives which are more directly related to nuclear safety: operation and safety, maintenance and safety, engineering.

Operation and safety initiative

Objectives

• to clearly define the role of each person or group on site involved in plant operation;

• to designate a single person responsible for plant operation, including safety, availability and other key issues, to guarantee a comprehensive decision-making process.

Key principles

1) A fully accountable operations department: the shift operations manager is responsible for plant operation in real time.

2) Enhanced professionalism and safety culture: six weeks' training for operators, four weeks for field operators; a training program in line with the needs of the managers and operators, a quality initiative to improve operations, based on experience feedback.

3) Support structures for the operations department: analysis, preparation, experience feedback, coordination and planning with the other departments.

4) A consistent organizational structure within the operations department: to develop a team spirit in the management team, clarify the decision-making process, enhance communications and unity in the department and between shifts.

5) An open operations department: for better mutual understanding across disciplines, off-shift periods for all operations, staff to support the outage team, and other department or site issues, close involvement in maintenance coordination while the unit is in operation.

6) A Safety and Quality Assurance team capable of providing support and consulting services and of performing an independent inspection and safety analysis:

- safety control by the operation shift manager,
- safety inspection by the safety engineer.

Safety engineers who no longer work on shift therefore do not only focus on operational activities, but also on maintenance and support activities.

Maintenance and safety initiative

Objectives

• to optimize the quality of maintenance by taking into account nuclear safety, cost, equipment unavailability, radiation doses, individual safety and working conditions,

• to maintain equipment reliability and keep maintenance costs under control: equipment is aging but must generally operate for some 40 years.

In other words, the overall goal is to shift from equipment-oriented maintenance to process-oriented maintenance.

Key principles

1) Improving safety in maintenance activities, by developing analysis capabilities, by simplifying and clarifying management lines, by improving the general knowledge and technical skills of the maintenance staff, and by improving interface management and work division.

2) Focusing on the owners' concerns, i.e. on what should be done, which quality requirements to apply, which cost and quality controls, rather than on whois going to carry out the job. This results in a new distribution of resources between job preparation, planning and control on the one hand, and job performance on the other hand; it also raises critical social and professional issues among the maintenance staff.

3) Reinforcing partnerships with the suppliers to:

• guarantee the quality of the suppliers' services;

• take into account their social concerns;

• develop the local and regional industrial fabric while considering similar national aspects and contracts;

• foster supplier commitment to safety, quality, cost control and radiation dose objectives.

4) Making plant outages a success by designating an outage manager with real authority, responsible for achieving safety objectives and coordinating the resources that he needs, with the support of a strong engineering team in charge of planning and experience feedback.

Engineering initiative

Objectives

• to improve plant performance;

• to keep long-term operating costs under control;

• to anticipate the response needed in case of a key equipment deficiency (e.g., a reactor vessel cover).

Key principles

1) To clarify the decision lines and support resources.

2) The site engineering resources work under the guidance of site management: decisions are made by site management in terms of issues, priorities, schedules and solutions to be implemented.

3) Balance of work between the site engineering branch and the CESB. This requires full transparency in terms of resource use, a common scale of issue assessment regarding what is at stake for each site and for the Division in terms of safety, cost, availability, work management, etc., a three-year plan, local and national decision-making committees.

4) Developing a multidisciplinary, project management approach to handle critical issues. This includes designating a project manager, and allocating specific resources in terms of expertise, time and budget.

5) Developing the experience feedback process to identify operational issues and propose appropriate solutions, using all operational data, reports and comparisons to improve plant safety and performance.

NUCLEAR SAFETY MANAGEMENT

Human factors are the key to nuclear operations, and above all, to nuclear safety. This means that, while safety needs to be managed, it must not be cut off from the global management process.

General principles

From the operational standpoint, nuclear safety objectives are expressed in two sets of measures:

a) Instructions, which constitute or express the safety requirements reference base.

In practice, these instructions cover two areas:

• compliance of installations

• compliance of operations procedures.

In both cases, the instructions are expressed at the sites or by corporate resources in the form of specifications, procedures, directives, regulations, etc.

b) goals, which take a variety of forms (objectives, policies, initiatives, etc.).

Goals go above and beyond instructions in expressing EDF's performance aims, particularly in safety-related areas. The goals thus provide an environment for decision-making at both strategic and day-to-day operations levels.

Although these two sets of measures are inextricably interlinked (safety cannot be restricted to instructions, which make no allowance for progress, while goals cannot be completely regulated), they must not be confused.

Human factors and the safety culture

The importance of people as drivers of progress is recognized. The notion of the safety culture has been developed – based on people, both individually and collectively – to ensure continued progress in this area.

This is the root cause of the decentralization process, which is the only way of ensuring steady progress in both safety and competitiveness, by making individuals more accountable for achieving objectives, and by devolving decision-making to the appropriate level, i.e. as low as possible, or, in other words, as close as possible to the action level.

In fact, these three phases developed with a considerable degree of overlap, rather than following one another in series.

This evolution in the safety concept led Nuclear Power Plant Operations to opt for a "governance" approach based on consistent decentralization. It is considered the only way of ensuring continued progress in both safety and competitiveness by making all players responsible for their actions and devolving decision-making to the appropriate levels.

This choice is based on the recognition that people are a key element in terms of safety, and the primary drivers of continued progress.

To achieve this, and in particular to balance compliance with instructions and fulfillment of safety/competitiveness goals on a day-to-day basis, the intelligence of all players must be recognized and utilized.

The safety culture enables each individual to put his or her intelligence to best use in helping achieve overall goals, above and beyond mere compliance with instructions. While the safety culture is intertwined with an understanding of other key factors (e.g. cost, availability, etc.), it is in fact this very interrelationship which should enable each individual to achieve the optimum balance between constraints and objectives in the different areas.

Implementation of instructions and strategic objectives concerning safety

To manage safety in accordance with the general principles and the global vision of the role of people, the Nuclear Generation Division is developing a range of processes and/or tools.

a) Sites (under the authority of the Site Manager) have primary responsibility for the safety of nuclear power plant units. As such, they must comply (or ensure compliance) with the relevant instructions. However, sites must also set specific goals, in accordance with national goals, with a view to enhancing global performance in terms of safety, availability and competitiveness.

To achieve this, the Site Management Team organizes the site, coordinates its operation and development, and supplements national instructions by issuing the necessary local instructions in accordance with national objectives.

The Site Management Team ensures the effective operation of this structure, and in particular compliance with national and local instructions.

This means that the Site Management Team must be able (in principle at any given moment) to evaluate the site's performance in relation to compliance with instructions and fulfillment of goals.

In practice, the sites set up internal organizational structures, perform internal investigations and checks, and utilize a range of indicators to track changes in these performance levels and select appropriate tools for change.

In addition to the feedback or reports established at the site's own initiative in response to events, the Site Manager "officially reports" to the Division Manager regarding the plant's safety performance and its progress, as follows:

- in general, at least once per year, or
- as required in relation to a specific subject.

b) Nuclear Power Plant Operations Management specifies mandatory actions and drives changes by issuing instructions and objectives, in addition to monitoring the effective operation of the overall system.

Within the scope of the decentralization approach, aimed at devolving responsibility to the sites in order to enhance global performance in terms of safety and competitiveness by ensuring the most appropriate responses, the Nuclear Generation Division aims to limit national instructions insofar as possible to those which bring real added value (in particular concerning standardization of equipment) and to maintain at site level those instructions in respect of which a choice closer to the ground is more appropriate (in particular concerning human factors), in spite of the convenience which might be expected to derive from a national policy.

In addition, national and local orientations or objectives are drawn up to supplement instructions and express national goals.

In defining instructions and objectives in the field of nuclear safety, Nuclear Power Plant Operations Management is supported by the organizational structures in place, in particular the Corporate Resources departments (in relation to preparation) and the Nuclear Operations Safety Committee (for validation).

This gives the departments a major role in providing support and advice to Management and to the nuclear power plants.

Primary monitoring is via the operational management structure, supported by site reporting, and supplemented by external monitoring actions (Nuclear Inspectorate, etc.) which fall under the heading of "reviews".

Finally, power plants and departments must alert Nuclear Power Plant Operations as appropriate.

Risk analysis: an important tool

The entire safety management structure is thus aimed at recognizing and mobilizing the intelligence of staff, and making them key safety players, rather than robots who simply apply procedures mechanically.

The first, and undoubtedly the most important, of these provisions, which fall within the scope of the five-year strategic plan, is activity-related risk analysis, a concrete expression of the safety culture at the level of operations.

This process of individual and collective calling into question, before acting, aims to identify in advance all of the factors which may prevent the activity concerned from complying with requirements (regarding safety, quality, radiation doses, industrial safety or cost), and to define appropriate preventive measures.

Risk analysis and the discussions this engenders help site managers, and in particular the Site Management Team, demonstrate priorities and options, what is possible and what cannot be achieved, via appropriate messages and attitudes.

Monitoring by Nuclear Generation Division Management (concerning nuclear safety)

Corporate Management must combine decentralization and devolution of responsibility with the performance of monitoring functions.

The monitoring activities performed by Corporate Management aim to ensure that the whole structure is functioning properly and enable achievement of high levels of safety performance, i.e.:

- compliance with instructions (one of the primary guarantees of safety),
- progress in achieving goals/objectives (above and beyond instructions),
- treatment of deviations by means of appropriate corrections.

To carry out these monitoring activities, Management is supported by certain processes and tools (which are deliberately limited in number):

a) management monitoring, site reporting;

b) external monitoring or review (mainly assessments by the Nuclear Inspectorate);

c) various types of feedback (on-site visits, functional structures, right of alert, Safety Authorities, etc.).

Utilization of these different methods enables Management to react as appropriate.

Safety management indicators and tools

Nuclear Power Plant Operations has a range of tools and indicators to support the processes described above and assist in safety management.

The main tools are: site safety reports, Nuclear Inspectorate assessments, self-assessment/self-diagnostics, the Safety-Availability observatory, plus a range of indicators. Some of the indicators are closer to the notion of a tool than that of an indicator in the strictest sense of the term.

a) Site safety reports

Each site produces an annual safety report.

The aim is to make this document the key element of the safety reporting performed by the Site Manager, and hence of the associated management monitoring.

This enables Site Managers to report on their site's safety conditions, and in particular compliance or otherwise with instructions, and fulfillment of, or progress in relation to, goals. It must thus contain a summary and the Site Manager's view on these aspects.

In addition, to maximize the usefulness of this document and the work behind it, it should be produced and presented in conjunction with the global reporting performed during the annual management appraisals to enable effective consideration of any consequences or lessons.

b) Tools

As mentioned earlier, task analysis can be considered an actual management tool.

The "safety-availability observatory" is another tool for use in managing activities in the field of human factors, and is mainly used by each site on an individual basis. It aims to recognize situations in which a conflict, or, on the contrary, a synergy between safety and availability has arisen, and to analyze decision-making processes to draw management lessons from the situation.

Self-assessment, or self-diagnostics, are tools used as required by individual sites to help drive progress as part of a local management initiative. Self-assessment, similar to assessments by the Nuclear Inspectorate, enables easier comparison of analyses by the sites, but is not mandatory.

c) Safety indicators

Safety cannot be summarized in a single indicator, even an indicator which incorporates a number of different aspects. In fact, such indicators can often be interpreted in contradictory fashion when defining indicators, therefore, the right questions must, above all, be asked, and correct analysis of the different indicators in relation to one another ensured.

However, indicators are chosen with an "idea" of the aspects to be managed or indicated.

In the field of safety, therefore, a distinction is made between two categories of indicators, some of which are also administrative indicators (results/monitoring indicators, etc.):

• "Condition" indicators, which may be similar to results indicators, and which generally represent fairly basic information, and can therefore lead to an objective measurement. They frequently concern instruction-related fields.

• "Management" or "monitoring" indicators, which generally reflect complex data, and are thus partly subjective or open to interpretation They usually relate to goals or objectives. As such, they can be referred to as management indicators, because of the questioning approach which they generate.

Management indicators include, in particular, the following:

• the number of significant incidents, with the associated sub-categories where applicable:

- number of failures to comply with Operating Technical Specifications,
- number of reactor trips,
- notable incidents,

• repetitiveness of the underlying causes of incidents;

• other major non-specific safety indicators (in particular unplanned capability loss, outage extension, dosimetry, etc.).

As an example, the "repetitiveness indicator" of the underlying causes of incidents aims to help depict and objectivize areas in which individual or collective working methods require improvement as a matter of priority. This is therefore a "management indicator".

These management indicators will be monitored on two levels: at the level of each unit or site on the one hand, and at the level of nuclear power plant operations on the other.

In addition to management indicators, which are viewed as being more like tools, a range of different indicators reflect a safety "condition". A list of ten indicators has been proposed, with a special effort made to select only objective and quantifiable indicators.

Barrier-related indicators:

- first barrier reliability indicator (I131 in primary coolant)
- second barrier leaktightness indicator (mean leak rate)
- steam generator leaktightness indicator (mean leak rate)
- third barrier leaktightness indicator (mean leak rate)
- abnormal gas release indicator (no. of peaks > threshold)

Safety function-related indicators:

- reactivity control function unavailability
- cooling function unavailability
- containment function unavailability
- support function unavailability

There is generally nothing to be gained from combining these condition indicators at nuclear power plan operations level. They should thus remain specific to each site or unit. However, result distributions and trends may merit analysis at national level.

CONCLUSION

At first glance, the purpose behind this process of change may seem far from safety concerns. It is in fact at the heart of safety and is fully intended to make individuals feel more accountable for achieving objectives and to impose the decision-making process at all levels. Any attempt to develop a safety culture, as detailed in INSAG 4, within the centralized system of the late 1980s, would not only have been naive, it would have made no sense at all.

Although this process marks a deep change of culture within the company, it is absolutely necessary. We still have a long way to go to achieve an overall safety culture, but the work is under way, and more and more people are aware that things are changing and are confident that they will succeed.

SESIÓN TÉCNICA D2a / TECHNICAL SESSION D2a

TOWARDS THE INTEGRATION OF REMANENT LIFETIME AND MAINTENANCE TECHNIQUES AND TOOLS

Maria Teresa AGUADO, Ignacio MARCELLES - TECNATOM

ABSTRACT

The remanent lifetime management of an industrial installation includes two main steps: the knowledge of components and equipment degradation status and, based-on it, the decisions to extend the design life, in a long term, or improve the reliability and availability in a short term.

To determine the degradation or ageing status of the materials and components, it is necessary to compile a great quantity of information coming from different sources: plant parameters monitoring, or other additional variables, vibrations for instance, inspections and testing results, etc. Nevertheless, due to the inherent difficulty related to the treatment and interpretation of the above information, it is appropriate the use of tools, containing, in addition to databases to help in its management, different modules or programmes to evaluate the components condition, or remanent lifetime.

Taking into account the current trends, basing maintenance strategies in the equipment condition, the above mentioned tools could achieve a double function: optimise the lifetime management, as well as maintenance and inspection, related to techniques to be used, scopes and frequencies.

Therefore, both remanent lifetime and maintenance techniques are converging based-on the component status evaluation means condition monitoring. In this sense, it is convenient to integrate the above strategies in all their scopes: management, evaluation, decisions, etc. There are some concrete experiences in the Spanish Nuclear Electric sector, that will be use in the paper as reference, and some additional initiatives focussed in this objective.

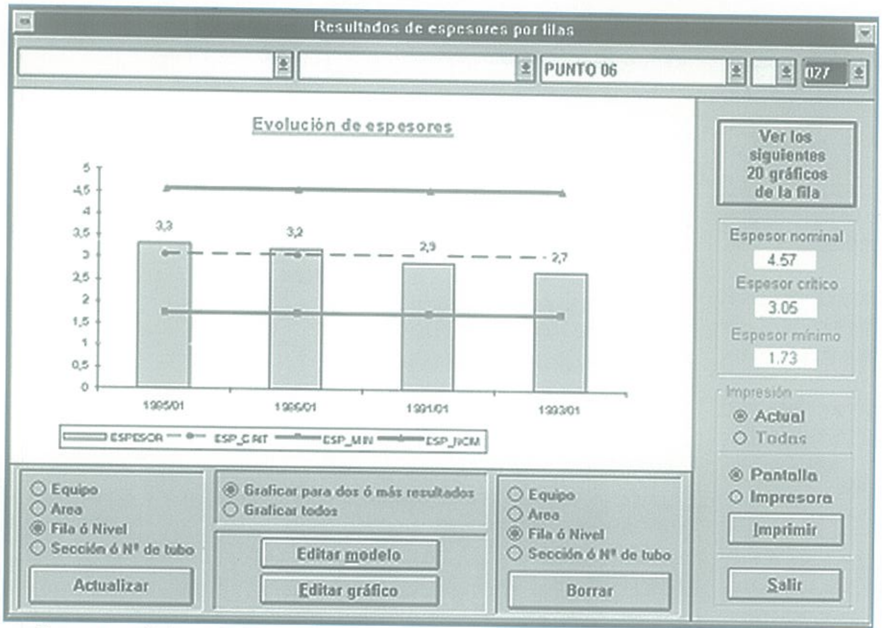


Figure 1. - *Thickness evolution.*

INTRODUCTION

The Life Management of Nuclear Power Plants is being converting in high-priority objective of the electrical companies, by economic and safety motives.

Remaining Life Management of any industrial installation consists of monitoring the degradation mechanisms of critical components, using available information: operation parameters surveillance, inspections, tests, maintenance, etc. taking decisions to minimise degradation. These decisions include basically the modification of the inspection and maintenance programs and, occasionally, plant operation. Therefore, maintenance techniques are contributing to lifetime evaluation, and lifetime management strategies are, in its turn, affecting maintenance programs.

On the other hand, the high costs of the corrective and preventive maintenance have obligated to be outlined the use of new predictive techniques, based-on condition monitoring as well as requirement and trends like Maintenance Rule and Risk Based Inspection and Testing. Therefore, maintenance strategies are more and more linked to the behaviour and ageing status surveillance as life management is.

The advances of the information technology allow incorporating into the traditional information file tools and parameters monitoring systems functions of results interpretation, management, etc. Thus, the integration of tools in the maintenance and life management areas is drawn as one of the most attractive options for exploitation costs minimisation of the power plants.

LIFE MANAGEMENT

Remaining life management of a nuclear power plant, or in general, of a industrial installation, includes two fundamental steps: the knowledge of the components and main equipment status and, based-on this, the appropriated decision making to optimize life management.

Estimate plant equipment status with certain precision requires the knowledge of the degradation mechanisms, which can affect the critical components, selected with safety, reliability and availability criteria. These mechanisms will affect in greater or minor degree to the component in function of materials, geometry, operation conditions, environment, etc.

Thus since, to determine the degradation phenomena that could affect the critical components, as well as their degree of incidence, this is, component status, it is fundamental the corresponding information, between other, design and manufacture: drawing, material specifications, manufacture reports, quality, etc., operation: temperatures, pressures, transient, operation times, etc. and incidences: failures, repairs, replacements, maintenance history, etc. This information, in the modern life management systems is stored in electronically format: data bases and spread sheet, digitised drawing, and is complemented with the inspection and tests results, on-line monitoring, etc.

Until now, the inspections and tests results have provided the most reliable and exact information on the equipment ageing status. The main objectives of the inspections and non-destructive tests are detection and sizing of the existing defects and the evaluation of the material degradation, that are the main factors limiting the components useful life. Databases are being used to storage the historical inspections and tests results.

In addition to inspections and tests, parameters monitoring and diagnosis is a technique of great success in the detection and surveillance of certain degradatory phenomena during operation, in the interval between inspections. It is important to select those variables whose evolution is characteristic or representative of the existence and extension of a specific degradatory phenomenon.

An example of complementarity between inspections and monitoring, it is fatigue monitoring, very extended among power plants. The inspections provide the real evidence of the defects existence, while fatigue monitoring accomplishes an inventory of the transient that sustains the monitored component, permitting to calculate an accumulated usage factor. In case that this factor is approximated to one or any defect is detected, it is necessary to accomplish a reassessment, whose results should be used to

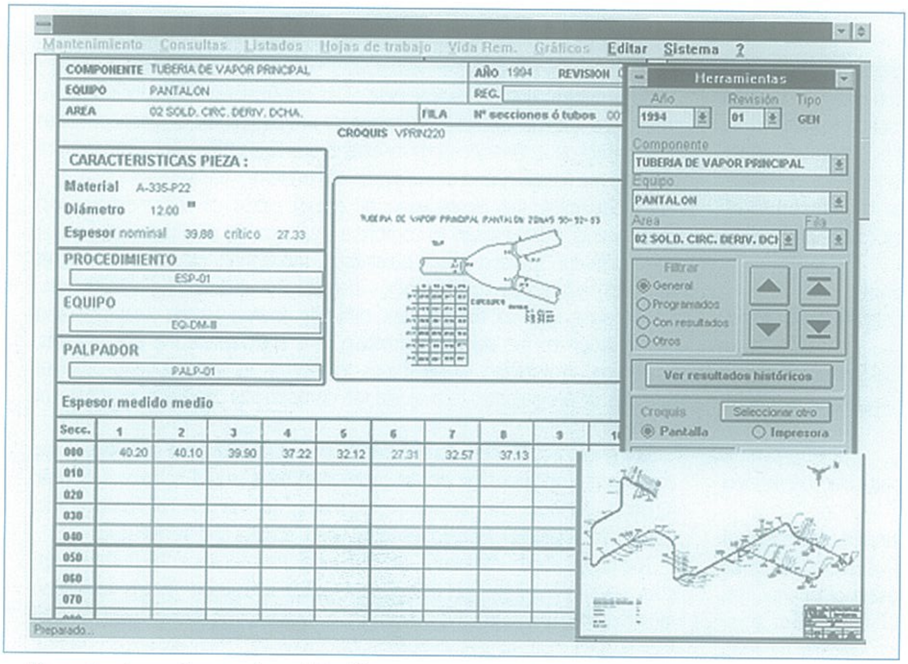


Figure 2. - *Inspections and remaining life management tool for thickness surveillance*

decide the more adequate action to continue operating in the same conditions, to soften the work conditions, component design modification, repair, replacement, etc.

TOOLS

The inspections provide a large volume of information, sometimes of a very heterogeneous nature and very difficult to interpret. To facilitate the manipulation and interpretation of this information a great number of applications have been developed that allow the storage of all the data obtained for specific components and techniques during an inspection. This information, adequately filtered allows to evaluate the plant status.

The current capabilities of those systems are, among others, automatic introduction of information, drawings and documents digitalisation, and historical files as well as tendencies survey based-on simple acceptance criteria.

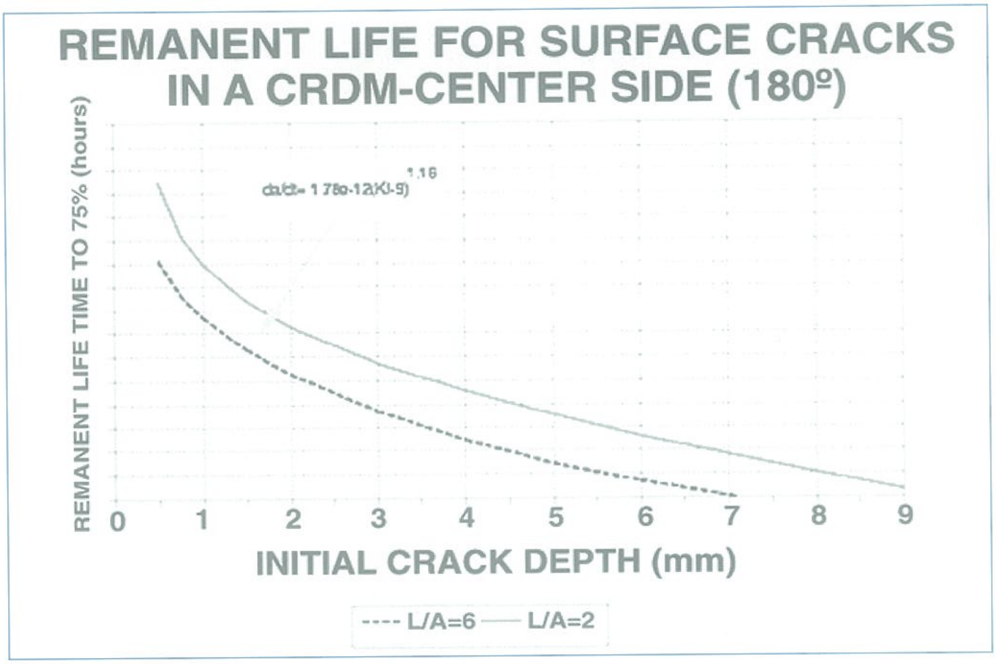


Figure 3. - *Remaining Life Assessment for surface cracks in a CRDM*

As example of simplest tools, are those related to techniques as thickness measurements, hardness, etc. consist of a trends study of the data (Figure 1).

By extrapolation is calculated when determined values will be reached, and through the application of an acceptance criteria, it will be established instant when an equipment should be re-inspected, repaired or replaced. As example, in Figure 2 is shown a screen of this type of tool, corresponding to thickness measures in pipelines. This application provides information on the points in which are accomplished the measures, the historical values that it has taken and, in function of the successive inspection results, calculates the remaining life.

To increase the usefulness of the stored information, more complex evaluation programs will be required to interpret the results. This situation is produced in those techniques in which is difficult to establishing the defects acceptance level, because depends on the material, equipment design, operation conditions, load, defect position, etc., like, for example, in ultrasound inspections, eddy current, magnetic particles or penetrating liquids. When a defect is detected and sized, studies of components integrity and fracture mechanics are performed.

Figure 3 shows an example of the remaining life assessment for surface cracks in CRDM,s with different shape factors and dimensions. When a defect, real or postulate, is known, it is possible to enter with its dimensions in the appropriate line and the operation hours before component failure or the recommended inspection time period are obtained.

Other application is the evaluation of flaws in reactor pressure vessel using indications evaluation handbooks (Figure 4) If a defect is detected during the inspection, it is possible, using this approach, obtain an inmediated evaluation of the defect. This evaluation requires complex thermal-stress and fracture mechanic analysis in order to determine critical crack size, crack growth and remanent lifetime.

Some of the available programs for inspections management at present have additional tools in order to generate recommendations on scope and periodicity modifications for next inspections in function of the previous inspections stored results, complemented with monitoring systems information.

MAINTENANCE

Traditionally, the maintenance strategy of large industrial plants, including Nuclear Power Plants, has been based on the intense use of preventive maintenance, accomplishing most of the performances on the equipment in fixed time period and with predetermined scopes, with independence of the equipment status.

The computer data processing tools used in maintenance have been limited to maintenance management and cost control, excluding the surveillance option of the equipment status. Thus, traditional maintenance management programs have been consists of databases that include the procedures, stocks, etc., permitting the work orders generation. In these

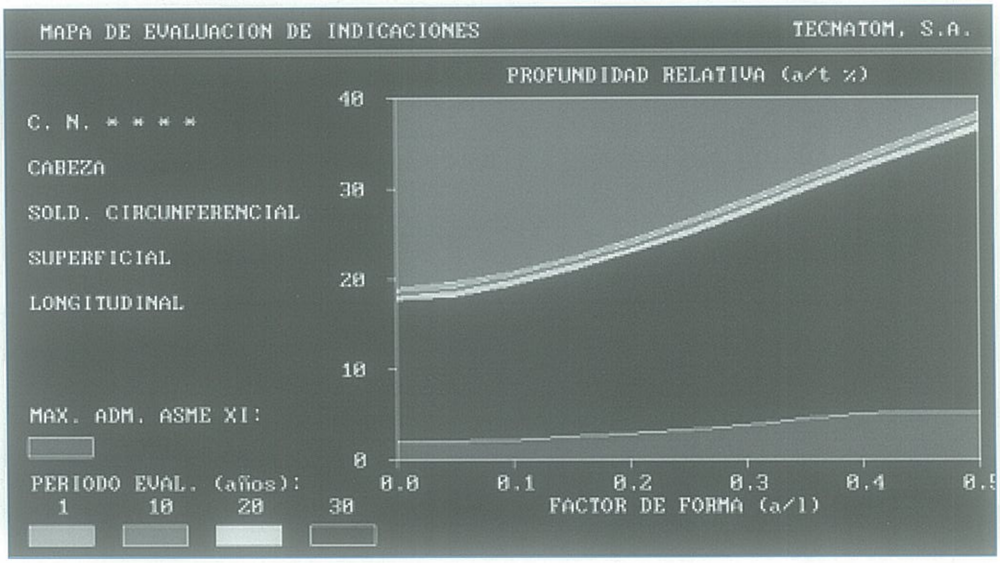


Figure 4. - *Indications Evaluation Handbook*

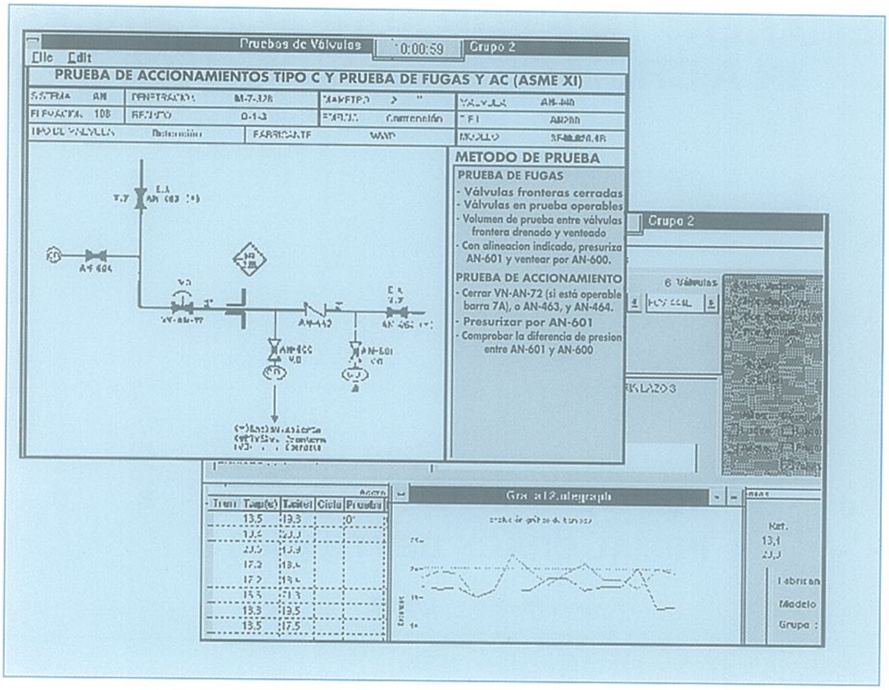


Figure 5. - *Management and surveillance tool for valve tests*

systems, data analysis remains in hands of a human analyst.

The success of predictive maintenance, that is based on monitoring of representative variables of the equipment status, and uses computer tools, that in addition to storing the parameters instant values, have results interpretation and evaluation capabilities.

Figure 5 shows a valves condition based maintenance program screen, that through the valve tests results storage and the associated parameters evolution surveillance, i.e. opening and closing times, allows to take decisions on the scope and the periodicity of the work to do in the valves.

Other typical example are the vibrations monitoring and analysis systems that, in rotating machines, are capable of determining numerous incipient failures through the modifications that suffers the vibrations spectrum. These systems has the advantage of the costs reduction associated with maintenance due that machines presenting high breakdown probability and the possible origin of this breakdown is known beforehand. The manager can plan the spare part acquisition and to decide the inspection or maintenance activities of the machine in low power demand moments, avoiding unnecessary and untimely stops.

An interrelationship between predictive and preventive maintenance provides evident advantages like activities reduction, establishing variable frequencies.

A typical example of the above mentioned is the action on large pumps, that in many plant have gone from be performed periodically to be realised after a efficiency test or a vibrations analysis indicate the possible existence of an anomaly, allowing costs reduction and malfunctions and breakdowns caused by mistakes and defects in the assembly be avoided.

Other additional requirements and trends that have to be taken into consideration are:

- The application of RBI / RBT that will allow the reduction of performances as well as optimisation of frequencies and scopes.

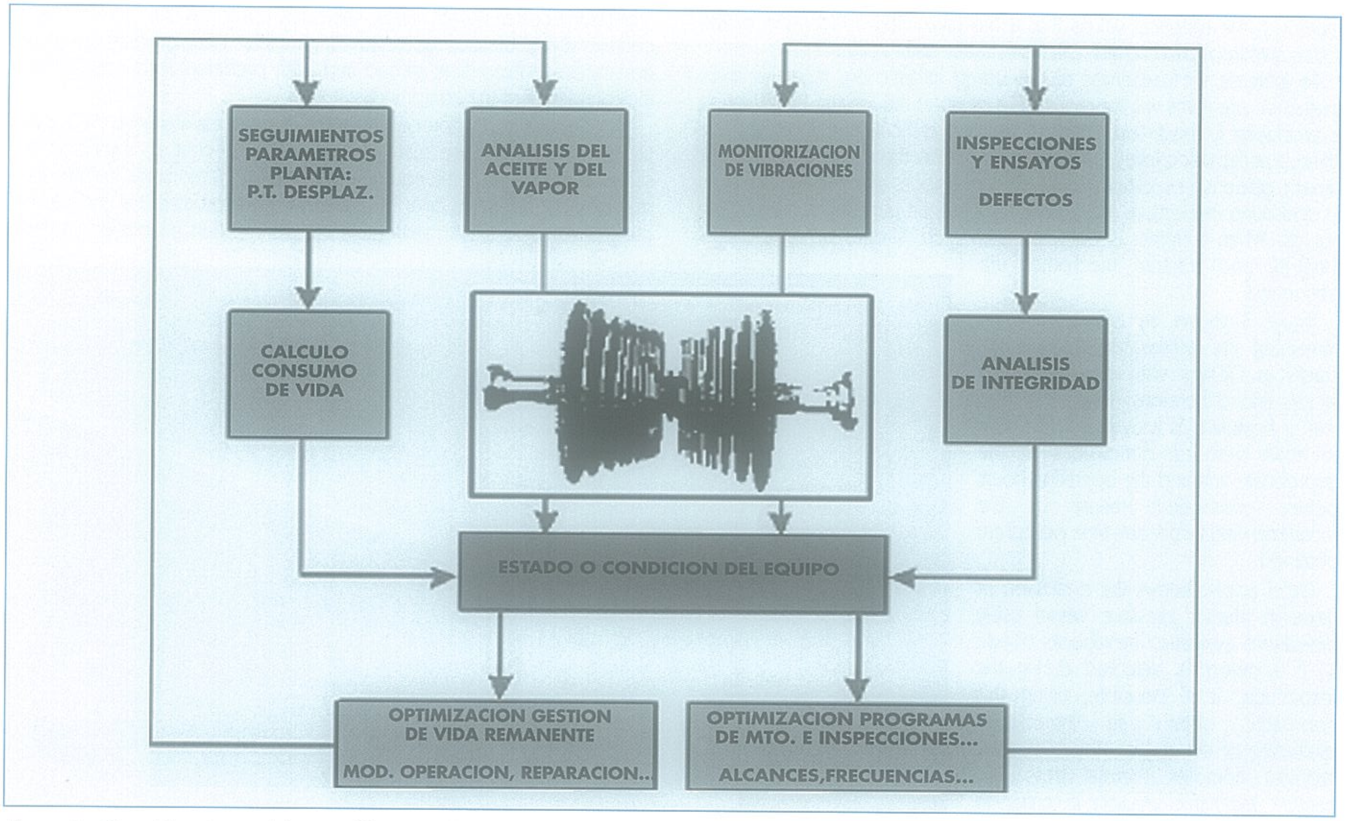


Figure 6. - *Plan of the steam turbine condition surveillance*

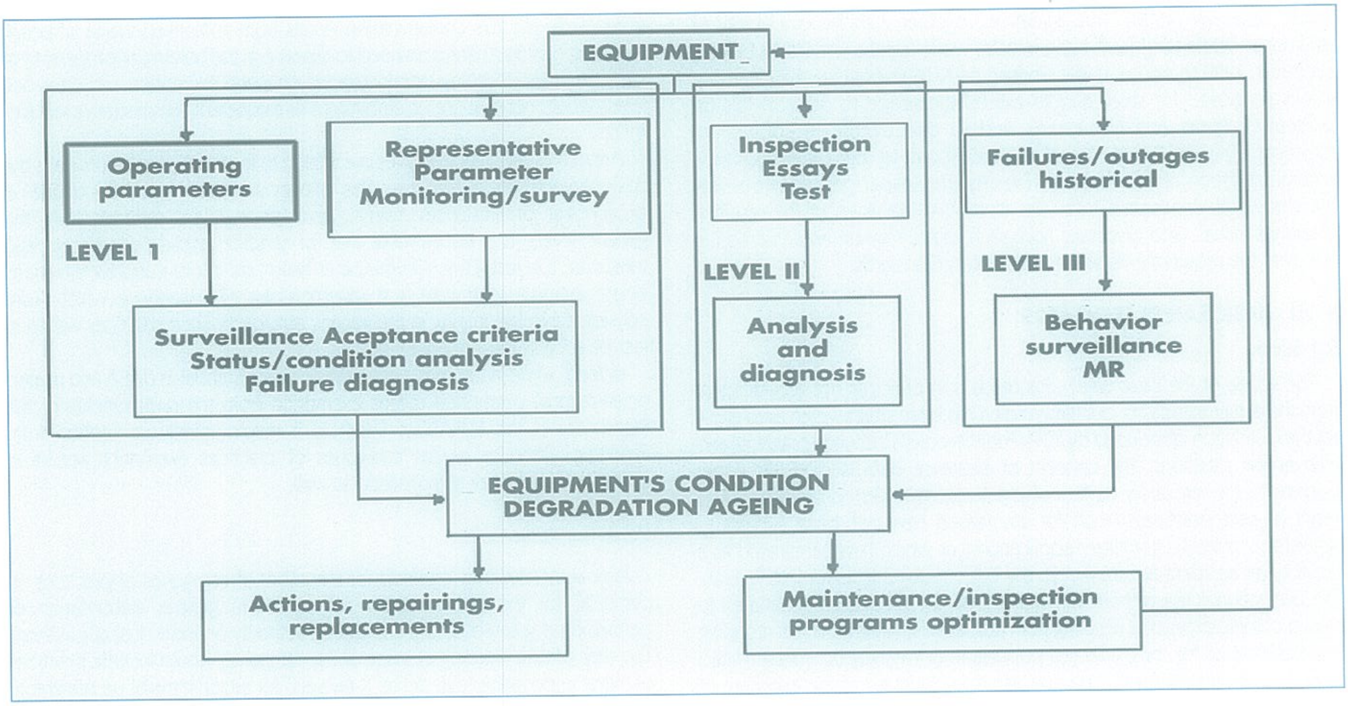


Figure 7. - *Remanent lifetime system project development scheme*

- The Maintenance Rule, that impose the surveillance of component behaviour of failures and situation analysis, conditioning corrective actions and maintenance optimisation.

Therefore, management tools that incorporate the functionality of the predictive maintenance monitoring and diagnosis systems, with operation parameters, inspection and tests surveillance and with management capacity to recommend modifications in the time schedule and scope of re-inspection, etc. are essentials.

CONCLUSIONS

The trend of maintenance and life management is to converge, in objectives: increase plant reliability and availability, and in means, based on the equipment condition.

To determine the degradation components status, independently of the objective, maintenance or life management, the required information is similar: inspection results, vibrations monitoring, plant variables surveillance, etc. In a future, a set of integrated tools or a single tool would be needed to evaluate equipment status using plant available data and support programs.

To illustrate this topic, we can take as reference Figure 7, that is an scheme about the option to put in practice the information integration to optimise the steam turbine strategies. Accomplishing a surveillance of the plant parameters, such as pressure, temperature, displacement, etc. with oil and steam analysis, vibrations and inspections and test results, the turbine components condition can be determined with high reliability: bearing, shafts, valves, disks, etc.

In general, this approach could be extended to all components and the whole plant and will be applied in Fase II of Spanish Remanent Lifetime project (Figure 7) that integrate different techniques into a computer system, allowing a reliable ageing surveillance and maintenance optimisation. The future challenge will be take advantage of these kind of systems to optimise, in parallel, remanent lifetime and maintenance strategies. Therefore, the system design must be flexible enough to be able to consider or introduce future requirements and strategies as well as new evaluation techniques.

In conclusion, life management as well as maintenance, tend to be based on the equipment condition, therefore they can be supported in similar and integrated tools, with capability to provide the appropriate recommendations to optimize the overall management of the installation. One more time, the key will be to achieve a high degree of collaboration among plant departments, taking adventage of the existing data and tools, in order to achieve a global objective.

SESIÓN TÉCNICA E4 / TECHNICAL SESSION E4

THE CONCEPT OF EXEMPTION AND CLEARANCE IN THE EU BASIC SAFETY STANDARDS CLEARANCE LEVELS FOR THE RECYCLING OF METALS FROM THE DISMANTLING OF NUCLEAR INSTALLATIONS

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1. INTRODUCTION

The concept of clearance has been introduced in the new Basic Safety Standards for the protection of the health of workers and the general public against the dangers arising from ionising radiation (Council Directive 96/29/EURATOM, adopted on 13 May 1996). In this way the new Basic Safety Standards provide a complete framework for the administrative requirements enabling an appropriate regulatory control of practices, commensurate to their radiological impact. Key features in this framework, in addition to clearance, are the closely related concept of exemption on the one hand and the concept of exclusion on the other hand.

These concepts pertain to different ways of avoiding regulatory resources to be wasted to such practices for which there would be no or nothing but a trivial benefit.

Meanwhile the Group of Experts established in terms of Article 31 of the EURATOM Treaty, giving scientific advice to the Commission on the Basic Safety standards and related issues, had already examined for may years the possible application of clearance levels. In 1988 guidance was offered on radiological protection criteria for the recycling of Steel (published in the Commission's Radiation Protection series No 43). Around the same time the concept of exemption had been subject of a broader international discussion, leading to the publication by IAEA of general guidance in

Safety Series 89 (1988). This guidance, together with the availability of additional data arising from experimental work, led the Article 31 Experts already in 1990 to set up a new working party to re-examine the clearance values proposed for steel, and to extend the scope to other metals (in particular copper and aluminium), and to direct reuse in addition to recycling. The results of this study are about to be published as a recommendation of the Group of Experts. This paper describes the way the study was conducted, provides illustrative examples of the resulting clearance values, and discusses how such values may be implemented in line with the requirements of the Basic Safety Standards.

2. EU - BASIC SAFETY STANDARDS

2.1 Scope

The scope of the Basic Safety Standards is in principle not very different from the earlier Standards, but the wording has been structures so as to allow for the distinction introduced by ICRP (Publication 60) between practices and intervention situations. The concept of clearance discussed in this paper pertains to the regulatory control of practices. Materials contaminated as a result of past practices which for any reason have not been subject to regulatory control (e.g. military applications) or which have terminated as a result of an accident are subject to the basic requirements for intervention. The distinction is not without ambiguity however: the actions undertaken to master chronic exposures resulting from past events, while aiming at reducing the exposure of the most affected population or cleaning up contaminated land to allow resettlement, may give rise to an increase of the exposure of other members of the public (e.g. from recycled scrap).

The EURATOM Directive further introduces a third category: work activities involving the presence of natural radiation sources. In the ICRP recommendations such exposures are either regarded as an intervention situation (e.g. radon in dwellings) or as practices. The European Directive considers this new area of radiation protection in its own right. It is dealt with in a separate Title VII of the Directive which allows a flexible approach based at the same time on the principles of intervention and of practices. Member States shall decide which work activities need attention and which control measures are suitable. Thus neither the administrative requirements discussed in the next chapter, nor the derogation from such requirements (exemption or clearance), apply directly to work activities.

It is also within the context of natural radiation sources that the concept of exclusion is introduced: certain categories of exposure to natural radiation sources are not amenable to control: they have been excluded from the scope of the Directive and need not be accounted for in the total exposure.

2.2 Administrative requirements

2.2.1 Reporting and prior Authorisation

The European Directive requires Member States to organise the supervision of practices by competent authorities in terms of their reporting by the undertaking and their prior authorisation by the competent authority. All practices in the scope of the Directive shall be reported, unless they are exempted from this requirement (Art. 3). Certain categories of practices are subject to prior authorisation (Art. 4). The disposal, recycling or reuse of materials containing radioactive substances is explicitly subject to prior authorisation (Art. 5).

2.2.2 Exemption

No reporting need be required for practices involving radioactive substances at levels of activity or activity concentrations below nuclide specific exemption levels listed in Annex 1 of the Directive. No reporting is required for apparatus satisfying certain criteria, in particular with regard to the conditions for disposal. The specification of such conditions implies that the exemption of apparatus containing radioactive substances does not free such apparatus from further requirements, but disposal of such sources is not subject to prior authorisation. On the other hand it is conceivable that material would be released to the environment and give rise to contaminated materials with activities and activity concentrations above the exemption levels. Provided this contamination results from authorised waste disposal, recycling or reuse there is no need to report e.g. the holding or processing of such materials. Thus any inconsistencies between exemption and clearance levels would not give rise to ambiguous or incoherent administrative requirements.

Annex 1 of the Directive gives in addition to the list of exemption levels the basic criteria for exemption. This allows Member States to define in exceptional circumstances specific exemption levels different from the generic levels. It is conceivable that for specific applications the generic values are too restrictive. On the other hand one could conceive situations where exposure pathways (e.g. ingestion) are of importance which were considered to be unlikely in the generic approach. Such practices would in fact be subject to prior authorisation.

Indeed, while in the Inter-Agency Basic Safety Standards (IAEA and related organisations) exemption means exemption from the requirements of the Standards, in the EURATOM Directive it means merely exemption from reporting. Only for certain categories of practices exemption results in exemption from prior authorisation as well.

2.2.3 Prior Authorisation

Prior authorisation is required for a number of categories of practices, in particular for the entire nuclear fuel cycle. In general authorisation or permission is granted by the competent authority on individual application. The very general wording of some of the categories would include practices of minor importance (e.g. dental X-ray sets) for which it might be preferable to grant authorisation by national legislation rather then upon individual application (the IA-BSS include also an intermediate type of administrative control: registration as opposed to licensing). Thus in Article 4.3 of the Directive, exemption from prior authorisation also applies to cases where "a limited risk of exposure does not necessitate the examination of individual cases...".

Exemption from reporting implies exemption from prior authorisation except for the deliberate direct or indirect administration of radioactive substances to persons. Exemption from reporting is unlikely to occur in the nuclear fuel cycle. Thus the only category for which the exemption levels have any significance is the production of consumer goods. It is worth noting however that this does not extend to applications which are explicitly not permitted on grounds of insufficient justification (e.g. in toys, see Art. 6.5.).

The conditions fro the authorisation of practices are spelled out only in the context of the radiation protection of the population. Thus it is required that plans for the discharge of radioactive effluents be examined and approved.

2.2.4 Disposal, recycling and reuse

The definition of disposal (see Art. 1) encompasses two different meanings, one which pertains to the emplacement of (solid) wastes in a disposal site, the other in a more general sense (see also Article 37 of the EURATOM Treaty and the concept of "discharge of radioactive effluents" discussed above). Article 5 of the Directive states that disposal (in whatever form) is subject to prior authorisation. This includes a fortiori the disposal of solid waste material. In addition also the recycling or reuse of such materials is subject to authorisation. Competent authorities may, however, establish clearance levels below which the disposal, recycling or reuse of materials is released from the requirements of the Directive. It is worth emphasising that in most situations of interest, the application of clearance levels is an individual decision of the competent authorities on the basis of a case-by-case evaluation of the practice which gives rise to the contaminated or activated material. The clearance levels as such may very well be defined generically. Anyway it is not for the undertaking to judge whether clearance levels apply to any of their waste streams. This is the fundamental difference between exemption and clearance levels. The holder of radioactive substances will look into the exemption rules to decide whether he should inform the authorities. Unless the practice is already reported, the authorities have no means of interfering.

2.2.5 Exemption and Clearance Criteria

Article 5.2 specifies that clearance levels should be established while taking into account the basic criteria for exemption spelled out in Annex 1. These are essentially the same as in the IA-BSS (taken over from Safety Series 89, 1988). The basic criteria are presumed to be fulfilled without further consideration if the effective dose to be incurred by any individual member of the public is of the order of 10 μSv (or less) in a year and the collective dose committed during one year is no more than about 1 man Sv.

Satisfying the above criteria implies automatic exemption. This does not mean that inversely it is not permitted to release any materials not complying with these numerical criteria. With regard to collective dose clearance is also possible if an assessment of optimisation of protection shows that exemption (clearance) is the optimum option (e.g. in case of a high administrative burden for a small benefit of maintaining regulatory control). The basic criteria allow to extend the criterion in terms of individual dose to levels higher than 10 μSv. Note that the original guidance (Safety Series 89) considered doses of a few tens of μSv to be trivial, rounding down to 10 μSv was merely convenient, also with regard to possible exposure from more than one exempted source.

The non-numerical basic criteria may allow even greater flexibility for the release of materials from regulatory control, as long as the radiological consequences are acceptable. This however would normally require a thorough case-specific examination, and it is probably more appropriate to speak in such situations of an "authorised release" rather than of clearance.

La mesa presidencial en el acto de clausura contó con la presencia de: José Palomo (Vicepresidente de la Comisión de Programas), Javier Villalba (Director de Producción de la Dirección de Generación de Iberdrola), Konrad Hädener (Secretario General de ENS), Juán Estapé (Presidente de la SNE), J.Luis Ramírez (Generalitat Valenciana), Aníbal Martín (Vicepresidente del CSN), Nils Díaz (Consejero de NRC-EE.UU.), Boris Gordon (Presidente de Gosatomnadzor -Russia) y Pierre Bacher (Vicepresidente del Comité Organizador -Francia).

3. RECYCLING OF METAL FROM THE DISMANTLING OF NUCLEAR INSTALLATIONS

3.1 Scope

Important quantities of scrap metal arise upon dismantling of nuclear installations, much of which is not or only slightly contaminated or activated. Even larger quantities of concrete arise, but even though building rubble may be recycled as aggregate for new concrete, it has no comparable market value and no comparable importance for international trade. The amounts of metal with a potential for recycling, essentially steel from power reactors and aluminium from enrichment plants, will be of the order of 10.000 tonne per year with the EU. Some 200 tonne of copper may be recycled, and some 1000 tonne of metal may be available for direct reuse. The amounts of clearable material assumed to arise is an important parameter in terms of the associated collective dose, but also in terms of individual doses to the extent that dilution with non-nuclear scrap material depends on the throughput. The dilution factors also depend on the type and capacity of furnaces considered and on whether the scrap metal finds its way to the overall recycling industry, or rather to a single smelter in proximity of the dismantled installation. Nuclear scrap represents only an extremely small fraction of the entire market, hence the dilution may be very important. The dilution parameters used in the study are 0.1 for carbon steel, 0.2 for stainless steel and aluminium and 0.3 for copper. These are quite conservative assumptions, but in the light of growing concern within the metal industry to avoid any radioactive scrap it may indeed be closer to reality to assume that only a few relatively smaller units will take this kind of material.

The scope of the study is anyway the release of metals for general recycling or reuse. It is noted that other options exist, such as recycling within nuclear industry (e.g. in waste containers) or under continued regulatory control in view of specific non-nuclear applications. The Article 31 Group of Experts concluded that recycling within nuclear industry should have priority over clearance to the public domain whenever it is economically sound to do so. This is a sound policy and an important consideration in the light of gaining public acceptance. Nevertheless this is not within the scope of the study and it should be noted that the clearance levels should not be used for ingots produced on-site or in dedicated facilities since then one can no longer apply a dilution factor to the final product which is less than unity. Ingots may be released only if it is assured that they will be subject to secondary melting.

Clearable scrap metal may arise also during normal operation and during revision or backfitting of nuclear installations. Such quantities of a few tens of tonnes per year need no separate consideration. Installations outside the nuclear fuel cycle, e.g. accelerator buildings, may also have a potential for recycling and the specific radionuclide distribution may be very different. Large quantities of metal may also be contaminated with naturally occurring radionuclides, e.g. with Ra-226 or Po-210 scales in oil and gas industry. In line with the Basic Safety Standards such work activities giving rise to specific waste problems should be dealt with in their own right.

The guidance offered by the Art. 31 Experts does not attempt to define unconditional clearance levels. In the terminology of IAEA interim guidance such values would be universally applicable to landfill disposal, recycling or incineration of all types of waste. The EU clearance levels pertain to metals, not to any other type of material, and the values for recycling are conditional only to the material being unsuitable for direct reuse (chopped in pieces). The values are, however, not conditional in the sense that there would be an administrative follow-up of the destination of the scrap metal.

3.2 Methodology

While referring to the guidance offered in Safety Series 89, ICRP points to the difficulty that exemption (or clearance) is a source-related issue while the triviality of dose (e.g. so μSv) is related to an individual (ICRP-publication 60, par. 288). The activity content of the metals should thus be related to an individual dose by constructing a set of exposure scenarios.

These scenarios need to take into account the entire sequence of scrap processing, starting with transport and handling of the scrap metal up to exposure from consumer goods made of recycled metal. The different steps in the metal processing have indeed been considered in the greatest possible detail. The exposed population consists essentially of workers employed in the scrapyard, smelter or refinery, or manufacturing industry. Workers are exposed to external radiation essentially from the scrap heap, to

	µSv/(Bq/g)		µSv/(Bq/cm²)	
nuclide	dose	pathway	dose	pathway
H-3	7.3 E-3	atmoshpheric	2.7 E-4	inhalation
Mn-54	6.1	external	0.38	external
Co-60	17	external	1.1	external
Sr-90	0.69	ingestion	1.2	inhalation
Ru-106	6.9	external	0.52	inhalation
Cs-137	17	external	0.26	external
Pm-147	1.7 E-3	inhalation	1.0 E-2	inhalation
Pu-239	40	inhalation	96	inhalation

Table 1: *limiting pathways of exposure and corresponding doses for a selected numbers of radionuclides (steel recycling).*

inhalation of resuspended dust upon handling and cutting of the scrap or of the fumes in the foundry. Secondary ingestion through hand contamination is allowed for as well as external beta ray exposure of the skin (an additional criterion of 50 mSv skin dose was introduced to avoid deterministic effects). Workers are also exposed as a result of the disposal of slags and dust on landfill. These by-products can be enriched in their radioactivity content as a result of element-specific distribution among fumes, slags and metal.

Members of the public may be exposed to external radiation from gamma-emitting radionuclides that are retained in the final product. Slags and dust may find certain applications also leading to public exposure by inhalation.

3.3 Parameters

Each scenario has a number of key parameters which need careful consideration. The physical parameters result from experimental work (e.g. distribution factors). Other parameters are related to the industrial practice (type of furnace) and other are directly related to the exposure pathway (dust concentration, exposure time). A deterministic approach was followed in defining the reference groups of exposed individuals and in the choice of parameters, even though some parameters (e.g. exposure time) are clearly probabilistic. A probabilistic approach is in principle more appropriate, but a deterministic calculation of doses for each scenario has the advantage of transparency. There was a clear consensus to avoid a cascade of conservative assumptions, but to go for a prudently realistic approach.

3.4 Dose Calculations

The entire sequence of calculations proceeds along the following lines:
- choice of scenarios
- pathways of exposure
- choice of parameters
- calculation of individual doses per unit activity concentration (per unit surface concentration for direct reuse)
- identification of the limiting scenario and pathway
- inversion of individual doses to yield activity concentrations corresponding to 10 µSv, and rounding to a power of ten.

The rounding to powers of ten is consistent with the approach followed for the exemption levels. It implies that in reality the individual doses are not exactly 10 µSv but can be up to 33 µSv. The rounding factors were examined so as to be not too large for the most important radionuclides. For a few radionuclides it was judged inappropriate to round down to 0.1 Bq/g, the doses corresponding to 1 Bq/g being judged acceptable.

Collective doses have been estimated both on the basis of individual doses and the number of people exposed and on the basis of a generic exposure scenario assuming widespread dispersion still correlated with human occupation. Multiple recycling was allowed for. For some radionuclides the collective dose at the clearance level is close to 1 man Sv, but for a realistic radionuclide distribution the overall impact is well below this criterion. Moreover it was considered that in the light of the benefit of recycling both in economic and ecological terms over landfill disposal, there is no doubt as to whether recycling is a sound option. It was concluded to retain only the individual dose criteria (10 µSv effective dose, in a few cases 50 mSv skin dose) for the establishment of the clearance levels.

3.5 Results

In Table 1 some examples are given of the highest doses calculated per unit Bq/g or per unit Bq/cm2 in case of steel recycling together with the corresponding limiting exposure pathway. The three major pathways, ingestion, inhalation and external exposure appear to be limiting depending essentially on the mode of radioactive decay of the radionuclides. The highest doses related to external exposure, and to inhalation of a-emitters. It is worth noting that the limiting pathway is not necessarily the same for mass and surface contamination.

Table 2 indicates similarly the limiting scenario. In terms of mass activity concentration the exposed population is constituted by certain categories of workers in the foundry, workers involved in the disposal of dust and slags, and of members of the public or workers being exposed to massive final products. The example given of the latter is that of a crew and their family living

Table 2: *limiting scenarios corresponding to the pathways identified in table 1*

	µSv/(Bq/g)		µSv/(Bq/cm2)	
nuclide	dose	scenario	dose	scenario
H-3	7.3 E-3	foundry	2.7 E-4	segmenting
Mn-54	6.1	ship	0.38	scrap
Co-60	17	ship	1.1	scrap
Sr-90	0.69	foundry	1.2	segmenting
Ru-106	6.9	dust disposal	0.52	segmenting
Cs-137	17	dust disposal	0.26	scrap
Pm-147	1.7 E-3	slag field	1.0 E-2	segmenting
Pu-239	40	slag field	96	segmenting

on a ship. The label of a scenario should not be paid too much attention: if a limiting scenario was dismissed another similar scenario would in most cases yield only slightly lower values, or another pathway of exposure would become important. In the case of surface contamination the exposed population consists essentially of the workers involved in receiving and representing the scrap metal. The two criteria thus are complementary even though mass contaminated material can be accounted for as surface contaminated (no distinction is made between fixed and removable contamination).

Table 3 gives the doses per unit mass activity concentration for the different metals that were considered (the highest dose was taken for either carbon or stainless steel). It was decided that doses are in general quite comparable and hence it was sound to define a single set of clearance levels irrespective of the nature of the metal. Note that for Pm-147 in copper the skin dose is the limiting factor ("trumpet" - scenario). Some examples of clearance levels are given in Table 4. The values range from 1 to 10.000 Bq/g. In most practical situations the distribution of radionuclides will be such that only the radionuclides with clearance levels at 1 Bq/g will be limiting. Table 5 gives values for surface clearance levels, both for recycling and reuse, and mass clearance levels, for three important radionuclides. In case of recycling, for sheets with a thickness of less than 10 g/m² the mass clearance level will be the most restrictive except for Pu-239 due to the release of dust upon segmenting the sheets. The values for reuse are typically one order of magnitude lower.

nudide	steel	copper	aluminium
H-3	7.3 E-3	1.2 E-4	5.6 E-4
Mn-54	6.1	2.5	2.6
Co-60	17	8.7	8.5
Sr-90	0.69	1.1	0.25
Ru-106	6.9	1.4	1.1
Cs-137	17	1.5	6.2
Pm-147	1.7 E-3	0.66*	3.3 E-4
Pu-239	40	6.9	3.0

Table 3: *maximum individual doses (mSv/(Bq/g)) for the recycling of different types of metal*

H-3	1000
Mn-54	1
Fe-55	10000
Co-60	1
Sr-90	10
Ru-106	1
Cs-137	1
Pm-147	10000
Pu-239	1**

Table 4: *Clearance levels (Bq/g) proposed for a selected number of radionuclides*

	Recycling		Reuse
	Bq/g	Bq/cm²	Bq/cm²
Co-60	1	10	1
Cs-137	1	100	10
Pu-239	1	0.1	0.1

Table 5: *mass-specific and surface-specific clearance levels for three important radionuclides, both for recycling and for reuse.*

3.6 Application

As already explained in chapter 2, the clearance levels are not meant to be available for the operator to decided by himself whether he can release metal scrap. It is the responsibility of the competent authorities to lay down the conditions in which such values can be used. The authorisation of dismantling operations will pertain to the entire sequence of operations, from the characterisation and sorting of the material up to the amounts that can be cleared at certain levels. The Art. 31 Experts have in particular recommended that:

- the total activity be averaged over a few 100 kg for mass concentrations, a few 100 cm² up to one m² for surface concentrations,
- surface and mass criteria apply together, surface activity including fixed and non-fixed activity,
- a sum-rule applies to mixtures of radioactivity.

Release for direct reuse requires a conservative assessment of surface contamination in case of non-accessible surfaces. Allowance shall be made for alpha-beta activity under paint or rust. No mass specific activities for reuse are given. In case of activated material this can be accounted as if it were surface activity. The release of ingots (with homogeneous mass contamination) was deliberately not considered, even though it would be relatively easy to do so using the same methodology. It should be emphasised that the values for recycling pertain only to materials which are (made) unsuitable for reuse and should not be used for ingots.

4. CONCLUSION: POLICY ISSUES

The recommendations of the Art. 31 Group of Experts do not constitute a policy statement. It is for Member States to decide which option is preferred. It is noted that there is a wide variety of options, with different benefits and drawbacks.

Recycling within nuclear industry allows a controlled exposure of workers and traceability of the manufacture of products. A dedicated smelter may accept materials with higher specific activity.

The fact that there is no or little dilution with other materials, however, yields higher activities in the final product. Recycling in an arbitrary smelter requires that workers' exposure be kept down to trivial levels, but does not require control over the final products or by-products. It is this option which was examined by the Experts and for which clearance levels were defined, but it is not necessarily the preferred option. In fact, whenever possible, the Experts recommend to give priority to recycling within nuclear industry.

The advantages of recycling or reuse over disposal are obvious, both in economic terms and in view of environmental concerns. Unrestricted release may, however, suffer from a difficult public acceptability and hence reluctance of the industry to process materials known to arise from nuclear installations.

In addition the metal industry has become increasingly aware of the need to control the incoming scrap for radioactivity. The inadvertent disposal of radioactive sources in scraploads can have dramatic consequences. There is also an increasing pressure to carry out such controls at the border rather than at the gate. This might be contrary to the rules of the internal market, except if justified on safety or health grounds. It should not constitute a means of protecting metal works against the receipt of slightly contaminated scrap placed on the market as a result of authorised dismantling operations.

It is at present not envisaged to impose uniform clearance levels at Community level. It is unlikely that internationally agreed unconditional clearance levels be available very soon. This does not imply that there is a legal problem with transboundary movements. The Basic Safety Standards strictly require the import of such materials to be reported only if the exemption levels are exceeded. These are indeed for many radionuclides an order of magnitude higher than the recommended clearance values, but this is by itself not problematic as long as the quantities involved are relatively small. It is prudent to monitor the evolution of such international trade in scrap metal in order to ascertain that the radiological consequences remain trivial.

The establishment of Community guidance on clearance levels for metal recycling constitutes an important tool within the process of authorisation of waste disposal or dismantling projects by competent authorities. The application of the clearance option will, however, remain a delicate matter, and an important effort should be made by all concerned parties to contribute to a clear public understanding of the issue.

PRENSA

Las actividades de Top Safe'98 se iniciaron con una rueda de prensa, que congregó a numerosos medios de comunicación de la Comunidad Valenciana. La presentación estuvo a cargo de Juan Estapé, Presidente de la SNE, y de Manuel Ibáñez, Xavier Jardí y José Palomo, miembros del Comité Organizador.

El Presidente de la Sociedad destacó las grandes cualidades de Valencia como sede de una conferencia internacional de alto nivel tecnológico como Top Safe, que congregaba a cerca de 400 participantes provenientes de más de 30 países, con el objetivo de intercambiar información y experiencias sobre los aspectos relacionados con la seguridad nuclear, y dirigida muy especialmente a servir de ayuda y referencia a los países del este de Europa en esta materia. Finalmente, agradeció a Juan Manuel Kindelán Presidente del CSN, su participación como Presidente de la conferencia, así como el apoyo brindado por la Generalidad Valenciana, el Ayuntamiento de la ciudad e Iberdrola.